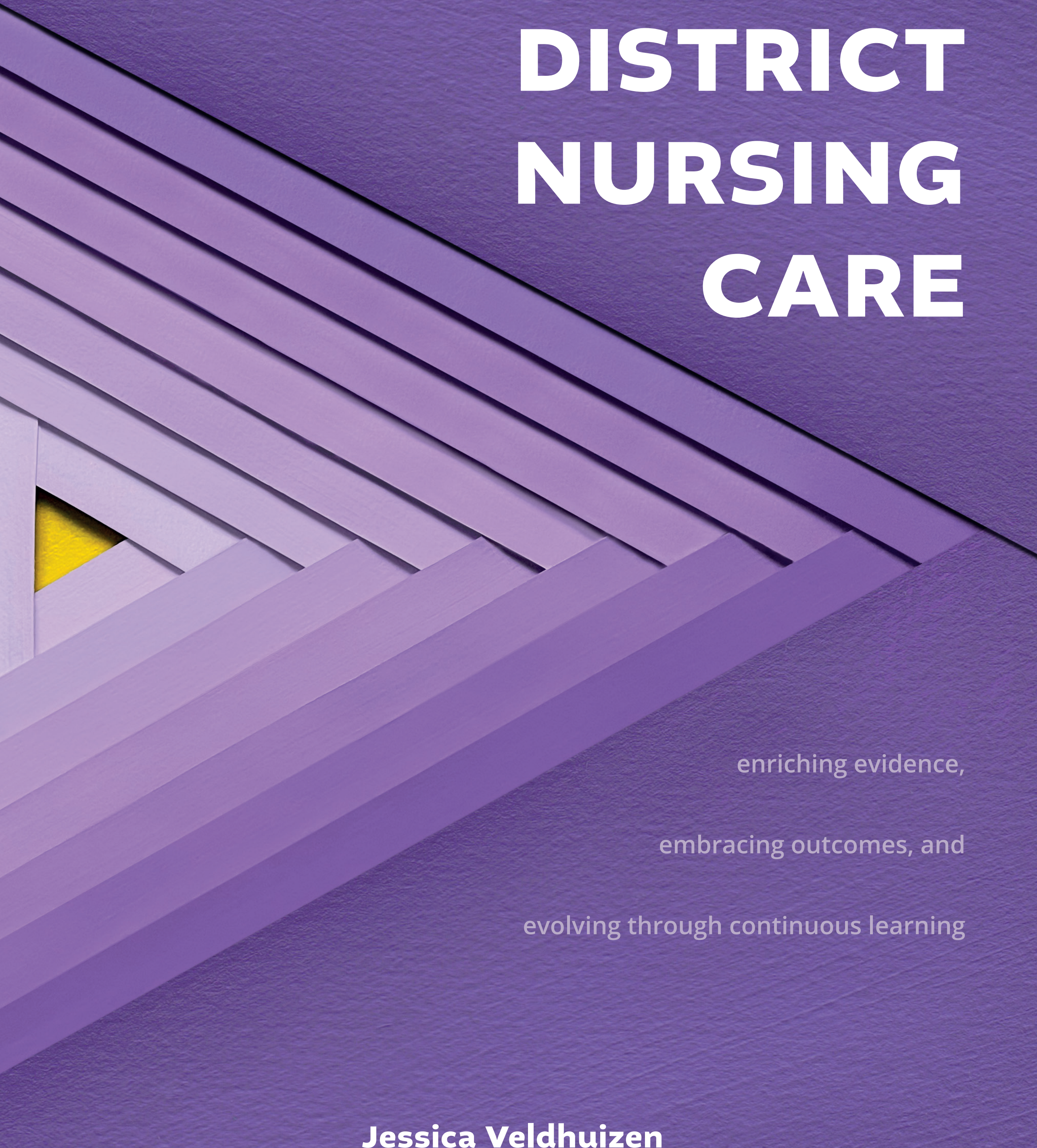

ADVANCING DISTRICT NURSING CARE

enriching evidence,

embracing outcomes, and

evolving through continuous learning

Jessica Veldhuizen

Advancing district nursing care

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Advancing district nursing care: Enriching evidence, embracing outcomes, and evolving through continuous learning

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Advancing District Nursing Care

Enriching evidence, embracing outcomes, and evolving through continuous learning

Vooruitgang in de wijkverpleging: het versterken van bewijs, omarmen van uitkomsten, en ontwikkelen door continu leren

(met een samenvatting in het Nederlands)

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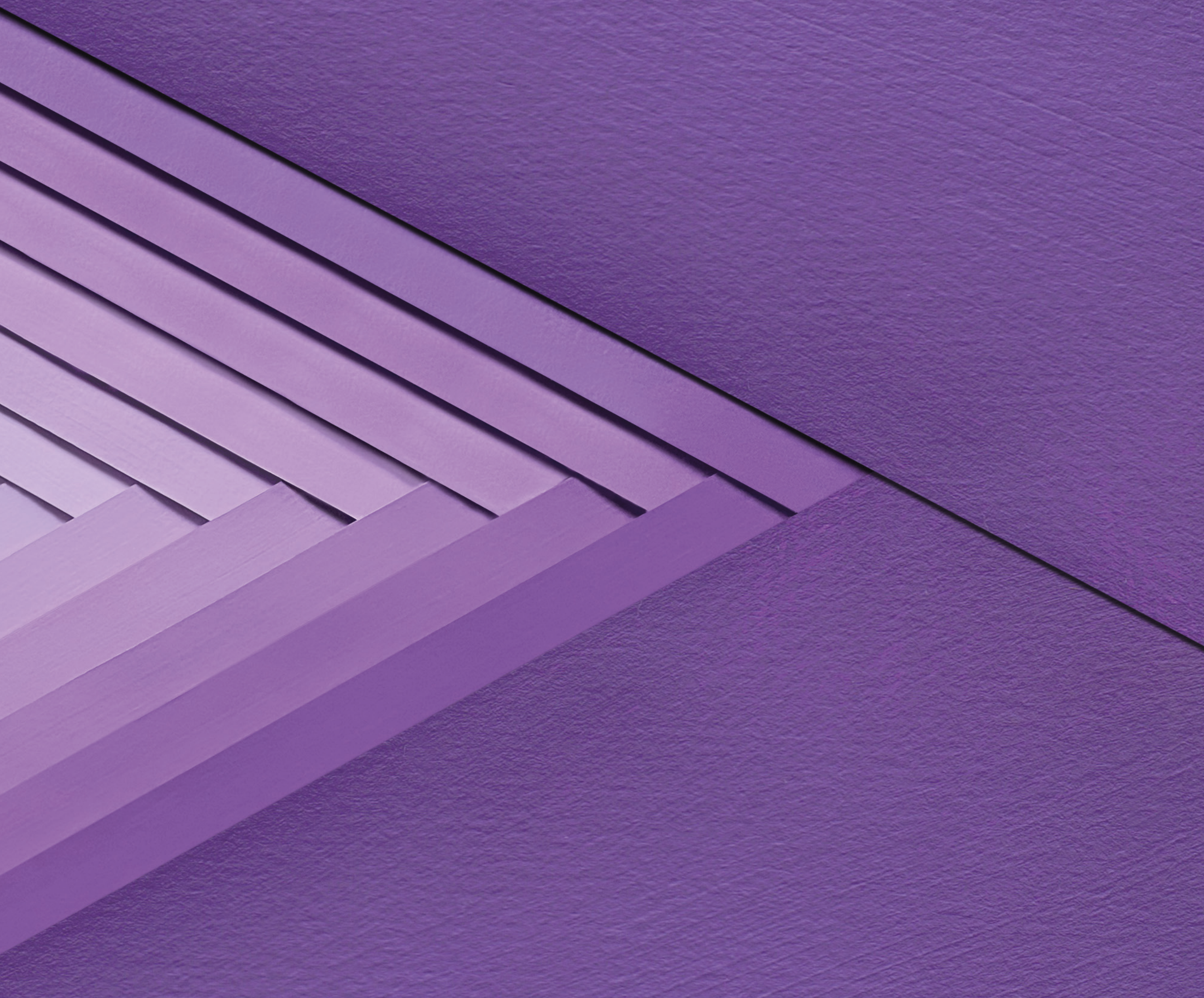
Content

1

General Introduction



Nursing care at home is under pressure

Nationwide and across the globe, the quality, affordability, and accessibility of home-based healthcare are under pressure. This issue stems from two main factors: the rapidly growing ageing population and the concurrent scarcity of healthcare professionals (1–7). Older people aspire to live independently in their homes for as long as possible (8,9). Additionally, governments worldwide have embraced policies promoting “ageing in place,” reallocating resources from institutions to homes and prioritising home-based services to honour the desire of older people to continue living at home while simultaneously addressing the rising costs associated with traditional institutional care (10,11). However, as individuals age, they often face various health-related challenges, including frailty, disabilities, and chronic diseases, leading to a substantial increase in care demands (3,4,12), especially in the home care setting (1,2). Moreover, the shortage of healthcare professionals delivering home-based care, especially nurses, has become an increasingly pronounced concern in recent years (5–7). This shortage has been exacerbated by the growing demand for nursing care at home due to the ageing population and the increasing complexity of healthcare needs. This persistent and widening gap between the demand for nursing care and the available supply of trained professionals puts pressure on home healthcare systems to provide high-quality care that is safe, effective, and responsive to patients (13).

District nursing care: providing nursing care at home

Providing care at home is of vital importance. The home care context, however, can be confusing due to the international differences in home care practices and the lack of definition of home care (14–16). Home care comprises a diverse range of tasks (e.g., preventive care, domestic aid, personal care, technical aid, rehabilitative services, end-of-life care) provided by various social or healthcare professionals within the individual’s own homes (e.g., nurses, physical and occupational therapists, physicians or social workers) (1,14,17). In this thesis, the term “district nursing care” is used, which refers to all *nursing* care provided at home. This choice is made because, predominantly, nurses[1] are the key providers of preventive, personal, technical, or end-of-life care, are involved with rehabilitative nursing care, or are in charge of arranging domestic aid for individuals living at home (1,18,19).

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[1] In this thesis, ‘nurse’ refers to all nursing and caregiving personnel, including healthcare assistants, vocational nurses, district nurses, and specialised nurses, unless explicitly stated otherwise.

District nursing care in The Netherlands

The definition, delivery, organisation and funding of *district nursing care* varies between countries worldwide (1,14,16). For this thesis, district nursing care is defined as a holistic healthcare approach that is preventive, supportive, or rehabilitative, offering a wide range of technical, psychosocial, and personal care services provided by nurses for individuals and communities. This aligns with other definitions in Europe (16,20) and reflects the scope of district nursing care in the Netherlands (21,22). In the Netherlands, in general, district nursing care delivers a wide range of nursing interventions and is critical in supporting independence, managing long-term conditions, and preventing and treating acute illnesses (2,22). Furthermore, district nursing plays a vital role in facilitating tailored care at home, with district nurses serving as the bridge between a client's circumstances, their care needs, and other social or healthcare professionals (22). On average, 139,500 district nursing care professionals delivered care in 2021 (23). The district nursing care workforce in the Netherlands comprises health aides (EQF level 2), healthcare assistants (EQF level 3), vocational nurses (EQF level 4), district nurses (EQF levels 5 and 6), and specialised nurses (EQF level 7). The exact roles and competencies of the district nurse are described in the area of expertise of district nurses (22). In 2021, district nursing professionals provided care to more than half a million people in the Netherlands, which averages 3.4% of the Dutch population (24).

District nursing care in the Netherlands primarily involves district nursing care organisations, with over 1,400 agencies offering these services in 2021 (24). In general, district nursing care is most often funded on a fee-for-service basis (11), but there are also organisations experimenting with monthly funding (25). This district nursing care is funded through the Health Insurance Act (Zorgverzekeringswet), with healthcare insurers responsible for the funding (11). Long-term district nursing care can also be funded via the Chronic Care Act (Wet Langdurige Zorg) when the individual requires high-level care or supervision, with a joint responsibility between central and local government and healthcare insurers (11). Additionally, district nurses arrange or provide social support at home, which is a responsibility of the municipality under the 2015 Social Support Act (Wet Maatschappelijke Ondersteuning 2015) (11). These various types of funding for district nursing care make it a shared responsibility of healthcare insurers, municipalities, and the national government (11). The high number of district nursing organisations and the diverse funding mechanisms contribute to fragmentation within district nursing care. The fragmentation created by this situation makes it difficult for district nursing organisations and healthcare professionals to collaborate effectively (26).

Advancing district nursing care: the need for more evidence

Considering the vital role of district nursing care and the fact that the population of older people in need of assistance at home is growing (1,2), it becomes clear that district nursing care plays a crucial role in primary care. The Dutch Council for Public Health and Society and the Dutch government underline that a solid and well-functioning primary care system is of great importance to society and that district nursing plays an essential role in it, alongside and jointly with general practitioners, social care services, and many other professionals (27–29). However, the existing body of evidence for district nursing care is limited, while this is essential to establish best practices and the effectiveness of district nursing care, as well as show the value of district nursing care and empowering nursing professionals (1).

A study involving district nursing care professionals from 17 countries underscored the urgent need for research across various areas (1), and recent reviews conducted in the field of district nursing care have indicated a scarcity of supporting evidence on the effects of nurse-led interventions in improving outcomes for individuals in the home care setting (30–34). The lack of evidence is concerning because there is a growing societal emphasis on delivering nursing care in home settings, underscoring the need for greater attention to district nursing care. The relative lack of focus on district nursing is troubling. Unfortunately, the COVID-19 pandemic once again highlighted this lack of attention and guidance, as most attention was directed towards hospitals and nursing homes, while the district nursing care setting also provided incredibly vital care (35–37). Since district nursing care is a specialised nursing practice that requires unique nursing interventions and competencies (22,38–40), and because of the current lack of attention and evidence for district nursing care, it is crucial to put more emphasis on advancing district nursing care with evidence.

Advancing district nursing care: providing insight into the effectiveness of care

Next to evidence, insight into the effectiveness of district nursing care is needed to advance district nursing care, which is one of the core dimensions of healthcare quality (41). Donabedian’s model can be used to measure the effectiveness of care, which focuses on structure, process and outcome measures (42) (Figure 1). “Structural” (or input) measures relate to the setting in which care is delivered, which comprises material, intellectual and human resources (41). “Process” measures comprehend care activities delivered by healthcare professionals and organisations (41). “Outcome” (or output) measures describe the effects of care delivery on the health outcomes of individuals and populations (41). These measures are linked, as structural measures affect process measures, which then influence outcome measures (42). Context factors such as environmental or population factors may also impact structures, processes, and outcomes (43,44) (Figure 1).

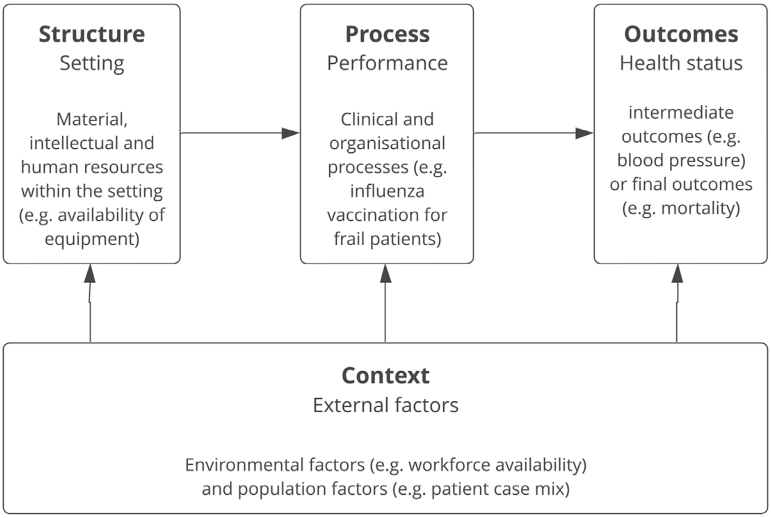

Figure 1. structure, process and outcomes of care as described by Donabedian (42), supplemented with insights from the World Health Organisation's report on improving healthcare quality (41) and insights from a system-orientated approach (43).

Understanding the effectiveness of district nursing care requires examining the delivered care and other actions of nurses and their impact on patient outcomes[2]. However, the exact actions of nurses and others involved in the care organisations are non-observable as these processes are difficult to quantify (43) or sometimes invisible (45,46) (i.e., black box). Therefore, to evaluate the care delivery of nurses on the individuals receiving district nursing care, the other components (i.e., the structure of care, external contextual factors, and outcomes of care) should be measured (43).

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[2] In this thesis, 'patient outcomes' refer to the health outcomes of individuals receiving care. As care can encompass preventive measures, and the individual may not necessarily be a traditional 'patient,' this thesis opts for 'patient outcomes' to enhance readability, even though it essentially relates to health outcomes for individuals.

The measurement of patient outcomes in district nursing care

The assessment of patient outcomes is essential to describe or reflect an individual's health status. There are different types of outcome measurements, such as patient-reported, observer-reported, clinician-reported, and performance outcomes. Patient-reported outcome measures (PROMs) are reported by the patient regarding their health status (e.g., numeric rating scale for pain intensity) (47). These can be measured as condition-specific (e.g., diabetes, breast cancer) or more generic, focusing on a life course (e.g., overall paediatric health, older individuals), as developed by The International Consortium for Health Outcomes Measurements (48,49). Observer-reported outcomes measures are measurements by someone other than the patient or health professional of the patient's health status (e.g., counts of seizure episodes) (47). Clinician-reported outcomes are outcomes a health professional measures concerning the patient's health status (e.g., pressure ulcer progression or blood pressure) (47). Performance outcomes are measurements based on standardised tasks undertaken by a patient according to standardised instructions (e.g., gait speed) (47). This thesis delves into outcomes assessments that are relevant for district nursing care, regardless of who measures these outcomes, taking the first step towards gaining deeper insights into the effectiveness of district nursing care.

In district nursing care, patient outcomes play a crucial part in the daily nursing clinical reasoning process, which includes assessing needed care, nursing diagnosis, planning care, outcome setting, implementation of interventions, and evaluating care (50,51). When measuring outcomes in district nursing, one can focus on nurse-sensitive patient outcomes[3] or patient outcomes in general. Nurse-sensitive outcomes are patient outcomes that are *relevant* based on the nurses' scope and domain of practice and where nursing inputs and interventions have an *influence* on the patient outcomes (52,53). The relevance and influenceability are vital for nurse-sensitive outcomes to account for the actions of the district nurse. However, given the extensive collaboration with other professionals, such as general practitioners and social care services, and the necessity to strengthen integrated care in primary settings (27,54), it is also important to broaden our perspective beyond nurse-sensitive outcomes and approach outcomes more from the patient's viewpoint, regardless of who influences them.

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[3] In this thesis, the term 'nurse-sensitive patient outcomes' is explicitly used when specifically referring to nurse-sensitive aspects. If 'nurse-sensitive' is not mentioned, the emphasis is primarily on the patient's perspective, with less attention to the nurse influencing the outcome.

Using patient outcomes for learning and improving

Patient outcomes are essential as they provide insight into the (cost) effectiveness and efficiency of care (52) and can be used for quality control (52,55,56). Ensuring the quality of care becomes crucial when there is increased demand for district nursing care. Moreover, grasping the effectiveness of nursing care delivery through patient outcomes offers opportunities for nurses to learn from their care delivery and to make quality improvements. However, at the moment of this writing, there is little evidence on what and how patient outcomes can be used in district nursing care for quality control and care improvements (57,58).

While patient outcomes play a significant role in the daily nursing clinical reasoning process, their current utilisation often remains limited to the individual patient level, and the application of patient outcomes for learning and improvement is still at an early stage (57,59). The literature underlines that outcomes are vital for learning and improving in practice (52,55,56,60). In current healthcare practice, measuring and learning from patient outcomes is a hot topic as a growing interest is seen in value-based healthcare (VBHC) (61–63). In value-based healthcare, the objective is to continuously improve delivered health outcomes to patients for the money spent (62). By measuring, tracking and improving health outcomes systematically, health systems pursue to 1) deliver better patient outcomes and overall population health more consistently, 2) identify and disseminate best practices, 3) control the total healthcare costs more effectively, and 4) rebuild the trust and motivation of health professionals (62).

The steps of systematically measuring, tracking, and improving health outcomes as part of a value-based healthcare system are consistent with a Learning Healthcare System (LHS). An LHS does not primarily focus on outcomes but emphasises collecting all available data to generate knowledge and applying it for learning and practice improvement (64). The Institute of Medicine defined the concept of an LHS as a system “that is designed to generate and apply the best evidence for the collaborative healthcare choices of each patient and provider; to drive the process of discovery as a natural outgrowth of patient care; and to ensure innovation, quality, safety and value in health care” (65). Information plays a central role in an LHS, and learning cycles are employed to enhance health outcomes (66,67). The learning cycle comprises three components: deriving data from practice (Practice to Data), generating knowledge from the data (Data to Knowledge), and applying that knowledge back into practice (Knowledge to Practice) (67). Thus: a learning healthcare system continually gathers data from patient care, analyses this information, and uses the insights to inform and improve healthcare practices, fostering a continuous cycle of learning and improving. In a Learning Healthcare System, outcomes and experience are continually improved by “applying science, informatics, incentives and culture to generate and use knowledge in the delivery of care" (67). An LHS is proposed as a pathway towards a more outcome-based or value-based approach in healthcare (68).

The potential of patient outcomes in advancing district nursing care

While there is much attention on learning and improvement through outcomes in healthcare, the focus is often primarily on hospital settings. When looking at the development of VBHC or PROMs, they are frequently tailored to hospital environments (62,69). Although there are indicators for primary care, they are not explicitly designed for district nursing care (58). Therefore, quality indicators specifically for district nursing care are developed in the Netherlands (70). The lack of attention to district nursing is unfortunate, especially considering the growing societal emphasis on home-based care settings. As district nursing care is at the beginning of using patient outcomes for learning and improvement, it is crucial to conduct research in this area. The research conducted for this thesis strengthens the scientific foundation for district nursing care and provides valuable support to enable nurses in advancing their district nursing practice.

The aim of this thesis

The aim of this thesis is twofold: 1) to strengthen the evidence base for district nursing care; and 2) to explore the use of outcomes for learning and improving in district nursing care. The first part of this thesis examines the current delivery of district nursing care and explores its challenges during the COVID-19 pandemic to strengthen the evidence base and get a better understanding of district nursing care. Alongside the goal of strengthening the evidence for district nursing care, the second part of this thesis explores the use of patient outcomes for learning and improving district nursing care. It focuses on nurse-sensitive patient outcomes relevant to district nursing care, their current measurement in practice, and what is needed to use outcomes for learning and improving district nursing practice.

Outline of this thesis

The first part of this thesis examines the current delivery of district nursing care and explores its challenges during the COVID-19 pandemic. **Chapter 2** presents predictors of district nursing care utilisation for community-living (older) people in the Netherlands based on an exploratory, quantitative study using claims data. **Chapter 3** describes a mixed-methods study on the impact of and needs during the COVID-19 pandemic in district nursing care.

The second part of this thesis explores the use of patient outcomes for learning and improving district nursing care. **Chapter 4** describes a systematic review of the literature, providing an overview of district nursing care interventions and their effects, and the nurse-sensitive patient outcomes used in district nursing care. In the Delphi study, described in **Chapter 5**, nurse-sensitive patient outcomes are determined together with experts (i.e., district nurses with a background in education, research, or policy). **Chapter 6** describes a survey study to explore the current use of nurse-sensitive patient outcomes in district nursing care. Then, in **Chapter 7**, a multi-method qualitative study has been conducted to provide insight into the barriers, facilitators and needs that influence the use of patient outcomes in district nursing care.

The final **Chapter 8** provides a general discussion of this thesis’s main findings, methodology, future research and implications for clinical practice, education, research, and policy.

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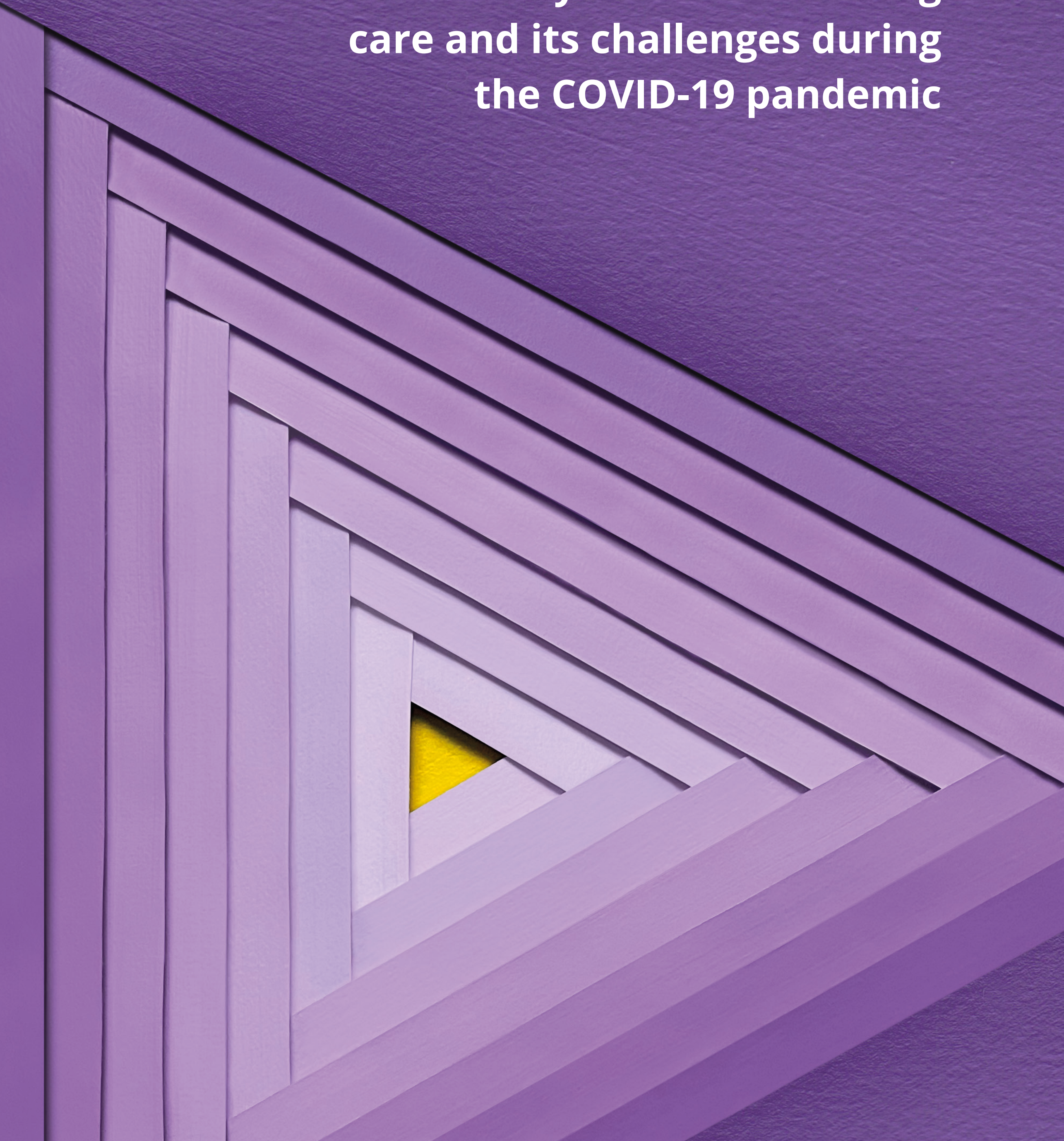
PART I

The current delivery of district nursing care and its challenges during the COVID-19 pandemic



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Predictors of district nursing care utilisation for community-living people in the Netherlands: an exploratory study using claims data

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Abstract

Objective: To explore predictors of district nursing care utilisation for community-living (older) people in the Netherlands using claims data. To cope with growing demands in district nursing care, knowledge about the current utilisation of district nursing care is important.

Setting: District nursing care as a part of primary care.

Participants: In this nationwide study, claims data were used from the Dutch risk adjustment system and national information system of health insurers. Samples were drawn of 5500 pairs of community-living people using district nursing care (cases) and people not using district nursing care (controls) for two groups: all ages and aged 75+ years (total N=22 000).

Outcome measures: The outcome was district nursing care utilisation and the 114 potential predictors included predisposing factors (e.g., age), enabling factors (e.g., socioeconomic status) and need factors (various healthcare costs). The random forest algorithm was used to predict district nursing care utilisation. The performance of the models and importance of predictors were calculated.

Results: For the population of people aged 75+ years, most important predictors were older age, and high costs for general practitioner consultations, aid devices, pharmaceutical care, ambulance transportation and occupational therapy. For the total population, older age, and high costs for pharmaceutical care and aid devices were the most important predictors.

Conclusions: People in need of district nursing care are older, visit the general practitioner more often, and use more and/or expensive medications and aid devices. Therefore, close collaboration between the district nurse, general practitioner and the community pharmacist is important. Additional analyses including data regarding health status are recommended. Further research is needed to provide an evidence base for district nursing care to optimise the care for those with high care needs, and guide practice and policymakers' decision-making.

Strengths and limitations of this study

- The results of this study confirm current knowledge that people in need of district nursing care are older and have higher median healthcare costs regarding general practitioner consultations, pharmaceutical care and aid devices.
- Because people in need of district nursing care visit the general practitioner more often and use more and/or expensive medications and aid devices, the results of this study underline that close collaboration between the district nurse, general practitioner and the community pharmacist is important.
- The random forest algorithm is robust to outliers, noise, overfitting and is capable of dealing with large amounts of observations as well as potential predictors.
- Because of the nature of claims data, it was not possible to include potentially relevant predictors based on the literature since this was not readily available in the dataset

Introduction

The worldwide population of 906 million older people aged 60 years and older in 2015 will increase rapidly to approximately 2.1 billion older people in 2050 (1). With increasing age and associated adverse consequences like frailty, disability and (multiple) chronic diseases, demands for care will grow and healthcare costs will increase (2-4). To meet the needs of older people and decrease their costs of care, policies of governments aim towards ageing in place, shifting care from institutions to home and prioritising community-based services (4). This leads to an increased demand for home healthcare. Home healthcare comprises all care delivered at home, including in-home nursing care, as well as housekeepers, mobile meals, physical therapy, occupational therapy, social work services and care provided by the general practitioner (GP) at home. Personal care, psychosocial care and technical nursing care to community-living older people are mostly performed by district nursing care (DNC) (5). Demands on DNC will increase due to the ageing population, the increase of complexity of care and the shortage of DNC professionals (2,4,6-8). In order to cope with these growing demands, knowledge about the current users of DNC is important.

The context of DNC can be confusing due to the international differences in DNC practices and the variety of titles and names used for district nurses (9-11). In general, DNC refers primarily to the formal nursing services and personal care provided by nurses or health assistants behind someone's front door, enabling people to remain living in their home environment (5,9,11). Two comprehensive studies have been conducted to identify differences in district nursing practices between countries in Europe (9,12). Both studies conclude that in each country, the healthcare system is embedded in a sociocultural and political context, asking for country-specific actions in order to cope with the growing demands on DNC (9,12). In the Netherlands, DNC has a technical, supportive, rehabilitative or preventive nature, covering technical nursing care, psychosocial care and personal care (5). It is directed at both individual patients and community populations (5). From 2015, DNC in the Netherlands is a shared responsibility of municipalities, insurers and the national government. It is funded on a fee-for-service basis, and it is financed through the Health Insurance Act (13). DNC is provided by district nurses, vocational nurses, healthcare assistants and health aides. In 2017, a total of 557 005 people received DNC, of which 343 300 people were women (61,6%), 276 115 people lived alone (49.6%) and 353 570 people were 75 years or older (63.5%) (14).

To study the utilisation of home healthcare, including DNC, the behavioural model of healthcare service utilisation by Andersen (15) is a widely applied model (16,17). The latest version of the model suggests that contextual and individual characteristics influence the use of health services (18). These characteristics are dependent on

1) predisposing factors (i.e., characteristics that exist before a person's illness, such as age, gender and health beliefs), 2) enabling factors (i.e., logistical aspects such as income, health insurance and travel time to available facilities), and 3) need factors (i.e., the level of disability and illness as perceived by the individual) (18). Two recent studies conducted in the Dutch context focusing on predictors in home healthcare including DNC identified age and gender (17) as predisposing factors, income (17) or social environmental characteristics (19) as enabling factor, and impairment, (17) physical functioning and daily functioning (19) as need factors. Both studies focus on home healthcare, which includes social work, household care, and/or care delivered by municipals, rather than district nursing specifically. Little is known regarding predictors associated with DNC utilisation compared with no DNC utilisation.

The aim of this study is to explore predictors of DNC utilisation for community-living (older) people in the Netherlands using claims data. The results of this study may contribute to better awareness and understanding of older people in need of DNC. This insight may also guide professionals, researchers, and policymakers in providing care and further research regarding the use and potential demands of DNC.

Materials and methods

Study design and data sources

To explore predictors of DNC for community-living (older) people, an exploratory study was conducted, using a nationwide patient-level dataset including healthcare claims data of all insured people in the Netherlands. In this study, people who use DNC were compared with people who do not use DNC.

The dataset used in this study has been created by combining three national datasets: data from the Dutch risk adjustment system by the Dutch Healthcare Authority, claims data of the Dutch national information system of health insurers (Vektis) and data with patient characteristics (Vektis characteristics). In the Dutch risk adjustment system, health insurers are compensated for predictable, health-related cost differences among insured people. Data regarding this risk adjustment (e.g., socioeconomic status, persons per household) are included in this dataset. The claims dataset includes all expenses that were claimed for all delivered care in 2017. The patient characteristics dataset includes variables as age and gender. The three datasets include data from all people living in the Netherlands. All data were collected during 2017. The datasets were linked and merged on person level using the pseudo-anonymised identification number. For the flow chart of the merging of the datasets and selection of variables, see (online) supplemental appendix 1. Only observations that were available in all datasets were included. Removed variables were irrelevant for the scope of the study (e.g., regarding persons living in a nursing home) or were already available in one of the other datasets. New variables were created when it was needed (i.e., to create dummy variables due to the format of the variable). Observations were removed if gender was missing (148,802 observations; 0.7%) or if the outcome was negative (22 observations; 0.0%). A negative outcome was possible if an administrative adjustment regarding DNC costs was made with respect to the previous year (2016), and no DNC costs were made in 2017. Due to people changing their health insurer during 2017, duplicates (581,210 observations; 3.3%) were identified and removed from the dataset. The final dataset comprised data from 16,833,188 persons on 115 variables (online supplemental appendix 1). To guide reporting, the Reporting of studies Conducted using Observational Routinely-collected data statement was followed ((online) supplemental appendix 2) (20).

Participants and sample

Because of prior knowledge that DNC is mainly provided to older people, DNC utilisation was predicted for two groups: those aged older than 75 years (75+) and the total population including all ages. Because of the long running time of the proposed analyses, calculations were made to determine a sample of sufficient size with a feasible length of the analysis running time. Samples of different sizes (250, 500, 1,000, 2,500, 5,000, 10,000) were drawn. A prediction model was made using the random forest algorithm by Breiman (21) and the implementation by Wright and Ziegler (22). Subsequently, the accuracies of the models were calculated for all samples. K-fold cross-validation has been performed, using 10 folds and 5 repeats. Figure 1 in (online) supplemental appendix 3 shows the accuracy of all models for all samples. A sample of 5,000 and 10,000 showed the best accuracy with small CIs and minor differences between both models. Due to the long runtime of a sample of 10,000 observations, a sample of 5,000 was preferred. An increase of more observations than 5,000 does not substantially improve the accuracy estimates of our models. A sample of 1.0% of the total population of DNC users came closest to the favourable sample. With 544,304 people receiving DNC in our final dataset, the sample was rounded up to 5,500 (1.01%). An equal amount of non-DNC users was drawn from the final dataset as controls, resulting in a total of 11,000 observations. Two separate samples of 11,000 observations were drawn for both groups (75+ years and all ages). The samples were drawn randomly from the total dataset, including 16,833,188 community-living persons in the Netherlands.

Patient and public involvement

Patients or the public were not involved in the design of the study.

Outcome variable and potential predictors

The outcome variable was DNC utilisation in 2017, operationalised as all people who claimed expenses regarding DNC they received in 2017. Next to the outcome variable, 114 potential predictors were included. Because of the nature of included datasets, only data were available on patient characteristics and healthcare utilisation costs. No data were available regarding health status or diagnosis. These predictors were divided into predisposing factors (age, gender), enabling factors (socioeconomic status, persons per household and source of income) and need factors. The need factors included the total costs regarding healthcare utilisation and were divided into nine categories: aid devices, pharmaceutical care, GP care, mental healthcare, paramedic care, oral care, transport and care abroad, other and cost-based groups, which include somatic morbidity, operationalised as having at least two types of costs for somatic pharmacy, diagnosis groups, physiotherapy groups or aid devices. The healthcare utilisation predictors comprised a sum of all costs a person made in 2017. An overview of all variables and their operationalisation can be found in (online) supplemental appendix 1.

Statistical analysis

To explore predictors of DNC utilisation, a predictive algorithm was performed for both groups (75+ years and all ages). The random forest algorithm by Breiman (21) and the implementation by Wright and Ziegler (22) were used. The random forest algorithm is a powerful, non-parametric statistical method for exploring large amounts of potential predictors (21). In a random forest algorithm, many decision trees are made, in which each node is split using the best among a subset of randomly chosen predictors (21). In this study, the random forest algorithm made 500 decision trees. Next, the predictions of all decision trees are aggregated (21).

Although the random forest algorithm is capable of dealing with large amounts of predictors, predictive performance may be affected by adding irrelevant predictors. Therefore, recursive feature elimination has been performed to select predictors for model estimation. In an initial, analysis was calculated with how many predictors the accuracy of the model would be the highest, comparing models with 1, 20, 40, 60, 80 and 100 predictors. The models with 40 predictors for both 75+ years and all ages had the highest accuracy (0.79 and 0.91, respectively) (see (online) supplemental appendix 4).

To evaluate the performance of the models, the prediction accuracy has been calculated using a k-fold cross-validation, using 10 folds and 5 repeats. In every fold, 10% of the sample is used as a test dataset and 90% as training dataset. With 10 folds and 5 repeats, the prediction accuracy has been calculated for the 50 models using the test sets.

To conclude what predictors (features) contribute most in the decision-making in the model, the feature importance method was applied (21,22). To measure the importance of the predictors in the models, the permutation accuracy importance measure has been used. To estimate the importance of a predictor, the random forest algorithm calculates how much the prediction error increases when data for that predictor are permuted while all others are left unchanged (23). The relative importance of predictors was ranked by tallying the number of inclusions of the predictor in all decision trees. The importance of the predictors was normalised on a scale from 0 to 100 and was plotted on the horizontal axis, with the ranked predictors on the vertical axis.

To provide a description of DNC users and non-DNC users, descriptive statistics were calculated for the predictors having a predictor importance of 25 out of 100 or higher. The cut-off of 25 was based on the elbow of the curve in the predictors importance plot. Because of the expected non-normal distribution, the median and IQR were calculated for the predictors. Histograms of the most important predictors were calculated to provide a visual interpretation of the data.

To calculate the magnitude and direction of the predictors on the probability of having district nursing, in addition to the random forest analysis, two binary (Bayesian) logistic regression analyses were conducted. The selected variables from the random forest analysis were included as independent variables. The use of DNC is taken as the outcome variable. ORs were provided to interpret the association between the independent variables and the outcome. For each variable estimate, a credibility interval was calculated. A credibility interval shows the probability (95%) that the true population value falls within this interval (24). All calculations were made using R V.3.5.3. (25).

Results

From the total population of 16,833,188 persons included in the dataset, 544,304 people received DNC in 2017 (3.2%). Of those aged older than 75 years, 328,767 (26.2%) received DNC. Of the total users of DNC, 60.4% were older than 75 years.

Accuracy of the models with 40 predictors

Using recursive feature elimination with 10-fold cross-validation and 5 repeats, 50 models were built with 40 predictors. The median accuracies for the models of 75+ and all ages were, respectively, 0.79 and 0.91 (figure 1).

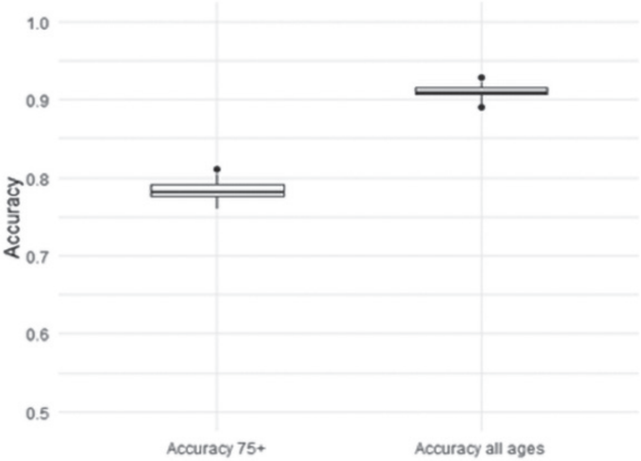


Figure 1. Accuracy of the random forest models for 75+ years and all ages
Notes: K-fold cross-validation has been performed, using 10 folds and 5 repeats. The boxplots show the distribution of the accuracies from the 50 models that were calculated in the test sets.

Predictor importance

In total, seven predictors had an importance of >25 and higher for the prediction of DNC utilisation in people aged 75 years and older. These were the total costs of GP consultations during office hours, the total costs of aid devices, age, total costs for the use of pharmaceutical care, total costs of ambulance transportation, total costs of GP consultation after office hours and the total costs of occupational therapy (figure 2). Other patient characteristics in the top 20 were low socioeconomic status, living alone and female gender.

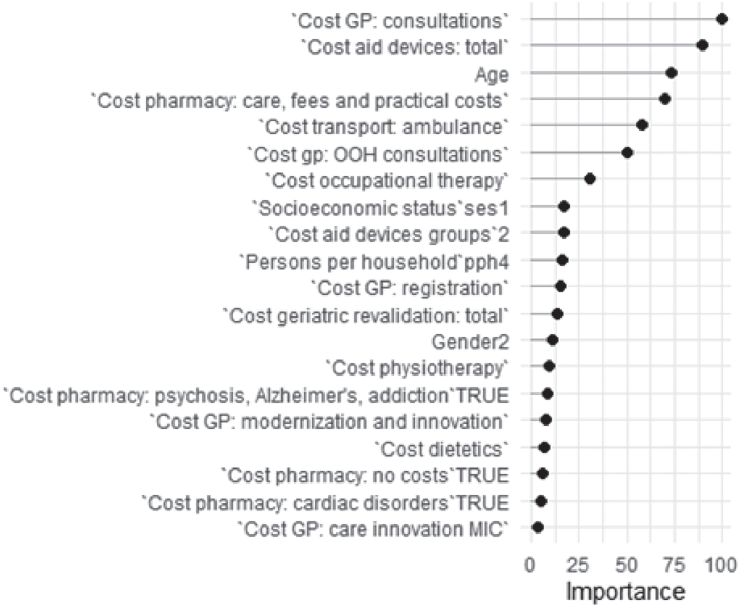


Figure 2. Predictor importance 75+ years
Notes: cost aid devices groups 2, compression stockings; gender2: female; GP, general practitioner; MIC: multidisciplinary integrated care; OOH, out-of-office hours (evening, night, weekend); pph4, persons per household group 4 (living alone); ses1, low socioeconomic status.

For the total population with all ages, three predictors of DNC utilisation had an importance of 25 and higher: age, the total costs of using aid devices and the total costs for the use of pharmaceutical care (figure 3). The top five most important predictors included the costs of GP consultations and the costs of ambulance transport. Other patient characteristics in the top 20 are somatic morbidity and living alone.

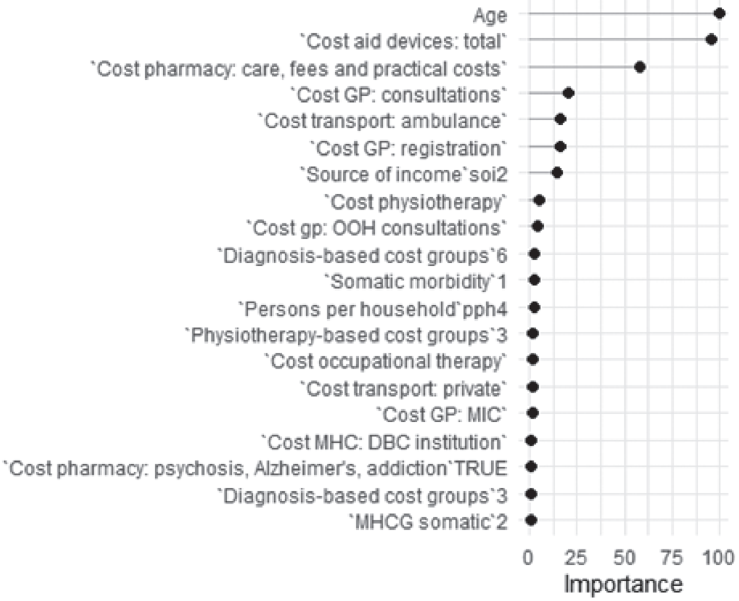


Figure 3. Predictor importance all ages
Notes: DBC, diagnosis treatment combination; diagnosis-based cost groups 3, unspecified; diagnosis-based cost groups 6, unspecified; GP, general practitioner; MHCG: multi-year high-cost group somatic 2, at least twice MHC costs in last 5 years: top 10%; MIC, multidisciplinary integrated care; OOH, out-of-office hours (evening, night, weekend); physiotherapy-based cost groups 3, unspecified; pph4, persons per household group 4 (living alone); soi2, source of income 2 (65 years and older); somatic morbidity 1, morbidity.

For those aged older than 75 years, all people receiving DNC had a higher median age and higher median total costs regarding GP consultation, use of aid devices and pharmaceutical care compared with those not receiving DNC (table 1). Regarding ambulance transportation, GP consultation after office hours and occupational therapy, people using DNC had higher overall costs in a year compared with those not using DNC (figure 4). For the group with all ages, people receiving DNC had a higher median age and higher median total costs regarding use of aid devices and pharmaceutical care compared with those not receiving DNC (table 1, figure 5).

Table 1. Descriptive statistics of important predictors with an importance of 25 or higher

	75+		All ages	
	No DNC	**DNC**	**No DNC**	**DNC**
Cost GP: consultations				
Median (min-max)	51 (0-2020)	129 (0-2884)		
IQR (Q1-Q3)	83 (18-102)	157 (-69-226)		
Cost aid devices: total				
Median (min-max)	0 (0-32492)	315 (0-15841)	0 (0-7604)	305 (0-71398)
IQR (Q1-Q3)	143 (0-143)	810 (50-859)	0 (0-0)	879 (33-911)
Age				
Median (min-max)	80 (76-107)	84 (76-103)	41(0-103)	79 (0-104)
IQR (Q1-Q3)	6 (78-84)	8 (80-88)	37 (22-59)	70 (16-86)
Cost pharmacy: care, fees and practical costs				
Median (min-max)	306 (0-35052)	944 (0-71390)	31 (0-133641)	918 (0-63177)
IQR (Q1-Q3)	634 (116-750)	1218 (421-1639)	140 (0-140)	1339 (396-1736)
Cost transport: ambulance*				
Median (min-max)	0 (0-4846)	0 (0-9608)		
IQR (Q1-Q3)	0 (0-0)	690 (0-690)		
Cost GP: OOH consultations*				
Median (min-max)	0 (0-1088)	0 (0-1998)		
IQR (Q1-Q3)	0 (0-0)	141 (0-141)		
Cost occupational therapy*				
Median (min-max)	0 (0-1232)	0 (0-1197)		
IQR (Q1-Q3)	0 (0-0)	0 (0-0)		

Notes: DNC: district nursing care; GP: general practitioner: OOH consultations: general practitioner consultations at evening, night, and weekends. Aid devices include CPAP equipment, compression stockings, materials for stoma patients, nebulizer with accessories, materials for urine collection, syringes with accessories (excluding diabetes), oxygen delivery devices and accessories, nutritional aids, and materials (excluding infants), phlegm suction equipment, and portable infusion pumps. *The differences in the medians and overall costs seem minimal. The histogram in Figure 5 shows the differences between district nursing care and no district nursing care.

Figure 4. Histogram of important predictors with an importance of 25 or higher for those aged 75+ years.

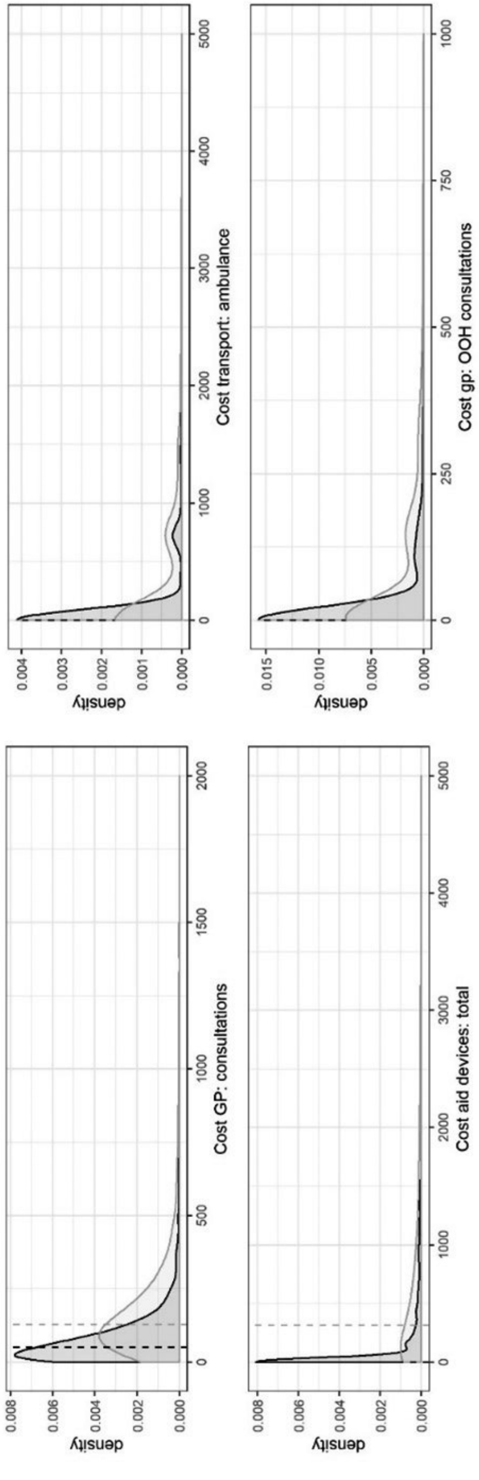
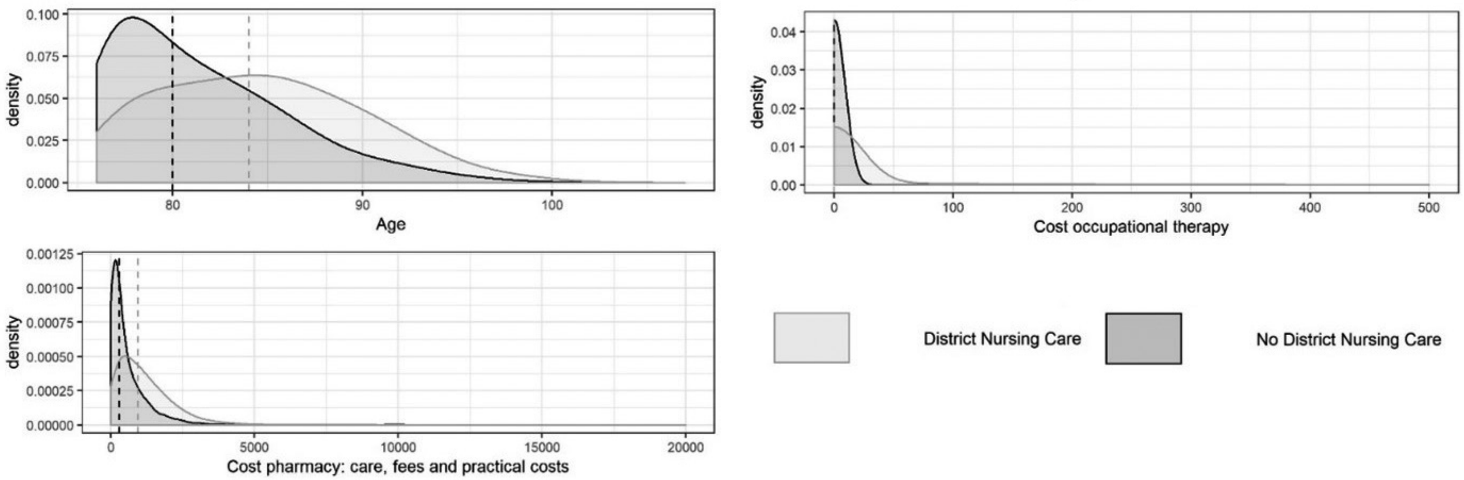


Figure 4. Histogram of important predictors with an importance of 25 or higher for those aged 75+ years. *(continued)*



Notes: These plots do not contain outliers of extremely high costs (horizontal axis) since the outliers made the plots not readable. The plots with outliers on the horizontal axis can be found in (online) supplemental appendix 5, figure 1. GP, general practitioner; OOH, out-of-office hours (evening, night, weekend).

Logistic regression and final model accuracy

The positive coefficients of the Bayesian logistic regression confirm that higher age and costs are important predictors of DNC utilisation (table 2). All variables in the model are credibly associated with the probability of DNC utilisation, with age having the highest association with the outcome DNC. The logistic regression models have an out-of-sample accuracy of 0.744 for those aged 75 years and 0.873 for all ages, which comes close to the accuracy of the random forest analyses (with accuracies of 0.79 and 0.91, respectively).

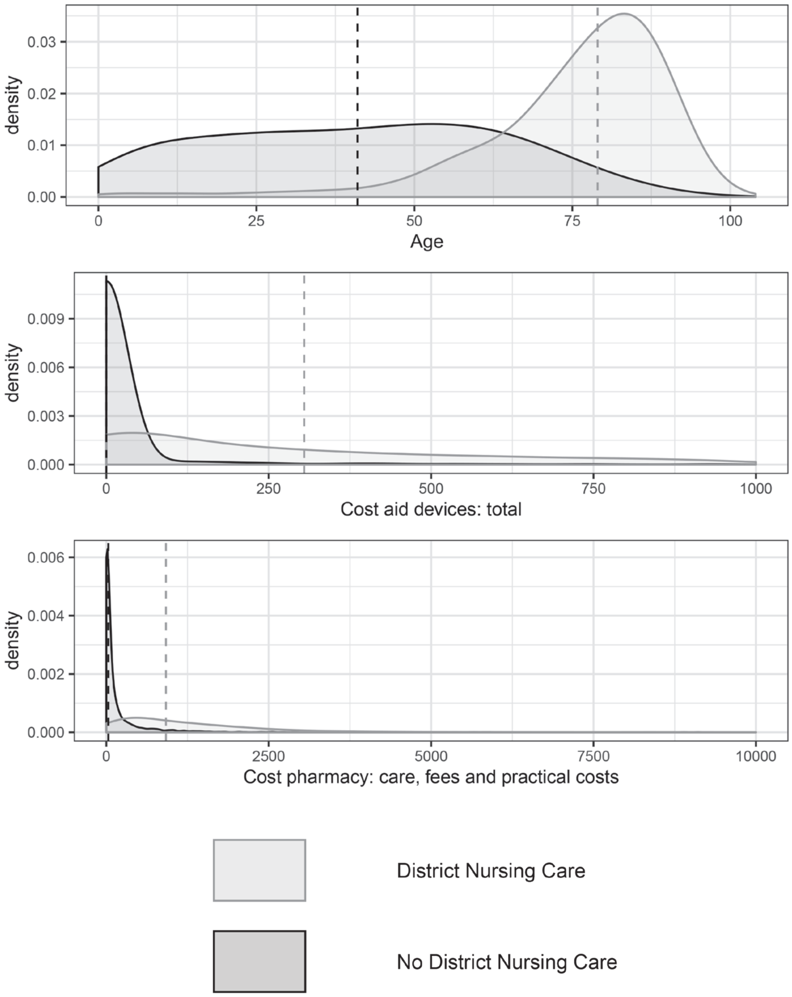


Figure 5. Histogram of important predictors with an importance of 25 or higher for all ages
Notes: These plots do not contain outliers of extremely high costs (horizontal axis) since the outliers made the plots not readable. These plots with outliers on the horizontal axis can be found in (online) supplemental appendix 5, figure 2.

Table 2. Bayesian logistic regression models for those aged 75+ years and all ages

	OR	Credibility interval	Accuracy of the model
Model 1: 75 years and older			**0.744**
Intercept	0.00005	0.00002–0.00010	
Cost GP: consultations	1.00455	1.00403–1.00507	
Cost aid devices: total	1.00038	1.00032–1.00046	
Age	1.11116	1.10120–1.12099	
Cost pharmacy: care, fees and practical costs	1.00035	1.00029–1.00040	
Cost transport: ambulance	1.00092	1.00078–1.00106	
Cost GP: OOH	1.00268	1.00211–1.00327	
Cost occupational therapy	1.00340	1.00254–1.00432	
Model 2: all ages			**0.873**
Intercept	0.00325	0.00255–0.00411	
Age	1.08240	1.07869–1.08620	
Cost aid devices: total	1.00154	1.00137–1.00171	
Cost pharmacy: care, fees and practical costs	1.00069	1.00062–1.00078	

Notes: The ORs of all healthcare utilisation costs are per euro, which explains the low ORs.

Discussion

This paper identified important predictors of DNC utilisation using claims data. For the population of older people (75+ years), seven predictors were the most important, being higher total costs of GP consultations during office hours, higher total costs of aid devices, older age, higher total costs for pharmaceutical care, higher total costs of GP consultations after office hours, higher total costs for transport by ambulance and higher total cost of occupational therapy. For the total population, older age, higher total costs for pharmaceutical care and higher total costs for aid devices were the three most important predictors. The logistic regression models with these variables have an accuracy of 0.87 for those aged 75+ years and 0.74 for all ages. Differences were found in the order of the predictor importance for the total population compared with those aged 75+ years. In the total population, age was the most important factor. When looking at 75+ years, age became less important, while the cost of GP consultations and the cost of using aid devices became more important.

Allocating the identified predictors in the behavioural model of healthcare service utilisation by Andersen (18), age was an important predisposing factor. None of the predictors with an importance of 25 or higher were enabling factors. Identified need factors were the costs for GP consultations during and after office hours, aid devices, pharmaceutical care, transport by ambulance and occupational therapy. These need factors can be seen as indicators for the level of disability and illness (i.e., more or severe disabilities or illnesses could lead to higher use and more costs, e.g., aid devices or pharmaceutical care). However, it is unfortunate that no data could be included regarding functioning and functional impairment, which are important predictors according to the literature (17,19). The literature overview by van Noort et al. (17) identified age, functional impairment, gender and income as important predictors of DNC severity. In our study, age was in both groups one of the most important predictors of DNC utilisation. The costs of using aid devices, pharmaceutical care, GP consultations and occupational therapy can be seen as an indicator of functional impairment. In our study, female gender and a low socioeconomic status were predictors only for those aged 75+ years. In this study, socioeconomic status is a measure based on income and educational level. A low socioeconomic status (low income and educational level) is a well-known predictor for frailty among home-dwelling older people (26). However, with an importance of <25, gender and low socioeconomic status were not as important as age and impairment. The systematic review by van den Bulck et al. (19) identified social environmental characteristics, physical functioning and daily functioning as important categories for case-mix predictors. An important social environmental characteristic that was identified in our study was a household size of one person per household (i.e., living alone), which was a predictor in the top 20 of both groups. Also, the costs of using aid devices, pharmaceutical care, GP consultations, and occupational therapy that were identified in this study can be seen as an indicator of physical or daily functioning.

Strengths and limitations

An important strength was using claims data from all insured people in the Netherlands. The results of this study are therefore applicable for the total population in the Netherlands. This dataset includes a large number of potential predictors of those using DNC and the healthy population who are not in need of DNC. Because of the size of the dataset, a powerful analysis was needed. The random forest algorithm is robust to outliers, noise, overfitting and is capable of dealing with large amounts of observations as well as potential predictors (21). Our aim was to get useful information about the relation between DNC utilisation and its predictors, rather than developing a clinical prediction rule. In a random forest analysis, the goal is not interpretability but providing accurate information (27). By calculating the importance of the predictors, the analyses offer a good balance of accuracy and understanding a model.

In the interpretation of the results, some limitations should be considered. First, because of the nature of claims data, it was not possible to include potentially relevant predictors based on the literature regarding health status, such as physical and daily functioning (17,19), since this information was not readily available in the dataset. While the costs of healthcare utilisation other than DNC can be seen as an indicator for limitations in daily functioning, the dataset provides no insight into the details regarding the functional impairment on the patient level. Second, while the analysis provides insight into important predictors, a limitation of the predictor importance analysis is that the plot does not show if the predictors are positively or negatively associated with the outcome. Only the strength of the dependency is reflected (21). This limitation has been minimised by providing descriptive statistics, histograms and the results of the Bayesian logistic regression.

Implications and further research

The results of this study showed that people in need of DNC have higher median healthcare costs regarding GP consultations, pharmaceutical care and aid devices compared with those not using DNC. People using DNC visit the GP more often and use more and/or expensive medications and aid devices. With a GP as a gatekeeper prescribing medication and sometimes the use of aid devices (28), a community pharmacist providing medication and materials, and a district nursing team providing the care for the patient, close collaboration between these professions is vital. A recent literature review showed that for the best individual, continuous care, an interprofessional non-hierarchical team should realise home visits, as these are central to patient-centeredness and clinical responsibility (29). Coordinated care by interdisciplinary teams is associated with better outcomes regarding emergency department visits, hospitalisations and long-term care admissions in homebound older adults (30). However, existing studies regarding this topic are mainly observational and further research based on well-controlled studies is needed (29). Additionally, it is needed to develop a strong evidence base for DNC in the near future, focusing on evidence-based guidelines and DNC service delivery, including the role of interprofessional care team members (31). These potential new insights could guide practice’s and policymakers’ decision-making regarding the use and demands for DNC.

Conclusion

This is the first study that identified predictors of DNC utilisation using claims data. Older people (75+ years) in need of DNC are older and have higher total healthcare costs regarding GP consultations during and after office hours, pharmaceutical care, aid devices, transportation with the ambulance and occupational care. For the total population with all ages, the most important predictors are older age, higher total costs for pharmaceutical care and higher total costs for using aid devices. Because no data regarding health status and diagnosis could be included due to the nature of the datasets available, additional analyses are recommended. Additionally, further research is needed to provide an evidence base for DNC to optimise the care for those with high care needs, and guide practice and policymakers' decision-making.

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Data availability statement: Data may be obtained from a third party and are not publicly available. The de-identified participant data used in this study is provided by healthcare insurers for the Dutch Healthcare Authority. This data is not openly available.
Patient consent for publication: Not required.
Ethics approval: This study does not need informed consent from the patients because the datasets were provided by the Dutch Healthcare Authority, which pseudonymised and de-identified patients' information before analyses. This was checked by the ethical review board, and a waiver of consent was granted.

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Supplemental materials

Appendix 1: overview of the variable selection, merging of datasets, and the operationalization per variable

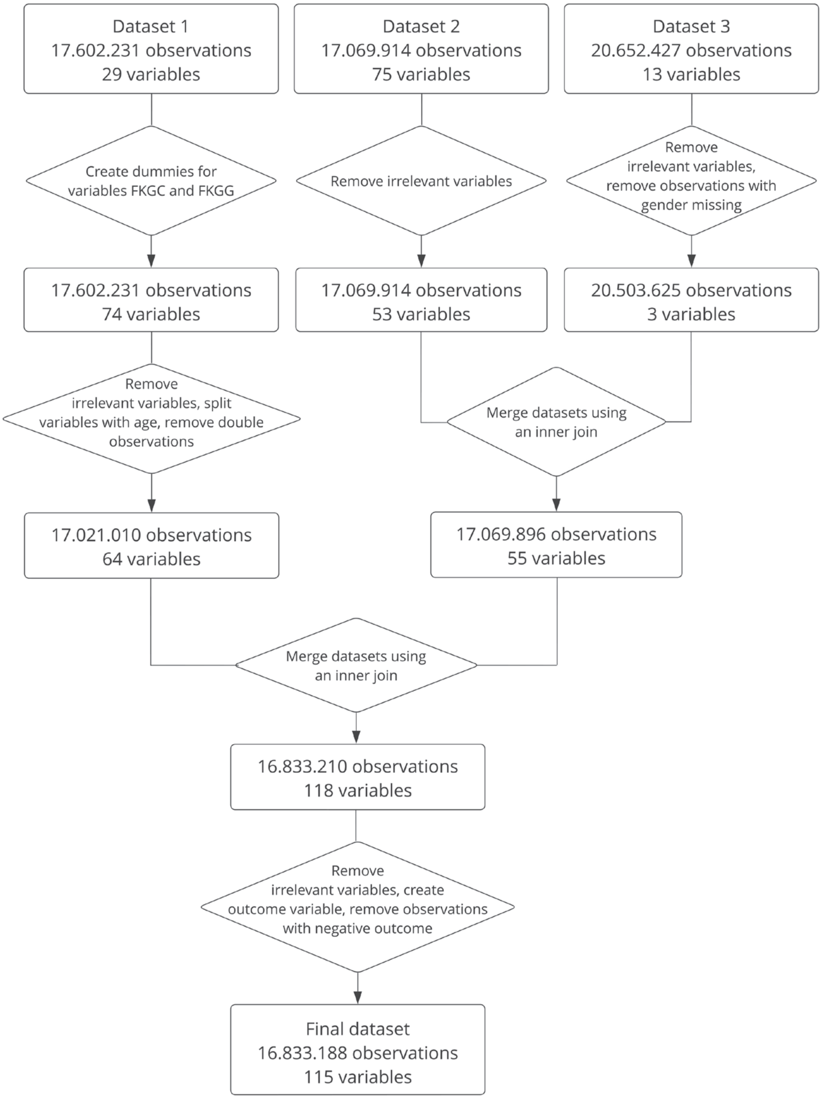


Figure 1. Flowchart of variable selection and merging of the datasets
Notes: Dataset 1= the Dutch risk adjustment system dataset by the Dutch Healthcare Authority (NZa); Dataset 2= claims data of the Dutch national information system of health insurers (Vektis); Dataset 3= characteristics dataset by Vektis; FKGC: pharmaceutical groups in curative care; FKGG: pharmaceutical groups in mental healthcare.

Table 1. Overview of the outcome variable, the potential predictors and their operationalization

Variables in final dataset	Operationalization	Dataset*
Outcome variable		
DNC	0 = no 1 = yes	Claims dataset
Predisposing factors		
Gender	1 = male 2 = female	Characteristics dataset
Age	Age in years	Characteristic dataset
Enabling factors		
Socioeconomic status	Comprises a combination of education and income, according to calculations by the Institute for Social Research (SCP). 0 = more than 15 persons per household 1 = very low SES (0-19% of population) 2 = low SES (20-39% of population) 3 = middle SES (40-69% of population) 4 = high SES (70-100% of population)	Risk adjustment dataset
Persons per household	1 = aged under 18 2 = more than 15 residents (permanent) 3 = more than 15 residents (moving in) 4 = one-person households 0 = other households 9999=missing	Risk adjustment dataset
Source of income	1 = insured persons aged under 18 2 = aged over 65 3 = fully incapacitated for work 4 = other disabled people 5 = persons entitled to social assistance 6 = students (aged 18-34) 7 = self-employed 8 = highly educated (aged 18-34) 9 = other	Risk adjustment dataset
Insurer	Insurer, not further specified	Risk adjustment dataset
Zip code	Zip code, not further specified	Risk adjustment dataset

Table 1. *(continued)*

Variables in final dataset	Operationalization	Dataset*
Need factors		
Aid devices		
Cost aid devices groups	0 = no costs 1 = CPAP equipment 2 = compression stockings 3 = materials for stoma patients 4 = nebulizer with accessories 5 = materials for urine collection 6 = Syringes with accessories (excluding diabetes) 7 = oxygen delivery devices and accessories 8 = Nutritional aids and materials (excluding infants) 9 = Phlegm suction equipment 10 = Portable infusion pumps	Risk adjustment dataset
Cost aid devices total	Total costs in euros	Claims data
Pharmaceutical care		
Costs pharmacy: no costs	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: glaucoma	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: thyroid disorders	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: psychosis, Alzheimer’s disease and addiction	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: depression	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Chronic pain excluding opioids	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Neuropathic pain complex	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: High cholesterol	0 = no 1 = yes	Risk adjustment dataset

Table 1. *(continued)*

Variables in final dataset	**Operationalization**	**Dataset***
Costs pharmacy: Type II diabetes without hypertension	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: COPD / Severe asthma	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: asthma	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Type II diabetes with hypertension	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: epilepsy	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Crohn's disease / Ulcerative colitis	0 = no 1 = yes	Risk adjustment dataset
Cost pharmacy: cardiac disorders	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: autoimmune diseases	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Rheumatism	0 = no 1 = yes	Risk adjustment dataset
Cost pharmacy: Parkinson's	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Type I diabetes	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Transplants	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Cystic fibrosis / pancreatic enzymes	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Brain / Spinal Cord Disorders: Multiple Sclerosis	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Brain / spinal cord disorders: other	0 = no 1 = yes	Risk adjustment dataset

Table 1. *(continued)*

Variables in final dataset	Operationalization	Dataset*
Costs pharmacy: Cancer	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Hormone sensitive tumors	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: HIV / AIDS	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Kidney disorders	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Psoriasis	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Pulmonary arterial hypertension	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Cancer based on add-on	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Growth disorders based on add-on	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Extremely high cost cluster 1	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Extremely high cost cluster 2	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Extremely high cost cluster 3	0 = no 1 = yes	Risk adjustment dataset
Costs pharmacy: Other	0 = no 1 = yes	Risk adjustment dataset
Cost pharmacy MHC: no costs	0 = no 1 = yes	Risk adjustment dataset
Cost pharmacy MHC: psychosis	0 = no 1 = yes	Risk adjustment dataset
Cost pharmacy MHC: psychosis depot	0 = no 1 = yes	Risk adjustment dataset

Table 1. *(continued)*

Variables in final dataset	Operationalization	Dataset*
Cost pharmacy MHC: chronic mood disorder	0 = no 1 = yes	Risk adjustment dataset
Cost pharmacy MHC: addiction	0 = no 1 = yes	Risk adjustment dataset
Cost pharmacy MHC: Bipolar regular	0 = no 1 = yes	Risk adjustment dataset
Cost pharmacy MHC: Bipolar complex	0 = no 1 = yes	Risk adjustment dataset
Cost pharmacy MHC: ADHD	0 = no 1 = yes	Risk adjustment dataset
Cost pharmacy MHC: other	0 = no 1 = yes	Risk adjustment dataset
Cost pharmacy MHC: empty	0 = no 1 = yes	Risk adjustment dataset
Cost pharmacy: care, fees and practical costs	Total costs in euros	Claims dataset
Cost pharmacy: separation care and trade	Total costs in euros	Claims dataset
General practitioner care		
Cost general practitioner: practice nurse	Total costs in euros	Claims dataset
Cost general practitioner: arrears fund	Total costs in euros	Claims dataset
Cost general practitioner: modernization and innovation	Total costs in euros	Claims dataset
Cost general practitioner: other	Total costs in euros	Claims dataset
Cost general practitioner: consultations during out-of-office hours (evening, nights and weekends)	Total costs in euros	Claims dataset

Table 1. *(continued)*

Variables in final dataset	Operationalization	Dataset*
Cost general practitioner: registration	Total costs in euros	Claims dataset
Cost general practitioner: consultations	Total costs in euros	Claims dataset
Cost general practitioner: practice nurse MHC	Total costs in euros	Claims dataset
Cost general practitioner: other rates	Total costs in euros	Claims dataset
Cost general practitioner: multidisciplinary integrated care	Total costs in euros	Claims dataset
Cost general practitioner: care innovation general practitioner	Total costs in euros	Claims dataset
Cost general practitioner: care innovation multidisciplinary integrated care	Total costs in euros	Claims dataset
Mental health care		
Cost MHC: primary care	Total costs in euros	Claims dataset
Cost MHC: DBC residence	Total costs in euros	Claims dataset
Cost MHC: DBC institution	Total costs in euros	Claims dataset
Cost MHC: DBC self-employed	Total costs in euros	Claims dataset
Cost MHC: personal budget	Total costs in euros	Claims dataset
Cost MHC: other	Total costs in euros	Claims dataset
Cost MHC: generalistic basic	Total costs in euros	Claims dataset

Table 1. *(continued)*

Variables in final dataset	Operationalization	Dataset*
Cost MHC: long-term care	Total costs in euros	Claims dataset
Demand for care package MHC	0 = no 1 = yes	Risk adjustment dataset
Paramedic care		
Cost physiotherapy	Total costs in euros	Claims dataset
Cost exercise therapy	Total costs in euros	Claims dataset
Cost speech therapy	Total costs in euros	Claims dataset
Cost occupational therapy	Total costs in euros	Claims dataset
Cost dietetics	Total costs in euros	Claims dataset
Cost geriatric revalidation: total	Total costs in euros	Claims dataset
Oral care		
Cost oral care: adults	Total costs in euros	Claims dataset
Cost oral care: children	Total costs in euros	Claims dataset
Cost oral care: dental prostheses	Total costs in euros	Claims dataset
Cost oral care: special payments	Total costs in euros	Claims dataset
Transport and care abroad		
Cost transport: ambulance	Total costs in euros	Claims dataset
Cost transport: private	Total costs in euros	Claims dataset
Cost care abroad: hospital	Total costs in euros	Claims dataset
Cost care abroad: other	Total costs in euros	Claims dataset
Cost care abroad: MHC	Total costs in euros	Claims dataset
Cost care abroad: care institute	Total costs in euros	Claims dataset
Other		
Cost other: hospital	Total costs in euros	Claims dataset
Cost other: other non-specified	Total costs in euros	Claims dataset

Table 1. *(continued)*

Variables in final dataset	Operationalization	Dataset*
Cost other: primary care in hospital	Total costs in euros	Claims dataset
Cost other: primary care in other institution	Total costs in euros	Claims dataset
Cost other: integrated primary care	Total costs in euros	Claims dataset
Cost other: MHC institution	Total costs in euros	Claims dataset
Cost other: non-specialized care	Total costs in euros	Claims dataset
Cost other: medical care	Total costs in euros	Claims dataset
Cost other: sensory impaired	Total costs in euros	Claims dataset
Cost maternity care: total	Total costs in euros	Claims dataset
Cost midwifery: midwife	Total costs in euros	Claims dataset
Cost midwifery: general practitioner	Total costs in euros	Claims dataset
Cost-based groups		
General somatic morbidity	General somatic morbidity, operationalized as having at least one type of costs for somatic pharmacy, diagnosis groups, physiotherapy groups or aid devices. 0=no morbidity 1=morbidity	Risk adjustment dataset
Multi-year high cost group somatic	0 = not in category 1-7 1 = 2 previous years high costs in the top 10 percent 2 = 3 years of high costs in the top 15 percent 3 = 3 years of high costs in the top 10 percent 4 = 3 years of high costs in the top 7 percent 5 = 3 years of high costs in the top 4 percent 6 = 3 years of high costs in the top 1.5 percent 7 = 3 years of high costs in the top 0.5 percent	Risk adjustment dataset

Table 1. *(continued)*

Variables in final dataset	**Operationalization**	**Dataset***
Multi-year high cost group MHC	0 = not in category 1-7 1 = at least once made MHC costs in last 3 years 2 = at least twice MHC costs in last 5 year: top 10 percent 3 = at least twice MHC costs in last 5 year: top 5 percent 4 = at least twice MHC costs in last 5 year: top 2,5 percent 5 = at least twice MHC costs in last 5 year: top 1 percent 6 = five times in last 5 years: top 5 percent 7 = five times in last 5 years: top 2,5 percent	Risk adjustment dataset
Region somatic	Unspecified; these regions are based on somatic costs.	Risk adjustment dataset
Region MHC	Unspecified; ; these regions are based on MHC costs.	Risk adjustment dataset
Diagnosis-based cost groups somatic	Unspecified; these groups are based on somatic diagnosis-related costs.	Risk adjustment dataset
Diagnosis-based cost groups MHC	Unspecified; these groups are based on MHC diagnosis-related costs.	Risk adjustment dataset
Physiotherapy-based cost groups	Unspecified; these groups are based on physiotherapy-related costs.	Risk adjustment dataset
Geriatric rehabilitation user groups	Unspecified; these groups are based on geriatric rehabilitation-related costs.	Risk adjustment dataset

Notes: Risk adjustment dataset: the Dutch risk adjustment system dataset by the Dutch Healthcare Authority (NZa); Claims dataset: claims data of the Dutch national information system of health insurers (Vektis); Characteristics dataset: characteristics dataset by Vektis;

Appendix 2: Reporting of studies Conducted using Observational Routinely-collected data (RECORD) statement

Table 1. The RECORD statement – checklist of items, extended from the STROBE statement

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found		RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	p. 1-2 p. 1-2 p. 2
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported			p. 4-6
Objectives	3	State specific objectives, including any prespecified hypotheses			p. 5, ¶4
Methods					
Study Design	4	Present key elements of study design early in the paper			p. 6, ¶2

Table 1. *(continued)*

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection			p. 6-7
Participants	6	(a) Cohort study - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up Case-control study - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls Cross-sectional study - Give the eligibility criteria, and the sources and methods of selection of participants (b) Cohort study - For matched studies, give matching criteria and number of exposed and unexposed Case-control study - For matched studies, give matching criteria and the number of controls per case		RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	p. 7. ¶2 NA SI Appendix 1

Table 1. *(continued)*

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.		RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	p. 8, ¶3, SI.Appendix 1
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group			p. 8, ¶3, SI.Appendix 1
Bias	9	Describe any efforts to address potential sources of bias			NA
Study size	10	Explain how the study size was arrived at			p. 7-8 SI.Appendix 3
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why			p. 9, ¶1-2, SI.Appendix 3

Table 1. *(continued)*

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) Cohort study - If applicable, explain how loss to follow-up was addressed Case-control study - If applicable, explain how matching of cases and controls was addressed Cross-sectional study - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses			p.9-10 NA p.6 NA p. 7-8 NA
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	p. 6-7 p. 6-7

Table 1. *(continued)*

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	p. 6-7
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram		RECORD 13.1: Describe in detail the selection of the persons included in the study (i.e., study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	pp. 11 ¶1
Descriptive data	14	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) Cohort study - summarise follow-up time (e.g., average and total amount)			p.11 p.6

Table 1. *(continued)*

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Outcome data	15	Cohort study - Report numbers of outcome events or summary measures over time Case-control study - Report numbers in each exposure category, or summary measures of exposure Cross-sectional study - Report numbers of outcome events or summary measures			NA
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period			p.10-16
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses			NA

Table 1. *(continued)*

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Discussion					
Key results	18	Summarise key results with reference to study objectives			p.16-17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias		RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	p.18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence			p.16-17, 20
Generalisability	21	Discuss the generalisability (external validity) of the study results			p.19

Table 1. *(continued)*

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based			p.21, ¶4
Accessibility of protocol, raw data, and programming code				RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	NA

Appendix 3: accuracy of models with different sample sizes

Samples of different sizes (250, 500, 1,000, 2,500, 5,000, 10,000) were drawn. A prediction model was made using the Random Forest Algorithm by Breiman (21) and the implementation by Wright and Ziegler (22). Subsequently, the accuracy of the models were calculated for all samples. K-fold cross-validation has been performed, using 10 folds and 5 repeats. Figure 1 shows the accuracy of all models for all samples. A sample of 5,000 and 10,000 showed the best accuracy with small confidence intervals and minor differences between both models. Due to the long runtime of a sample of 10,000 observations, a sample of 5,000 was preferred. A sample of 1,0% of the total population of district nursing care users came closest to the favorable sample. With 544,304 people receiving DNC in our final dataset, the sample was rounded up to 5,500 (1.01%).

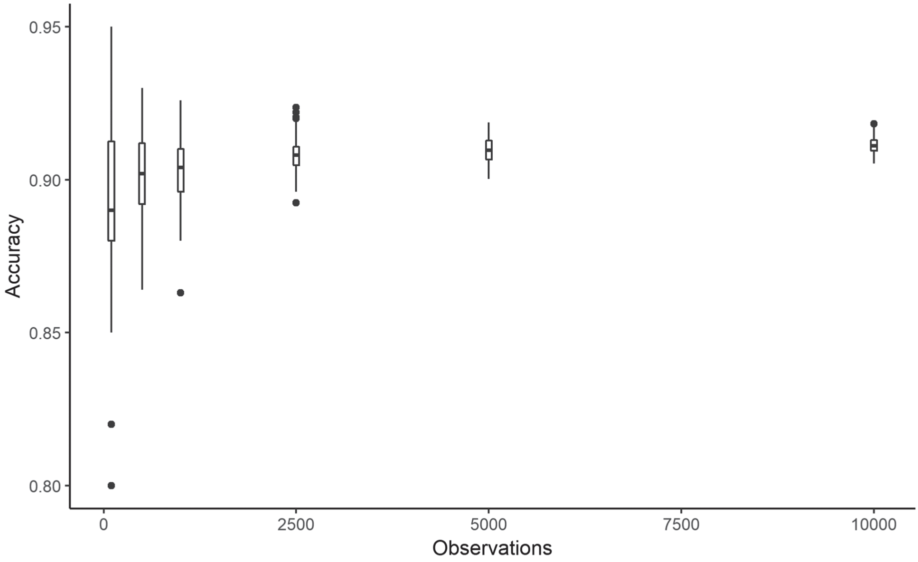


Figure 1. Accuracy of multiple models for different sample sizes

Appendix 4: accuracy for different model sizes

In an initial analysis was calculated with how many predictors the accuracy of the model would be the highest, comparing models with 1, 20, 40, 60, 80, and 100 predictors. Models were built using recursive feature elimination with a 10-fold cross-validation with 5 repeats. Table 1 provides an overview of the median accuracy of the 50 models for all difference sizes. The models with 40 predictors for both groups (75+ and all ages) have the highest median accuracy compared to the models with 1, 20, 60, 80, of 100 predictors. The median accuracies for the models are 0.79 and 0.91 for those aged older than 75 years and all ages respectively.

Table 1. Median accuracy of the 50 models, calculated per size of the model (1, 20, 40, 60, 80, 100 predictors)

	75+	**All ages**
1 predictor	0.686	0.815
20 predictors	0.783	0.910
40 predictors	0.786	0.911
60 predictors	0.784	0.910
80 predictors	0.785	0.910
100 predictors	0.784	0.910

Appendix 5: histogram plots with outliers

Figure 1. Histogram with outliers of important predictors with an importance of >25 for those aged 75+

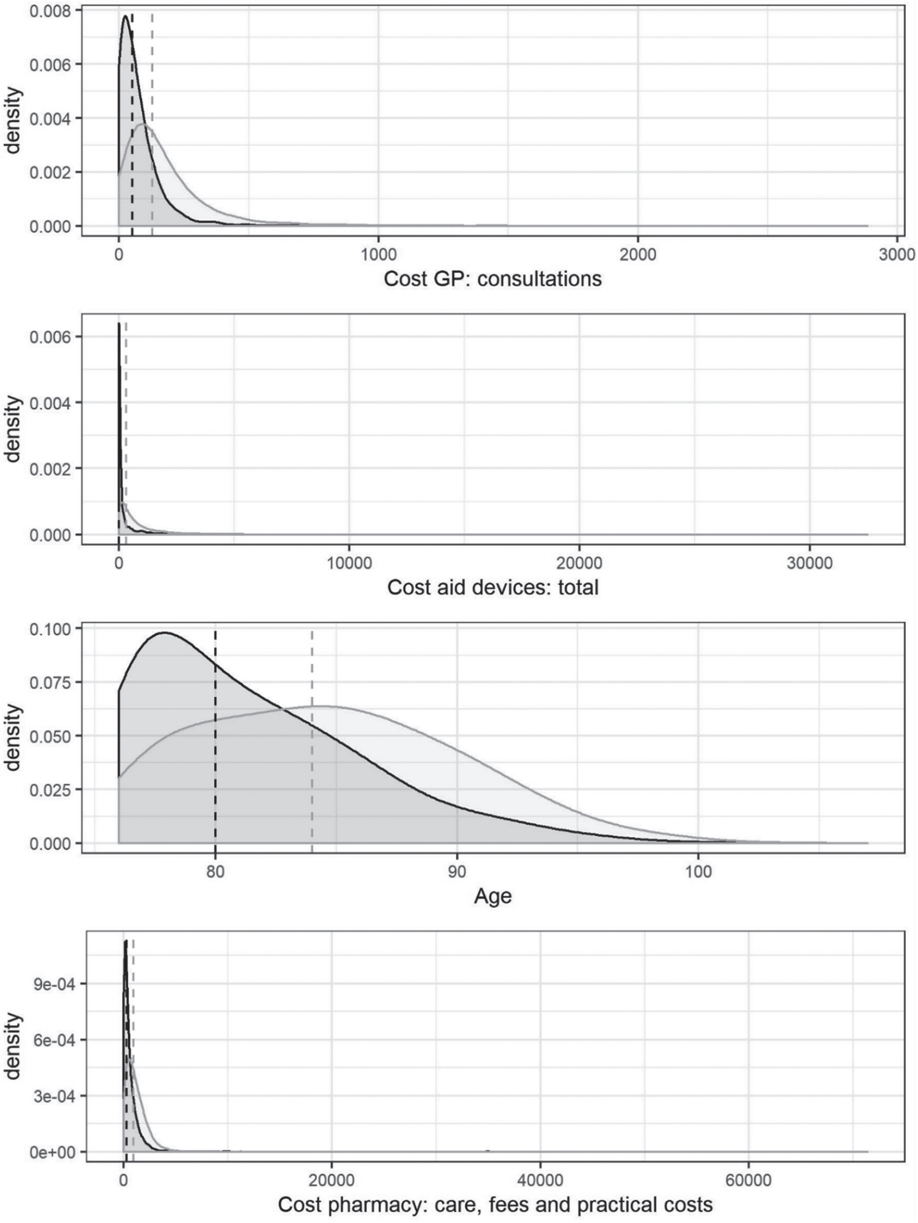
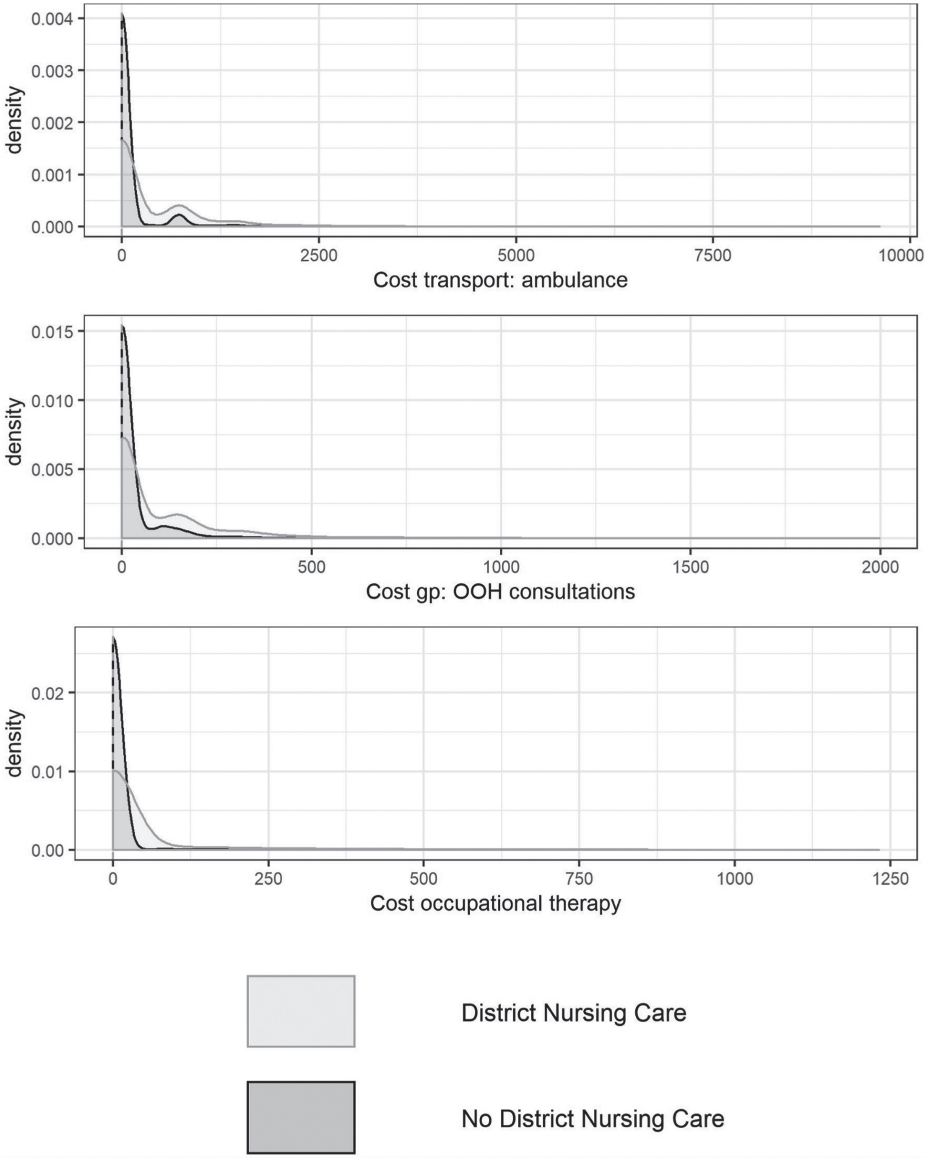


Figure 1. Histogram with outliers of important predictors with an importance of >25 for those aged 75+ *(continued)*



Notes: These plots were zoomed in on the vertical axis to make the plot readable.

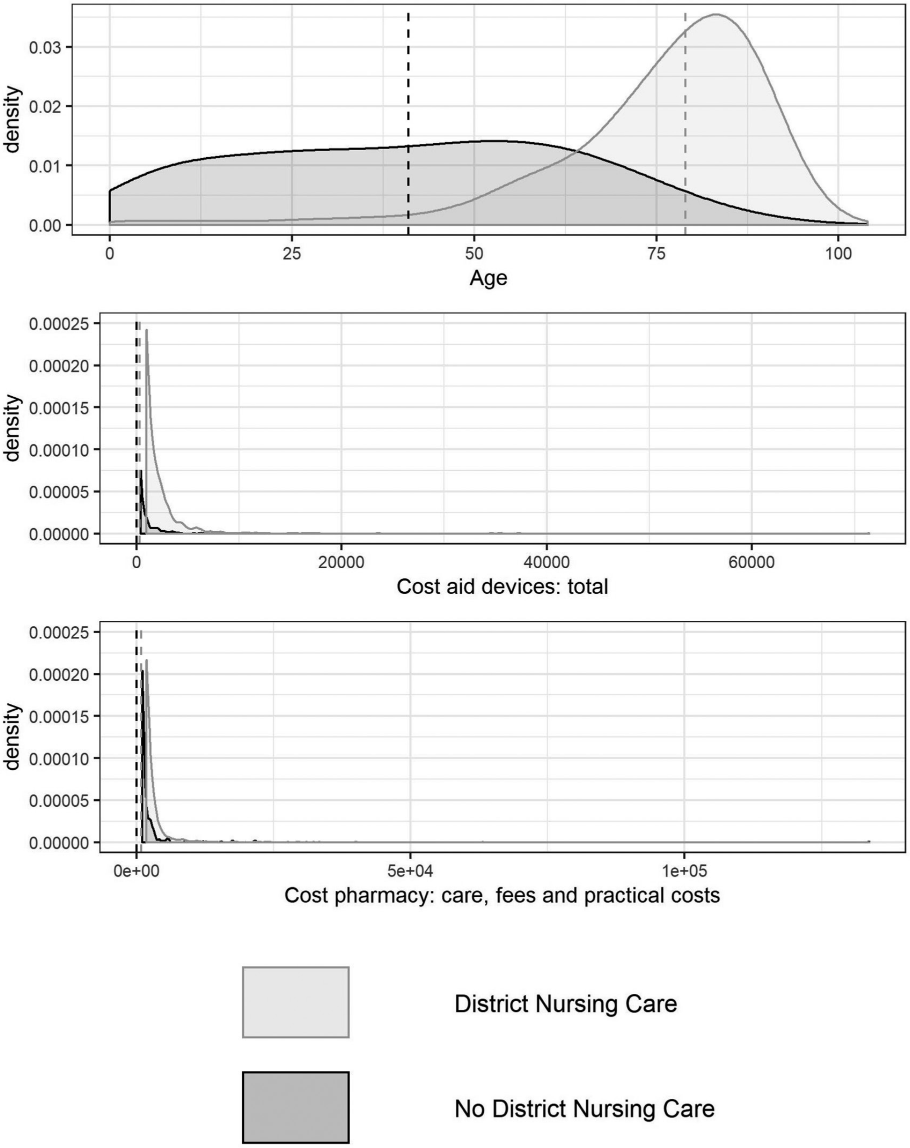


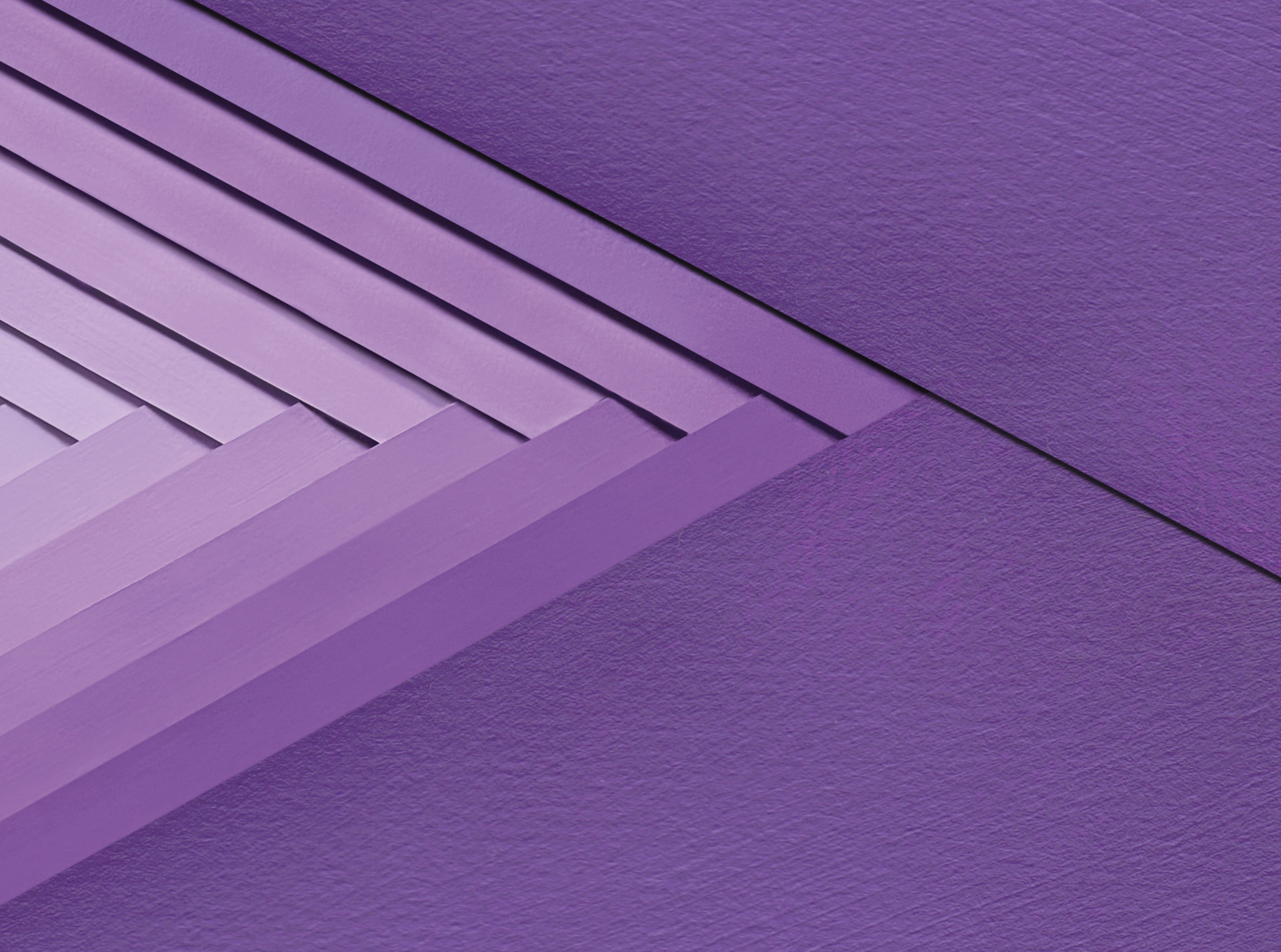
Figure 2: Histogram with outliers of important predictors with an importance of 25 or higher for all ages
Notes: These plots were zoomed in on the vertical axis to make the plot readable.

3

The impact of COVID-19 from the perspectives of Dutch district nurses: A mixed-methods study

Veldhuizen JD, Zwakhalen S, Buurman BM, Bleijenberg N.

International journal of environmental research and public health.
2021 Dec 16;18(24):13266.



Abstract

Little is known about how COVID-19 affects older patients living at home or how it affects district nursing teams providing care to these patients. This study aims to (1) explore, from the perspectives of Dutch district nurses, COVID-19′s impact on patients receiving district nursing care, district nursing teams, and their organisations during the first outbreak in March 2020 as well as one year later; and (2) identify the needs of district nurses regarding future outbreaks. A mixed-methods, two-phase, sequential exploratory design was followed. In total, 36 district nurses were interviewed during the first outbreak (March 2020), of which 18 participated in the follow-up questionnaire in April 2021. Thirteen themes emerged, which showed that the COVID pandemic has substantially impacted patient care and district nursing teams. During the first outbreak, nurses played a crucial role in organising care differently and worked under high pressure, leading to exhaustion, tiredness, and psychosocial problems, including fear of infection. A year later, nurses were better prepared to provide COVID care, but problems regarding work pressure and mental complaints remained. The identified needs focus on a sustainable implementation of leadership roles for district nurses. At the organisational and national levels, more support and appreciation are needed in terms of trust and appropriate policies.

Introduction

COVID-19 has had a significant impact on healthcare systems worldwide (1). In the short span of a few months, the number of deaths rose rapidly, and on 11 March 2020, the World Health Organization (WHO) declared COVID-19 to be a pandemic (2). Globally, much attention has been given to the infection rates of COVID-19 patients in in-tensive care units (ICUs), hospitals in general, and long-term care facilities (3,4). However, relatively little attention has been paid to how COVID-19 affects older patients living at home and to the homecare professionals who care for these patients in their own home (3).

Professional care assistance at home is provided through district nursing care and other healthcare professionals, such as general practitioners and (paramedic) professionals in primary care (5,6). The organisation, delivery, and funding of district nursing care varies around the world (7–9). In general, district nursing teams provide rehabilitative, preventive, or supportive care that covers all technical, psychosocial, and per-sonal care to enhance peoples' health and quality of life (8,10). They visit many patients per day and provide nursing services and personal care services, such as assisting them with their medication intake, activities of daily living (ADLs), providing wound care, and supporting patients in the terminal phase of their lives (8,10).

During the COVID pandemic, district nursing teams worked on the front lines, visiting (frail) older people at home. This required considerable flexibility, creativity, and pragmatism in their work (3,4). The teams played an essential role in detecting and preventing COVID-19 among high-risk patients and supporting those with confirmed or suspected COVID-19 who remained at home (11,12). Some qualitative studies have described the impact of COVID-19 on home healthcare workers (11) and home health aides in the US (13). Sterling et al. conducted 33 in-depth interviews with homecare workers in New York during the pandemic and found that home healthcare workers felt invisible despite working on the front lines (11). They were scared due to the high risk of virus transmission, were forced to make difficult trade-offs, and received varying amounts of information, supplies, and training (11). Another study by Osakwe revealed that home health aides experienced limited access to information, dilemmas related to enhanced COVID-19 precautions, and felt alone (13).

Despite the existence of studies such as those mentioned above, insights into the impact of COVID-19—specifically on those working in district nursing care—remain limited, especially for the situation in Europe and the Netherlands. It is unclear how COVID-19 has impacted district nursing teams and their organisations. Additionally, while some studies have described the impact of COVID-19 on community-dwelling older adults in general (14,15) or its effect on people with disabilities (16), the impact of COVID-19 on patients receiving district nursing care remains scarce. Therefore, this study focuses on how COVID-19 has affected the patients who are receiving and the nursing teams who are delivering district nursing care from the perspectives of district nurses.

Since the pandemic has changed across different waves, it is vital to understand how COVID-19′s impact among district nursing teams and patients has evolved over time. Little is known about how district nurses perceived the impact during and one year after the first outbreak and whether issues of concern have changed. Therefore, the aim of this study was to 1) explore, from the perspectives of Dutch district nurses, the impact of COVID-19 on patients who are receiving district nursing care, district nursing teams, and their organisations during the first outbreak in March 2020 as well as one year later and 2) to identify the needs of district nurses regarding future outbreaks.

Materials and Methods

Design

A mixed-methods study was performed in the Netherlands using two time frames, the first of which took place between March and May 2020 (first outbreak), and the second of which took place one a year later (April 2021). This mixed-methods study followed a two-phase, sequential exploratory design, in which the results of the first qualitative method (semistructured qualitative interviews) informed the second quantitative method (questionnaire) (QUAL → quan) (17).

Setting and Participant Selection

In the Netherlands, district nursing care is provided by teams of district nurses, vocational nurses, nursing assistants, and nursing aides (i.e., district nursing team). In 2018, 589,000 people received district nursing care (3.4% of the total population in the Netherlands), with a total cost of EUR 3.6 billion (18). District nursing care was provided by 12,400 district nurses (European Quality Framework (EQF) level 5/6), 16,108 vocational nurses (EQF level 4), 41,799 nurse assistants (EQF level 3), and 4759 nurse aides (EQF levels 1 and 2) (19). Other relevant positions within district nursing care in the Netherlands include specialised nurses, who have expertise in a specific topic (e.g., wound care) (EQF level 5/6), case managers for people with dementia (EQF level 5/6), and advanced nurse practitioners (EQF level 7). In general, the district nurse is in charge of care processes and assesses patient care needs and coordinates the patient's care (10,20). Because district nurses have been in charge of patient-related decision-making processes during the COVID-19 pandemic, district nurses were the target population of the current study.

District nurses establish organisational and professional ties with patients, informal caregivers, other healthcare professionals, local policy makers, and health insurers (21,22). To equip and prepare district nurses to establish these connections, the Dutch Nurses' Association developed a nationwide leadership programme for district nurses in the Netherlands (22). This Dutch ambassador programme for district nurses is a 9-month leadership programme that started in 2013. Because district nurses who en-rolled (and are presently enrolled) in this ambassador programme have more estab-lished organisational and professional links, only these nurses were invited to participate in the study. Up until March 2020, seven groups, comprising a total of 105 nurses, had finished this programme. The 105 nurses were contacted for the interviews via email. A convenience sample was used to select participants from this group. After receiving permission to participate, the interviewer contacted each nurse to provide more information about the study and to schedule an interview by phone.

For the follow-up questionnaire, the sample consisted of nurses who had participated in the previous interviews. No other nurses were invited to take part because the questionnaire also included a member check in which the participants reviewed the results of the first interviews. During this member check, the nurses checked if they agreed with the summary of the qualitative part of the study. Because the member check could only be conducted with previously participating nurses, only those who had participated in the interviews were contacted for the follow-up questionnaire. An additional reason for only contacting these nurses was to reduce the burden on all of the district nurses in the Netherlands. Finally, this mixed-methods study followed a QUAL → quan approach, and the emphasis of the current study lies on the qualitative part.

Data Collection

Individual Interviews

The first detected COVID-19 patient in the Netherlands was reported on 27 February 2020, thus marking the start of the COVID-19 outbreak in the Netherlands. This outbreak continued until the end of May 2020, with a peak of 620 patients being admitted to the hospital per day on 27 March (23). During this time, 16 interviewers with a background in nursing research and district nursing care held interviews in April and May 2020. Furthermore, NB, SMGZ, and BMB developed a semi-structured guide based on insights and experiences from district nursing practice (Appendix A). District nurses shared their experiences with the Dutch Nurses' Association (V&VN) and the National Scientific Collaboration for District Nursing Care (in Dutch: Wetenschappelijke Tafel Wijkverpleging) during the COVID pandemic. This input was used to create the interview guide, which consisted of a protocol for the interviewer on how to conduct the interview, followed by questions regarding participant characteristics, the impact of COVID-19 on the nurse and nursing team, the impact on the patient, the effect on the organisation, current needs in district nursing care, and anticipated future challenges. All of the interviews were held by phone to reduce any burden on the nurse and to prevent the spread of COVID-19. The intended duration was 30 min. The interviews were recorded after receiving verbal permission from the nurse.

Follow-Up Questionnaire

In April 2021, a year after the first outbreak, a link to an online questionnaire was sent by email to the nurses who participated in the interviews a year before. Due to high care demands during the intensive year for district nurses, a questionnaire was chosen instead of a follow-up interview. An online questionnaire was developed based on the results of the thematic analysis of the interviews. The results were presented in multiple themes. Per theme, three questions were asked: (1) “Do you recognise this description of the impact during the first COVID-19 outbreak in 2020?” (yes; no). If participants marked “no”, then they were asked to explain why they did not recognise the description. This question was asked as a member check of the themes that were analysed. To identify the impact of COVID-19 one year later, two additional questions were asked: (2) “How is the current situation in 2021′?”(improved; unchanged, deteriorated; improved and deteriorated) and (3) “Can you describe or explain the current situation?” (Appendix B). The first two questions were closed questions, whereas the third one was open. The questionnaire was distributed online using Qualtrics, an online survey platform (24). The nurses were able to fill out the questionnaire between 1 and 30 April, 2021. Two reminders were sent during this period to increase the response rate.

Data Analysis

Interviews

Directly after the interview was held, the interviewer summarised the interview using the themes that were outlined in the interview guide. To check the validity, a nursing student (EQF level 6) compared the summaries to the recordings. No changes were made to the summaries. The summaries were then examined using a thematic analysis approach (Braun and Clarke, 2006), for which a nursing student (EQF level 6) and a researcher (JDV) independently coded and grouped them into categories and overarching themes. Differences were resolved by discussion until agreement was reached.

Follow-Up Questionnaire

The first closed question regarding the member check was scrutinised using descriptive statistics (absolute numbers and percentages, means and standard deviations). Excel (version 2108, Microsoft Corporation, Washington, U.S.) company, city, country) was employed to calculate all of the descriptive statistics. In the open field of this question, the nurses had the chance to add or change information to describe the impact of the pandemic in. The open question where the nurses explained their perspectives was summarised, and minor changes were made to the results of the interviews (e.g., the results were more nuanced by adding words such as “often” or “sometimes”). The second closed question regarding the current situation was examined using descriptive statistics. The third open question was analysed using thematic analysis in the same way as stated above.

Ethical Considerations

Participation was completely voluntary. Because the nurses were not subjected to any actions, no ethical approval was needed under the Dutch law on medical research (WMO). However, all of the participants agreed to take part and provided consent, and permission to record the interview was obtained and recorded at the start of the interview. Additionally, the nurses gave their consent to participate in the follow-up questionnaire by ticking a corresponding box at the beginning of the questionnaire. The data were stored and examined based on the Dutch Personal Data Protection Act (AVG). Any personal details were removed from the questionnaire data to assure the anonymity of the data.

Results

Between April and May 2020, 105 district nurses were contacted to participate, of which 36 responded and were interviewed (34.3%). These nurses worked in 11 of the country’s 12 geographic areas (provinces); the mean years of work experience in district nursing care was 9.5 years (Table 1). In total, 34 nurses were contacted in April 2021 for the follow-up questionnaire. At the end of April 2021, 18 out of 34 district nurses had finished the questionnaire (53%). The mean duration of the interviews was 32 min.

Following the interviews, 13 themes were identified that described the impact of COVID-19 during the first outbreak in 2020 from the perspectives of the district nurses. The themes described 1. the downscaling and upscaling of district nursing care; 2. the changed daily care routine; 3. the impact on informal caregivers; 4. working with personal protective equipment (PPE); 5. increased work pressure; 6. fear of infection; 7. psychosocial effects and mental support; 8. leadership and the nurse’s role within the organization; 9. support from the organization; 10. uncertainty and worries about the future; 11. role and collaboration within district nursing care; 12. necessary changes for the future at the organizational and national levels; and 13. preparing for the future. These 13 themes were divided into three main themes: 1. impact on daily care for patients; 2. impact on district nursing teams; and 3. worries about and needs for the future.

Table 1. Demographic characteristics of interview and follow-up questionnaire participants.

	Interviews (2020) N = 36	**Follow-Up Questionnaire (2021) N = 18**
Age; mean (sd)	43.0 (12)	42.5 (10.3)
Sex: female; n (%)	33 (91.7)	18 (100)
Function; n (%)		
District nurse	19	14
Case manager for people with dementia	4	3
Advanced nurse practitioner (in training)	1	1
Other (e.g., specialised wound care nurse, short-term care stay nurse)	2	0
Years of experience in district nursing care; mean (SD)	9.5 (5.2)	14 (7.0)

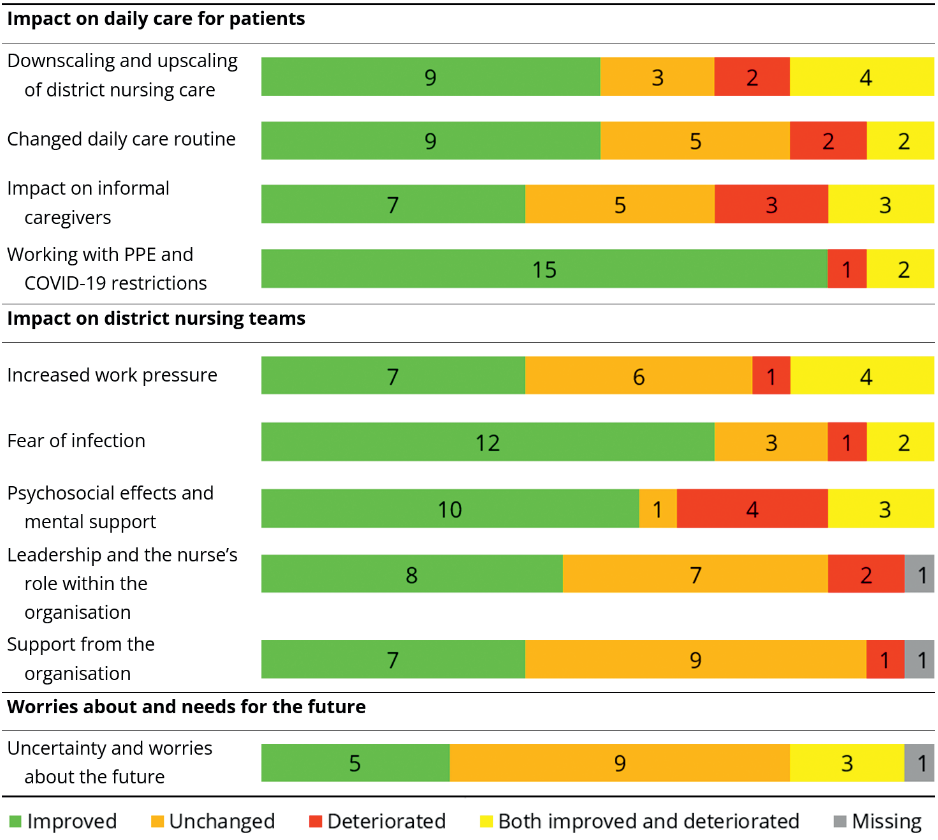
A year after this first outbreak, the nurses were asked to reflect on the identified impact and whether the situation had improved, remained unchanged, deteriorated, or had both improved and deteriorated (Figure 1).

Impact on Daily Care for Patients

Downscaling and Upscaling of District Nursing Care

In 2020, nursing care for community-dwelling patients was often downscaled to a minimum (i.e., less care was provided to the patients) for three main reasons: 1. patients rejected care for fear of COVID-19 infection; 2. patients did not need care because of delayed operations; or 3. care could not be delivered due to the insufficient availability of nurses. Sometimes, more district nursing care was needed because nursing homes, outpatient clinics, and care organisations for social and day care were closed. Due to the downscaling of district nursing care, some patients learned to use healthcare aid devices and technology.

A year later, most of the nurses found that the down- and upscaling of district nursing care improved (n = 9): Care at home had largely returned to its normal level, regular care by hospitals was continued (e.g., planned knee operations), and day care and nursing homes were opened again for frail older adults and people with dementia. Downscaling care at home was limited as much as possible, but it was sometimes still necessary given insufficient staffing levels and great care demands due to delayed or changed care. Care became more focused on the patient's self-reliance and self-management compared to one year prior. According to the nurses, the (extra) use of healthcare technology should remain.



Notes: PPE: personal protective equipment

Figure 1. An overview of the changes in the impact of COVID-19 on district nursing care in 2021 a year after the first COVID-19 outbreak (2020) (N = 18).

Changed Daily Care Routine

During the first outbreak, care at home changed. District nurses experienced often that patients needed more psychosocial care or required (after) care due to COVID-19 infection. Potentially, there were fewer new patients in the picture because no physical home visits were allowed, and (video) calling was not always possible.

During the second outbreak, most nurses found that the changed daily care routine had improved (n = 9), while others found that it had remained unchanged (n = 5) or had deteriorated (n = 2). Indirect consequences such as loneliness and psychosocial problems among patients remained, but there was better support, and more attention was given to the patient's needs. Patient visits remained limited. Overall, the alternation of digital and physical contact was (better) applied, and digital care consultations improved.

The Impact on Informal Caregivers

In 2020, some informal caregivers provided less care due to fear of infection. Under other conditions, informal caregivers provided more care because they had more time available (e.g., they had lost their jobs or worked from home) or because informal care was needed due to the downscaling of care or the halting of day care activities for pa-tients with dementia. This sometimes led to informal caregivers becoming stressed. The nurses experienced more contact and teamwork with informal caregivers.

A year later, the impact on informal caregivers was divided between improved (n = 7) and unchanged (n = 5) or deteriorated (n = 3). Sometimes, informal caregivers could and wanted to provide more care, which was partly due to the availability of PPE. At other times, the informal caregivers withdrew more for fear of infection or because they had less time available in their personal lives. Some caregivers were overworked and tired, with no space or time to recharge due to a lack of relaxation. There was still good contact and better cooperation with informal caregivers.

Working with PPE and COVID-19 Restrictions

At the start of the COVID-19 pandemic, there were many questions about the safety of care at home. There was a lack of knowledge regarding PPE, and patients and nurses feared whether there was sufficient PPE available for safe care. Clear explanations and guidelines diminished this anxiety. However, the guidelines that were provided by the government or organisations were unavailable, unclear, or differed across organisations. Nurses and patients were frustrated by this lack of clarity. Some organisations had an acute shortage of PPE; other organisations had no deficits. The shortage of PPE felt there was less appreciation for district nursing care compared to other settings such as hospitals. With PPE, care was different and much more intense: Face masks (instinctively) provided distance and made it difficult for people to understand one another.

During the second outbreak, most nurses found that working with PPE had improved (n = 15): sufficient materials, documentation, and protocols were available. Nurses and patients were used to working with PPE. Sometimes, anxiety among patients and caregivers persisted despite the use of PPE. Vaccination, more knowledge, and being able to work preventively with PPE provided an increased feeling of safety. Face masks still created distance, and communication remained an obstacle. After one year, patients and informal caregivers had become tired of the COVID-19 situation. They did not see the seriousness of the situation, causing more laxity in testing, incorrect or no use of PPE, and less adherence to quarantine and other restrictions.

Impact on District Nursing Teams

Increased Work Pressure

Depending on the number of COVID-19 infections among patients in 2020, the nurses had to work overtime, leaves of absence were withdrawn, and the nurses sometimes needed to be available and in action mode continuously. This time was experienced as a busy and chaotic period to work during because nursing student internships were halted, nurses became infected with COVID-19, or they needed to work on COVID teams. However, the "crisis mode" provided more challenge and creativity in their work, which was experienced as being positive. In areas with fewer COVID-19 infections, the downscaling of care at home sometimes led to more peace of mind at work.

A year later, the increased work pressure experienced in 2020 was equally divided between improved (n = 7) and unchanged (n = 6) or deteriorated (n = 1). On the one hand, less work pressure was experienced a year later due to fewer new patients, fewer infections among patients and district nursing professionals, the nurses having more free time available in their private lives, and people having gotten used to the circumstances. There was a feeling that the workload was better distributed within the organisation and a sense of balance was slowly returning. During quiet periods, there was room for leave among colleagues. On the other hand, more work pressure was experienced due to work overload and high absenteeism among district nursing personnel. This required considerable flexibility, which was experienced as tiring. The nurses ran on reserves, with insufficient space or time to recharge. They became emotional more quickly and wanted the situation to return to normal. The "action mode" was often still present.

Fear of Infection

During the first outbreak, there was a fear of COVID-19 infection among nurses: They were afraid to infect or have infected patients and hence called in sick frequently. There was a sense of guilt and failure when dropping out because of an infection.

A year later, most nurses found that their fear of infection had improved (n = 12). Anxiety among healthcare providers had decreased because they were attuned, had improved knowledge, and had more experience working during the COVID-19 pandemic. Additionally, PPE was more (preventively) applied, and more patients, caregivers, and colleagues were vaccinated. Guilt for dropping out because of a (potential) infection was often still present.

Psychosocial Effects and Mental Support

The nurses experienced stress, fear, and insecurity about the future during the first outbreak. Mental support was provided to patients and colleagues, and anxiety was managed, which took extra time and energy. Fellowship and solidarity between colleagues were increased, but this sometimes declined as physical meetings were not allowed.

When the second outbreak occurred, psychosocial effects and mental support tended to improve (n = 10), sometimes with deterioration (n = 4), or had improved and deteriorated (n = 3). Sometimes, stress and uncertainty were still present, but there was often less stress and work pressure because there were fewer COVID-19 cases. The feeling of powerlessness among the nurses was reduced due to more treatment options being available for patients infected with COVID-19. Often, solidarity, cooperation, and good initiatives prevailed among teams so that members supported each other and paid more attention to one another. Insufficient attention was given to indirect problems among district nursing staff due to the COVID-19 outbreak. There were more incidences of dropping out among district nursing staff due to mental complaints because of the long duration of the crisis.

Leadership and the Nurse's Role within the Organisation

The first COVID-19 outbreak demanded great leadership from nurses at different levels. Providing leadership to district nursing teams remotely was difficult because of missed signals. Nurses had to make choices regarding downscaling care, but it was sometimes difficult to make trade-offs (e.g., downscaling care or continuing care with risks for patients and the district nursing team). According to some nurses, there was a return to old structures, with more hierarchy and less flexibility, with managers making decisions without nurses being involved. Additionally, management often stopped including nurses in policy matters (e.g., projects within or between organisations). It was sometimes a struggle to act autonomously as a nurse. For other nurses, decision-making processes within the organisation were faster, and more choices were made in a bottom-up fashion by nurses instead of through a top-down approach by management.

A year later, experiences regarding leadership and the nurse's role varied; it was often unchanged (n = 7) or deteriorated (n = 2), but for some nurses, it had improved (n = 8). District nurses still had to make difficult choices. In some cases, district nurses were not involved in the decisions that were made by their managers, and they experienced little room to voice their opinions. Additionally, organisations were structured with more hierarchy. In other cases, there was similar or more attention given to the autonomy and leadership of district nurses, and some nurses had leeway to participate in other projects. There was more time for the nurses to do what they are good at, and district nursing teams were completely self-managed once more.

Support from the Organisation

During the first outbreak, nursing organisations provided various prerequisites such as necessary materials (e.g., PPE, thermometers, tablets), study time to enhance knowledge, testing options for district nursing staff, emotional support and psycho-logical assistance, and childcare for district nursing staff. There was gratitude, appreciation, and recognition for district nursing teams; for example, they received small gifts such as flowers and compliments from management. The ways in which organisations communicated COVID-related information was conducted differently (e.g., one organisation set up a helpline for questions staffed by district nurses; elsewhere, managers were constantly available and focused on eliminating knowledge deficits). Communication within organisations was experienced differently, from “poor” to “excellent”.

During the second outbreak, most nurses found that support from their organisation had improved (n = 7) or remained unchanged (n = 9). Support and appreciation often improved or remained the same. Support was experienced as pleasant and fit well with what was needed. Manager communication and accessibility had improved. A few nurses mentioned that management showed insufficient attention.

Worries about and Needs for the Future

Uncertainty and Worries about the Future

In 2020, the nurses experienced uncertainty and were concerned about the future related to the use of care (e.g., postponed hospital admissions, closed day care), the costs of care (costs for purchasing needed materials and reimbursement for non-provided care), and how care could stay patient-centred with attention given to frail older adults.

In 2021, most nurses still experienced uncertainty and worries about the future (n = 9). They explained that they were more prepared than they had been one year prior and knew how to identify and treat someone with COVID-19. However, uncertainty re-mains about the long-term consequences of COVID-19 for patients, district nursing teams, and organisations.

Future Role and Collaboration within District Nursing Care

During the first outbreak, the nurses felt that district nursing leadership must be maintained in the future with respect to their professional autonomy. A balance should be sought in restarting care by looking critically at building up and scaling down needed care. In this regard, more attention should be paid to the patient’s self-reliance and self-management, eliminating unnecessary care, the use of informal care, and the use of healthcare aid devices and technology. The COVID-19 pandemic showed that district nursing care could manage complex forms of care such as transmural care, acute care at home, and complicated wound care. More could be implemented to improve collaboration across the boundaries of organisations.

During the second outbreak, most nurses found that necessary changes for the future had been fully (n = 4) or partly achieved (n = 9) (Figure 2). Three nurses found that the required changes had not been achieved. The nurses experienced insufficient room to focus on other tasks, such as prevention or improving district nursing care. Cross-organisational collaboration in primary care often improved but was found to be declining once again in some cases. Cooperation with hospitals and intramural institutions was enhanced. The nurses hoped that collaboration would continue to exist.

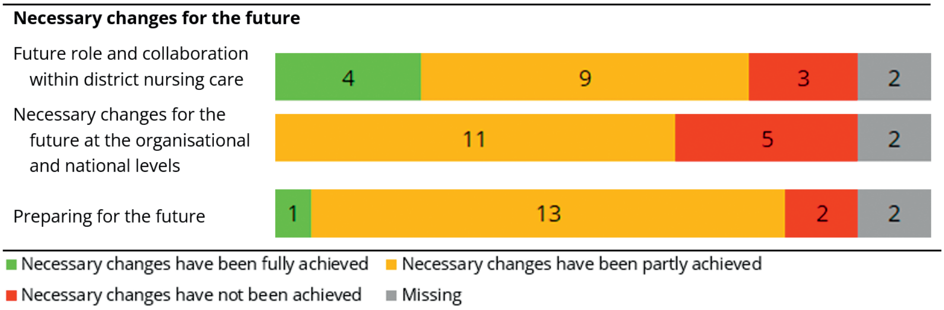


Figure 2. Necessary changes for the future identified in 2021, a year after the first outbreak (2020) (N = 18).

Necessary Changes for the Future at the Organisational and National Levels

In 2020, the nurses mentioned that fundamental changes were needed at the organisational and national levels. The nurses stated that more attention should be given to district nursing care, especially regarding the safety of care and loneliness among patients during the pandemic. They also stated that the government and insurers should also provide more support, attention, and appreciation for district nursing care. The nurses mentioned that a specific policy for district nursing during the pandemic was desirable. A national knowledge platform to share knowledge would be helpful, and guidelines should be better translated to district nursing. Nurses perceived that more research should be conducted and shared regarding COVID-19 (e.g., recognising signals, evaluation of past periods) in district nursing care.

One year later, the nurses found that necessary changes at the national level had been either partially (n = 11) or not achieved (n = 5). The importance of nurses has be-come more visible. However, there is still a need to bring the impact of COVID in district nursing to the attention of the general public. District nurses must show more leadership and make themselves heard. Nurses wish for more appreciation for district nursing in the form of higher salaries and more confidence in district nursing as a profession. According to the nurses, the government and insurers must provide more time and financial resources.

Preparing for the Future

In 2020, the nurses mentioned that a (national) plan for new COVID-19 outbreaks is desirable to provide safe and responsible care. Care tasks surrounding the patient (e.g., prevention at the community level) should be resumed instead of (only) focusing on the primary process. Additionally, care pathways and rehabilitation processes should be established for ex-COVID patients.

One year later, most nurses found that the necessary changes had been partially achieved (n = 13). Solid plans and guidelines are available for new outbreaks; however, working in district nursing care requires customising care to specific patients. The nurses stated that they had learned a lot in a short period and did many things well. It is unclear how nurses should deal with the overall damage from the pandemic. The care path for ex-COVID patients still requires improvements.

Discussion

To the best of our knowledge, this is the first mixed-methods study that describes the impact of the COVID-19 pandemic on district nursing care from the perspectives of Dutch district nurses. Our study shows that the pandemic has had a deep impact on patients, informal caregivers, and district nursing teams. Care for patients has changed, and together with the patient and informal caregivers, nurses have often experienced more work pressure and more psychosocial problems, including a greater fear of infection. The role of the district nurse as a leader has changed substantially. The study also identified multiple needs for the future, where more focus should be placed on the role of nurses, necessary changes at the organisational and national levels, and how district nursing teams can be better prepared for the future.

While nurses in district nursing care generally experienced high work pressure prior to the COVID-19 pandemic (25), even greater work pressure was experienced during the first outbreak due to providing COVID care in the community, combined with more care at home because nursing homes, outpatient clinics, and care organisations for social and day care were closed down. On the other hand, care for patients at home was often downscaled due to fear of infection, delayed operations, or insufficient availability of nurses. This has been seen in other studies as well (26,27). This shift in care delivery at home had a high impact on informal caregivers, sometimes leading to informal caregivers becoming stressed during the first outbreak as well as a year later. Chan et al. stated that informal caregivers are the “forgotten healthcare workers during the COVID-19 pandemic” and emphasised that urgent research is needed in district nursing care to support health needs during extreme events such as the COVID-19 pandemic (28). The lack of knowledge, guidelines, and materials such as PPE during the first months made district nurses feel less appreciated as a nursing profession. This was seen not only in the Netherlands, but in other countries as well (11,26,29). The change in workload for nurses had a deep impact on their wellbeing and mental health; they experienced stress, fear, and insecurity. Those working in district nursing care and other healthcare workers were at high risk for mental problems and burn-out, especially during the COVID-19 pandemic (30–32). This requires additional efforts at the organisational and national levels to support district nursing teams (11,30,33,34).

One year after the first outbreak, the nurses perceived that significant improvements had been made regarding PPE, as more materials were available. There was less fear of infection due to sufficient PPE and the availability of vaccinations. Support from organisations had also improved or remained unchanged, which was a good thing since most nurses were optimistic about support in 2020. On the other hand, the impact on caregivers and the effect on time and energy among nurses were often unchanged or had even deteriorated. These caregivers and nurses were overworked and tired, with no ability to recharge due to a lack of time to relax. However, some nurses experienced less work pressure because of fewer new patients, fewer infections among patients and district nursing staff, and more available free time in their personal lives. Psychosocial effects and mental support had sometimes improved; however, some nurses experienced deterioration. The nurses felt that insufficient attention was given to indirect problems among nurses. Due to the long duration of the crisis, there were more incidences of dropping out among nurses due to complaints about mental health.

Looking at needs during the first outbreak and one year later, most change is needed regarding the role of nurses and support and trust at the national level. District nursing is marked as a specialty nursing practice at the national (35) and international levels (36–39), with specific nursing interventions and competencies. At the national level, the ambassador’s project was developed to strengthen district nurses’ leadership skills (22). Although the importance of district nurses has become more visible among the public, they wish for more confidence in district nursing as a profession. During the first outbreak, the nurses experienced a return to old structures with more hierarchy, less flexibility, and insufficient leeway to focus on other tasks, such as policy developments or quality improvements. The nurses desire more trust, support, attention, and appreciation by health insurers and the government. Additionally, the nurses felt that their role as a nursing leader, having a crucial responsibility both for team members (i.e., translating guidelines and supporting others) and patients (organising care), must be maintained concerning their professional autonomy. In terms of the care provided, the pandemic has shown that district nurses are able to manage complex care (such as transmural care, acute care at home, and complicated wound care), and the nurses wish to continue doing so. This indicates a district nurse can fulfil the specialist-generalist role (40). During the first wave of the pandemic, the nurses experienced improved cross-organisational collaboration. However, one year later, this sometimes declined again. Additionally, the nurses felt that cooperation with hospitals and other care facilities could be improved. The lack of cooperation can be explained by the organisation of district nursing practice in the Netherlands, in which district nursing care is provided by 3070 different care organisations (18). More uniformity among district nursing care organisations could help improve collaboration among the various care providers.

Initially, this study aimed to identify how the pandemic has affected organisations and organisational choices. This question was part of the interview guide. However, after analysing the results, it was decided to place the answers under other themes since they fit better under such themes (e.g., the upscaling and downscaling of care under the impact of daily care for patients, and support from the organisation under the impact on district nursing teams). This study focused on the perspectives of district nurses during the COVID-19 pandemic, in which they fully focused on organising and providing care for patients and their teams. This may explain why the effects at the organisational level were not as visible for the nurses. To identify the impact of COVID-19 at the organisational level, additional research conducted with managers of organisations would be helpful.

Strengths and Limitations

This study rapidly identified the experiences and impact of COVID-19 on district nursing care during the first outbreak. Nurses from multiple organisations across the Netherlands were included. Additionally, the mixed-methods design provided us with valuable insights into the experiences of district nurses during the pandemic over time. Furthermore, the results of the interviews were checked by those who responded to the questionnaire as a member check.

While the number of respondents for the interviews was sufficient and the response rate to the follow-up questionnaire was relatively high (53%), the total number of district nurses participating one year later with the questionnaire was low. One possible reason for the nurses not participating in the questionnaire could be that they did not remember the interviews. The low number of participants (N = 18) in the quantitative part of the study makes it problematic to generalize the findings nationwide. The results of the study should therefore be carefully interpreted. In addition, we selected a specific group of district nurses who took part in the Dutch district nurses ambassador's leadership programme. This programme includes nurses who are motivated to participate in that programme, making it difficult to generalise the findings for all nurses. Finally, it is possible that the identified themes were prompted by the inter-view guide, which also focused on the impact on the patient, nursing teams, and at the organisational level. However, in this study, following the results of the interviews, it was decided not to create a special theme regarding the impact at the organisational level since not enough input regarding the impact of COVID on the organizational level was identified.

Implications for Practice, Policy and Research

The results of our study show that district nurses have played a crucial role during the pandemic, and not only in direct patient care; nurses have supported their team members and have played a significant role in their organisations, translating policy guidelines into practical ones. The nurses have become able to handle complex care and set up different workarounds and innovative collaboration among various organisations in their working area. The nurses highlighted that this role should be maintained after COVID-19. Moreover, organisations should constantly foster nurse leadership and invite district nurses to the table to discuss organisational matters more often. At the same time, nurses should be proactive and take the opportunity to assume their role. At the policy level, more attention should be given to the vital work of district nursing. There is a pressing need for the importance of district nursing care to be recognised, prioritised, and adequately resourced at the organisational and national levels (3,4,41). Moreover, to be better prepared for future pandemics and the current demographical and societal challenges that disrupt healthcare service delivery, a solid evidence base for district nursing care is required (9).

Conclusions

This study shows that the COVID-19 pandemic has substantially impacted patient care and professionals in district nursing care. Nurses have played a crucial role in organising care differently and have worked under high pressure, leading to exhaustion, tiredness, and psychosocial problems, including a fear of infection. While nurses have become better prepared to provide COVID-19 care after one year, change is still needed, especially regarding the sustainable implementation of leadership roles for district nurses within and outside their respective organisations to enhance district nursing practice for patients and professionals. Additionally, more support and appreciation are needed in terms of trust and appropriate policies at the organisational and national levels.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available upon request from the corresponding author. The data are not publicly available due to privacy restrictions (i.e., containing information that could compromise research participant privacy).

Conflicts of Interest: The authors declare no conflicts of interest. No funding was available, and therefore, no funders had a role in the study’s design; in the collection, analysis, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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Appendices

Appendix A. Interview Guide

General Questions

- Are you currently working in district nursing care? If not, where are you working? If not related to district nursing care, finish the interview
- At what organisation are you working?
- For how long have you been working in district nursing care?
- What is your function title?
- How old are you?

Specific Questions Regarding the Impact of COVID-19 on District Nursing Care

- What impact have you experienced as a result of the COVID-19 crisis?
- What is the impact of COVID-19 on the client?
- What is the impact of COVID-19 on the organisation and organisational decisions?
- Are you well equipped in your work in district nursing care to properly perform your role during the COVID-19 crisis? Please explain.
- Where are the greatest needs in district nursing care at this moment (during the COVID-19 crisis)?
- What challenges do you foresee for yourself, the client, and the organisation in the near future?
- What do you need and from whom to respond to these challenges?

Appendix B. Online Questionnaire

General questions

Question	Answer Options
What is your gender?	Male Female I’d rather not say
How old are you?	<open field>
What is your current function?	District nurse (bachelor’s degree required) Specialised nurse Nurse specialist Other <open field>
What is your education level?	Bachelor’s degree Master’s degree at a university for applied science Master’s degree in education at university
How many hours per week do you work in district nursing care?	<open field>
How long have you been working in district nursing care?	<open field>

Specific questions for the first 10 subthemes (the downscaling and upscaling of district nursing care; changed daily care routine; the impact on informal caregivers; working with personal protective equipment (PPE) and COVID-19 restrictions; increased work pressure; fear of infection; psychosocial effects and mental support; leadership and the nurse’s role within the organisation; support from the organisation; uncertainty and worries about the future).

Question	Answer Options
Do you recognise the above description of (the subtheme) in district nursing care during the first outbreak? If not, please explain	Yes No <open field>
How is the current situation of downscaling in district nursing care?	Situation is improved Situation is unchanged Situation is deteriorated Situation is both improved and deteriorated
Please explain	<open field>

Specific questions for the last three subthemes (future role and collaboration within district nursing care; necessary changes at the organisational and national levels; preparing for the future).

Question	Answer Options
Do you recognise the above description of (the subtheme) in district nursing care during the first outbreak? If not, please explain	Yes No, <open field>
Has the situation regarding your future role and collaboration in district nursing care already been realised or implemented?	Yes Yes, partly No
Please explain	<open field>

Final questions

Question	Answer Options
What has helped you the most during the COVID-19 crisis in district nursing care?	<open field>
What has bothered you the most during the COVID-19 crisis in district nursing care?	<open field>
This is the final question. If there is anything else you would like to say about this subject or research, you can do so here.	<open field>

PART II

The use of patient outcomes for learning and improving in district nursing care

4

Evidence-based interventions and nurse-sensitive outcomes in district nursing care: A systematic review

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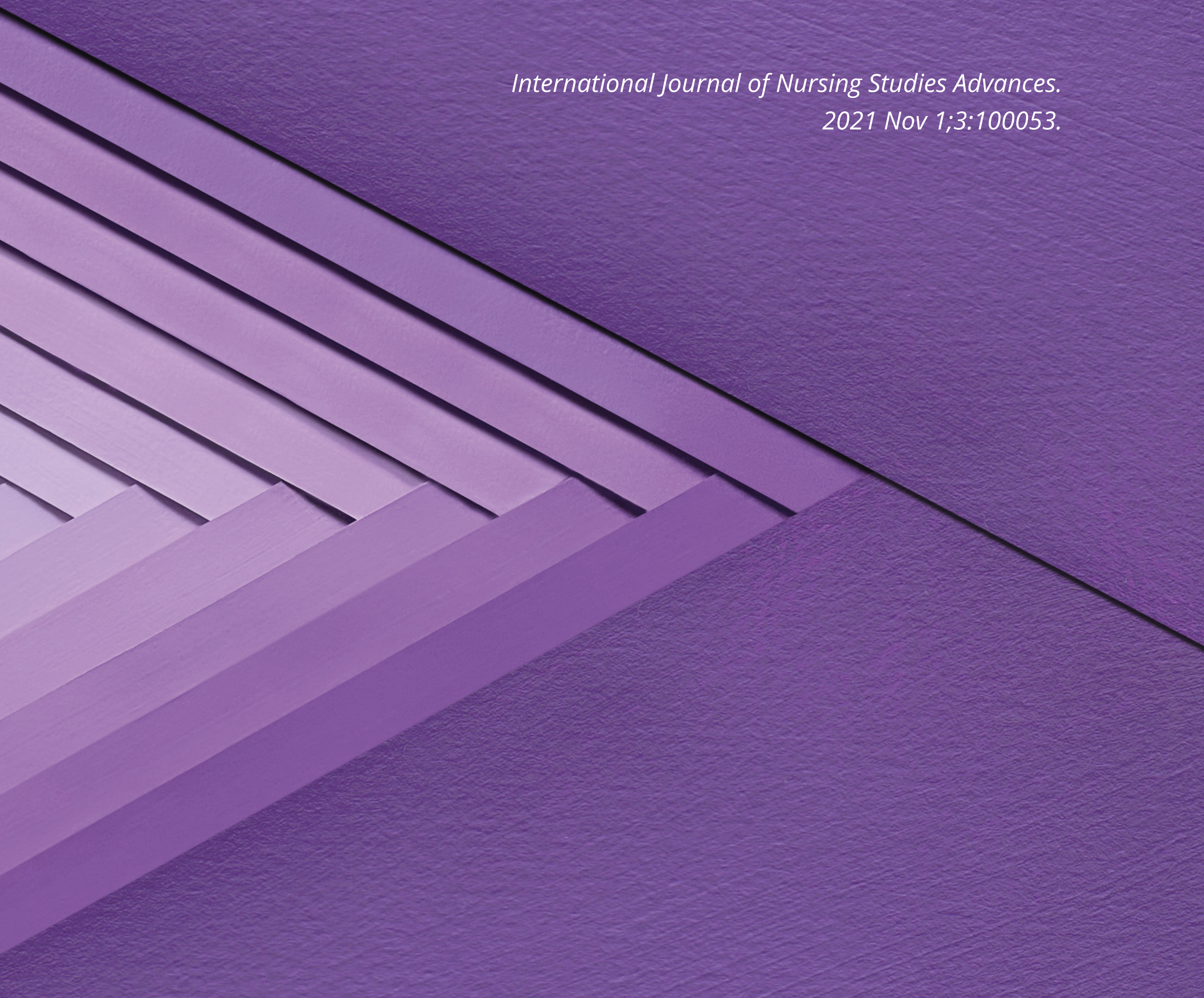

Abstract

Background: Measuring nursing interventions and nurse-sensitive outcomes in a standardized manner is essential because it provides insight into the quality of delivered care. However, there is currently no systematic overview of the interventions conducted by district nurses, the evidence for the effects of these interventions, or what nurse-sensitive outcomes should be measured.

Objective: 1) To provide an overview of interventions for community-living older people evaluated in district nursing care and evidence for the effects of these interventions and 2) to identify the nurse-sensitive outcomes that are used to evaluate these district nursing care interventions, how these outcomes are measured, and in which patient groups they are applied.

Design: A systematic review of the literature.
Setting: District nursing care.
Data sources: MEDLINE, CINAHL, PsycInfo, and EMBASE.

Methods: Only experimental studies evaluating district nursing care interventions for community-living older people were included. A data extraction form was developed to extract the study characteristics and evaluate interventions and nurse-sensitive outcomes. The methodological quality of the included studies was reviewed using the 13-item critical appraisal tool for randomized controlled trials by the Joanna Briggs Institute.

Results: A total of 22 studies were included. The methodological quality of the studies varied, with scores ranging from 6 to 11 on a scale of 0–13. The 22 interventions identified were heterogeneous with respect to intervention components, intervention delivery, and target population. The 44 outcomes identified were grouped into categories following the Nursing Outcome Classification and were measured in various ways and at various times.

Conclusion: This is the first systematic review summarizing the evidence for the effectiveness of nurse-led interventions conducted by district nurses on community-living older people. It is unclear what interventions are effective and what outcomes should be used to substantiate district nursing care effectiveness. Because only studies with experimental designs were included, this analysis may provide an incomplete assessment of the effectiveness of interventions in district nursing care. Therefore, it is highly necessary to produce methodologically strong evidence through research programs focusing on district nursing care.

Systematic review registration number: PROSPERO (CRD42017058768).

What is already known about the topic?

- Measuring the effects of nursing interventions and nurse-sensitive outcomes in a standardized manner is crucial, as it provides insight into the quality of delivered care.
- There is currently no systematic overview of the interventions conducted by district nurses, the effects of these interventions, and the measured nurse-sensitive outcomes.

What this paper adds

- This review demonstrates that experimental studies focusing on district nursing interventions are highly heterogeneous concerning the patient population included, intervention components, execution, structure, and outcome measurements.
- It is unclear which interventions are effective and what outcomes should be used to substantiate district nursing care effectiveness.
- With this scarcity of evidence, it is highly necessary to produce methodologically strong evidence of effective district nursing interventions by conducting robust research programs

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Introduction

Worldwide, the demand for the delivery of all care at home is predicted to increase greatly in the coming decade. This is due to the rapidly growing ageing population in combination with the desire of the majority of older people to continue to live at home as well as the financial incentives and public demands of health insurers to provide care at home (1–4). District nursing services are the key providers of nursing care in the community, in addition to other healthcare professionals, such as general practitioners and other (paramedic) professionals in primary care (5,6). The organization of district nursing care, including its delivery and funding, varies worldwide (1,7,8). In this study, district nursing care was defined as any technical, medical, supportive or rehabilitative nursing care intervention or assistance with personal care for (older) people living at home (8). This definition is in accordance with the definition used for community-care nursing in Europe (8,9) and reflects district nursing care in the Netherlands (10).

Measuring nursing interventions and nurse-sensitive outcomes in a standardized manner is essential and provides insight into the quality of delivered care, which could guide learning and development in district nursing practice (1,11). To support nurses in providing care to patients, the nursing intervention classification (NIC) provides a comprehensive, research-based, standardized classification of interventions for nurses and other professionals (12). Interventions are defined as "any treatment, based upon clinical judgement and knowledge, that a nurse performs to enhance patient outcomes" (12). The Nursing Outcome Classification (NOC) is a comprehensive, standardized classification of outcomes to evaluate the impact of interventions provided by nurses or other professionals (13). Patient outcomes are needed to measure the effects of delivered healthcare services on patients' health and wellbeing (14,15). For district nursing care, it is necessary to focus on nurse-sensitive outcomes, which are patient outcomes that are *relevant* to the nurses' scope and domain of practice and can be *influenced* by nursing input/interventions (16).

There is currently no systematic overview of the interventions conducted by district nurses or the nurse-sensitive outcomes they achieve for patients (1,17). While the systematic review by Joling et al. (2018) identified 567 quality indicators for older people for community care (18), only 18 indicators focused on patient outcomes, of which nine were assessed as nurse-sensitive (19). It is unclear what outcomes are used in district nursing research. A study amongst district nursing care professionals from 17 countries identified a pressing need to generate an evidence base for district nursing care and evaluate home care services and outcomes for patients to guide district nursing care (1). This evidence is needed because district nursing care is a speciality nursing practice requiring specific nursing interventions and competencies (20–24). Because the literature on interventions and nurse-sensitive outcomes for district nursing care is scarce, a thorough systematic review of the literature is needed.

The aims of this review are 1) to provide an overview of interventions for community-living older people evaluated in district nursing care and evidence for the effects of these interventions; and 2) to identify the nurse-sensitive outcomes that are used to evaluate these district nursing care interventions, how these outcomes are measured, and in which patient groups they are applied.

Methods

An a priori research protocol was written for this systematic review and published in PROSPERO (CRD42017058768). To guide the systematic review, the steps described in the Joanna Briggs Institute Manual for Evidence Synthesis were followed to conduct the review (25). To guide the reporting of this manuscript, the Preferred Reporting Items of Systematic reviews and Meta-Analyses (PRISMA) was followed (26) (Supporting Information Appendix 1).

Design

Search strategy

Studies evaluating the effectiveness of district nursing interventions were identified using a systematic search. The following electronic databases were searched: MEDLINE, CINAHL, PsycInfo, and EMBASE. The search strategy used a combination of key terms related to nurse-led district nursing care interventions for older people (Supporting Information Appendix 2). The search strategy was developed with information specialists from the Cochrane Centre Netherlands and the University of Applied Sciences Utrecht. The database searches were conducted on the 12th of February 2020.

Inclusion criteria

Only empirical studies evaluating district nursing care interventions for community-living older people (aged 60+) and interventions conducted in patients with a mean age of 60 or older were included. Following the advice of the Effective Practice and Organization of Care (EPOC) Group from Cochrane, only randomized controlled trials, controlled clinical trials, controlled before-and-after studies, and interrupted time-series studies were included (27). Studies evaluating district nurse-led interventions were included. Studies reporting on nurses working in general practices or hospitals and studies in which the nurse's role was unclear were excluded. Studies with at least one face-to-face contact between the district nurse and the patient, either in person or via telehealth, were included. Interventions with only remote monitoring were excluded. To be included, at least one of the outcomes used in the studies had to be nurse-sensitive for district nursing care, following the definition by Doran (2011) (16). No limits were applied on the control group or publication date. Findings from multiple articles reporting on the same study (i.e., reports of the same evaluation of an intervention) were combined. All publications that met the inclusion criteria were uploaded into Rayyan, a web application for systematic reviews that offers researchers a dashboard through which to work through the details of their processes while also allowing full transparency for reviewers (28).

Study selection

After all publications were added to Rayyan, duplicate studies were removed. Two reviewers independently assessed the titles and abstracts of all potentially relevant studies for inclusion. In Rayyan, the reviewers were able to read the titles and abstract and make a decision to include or exclude the study. The full texts of studies deemed relevant were obtained, and the assessment of inclusion was repeated independently by two reviewers using Microsoft Excel. To guide the screening and selection of studies, an inclusion criteria screening tool was developed and used by both reviewers (Supporting Information Appendix 3). Any disagreements on inclusion were resolved by discussion (JDV and TBH). The results of articles that reported the same study were combined. The number of abstracts and papers identified and excluded, along with the reasons for their exclusion, were recorded.

Data extraction

A data extraction form was developed to extract relevant data from the included studies describing the study characteristics, evaluated interventions and outcomes. The study characteristics extracted were the author names, title, year, country, and design of the study. The intervention data extracted were the study population, sample size, description of the intervention, and a control group description. Regarding the outcomes, the name of the outcome, how the outcome was measured, the measurement instrument or data registry used, the time over which the outcome was measured, and the effects that were measured were extracted. The two reviewers initially piloted the data extraction process with two studies. In the next stage, each reviewer independently extracted data from half of the studies. After extraction, both reviewers checked the data extraction of the other reviewer. The data were compared, and differences were resolved by discussion between the two reviewers (JDV and TBH) until agreement was reached.

Critical appraisal of methodological quality

The studies' methodological quality was independently reviewed by two reviewers (JDV and TBH) using the 13-item critical appraisal tool for randomized controlled trials developed by the Joanna Briggs Institute (29). The thirteen items were scored as zero if an item was not met or the item was unclear and as one if an item was clearly met. No single approach is considered the best practice for deciding when a study's quality is sufficient (30). Therefore, the total score of the critical appraisals and risks of bias are presented.

Method of data synthesis

Due to the expected heterogeneity of the included studies, a narrative synthesis was performed to describe the studies in terms of study characteristics, evaluated interventions, and reported outcomes and to provide an overall description of the available evidence. Using content analysis, the outcomes and interventions were thematically categorized and presented narratively. The outcomes were organized into the following categories based on the Nursing Outcome Classification, which is one of the most commonly used standardized nursing terminology (31): functional health, physiological health, psychosocial health, health knowledge and behaviour, perceived health, and family health. The categories of death and healthcare utilization were added following previous research (19,32). Healthcare utilization was used instead of costs when both were described. The total costs of healthcare utilization or interventions were not included in the narrative synthesis.

Ethical approval, informed consent and registration

Ethical approval and informed consent were not required since no participants were involved in this systematic review of the literature. An a priori research protocol for this systematic review is published in PROSPERO (CRD42017058768).

Results

Study selection

The search resulted in 5569 records. After removing duplicates, 3380 titles and abstracts were screened using the inclusion criteria, and 381 records were retrieved for full-text screening. After the final selection, 22 studies (reported in 24 articles) were included in this systematic review (Figure 1). In the description of the results below, all studies will be referred to by their reference number between brackets. The reference number and corresponding full reference are provided in Table 1.

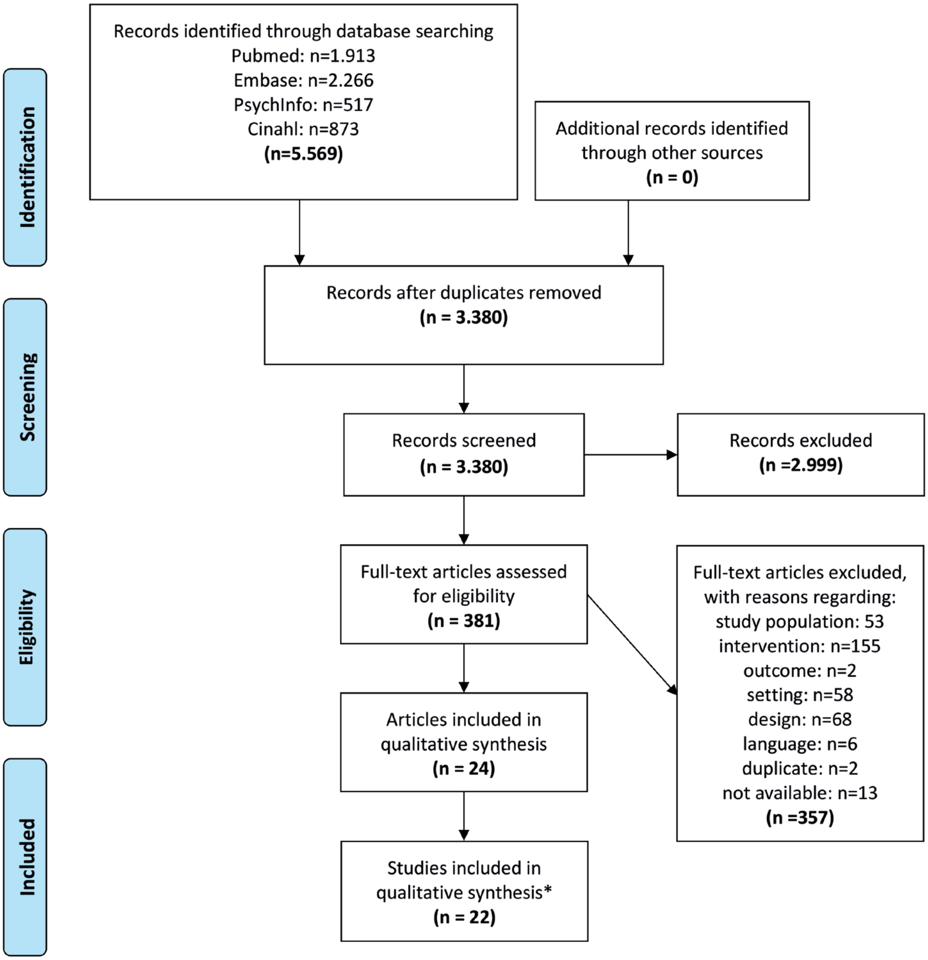

Figure 1. PRISMA flow diagram

Notes: ***** in total, 24 articles were included that described 22 studies. Two studies were described twice in separate articles.

Table 1. Characteristics of included studies.

Ref #	Author, year, country,	Design, sample patient group	Control group	Intervention	Outcomes measured	Differences in effects between the intervention and control groups	Quality of the study*
[1] (33)	Toivo et al.(2019), Finland.	Cluster randomized controlled trial, clustered at home care service area (N=5). Older people (65+) (N=188).	Standard home care: care provided by the home care units.	The Coordinated Medication risk Management (CoMM) intervention	•Medication-related outcomes: a) Potentially inappropriate medications; b) excessive use of psychotropics, anticholinergic and serotonergic load; c) clinically significant drug-drug interactions	No statistically significant effects were found for the measures.	6/13
[2] (34)	Zhu et al. (2018), China.	Randomized controlled trial. People with a diagnosis of hypertension (N=134).	Free annual health check, health education leaflets, and a follow-up with pharmacological treatment.	A nurse-led hypertension management model	• Blood pressure (systolic and diastolic) • Adherence to medication and non-pharmacological behaviours • Self-efficacy • Quality of life • Satisfaction with the care provided	A statistically significant decrease in systolic and diastolic blood pressure and higher satisfaction were observed. No effects were found for other measures.	7/13
[3] (35)	Buurman et al. (2016), the Netherlands.	Randomized controlled trial.Older people (65+) at risk for functional decline (N=674).	During hospital stay: a comprehensive geriatric assessment was conducted, care was provided and a treatment plan was developed. Multidisciplinary care was provided by a geriatric team. After discharge: no additional care.	Comprehensive Geriatric Assessment and Transitional care bridge program	• Activities of daily living • Mortality status • Cognitive function • Time to unplanned hospital readmission within 6 months • Time to discharge from the nursing home to the community	A statistically significant protective effect was observed for mortality. No effects were found for other measures.	11/13

Table 1. *(continued)*

Ref #	Author, year, country,	Design, sample patient group	Control group	Intervention	Outcomes measured	Differences in effects between the intervention and control groups	Quality of the study*
[4] (36)	Dorresteijn et al. (2016), the Netherlands.	Randomized controlled trial. Older people (70+) concerned about falling (N=389).	Care as usual: no standard treatment for concerns about falls was available during the study period.	A Matter of Balance (AMB-Home): a home-based, cognitive behavioural program	• Fall-related outcomes: a) concerns about falls; b) avoidance of activity due to concerns about falls; c) number of falls; and d) medical attention received after fall incident • Disability	A statistically significant decrease was observed for indoor falls, disability, concerns about falls and avoidance of activity as a result of concerns about falls. No effects were found for other measures.	11/13
[5] (37,38)	Ng and Wong (2018), China; Wong et al. (2016), China.	Randomized controlled trial. People with end-stage heart failure (N=84).	Predischarge palliative care referral consultation and standard discharge planning including a scheduled outpatient palliative care clinic. The control group received two attention control social calls. An unstructured episodic home care service could be arranged for patients upon discharge if needed.	Transitional Care Palliative End-Stage heart failure programme: the Home Palliative heart failure (HPHF) program	• Readmission to hospital • Symptom intensity/burden • Functional status in palliative care • Quality of life • Satisfaction with care • Outcomes related to chronic heart failure (fatigue, dyspnoea, emotional status, mastery) • Caregiver burden	Statistically significant lower readmission to the hospital at 3 months, higher quality of life, higher satisfaction, and lower caregiver burden. Statistically significant lower health complaints were observed for dyspnoea, depression/emotional functioning and mastery at four weeks. No effects were found for other measures.	10/13

Table 1. *(continued)*

Ref #	Author, year, country,	Design, sample patient group	Control group	Intervention	Outcomes measured	Differences in effects between the intervention and control groups	Quality of the study*
[6] (39,40)	Suijker et al. (2017), the Netherlands; Suijker et al. (2016), the Netherlands.	Cluster Randomized controlled trial, clustered at general practices (N=24). Older people (70+) at risk for functional decline (N=2283).	Care as usual (not further specified)	Nurse-Led Multifactoral Care to prevent disability in community-living older people	• Disability ((instrumental) activities of daily living) • Health-related quality of life • Quality-adjusted life years • Self-perceived quality of life • Emotional wellbeing • Incidence of falls • All-cause mortality • Healthcare utilization: a) general practitioner consultations; b) general practitioner visits after office hours; c) personal care hours; d) home nursing hours; e) daycare; f) residential care; g) nursing home admission; h) emergency room visits; i) hospital admission	Statistically significant lower general practitioner consultations and costs were observed. Unfavourable higher number of nursing home admission days and hours of personal care and home nursing were observed. No effects were found for other measures.	11/13
[7] (41)	Sherman et al. (2016), Sweden.	Cluster Randomized controlled trial, clustered at healthcare centre (N=16). Older people (75+) (N=438).	Care as usual (not further specified)	Preventive home care visits by district nurses	• Health index (health and wellbeing) • General health • Health behaviour • Health problems • Knowledge of community/local assistance • Medication use • Satisfaction with intervention	A statistically significant increase in knowledge of community/local assistance was observed. A significant unfavourable higher use of medication was observed. No effects were found on other measures.	7/13

Table 1. *(continued)*

Ref #	Author, year, country,	Design, sample patient group	Control group	Intervention	Outcomes measured	Differences in effects between the intervention and control groups	Quality of the study*
[8] (42)	Bruce et al. (2016), USA.	Cluster Randomized controlled trial, clustered at nurse teams (N=21). Older people (65+) at risk for depression (N=755).	Enhanced Usual Care: Nurses participated in depression assessment training. They did not receive training and were expected to follow their agencies' standard procedures for depression.	The Depression CARE for PATients at Home (CAREPATH)	• Hospitalization during intervention • 30-day hospitalization after start of intervention	A statistically significant lower number of hospitalizations was observed. No effect was found for 30-day hospitalization.	6/13
[9] (43)	Ukawa et al. (2012), Japan.	Randomized controlled trial.Older people (65+) (N=252).	Care as usual: No subjects had any restrictions in receiving medical and formal nursing care.	Functioning Improvement Tool home visit program	• Cognitive functioning	A statistically significant improvement of cognitive function was observed.	8/13

Table 1. *(continued)*

Ref #	Author, year, country,	Design, sample patient group	Control group	Intervention	Outcomes measured	Differences in effects between the intervention and control groups	Quality of the study*
[10] (44)	Pekmezaris et al. (2012), USA.	Randomized controlled trial. People with heart failure (N=168).	Care as usual: patients were admitted to a certified home healthcare agency following a hospitalization. They were managed via guidelines and standards. Usual care patients received live, face-to-face nursing visits only.	Remote Patient Monitoring	• All-cause hospitalization • Hospital length of stay • Emergency department visit • Healthcare utilization	No statistically significant effects were observed.	9/13
[11] (45)	Ploeg et al. (2010), Canada.	Randomized controlled trial.Older people (75+) at risk for functional decline (N=719).	Care as usual (not further specified)	Preventive primary care outreach	• Quality-adjusted life-years (disease burden) • Healthcare and social services costs • Functional status • Self-rated health • Mortality	No statistically significant effects were observed.	9/13

Table 1. *(continued)*

Ref #	Author, year, country,	Design, sample patient group	Control group	Intervention	Outcomes measured	Differences in effects between the intervention and control groups	Quality of the study*
[12] (46)	van Hout et al. (2010), the Netherlands.	Randomized controlled trial.Frail older people (75+) (N=651).	Care as usual: varied from no care at all to regular primary care physician visits to home care involvement.	The preventive home visit program	• Functional status • Disability in (instrumental) activities of daily living • Hospital admittance • Time until nursing home admission • Time until death	No statistically significant effects were observed.	10/13
[13] (47)	Kwok et al. (2008), China.	Randomized controlled trial.Older people (60 years and older) with chronic heart failure (CHF) (N=105).	Care as usual: Follow-up in hospital outpatient clinics by the same group of designated geriatricians and cardiologists as the intervention group.	Post-discharge community nursing programme	• Functional status • Cognitive function • Psychological state • Handicap • Healthcare utilization: a) community nursing, b) emergency care, c) hospital stay, d) outpatient clinics, 3) readmission	Significantly lower handicap, emergency care and hospital stay rates were observed. No effects were found for other measures.	8/13

Table 1. *(continued)*

Ref #	Author, year, country,	Design, sample patient group	Control group	Intervention	Outcomes measured	Differences in effects between the intervention and control groups	Quality of the study*
[14] (48)	Bouman et al. (2008), the Netherlands.	Randomized controlled trial.Older people (70+) with poor health status (N=330).	Care as usual: participants could use or apply for all available care within the Dutch healthcare system.	Home visitation program for older people living at home.	• Self-rated health • Functional status ((instrumental) activities of daily living) • Quality of life • Changes in self-reported problems • Health complaints • Depressive complaints • Mental status • Locus of control • Social support • Loneliness • Medication volume and cost • Aids and modifications to the home • Mortality • Use of extramural and institutional care	No statistically significant effects were observed.	9/13

Table 1. *(continued)*

Ref #	Author, year, country,	Design, sample patient group	Control group	Intervention	Outcomes measured	Differences in effects between the intervention and control groups	Quality of the study*
[15] (49)	Markle-Reid et al. (2006). Canada.	Randomized controlled trial.Older people (75+) (N=288).	Care as usual: using home care services through community-based agencies	Proactive Nursing Health promotion	• Functional status • Mental health (presence of depression) • Perceived social support • Coping style	A statistically significantly greater improvement in mental health functioning (as part of functional status) and reduction in depressive symptom scores were observed. A partial effect was found for perceived social support. No effects were found on other measures	9/13
[16] (50)	Feldman et al. (2004), USA.	Cluster Randomized controlled trial, clustered at nurse level (N=144). Older people (65+) with chronic heart failure (N=371).	Care as usual (not further specified)	Intervention to Improve Heart Failure Outcomes in Community-Based Home Health Care.	• Healthcare utilization: a) home health nurse visits, b) physician visits, c) inpatient rehospitalization, d) emergency department visits • Quality of life • Satisfaction with the care provided	A statistically significant lower number of home health nurse visits was observed. No effects were found on other measures.	7/13
[17] (51)	Dougherty et al. (2002), USA.	Randomized controlled trial.Older women (55+) with involuntary urine loss (N=178).	Feedback on information obtained at the baseline visit that neither constituted nor promoted treatment.	Behavioural Management for Continence (BMC)	• Urine loss: a) episodes of urine loss; b) micturition frequency; c) urine loss severity (objective and subjective measure). • Quality of life	Significantly fewer episodes of urine loss (subjective), lower severity of urine loss and higher quality of life were observed.	8/13

Table 1. *(continued)*

Ref #	Author, year, country,	Design, sample patient group	Control group	Intervention	Outcomes measured	Differences in effects between the intervention and control groups	Quality of the study*
[18] (52)	Hermiz et al. (2002), Australia	Randomized controlled trial. People with chronic obstructive pulmonary disease (COPD) (N=177).	Usual care comprised discharge to general practitioner care with or without specialist follow-up. The discharge did not include routine nursing care or other community follow-up.	Home-Based Care Intervention	• Community nurse visits • Patient satisfaction with care • General practitioner involvement • Admission to emergency department/hospital • Functional status • Knowledge of health • Disease-specific quality of life	The intervention group received statistically significantly more visits from community nurses and displayed greater knowledge and satisfaction. No effects were found on other measures.	6/13
[19] (53)	Stuck et al. (2000), Switzerland	Randomized controlled trial.Older people (75+) (N=791).	Traditional home care (not further specified)	In-home preventive visits with multidimensional geriatric assessments to prevent disability in community-dwelling older people at low and high risk for nursing home admission.	• Assistance in (instrumental) activities of daily living • Number of permanent admissions to a nursing home • Health care cost and utilization • Affect • Cognitive function • Gait and balance • General health • Number of medications	Partial statistically significant lower assistance in (instrumental) activities of daily living, and higher gait and balance was observed. A partial unfavourable significantly higher number of nursing home admissions was observed. No effects were found on other measures.	8/13

Table 1. *(continued)*

Ref #	Author, year, country,	Design, sample patient group	Control group	Intervention	Outcomes measured	Differences in effects between the intervention and control groups	Quality of the study*
[20] (54)	van Haastregt et al. (2000), the Netherlands	Randomized controlled trial.Older people (70+) at risk for falls (N=316).	Participants in the usual care group did not receive any special attention or intervention for the prevention of falls and impairments in mobility. The doctors and healthcare staff dealing with the participants were not told which patients were allocated to the usual care group.	Multifactoral home visits	• Falls: 1) number of falls; 2) injurious falls; 3) falls resulting in medical care; 4) fear of falling. • Mobility impairment • Number of physical complaints • Perceived health • Perceived gait problems • Daily activity • Mental health • Social functioning • Loneliness	A significantly lower decline in daily activity and less fear of falling. No effects were found on other measures.	8/13
[21] (55)	McWilliam et al. (1999), Canada	Randomized controlled trial. Chronically ill older people (65+) (N=298).	Care as usual and attention associated with in-home service, with minimum hours of service equal to the maximum intervention hours.	Home-Based Health Promotion Intervention	• Morale • Self-care agency • Self-esteem • Interpersonal dependency • Locus of authority in decision-making, desire for information • Self-related health, ability to manage health • Rehospitalizations • Quality of life	A statistically significant higher interpersonal dependency, perceived ability to manage health, self-care agency, locus of authority, and quality of life was observed. An unfavourable statistically significant higher desire for information was identified. No effects were found on other measures.	8/13

Table 1. *(continued)*

Ref #	Author, year, country,	Design, sample patient group	Control group	Intervention	Outcomes measured	Differences in effects between the intervention and control groups	Quality of the study*
[22] (56)	van Rossum et al. (1993), the Netherlands	Randomized controlled trial.Older people (75+) (N=580).	The control group received no home visits. They could use or apply for all the regular services in the area as before.	Preventive home visits for older people.	• Mortality • Self-rated health status • Functional status • Wellbeing: depressive state • Wellbeing: mental state • Healthcare utilization: a) use of community care; b) use of institutional care; c) care expenditure; d) referrals to outpatient clinics.	A significantly lower number of referrals to outpatient clinics was observed. No effects were found on other measures.	9/13

Notes: *Methodological quality of the studies, calculated using the -13item critical appraisal tool for randomized controlled trials by the Joanna Briggs Institute.

Description of included studies

The studies were published between 1993 and 2019 and conducted in the Netherlands [3, 4, 6, 12, 14, 20, 22], the United States of America [8, 10, 16, 17], Canada [11, 15, 21], China [2, 5, 13], Australia [18], Finland [1], Japan [9], Switzerland [19], and Sweden [7] (Table 1). Five studies followed a cluster randomized controlled trial design, clustered at the healthcare centre or general practice level [6, 7], home care service level [1], nursing team level [8] or nurse level [16]. The remaining 17 studies used a randomized controlled trial design. Measurements were performed between 1 and 36 months after baseline. The sample size ranged from 84 to 2283 participants, and a total of 10,169 older people were involved in the included studies.

Methodological quality

Twenty-four articles reported on 22 studies, with two studies being described in two articles [5, 6]. The quality scores of the 22 studies ranged from 6 to 11, with a total possible score of 13 (Table 2). The mean and median quality scores of the studies were 8 (IQR: 2.25; Q1-Q3: 6.88–9.13]. The weaknesses identified were a lack of blinding and limited description of reliable outcome measurements (i.e., unclear description of the reliability of measurements (29)). In seven studies, the outcome assessors were not blinded to treatment assignment [1, 7], or it was unclear whether blinding occurred [2, 16–18, 20]. In three studies, the outcomes were measured in a reliable way [4, 5, 21]. All studies stated that the outcomes were measured in the same way (i.e., the same instruments and measurement timing were used) between the intervention and control groups.

Interventions

A total of 22 interventions were identified (Table 3). None of the included studies evaluated the same intervention. In nine studies, the interventions were conducted following a protocol [2–4, 6, 8, 12, 16, 20, 22], whereas in three studies, only part of the intervention was protocol-dependant [5, 14, 17]. The interventions were heterogeneous in the type of patients, intervention components, and delivery.

Table 2. Methodological quality.

Published article	**Ref#**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Total score***
Toivo et al. (2019)	[1] (33)	Y	N	N	N	N	N	Y	Y	Y	Y	U	N	Y	6/13
Zhu et al. (2018)	[2] (34)	Y	U	Y	N	N	U	N	Y	Y	Y	U	Y	Y	7/13
Buurman et al. (2016)	[3] (35)	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	U	Y	Y	11/13
Dorresteijn et al. (2016)	[4] (36)	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	11/13
Ng and Wong (2018), Wong et al. (2016)	[5] (37,38)	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y	10/13
Suijker et al. (2016, 2017)	[6] (39,40)	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	U	Y	Y	11/13
Sherman et al. (2016)	[7] (41)	Y	Y	Y	N	N	N	U	N	Y	Y	U	Y	Y	7/13
Bruce et al. (2016)	[8] (42)	Y	U	Y	U	N	Y	Y	U	U	Y	U	N	Y	6/13
Ukawa et al. (2012)	[9] (43)	Y	Y	Y	N	N	Y	Y	Y	U	Y	U	U	Y	8/13
Pekmezaris et al. (2012)	[10] (44)	Y	Y	Y	N	N	Y	Y	U	Y	Y	U	Y	Y	9/13
Ploeg et al. (2010)	[11] (45)	Y	Y	Y	N	N	Y	U	Y	Y	Y	U	Y	Y	9/13
van Hout et al. (2010)	[12] (46)	Y	Y	Y	U	N	Y	Y	Y	Y	Y	U	Y	Y	10/13
Kwok et al. (2008)	[13] (47)	Y	N	N	N	N	Y	Y	Y	Y	Y	U	Y	Y	8/13
Bouman et al. (2008)	[14] (48)	Y	Y	Y	U	N	Y	Y	U	Y	Y	U	Y	Y	9/13
Markle-Reid et al. (2006)	[15] (49)	Y	Y	Y	N	N	Y	Y	N	Y	Y	U	Y	Y	9/13
Feldman et al. (2004)	[16] (50)	U	U	Y	U	N	U	Y	Y	Y	Y	U	Y	Y	7/13
Dougherty et al. (2002)	[17] (51)	Y	U	Y	N	N	U	Y	Y	Y	Y	U	Y	Y	8/13
Hermiz et al. (2002)	[18] (52)	Y	U	Y	U	N	U	Y	N	U	Y	U	Y	Y	6/13

Table 2. *(continued)*

Published article	**Ref#**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Total score***
Stuck et al. (2000)	[19] (53)	Y	U	Y	N	N	Y	U	Y	Y	Y	U	Y	Y	8/13
van Haastregt et al. (2000)	[20] (54)	Y	U	Y	U	N	U	Y	Y	Y	Y	U	Y	Y	8/13
McWilliam et al. (1999)	[21] (55)	U	U	Y	U	N	Y	Y	Y	U	Y	Y	Y	Y	8/13
van Rossum et al. (1993)	[22] (56)	Y	Y	Y	N	N	Y	Y	Y	Y	Y	U	N	Y	9/13
		20/22	12/22	20/22	2/22	0/22	15/22	17/22	16/22	18/22	22/22	3/22	18/22	22/22	

Notes: Q1: Was true randomization used for the assignment of participants to treatment groups? Q2: Was allocation to treatment groups concealed?; Q3: Were treatment groups similar at baseline?; Q4: Were participants blind to treatment assignment?; Q5: Were those delivering treatment blind to treatment assignment?; Q6: Were outcome assessors blind to treatment assignment?; Q7: Were treatment groups treated identically other than the intervention of interest?; Q8: Was follow-up complete, and if not, were differences between groups with respect to their follow-up adequately described and analysed?; Q9: Were participants analysed in the groups to which they were randomized?; Q10: Were outcomes measured in the same way in different treatment groups?; Q11: Were outcomes measured in a reliable manner?; Q12: Was an appropriate statistical analysis performed?; Q13: Was the trial design appropriate and any deviations from the standard randomized controlled trial design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?' Y = yes; N = no; U = unclear; * Total score is based on the number of questions answered with 'yes'.

Table 3. Interventions identified and ordered by the target population.

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	Summary of the intervention	Interventionist, training of interventionist, other professionals involved	Number and duration of visits of calls, total duration of the intervention.
General population of older people			
1 – (33). Coordinated Medication risk Management (CoMM): A risk management intervention for the general population of older patients (65+) receiving home care. Assessment, triage, referral (meeting with other professionals), implementation of actions. Unclear whether the intervention was protocol-dependant.	In the Coordinated Medication risk Management (CoMM) procedure, the core was a triage that customized medication reviews according to each home care clients' needs and enhanced use of existing resources. In a drug-related risk screening at home, nurses interviewed their clients using the Drug Related Problem Risk Assessment Tool (DRP-RAT). The drug-related problems needing intervening actions were screened during routine home visits. Findings were reported to the home care team (a leading nurse, nurses and practical nurses), which forwarded the risk screenings to the coordinating pharmacist. Practical nurses also conducted medication reconciliation and compiled medication lists.	Home care practice nurse (n=unclear), Home care nurse (n=unclear), practical nurse (n=unclear) Nurses were trained to screen clinically significant drug-related problems. Pharmacist: consultations were identified based on reports and medication lists Physician: if critical medical concerns were identified, the client's physician was contacted. These consultations took place in collaborative triage meetings.	One home visit for screening and triage meetings. The durations of the visit and triage meetings were unclear. Total duration of the intervention: unclear.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
7 – (41). Preventive home visit intervention for older people (75+). Assessment, care planning, performing interventions, monitoring, referral. Unclear whether the intervention was protocol-dependant.	During a preventive home visit, the district nurses followed a health dialogue guide. The health dialogue followed the nursing process: assessment of health, planning, diagnosis of health needs, nursing intervention and evaluation of nursing care. If any potential health problems were observed, they were evaluated using various assessment tools. If needed, health aid products were prescribed, medications were checked, and care was coordinated. Information was provided regarding activities in the local community, county council facilities and safety at home. Follow-up contacts were possible if needed.	District nurse (N=35). A one-day course was designed explicitly for district nurses. During the course, they received various materials. No other professionals were involved.	One home visit, with additional follow-up contacts if needed. The home visit was expected to last 60 min. Total duration of the intervention: one visit per patient, with multiple patients spread over 12 months.
9 – (43). Functioning Improvement Tool home visit program for older patients (65+) receiving preventive care at home. Providing guidance to complete a tool. Unclear whether the intervention was protocol-dependant.	During a home visit, the nurse or dental hygienist provided guidance to the patients to complete the Functioning Improvement Tool (FIT), which is a tool for identifying problems in daily life and recording the impressions of their daily tasks. It consisted of six steps: 1) recording activities; 2) recording the reason for daily tasks; 3) categorizing daily tasks into “will” or “duty”; 4) calculating the percentage of daily tasks in each category; 5) calculating a cobweb graph and daily task balance; 6) recording impressions of the daily tasks.	Nurse (not further specified) (n=5), dental hygienist (n=1). The nurses and dental hygienist were trained in the appropriate use of the FIT through lectures and role-playing. No other professionals were involved.	Home visits once a month for three months with a duration of 60 minutes per visit. Total duration of the intervention: three months.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
12 – (46). The preventive home visit program for frail older people (75+). Assessment, care planning, performing interventions, monitoring, referral. The intervention was protocol-dependant.	The visiting program assessed health risks and care needs using the resident assessment instrument (RAI) home care version. The assessments were entered on laptops, which enabled identification of 30 modifiable health risks. Nurses recommended interventions based on the RAI manual and a nationally issued nursing guideline. Individually tailored care plans were executed. The nurses left a copy of the care plan at a person's home to inform and encourage other visiting health professionals to add notes. The nurses visited a patient to execute and monitor the care plan, evaluate changes in care needs, and adapt the care plan when needed.	Community nurses (n=8) Nurses were trained during a 2-day session. No other professionals were involved. In case of urgent medical matters, the nurses were allowed to consult the primary care physicians.	At least four visits within a year. Additional visits or phone contacts, if necessary. Duration of a visit ranged from 45–75 minutes. Total duration of the intervention: 18 months.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
15 – (49). Proactive Nursing Health promotion for older people (75+) in need of personal support services. Assessment, education, care planning, performing interventions and referral. Unclear whether the intervention was protocol-dependant.	In the intervention, the participant's resources and environmental supports were bolstered by conducting an initial and ongoing health assessment, identifying and managing risk factors for functional decline, providing health education regarding healthy lifestyles and the management of chronic illnesses, referral to and coordination of community services, building a trusting, supportive and meaningful relationship with the client and his or her caregiver, and providing caregiver support. Factors influencing health were identified and addressed together with clients through the development of a care plan.	Home care registered nurse (n=unclear) The nurses had basic education. Unclear whether nurses were trained with regard to conducting the study. No other professionals were involved.	Home visits or telephone contacts with a duration of ≥10 minutes. The median number of visits was five home visits and one telephone call. The average time per visit was 60 minutes. Total duration of the intervention: 6 months.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	Summary of the intervention	Interventionist, training of interventionist, other professionals involved	Number and duration of visits of calls, total duration of the intervention.
19 – (53). Disability prevention in community-dwelling older people (75+) at low and high risk for nursing home admission. Assessment, physical examination, problem identification, care planning, monitoring. Unclear whether the intervention was protocol-dependant.	A health nurse obtained medical histories, administered physical examinations, and measured haematocrit and glucose levels in blood samples. Additionally, a comprehensive geriatric assessment was performed, focusing on hearing, vision, nutritional status, oral health, appropriateness of medication use, safety in the home, access to the external environment, and social support. Based on this in-home visit, the nurse prepared a problem list and discussed each case with one of the project team's geriatricians and developed rank-ordered recommendations. In-home follow-up visits were implemented every three months to monitor the implementation of the recommendations, make additional recommendations if new problems were detected and facilitate compliance.	Health nurse (registered nurse with an additional degree in public health nursing) (n=3) The nurses received training regarding physical assessment, gerontology, and performance of preventive home visits before and during the project. Geriatrician: the problems identified by the nurse were discussed with the geriatrician.	In-home visits every 3 months (total of 8 visits). The mean duration of a single visit was 74 minutes. Total duration of the intervention: 2 years.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
21 – (55) Home-Based Health Promotion Intervention for chronically ill older people (65+), discharged from the hospital. Reflective dialogue to define needs and action priorities. Unclear whether the intervention was protocol-dependant.	The education intervention focuses on guided reflection by nurses. Through reflective dialogue, individuals were intended to acquire an understanding that altered their expectations, beliefs, values, and perceptions related to their chronic illness experiences. The individualized process focuses on redefining needs and action priorities.	Specialized community home nurses (n=2). Nurses were specially trained (not further specified). No other professionals were involved.	Approximately 12–16 home visits. The duration of a visit was 1 hour. Total duration of the intervention: a maximum of 22 weeks.
22 – (56). Preventive home visits for older people (75+) not receiving home care. Discussing health topics, information provision, advice, referral. The intervention was protocol-dependant. The nurses used a checklist and additional guidelines that were developed to enable them to discuss the various health topics.	During multiple home visits, the nurses discussed health topics, provided information, and gave advice. During the visits, no physical examinations were performed. If necessary, subjects were advised to contact other services. Subjects in the intervention group could also contact the nurse by telephone every day to discuss problems or to ask for an extra visit. Each participant was visited by the same nurse during the entire intervention period, and if subjects became institutionalized, the visits continued as before.	The nurses had been performing in-home care nursing for many years and were employed specifically for the study. Unclear whether the nurses were trained with regard to conducting the study. No other professionals were involved.	Four visits a year for three years with extra visits if necessary. In general, the visits lasted 45 to 60 minutes. Total duration of the intervention: three years.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
Older people with poor health status, at risk for functional decline or falls			
3 – (35). Comprehensive Geriatric assessment and Transitional care bridge program for older patients (65+) at risk for functional decline, discharged from the hospital. Assessment, care planning, performing interventions, monitoring. The intervention was protocol-dependant. Additionally, evidence-based intervention protocols for geriatric conditions were available.	All randomized participants received a systematic, comprehensive geriatric assessment within 48 hours of admission by a geriatric-trained registered nurse. Afterward, the community-care registered nurse was contacted to visit the hospital to receive a personal handover of the assessment, to initiate the personalized care and treatment plan, and to meet with the participant and informal caregiver to discuss their needs. After discharge, the nurse performed medication reconciliation, answered the participant's questions, and completed a needs assessment during a home visit within two days after discharge. If a participant was discharged to a nursing home, the nurse also visited the nursing home. In the following visits, the actions described in the care plan were followed. Geriatric conditions were monitored, and interventions were continued or initiated.	Geriatric-trained registered nurse (n=unclear), community-care registered nurse (n=unclear). Before the start of the intervention, the community-care registered nurse who conducted the transitional care bridge program received ten days of additional training. Geriatrician, geriatric consultation team, the team on the ward in the hospital: conducted the comprehensive geriatric assessment and provided all care needed during a hospital stay.	The assessment was performed in the hospital within 48 hours after admission, a visit by the community-care nurse during admission. Home visits by the community-care nurse at 2, 6, 12, and 24 weeks after discharge. The duration of the visits was unclear. Total duration of the intervention: 24 weeks.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
6 – (39,40). Nurse-Led Multifactoral Care intervention for older patients (70+) at risk for functional decline. Assessment, care planning, performing interventions, care coordination, referral. The intervention was protocol-dependant.	The participants in the intervention group received 1) a systematically administered comprehensive geriatric assessment conducted by the community-care registered nurse; 2) an individually tailored care treatment plan consisting of multifactorial interventions. Diagnostic assessments and interventions were derived from a toolkit containing standardized, evidence-based protocols. Possible interventions were referral to a general practitioner, referral to a paramedic, giving advice, or follow-up visit by the nurse. Subsequently, the nurse discussed the yield of the assessment with the general practitioner; and 3) nurse-led care coordination with multiple follow-up visits.	Community-care registered nurse (n=15). All nurses followed formal 10-day training in providing integrated elderly care in the community before the start of the study. General practitioner: the results of the comprehensive geriatric assessment were discussed with the general practitioner.	One home visit (60 minutes) and between 3–8 additional home visits within 12 months (duration unclear). Total duration of the intervention: 12 months.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
11 – (45). Preventive primary care outreach intervention for older patients (75+) at risk for functional decline. Assessment, care planning, health promotion, referral. Unclear whether the intervention was protocol-dependant.	The intervention consisted of a comprehensive initial assessment, collaborative care planning, health promotion, and referral to community health and social support services. An experienced home care nurse delivered the intervention using the resident assessment instrument (RAI) for the home care system. Patient assessments were completed in their homes and triggered new interventions and recommendations at each assessment. Guidelines were used for further assessment and care planning. Referrals were made to various health services. After each visit, the nurses left a card in the home outlining their interventions and any actions required by the patient. The nurses monitored and encouraged patient adherence to their recommendations through follow-up phone calls and home visits.	Home care nurses (n=3). Unclear whether nurses were trained with regard to conducting the study. Family physician: After each home visit, nurses faxed a physician communication form to the patient's family physician. This form outlined the client assessment protocols that were triggered at the visit, nursing actions that were taken to tackle any problems, and areas of follow-up required by the physician.	Three home visits over a year (baseline, after 6 months and after 12 months). Additional home visits or phone calls were possible if necessary. The duration of the visits was unclear. Total duration of the intervention: 12 months.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	Summary of the intervention	Interventionist, training of interventionist, other professionals involved	Number and duration of visits of calls, total duration of the intervention.
4 – (36). A Matter of Balance (AMB-Home): a cognitive behavioural program for older people (70+) concerned about falling. Problem identification, education about fall-related themes, action planning. The intervention was protocol-dependant.	The intervention consisted of three strategies: 1) identifying and restructuring misconceptions about falls and fall risk; 2) setting realistic personal goals for increasing activity levels and safe behaviour; 3) promoting the uptake of old and new daily life activities that were avoided due to concerns about falling. In the program, seven pre-defined themes of the program were discussed: concerns about falls; thoughts about falling; physical exercise; asserting oneself; overcoming personal barriers; safe behaviour; and managing concerns about falls. Each session was similarly structured with a review of the previous session, a discussion of the main theme, and the formulation of a personalized action plan related to the discussed theme.	Community nurses (n=8) who were qualified in geriatrics and worked at local home care agencies Before the start of the trial, the nurses received a 2-day, mandatory training. No other professionals were involved.	There were seven individual sessions, including three home visits (60, 60 and 75 min, respectively) and four telephone contacts (35 min each). Total duration of the intervention: four months.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
20 – (54). Multifactoral home visits for older people (70+) at risk for falls. Assessment, advice, performing interventions, referral. The nurses followed a structured protocol for home visits.	During the home visits, the older people were screened for several medical, environmental, and behavioural factors potentially influencing falls and mobility. The screening was followed by advice, referrals, and other actions aimed at dealing with the hazards observed.	Community nurse (n=unclear). Unclear whether nurses were trained with regard to conducting the study. No other professionals were involved.	Five home visits. The mean duration per visit was 51 minutes. Total duration of the intervention: 12 months.
14 – (48). Home visitation program for older people (70+) with a poor health status living at home. Assessment, advice or referral. The nurses followed a structured protocol to assess health problems and risks via interview. Unclear whether the complete intervention was protocol-dependant.	Participants in the intervention group received a visit approximately every two months, always from the same nurse. To increase adherence, the nurses contacted the older people by telephone 1 to 4 weeks after each visit. During the first visit, the nurses recorded the problems as indicated by the participants. The EasyCare Questionnaire and additional checklists on a variety of topics were then used to detect further problems, which were detected by the nurses using diagnostic instruments. No physical examinations were performed. After the assessment, either advice was given or the older people were referred to professional and community services.	Home nurses (auxiliary community nurses) (n=3) from a local home care organization conducted the visits under the supervision of a public health nurse (community nurse). Unclear whether nurses were trained with regard to conducting the study. General practitioner: They were kept informed at regular intervals. They received an overview of all treated problems for each participant in the intervention group, including the accompanying recommendations and results of the interventions.	The program consisted of 8 visits. The visits lasted between 60 and 90 minutes. Total duration of the intervention: 18 months.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	Summary of the intervention	Interventionist, training of interventionist, other professionals involved	Number and duration of visits of calls, total duration of the intervention.
Disease-specific: chronic heart failure			
5 – (37,38)Home Palliative Heart Failure program for end-stage heart failure patients discharged from the hospital to the palliative care team. Assessment, care planning, performing interventions, referral. The interventions in the program were governed by standardized protocols. Unclear whether the complete intervention was protocol-dependant.	The key palliative care components of the Home Palliative Heart Failure program were physical and psychological symptom assessment and management, social support, spiritual and existential aspects of care whenever applicable, setting goals of care, and discussion of treatment preference and end-of-life issues based on patients' and families' beliefs and values. The palliative care nurse case managers made referrals to the palliative care physician and other appropriate health services if necessary.	Palliative care nurse case managers (n=4) who were registered nurses with post-registration training in palliative home care and experience in caring for end-stage heart failure patients. Trained volunteers (nursing students) were recruited to support the nurse case managers in the delivery of the intervention. The nurses and volunteers received 18 and 9 h of training, respectively. No other professionals were involved.	One predischarge visit, four visits in the first four weeks. In the subsequent two months, a maintenance intervention dose of monthly home visits supplemented by a social visit and a telephone follow-up by volunteers. The duration of the visit and telephone follow-up was unclear. Total duration of the intervention: 12 weeks.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
10 – (44). Remote Patient Monitoring, a telehealth intervention for patients with heart failure, discharged from the hospital. Monitoring. Unclear whether the intervention was protocol-dependant.	Both intervention and control group patients were admitted to a certified home healthcare agency following a hospitalization. Both groups were managed via disease management program guidelines and standards of care for heart failure. Patients in remote patient monitoring groups received a combination of live nursing visits and remote patient monitoring visits. The technology utilized closely replicates a face-to-face encounter through two-way video monitoring. With video screens, microphones, and accessories, this technology allows patients and nurses to see each other, speak to each other, and exchange information while in different locations.	Home care nurses (n=unclear). Nurses were trained to teach patients how to manage their conditions through medication, diet, and lifestyle modifications, following a disease management program pathway. No training was available specifically for remote patient monitoring. No other professionals were involved.	A typical visit schedule for patients in the remote patient monitoring group began with one live nursing visit and two remote visits for the first two weeks, followed by an increased frequency of remote visits and a slow tapering of live visits. The duration of the visits was unclear. Total duration of the intervention: 90 days.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	Summary of the intervention	Interventionist, training of interventionist, other professionals involved	Number and duration of visits of calls, total duration of the intervention.
13 – (47). Post-discharge community nursing programme for older patients (60+) with heart failure discharged from the hospital. Assessment, monitoring and referral. Unclear whether the intervention was protocol-dependant.	The intervention consisted of 1) a visit by a community nurse before discharge from the hospital and 2) a visit within seven days after discharge by a community nurse. During this visit, the nurse checked vital signs and signs for poor control of chronic heart failure. Medications were checked, and if necessary, home and daycare services were arranged. 3) Home visits were performed at weekly intervals for four weeks (not further specified). 4) Home visits were performed monthly after weekly home visits (not further specified). When patients were re-admitted to the hospital, the nurse visited the patient in the hospital to provide background information. Community nurses were available via a telephone hotline during office hours.	Community nurse (n=unclear). Unclear whether nurses were trained with regard to conducting the study. Close collaboration with geriatrician or cardiologist.	Multiple home visits and/or telephone calls. The mean number of visits was 8.8 home visits and/or 5.3 telephone calls. The duration of the visits was unclear. Total duration of the intervention: unclear.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
16 – (50). Improve Heart Failure Outcomes in Community-Based Home Health Care intervention for older people (65+) with chronic heart failure. Care management, goal setting, education, evaluation The intervention was protocol-dependant.	The intervention consisted of 1) a formal nursing protocol or "Health Outcomes, Management and Evaluation" ("HOME") Plan, in which the nurse helped the patient with medication, diet and activity recommendations and checked vital signs. The HOME plan outlined twelve specific objectives to be achieved by the nurse within nine visits; 2) a consumer-orientated patient self-care guide; and 3) interactive practitioner training designed to improve nurses' patient teaching and support skills.	Nurses (not further specified) (n=144). Nurses in the intervention group were trained to augment usual care with the HOME Plan for all of their CHF patients regardless of whether the patient was included in the study. No other professionals were involved.	The interventions consist of nine home visits. The duration of the visits was unclear. Total duration of the intervention: four weeks.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
Disease-specific: other			
18 – (52). Home Based Care Intervention for patients with chronic obstructive pulmonary disease after discharge from the hospital. Assessment, education, care management, problem identification, care planning, referral, follow-up. Unclear whether the intervention was protocol-dependant.	The intervention comprised two home visits by a community nurse. The first included a detailed assessment of the patient's health status and respiratory function. The nurses provided verbal and written education, advice on the disease and management of care. The nurses identified problem areas and, if indicated, referred patients to other services, such as home care. After the visit, a care plan documenting the problem areas provided education and referral to other services was provided to each patient's general practitioner. At the second home visit, the nurses reviewed patients' progress and the need for further follow-up.	Community nurse (n=unclear). Unclear whether nurses were trained with regard to conducting the study. General practitioner: referral to other services was provided to each patient's general practitioner.	Two home visits: the first within a week after discharge and the second one month later. The duration of the visits was unclear. Total duration of the intervention: one month.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
2 – (34). A nurse-led hypertension management model for patients with a diagnosis of hypertension. Assessment, care planning, performing interventions, monitoring and referral. The intervention in the study was protocol-dependant. The protocol included information regarding the home visits, telephone follow-ups and referrals.	The intervention consisted of a home visit, a telephone follow-up and referral. 1) The nurse conducted a home visit to patients within three days after recruitment. The patient's knowledge, behaviour, and the status of their identified health problems were assessed. According to the results, the nurses performed relevant interventions. 2) After the home visit, follow-up via telephone calls was conducted biweekly by the nurse. Previous health problems, the current condition of patients, and modifications in their knowledge, behaviour, and status were monitored. The previous behavioural contract was also reviewed and discussed. 3) When the patient reported increased blood pressure, a trained nurse would assess their adherence and/or any current illnesses or living circumstances that may affect their blood pressure. If needed, the patient was referred to other health services	Nurses at the community level (not further specified) (n=4). Nurses were trained during a 36-h pre-intervention training to enhance the nurses' decision making. General practitioner: If the patient had symptoms that required medication adjustment or a further health check, they were referred to the general practitioner. The general practitioner was responsible for providing (pharmacological) treatment. Researcher: The researcher was in charge of support for the nurses' decision making and assessment of the quality of care delivered.	One home visit of 60 minutes, biweekly telephone follow-up calls of 10 minutes. Total duration of the intervention: four weeks.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
8 – (42). The Depression CARE for PATients at Home (CAREPATH), a depression management intervention for older people (65+) at risk for depression. Assessment, care management, goal setting. The intervention was protocol-dependant (the depression care management protocol and CAREPATH protocol).	The intervention guides nurses in managing depression during routine home visits. For individuals who screened positive for depression, nurses assessed depression severity using the 9-item patient health questionnaire, with higher scores indicating severe depression. For beneficiaries with a score of 10 or greater, nurses followed depression care management guidelines during routine visits, including weekly depressive symptom assessment using the patient health questionnaire, care coordination with physicians or specialists, management of side effects and adherence to antidepressant medications, beneficiary and family education, and assistance with setting short-term functional and behavioural goals. For beneficiaries with lower scores, the protocol included education and encouragement, weekly monitoring for 2 weeks, and employing the full protocol when needed.	Home health nurses (not further specified) (n=178). Both the intervention and control groups received depression assessment training. The intervention group also received training in depression management. Physicians, primary clinicians: discussed care coordination.	The intervention was conducted during routine visits. The protocol should be followed weekly or, for patients seen less frequently, at each visit. The duration of the visits was unclear. Total duration of the intervention: unclear.

Table 3. *(continued)*

Reference#, reference, name and type of intervention, target population, intervention features, protocol dependency of the intervention	**Summary of the intervention**	**Interventionist, training of interventionist, other professionals involved**	**Number and duration of visits of calls, total duration of the intervention.**
17 – (51). Behavioural Management for Continence (BMC) intervention for older women (55+) with involuntary urine loss. Performing interventions, training. The bladder training was protocol-dependant. Unclear whether the complete intervention was protocol-dependant	The intervention consisted of three sequenced stages: 1) self-monitoring, 2) bladder training, and 3) pelvic muscle exercise with biofeedback. At the start of the intervention, the nurse and the participant established the woman's goals for continence. The patients decided whether they wanted to begin with self-monitoring or bladder training. After bladder training, the nurse and participant used the bladder diary and goals for continence to decide whether the participant continued pelvic muscle exercise with biofeedback. A re-evaluation of outcome variables and goals was obtained at the end of each phase. If the woman's goals were achieved, the intervention was ended.	Community-based nurses (n=unclear). Unclear whether nurses were trained with regard to conducting the study. No other professionals were involved.	Behavioural management for continence required 20–24 weeks: a) self-monitoring ±2–4 weeks; b) bladder training ±6–8 weeks; and c) pelvic muscle exercise with biofeedback ±12 weeks. It was unclear how many visits were conducted and how long the visits lasted.

Notes: The numbers in the first column are the reference numbers of the included studies from Table 1.

Patient groups

Interventions focused on different patient groups, with most studies including older patients in general [1, 7, 9, 12, 15, 19, 21, 22] or older people with a poor health status [14], older people at risk for functional decline [3, 6, 11], older patients at risk for falls [4, 20], or (older) patients with (end-stage) heart failure [5, 10, 13, 16].

Intervention components

In total, 20 of the 22 included interventions consisted of various components. None of the interventions or intervention components were comparable. Similar components amongst the interventions were assessment or problem identification [1–8, 11–14, 18–20]; care planning, goal setting, action planning or defining needs and action priorities [2–8,11, 12, 15, 16, 18, 19, 21]; referral or triage [1, 2, 5–7, 11, 12–15, 18, 20, 22]; regular care interventions, physical examinations, or implementation of actions (e.g., helping a person with medication) [1–3, 5–7, 12, 15, 17, 19, 20]; monitoring, evaluation or follow-up [2, 3, 7, 10, 12, 13, 16, 18, 19]; education, information provision, health promotion or advice [4, 11, 14–16, 18, 20, 22]; care coordination or care management [6, 8, 16, 18]; reflective dialogue or health theme discussion [21, 22], and providing guidance or training [9, 17]. In total, 18 interventions included three or more of the aforementioned components. The interventions were delivered via home visits [1, 3, 6–10, 14, 16–22] or a combination of home visits and telephone contact [2, 4, 5, 11–13, 15]. The number of contact moments via home visits or telephone calls varied between one and sixteen visits. In six interventions, it was possible to have additional contact if needed. The duration of the contact moments ranged from 10–90 minutes.

Interventionists

The nurses delivering the interventions were referred to as home care practice nurses, home care (registered) nurses, (practical) nurses, district nurses, community (home) nurses, home (health) nurses, community-care registered nurses, or palliative care nurse case managers. In total, 413 nurses were involved in the included studies. In nine studies, it was not clear how many nurses were involved [1, 3, 10, 13, 15, 17, 18, 20, 22]. A dental hygienist [9] or nursing student [5] conducted the intervention in combination with nurses in two studies. In 10 studies, other healthcare professionals were involved in conducting part of the study (e.g., for conducting a comprehensive assessment; for reference when medical attention was needed; or for discussing identified care needs, care provision or care coordination) [1–3, 6, 8, 11, 13, 14, 18, 19]. In 14 studies, the nurses had special training on how to conduct the intervention [1–10, 12, 16, 19, 21].

Nurse-sensitive outcomes

In total, 44 nurse-sensitive outcomes were identified, grouped into various categories and measured in various ways at different time points. The identified outcomes were grouped into the following eight categories based on the Nursing Outcome Classification (13): functional health outcomes (n=5); physiological health outcomes (n=7); psychosocial health outcomes (n=8); health knowledge and behaviour outcomes (n=7); perceived health outcomes (n=6); family health outcomes (n=1); death outcomes (n=1); and healthcare utilization outcomes (n=9) (Table 4). The outcomes measured most often in the studies were quality of life [2, 5, 6, 14, 16–18, 21], activities of daily living [3, 4, 6, 12, 14, 19–21], (self-rated) general health [7, 11, 14, 19–22], functional status [5, 11–13, 15, 22], cognitive functioning [3, 9, 13, 14, 19, 22], time to death or mortality status/rate [3, 6, 11, 12, 14, 22], and satisfaction with provided care [2, 5, 16, 18]. With regard to healthcare utilization, the most often measured outcomes were (time to) hospital (re)admission [3, 5, 6, 8, 10, 12–14, 16, 18, 21], community nursing [3, 6, 13, 16, 18, 22], institutionalization [6, 12, 14, 19, 22], and emergency care attendance [6, 10, 13, 14, 16].

Table 4. Outcomes used in district nursing care.

Outcomes	Study	Patient population	Instrument used	Time of measurement after baseline	Significant effect measured
Functional health					
Activities of daily living, disability, impairment in mobility, self-care agency	3, 4, 6, 12, 14, 19, 20, 21	• Older people at risk for functional decline [3, 6] or falls [4, 20] • Frail older people [12] or older people with poor health status [14] • Older people [19, 21]	• Katz index [3, 6] • 18-item GARS [4, 12, 14] • Lawton's multilevel assessment instrument [19] • Mobility control and range scales of the SIP68 [20] • Frenchay activities index [20] • Kearney & Fleisher's self-care agency instrument [21]	• 5–6 months [3, 4, 6, 12, 21] • 12 months [4, 6, 14, 20, 21] • 18 months [6, 12, 14, 20] • 24 months [6, 14] • 36 months [19]	4, 19 (partially), 20 (partially), 21 (at 12 months)
Functional status	5, 11, 12, 13, 15, 22	• People with heart failure [5, 13] • Older people [11, 15, 22] • Frail older people [12]	• Palliative Performance Scale [5] • Activities of daily living section of the older Americans resources and services multidimensional functional assessment [11] • COOP-WONCA chart [12] • SF-36 [12, 15, 22] • Six-minute walking test [13]	• 1 month [5] • 2–3 months [5] • 6 months [11, 12, 13, 15] • 12 months [11] • 18 months [12, 22] • 36 months [22]	15 (partially, only for mental health functioning)
Gait and balance	19, 20	• Older people [19] • Older people at risk for falls [20]	• Tinetti's fall risk index [19] • Unclear [20]	• 12 months [20] • 18 months [20] • 24 months [19]	19 (partially)

Table 4. *(continued)*

Outcomes	Study	Patient population	Instrument used	Time of measurement after baseline	Significant effect measured
Self-care adherence	2	• People with hypertension [2]	• Wong's adherence form [2]	• 3 months [2] • 4 months [2]	
Handicap	13	• People with heart failure [13]	• LHS [13]	• 6 months [13]	13
Physiologic health					
Cognitive functioning	3, 9, 13, 14, 19, 22	• Older people at risk for functional decline [3] • Older people [9, 19, 22] • People with heart failure [13] • Older people with poor health status [14]	• MMSE [3, 9, 14, 19] • AMT [13, 22]	• 3 months [9] • 6 months [3, 13] • 18 months [14, 22] • 24 months [19] • 36 months [22]	9
Number of medications	7, 14, 19	• Older people [7, 19] • Older people with poor health status [14]	• Self-developed instrument [7, 14, 19]	• 12 months [7] • 18 months [14] • 24 months [19]	7 (unfavourable)
Potentially inappropriate medications, excessive use of psychotropic, anticholinergic and serotonergic load, drug-drug interactions	1	• Older people [1]	• DART [1]	• 12 months [1]	

Table 4. *(continued)*

Outcomes	Study	Patient population	Instrument used	Time of measurement after baseline	Significant effect measured
Blood pressure (systolic and diastolic)	2	• People with hypertension [2]	• Calibrated sphygmomanometer and stethoscope [2]	• 3 months [2] • 4 months [2]	2
Episodes of urine loss	17	• Older women with urine loss [17]	• Bladder diary [17]	• 6 months [17] • 12 months [17] • 18 months [17] • 24 months [17]	17
Micturition frequency	17	• Older women with urine loss [17]	• Bladder diary [17]	• 6 months [17] • 12 months [17] • 18 months [17] • 24 months [17]	
Urine loss severity in grams	17	• Older women with urine loss [17]	• Pad test [17] • Self-developed question [17]	• 6 months [17] • 12 months [17] • 18 months [17] • 24 months [17]	17
Psychosocial health					
Mental health, emotional well-being, psychological state	6, 20,13	• Older people at risk for functional decline [6] or falls [20] • People with heart failure [13]	• SF-36 subscale [20] • SF-36 [6] • GHQ [13]	• 6 months [6, 13] • 12 months [6, 20] • 18 months [6, 20] • 24 months [6]	

Table 4. *(continued)*

Outcomes	Study	Patient population	Instrument used	Time of measurement after baseline	Significant effect measured
Depressive complaints, affect	14, 15, 19	• Older people with poor health status [14] • Older people [15, 19]	• GDS [14, 19] • CES-D [15]	• 6 months [15] • 18 months [14] • 24 months [19]	15
Loneliness	14, 20	• Older people with poor health status [14] • Older people at risk for falls [20]	• Loneliness scale [14] • Unclear [20]	• 12 months [20] • 18 months [14, 20]	
Social support	14, 15	• Older people with poor health status [14] • Older people [15]	• SSL12 [14] • PRQ-85 [15]	• 6 months [15] • 18 months [14]	15 (partially)
Social functioning	20	• Older people at risk for falls 20]	• Adjusted version of Donald's social activities battery [20]	• 12 months [20] • 18 months [20]	
Coping style	15	• Older people [15]	• Moos' coping questionnaire [15]	• 6 months [15]	
Morale	21	• Older people [21]	• LSI-A [21]	• 5–6 months [21] • 12 months [21]	
Health knowledge and behaviour					
Knowledge about aspects of disease and contact with the local community, desire for information	7, 18, 21	• Older people [7, 21] • People with COPD [18]	• Self-developed instrument [7, 18] • Locus of authority decision making [21]	• 3 months [18] • 5–6 months [21] • 12 months [7, 12]	7, 18, 21 (unfavourable)

Table 4. *(continued)*

Outcomes	Study	Patient population	Instrument used	Time of measurement after baseline	Significant effect measured
Self-efficacy, locus of control, locus of authority in decision making	2, 14, 21	• People with hypertension [2] • Older people with poor health status [14] • Older people [21]	• Short-Form CDSES [2] • Pearlin mastery scale [14] • Beiseckers' locus of authority in decision-making questionnaire [21]	• 3 months [2] • 4 months [2] • 5–6 month [21] • 12 month [21] • 18 months [14]	21 (at 12 months)
Self-esteem	21	• Older people [21]	• Rosenberg self-esteem scale [21]	• 5,5 months [21] • 12 months [21]	
Number of falls	4, 6, 20	• Older people [4] • Older people at risk for functional decline [6] or falls [20]	• Self-reported via calendar [4] or questionnaire [6, 20]	• Every month or up to 12 months [4] • 6 months [6] • (Within) 12 months [4] • 12 months [6, 20] • 18 months [6, 20] • 24 months [6]	4 (partially)
Concerns about falls and avoidance of activity, fear of falling	4, 20	• Older people [4] • Older people at risk for falls [20]	• 16-item FES-I [4, 20]	• 5 months [4] • 12 months [4, 20] • 18 months [20]	4, 20
Health behaviour	7, 18	• Older people [7] • People with COPD [18]	• Self-developed instrument [7, 18]	• 3 months [18] • 12 months [7]	
Independence to manage health	21	• Older people [21]	• IDI [21]	• 5–6 months [21] • 12 months [21]	21

Table 4. *(continued)*

Outcomes	**Study**	**Patient population**	**Instrument used**	**Time of measurement after baseline**	**Significant effect measured**
Perceived ability to manage health	21	• Older people [21]	• SF-36 [21]	• 5–6 months [21] • 12 months [21]	21
General health (self-rated)	7, 11, 14, 19, 20, 21, 22	• Older people [7, 11, 19, 21] • Older people with poor health status [14] • Older people at risk for falls [20]	• Health index [7] • Self-developed instrument [7] • Single item from SF-36 [11, 14, 20, 22] • SF-36 [21] • COOP-WONCA chart [19]	• 5–6 months [21] • 12 months [7, 11, 14, 21] • 18 months [14, 22] • 24 months [14, 19] • 36 months [22]	
Quality of life	2, 5, 6, 14, 16, 17, 18, 21	• People with hypertension [2], heart failure [5, 16] or COPD [18] • Older people at risk for functional decline [6] • Older people with poor health status [14] • Older women with urine loss [17] • Older people [21]	• LHFQ [16] • SF-36 [2, 14] • SF-20 [14] • McGill quality of life questionnaire [5] • CHQ [5] • EQ-5D [6] • Cantril's Ladder [6] • IIQ [17] • St. George's respiratory questionnaire [18] • Spitzer's QL-Index [21]	• 1 month [5] • 2–3 months [2, 5, 16, 18] • 4 months [2] • 5–6 months [6, 17] • 12 months [6, 17, 21] • 18 months [6, 17] • 24 months [6, 17]	5, 17, 21

Table 4. *(continued)*

Outcomes	Study	Patient population	Instrument used	Time of measurement after baseline	Significant effect measured
Satisfaction with care provided	2, 5, 16, 18	• People with hypertension [2], heart failure [5, 16] or COPD [18]	• Modified version of Reeder-Chen's clients satisfaction [16] • Self-developed satisfaction assessment [2, 5] • Unclear [18]	• 1 month [5, 16] • 2–3 months [2, 5, 18] • 4 months [2]	2, 5, 18
Symptom intensity/ burden, health complaints, physical complaints	5, 14, 20	• People with heart failure [5] • Older people with poor health status [14] • Older people at risk for falls [20]	• ESAS [5] • SCL-90 [14] • Unclear [20]	• 1 month [5] • 2–3 months [5] • 12 months [20] • 18 months [14, 20]	5 (partially)
Health problems, changes in self-reported problems,	7, 14	• Older people [7] • Older people with poor health status [14]	• 38 item questionnaire based on VIPS model [7] • Self-developed instrument [14]	• 12 months [7, 14] • 18 months [14] • 24 months [14]	
Quality-adjusted life-years (QALY)	11	• Older people [11]	• HUI-mark 3-HRQL utility scores [11]	• 6 months [11] • 12 months [11]	
Family health					
Caregiver burden	5, 6	• People with heart failure [5] • Older patients at risk for functional decline [6]	• ZBI [5] • CarerQol [6]	• 1 month [5] • 2–3 months [5] • 6 months [6] • 12 months [6] • 18 months [6] • 24 months [6]	5

Table 4. *(continued)*

Outcomes	Study	Patient population	Instrument used	Time of measurement after baseline	Significant effect measured
Death					
Mortality status, time until death, mortality rate, mortality	3, 6, 11, 12, 14, 22	• Older people at risk for functional decline [3, 6] • Older people [11, 22] • Frail older people [12] or older people with poor health status [12, 14]	• Registry or claims records [3, 6, 11, 12, 14, 22]	• 1 months [3] • 6 months [3, 6, 12] • 12 months [6, 11, 22] • 18 months [6, 12] • (Within) 24 months [6, 14, 22] • (Within) 36 months [22]	3
Healthcare utilization					
Health care utilization: (time to) hospital (re) admission (in days)	3, 5, 6, 8, 10, 12, 13, 14, 16, 18, 21	• Older people at risk for functional decline [3, 6] or depression [8] • People with heart failure [5, 10, 13, 16] or COPD [18] • Frail older people [12] or older people with poor health status [14] • Older people [21]	• Registry or claims records [3, 5, 6, 8, 10, 12, 13, 14, 16, 18, 21]	• (Within) 1 month [5, 8, 10] • (Within) 2–3 months [5, 8, 10, 16, 18] • (Within) 5–6 months [3, 6, 12, 21] • 12 months [6, 12] • 18 months [6, 12] • (Within) 24 months [6, 14]	5 (within 3 months) 8 (within 2 months)

Table 4. *(continued)*

Outcomes	Study	Patient population	Instrument used	Time of measurement after baseline	Significant effect measured
Healthcare utilization: (time to) community nursing	3, 6, 13,16, 18, 22	• Older people at risk for functional decline [3, 6] • People with chronic heart failure [13, 16] or COPD [18] • Older people [22]	• Registry or claims records [3, 6, 13, 16, 18]	• 3 months [16, 18] • (Within) 6 months [3, 6, 13] • 12 months [6] • 18 months [6] • 24 months [6]	6 (unfav-ourable), 16, 18 (unfavourable)
Health care utilization: (time to) institutionalization to nursing home / care home	6, 12, 14, 19, 22	• Older people at risk for functional decline [6] • Frail older people[12] or older people with poor health status [14] • Older people [19, 22]	• Registry or claims records [6, 12, 14, 19, 22]	• 6 months [6, 12] • 12 months [6] • 18 months [6, 12] • (Within) 24 months [6, 14] • (Within) 36 months [19, 22]	6 (unfavou-rable), 19 (partially and unfavou-rable)
Healthcare utilization: physician visits during and after working hours	6, 14, 16, 18	• Older people at risk for functional decline [6] • Older people with chronic heart failure [16] or COPD [18] • Older people with poor health status [14]	• Registry or claims records [6, 14, 16, 18]	• 3 months [16, 18] • 6 months [6] • 12 months [6] • 18 months [6] • (Within) 24 months [6, 14]	6
Healthcare utilization: emergency care attendance	6, 10, 13,14, 16	• Older people at risk for functional decline [6] • People with heart failure [10, 13, 16] • Older people with poor health status [14]	• Registry or claims records [6, 10, 13, 14, 16]	• (Within) 1 months [10] • (Within) 3 months [10, 16] • 6 months [6, 13] • 12 months [6] • 18 months [6] • (Within) 24 months [6, 14]	13

Table 4. *(continued)*

Outcomes	Study	Patient population	Instrument used	Time of measurement after baseline	Significant effect measured
Health care utilization: number of days in hospital wards, hospital stay	10, 13, 14	• People with heart failure [10, 13] • Older people with poor health status [14]	• Registry or claims records [10, 13, 14]	• (Within) 1 months [10] • (Within) 3 months [10] • 6 months [13] • (Within) 24 months [14]	13
Health care utilization: referral to outpatient clinics	13, 14, 22	• People with heart failure [13] • Older people with poor health status [14] • Older people [22]	• Self-registered by patient [13, 14, 22]	• 6 months [13] • (Within) 24 months [14] • (Within) 36 months [22]	22
Healthcare utilization: physiotherapy contacts	22	• Older people [22]	• Registry or claims records [22]	• (Within) 36 months [22]	

Table 4. *(continued)*

Outcomes	Study	Patient population	Instrument used	Time of measurement after baseline	Significant effect measured
Aids and modifications to the home	14	• Older people with poor health status [14]	• Self-developed questionnaire [14]	• (Within) 24 months [14]	

Notes: The numbers in each column are the reference numbers of the included studies from table 1. GARS: Groningen Activity Restriction Scale; SIP68: sickness impact profile short generic version; COOP/WONCA: The Dartmouth Corporation Functional Health Assessment Charts/World Organization of Family Doctors; SF-36: The Medical Outcomes Study 36-item Short-form Health Survey; FES-I: Falls Efficacy Scale-International; VIPS: wellbeing, integrity, prevention and safety; LHS: London Handicap Scale; ESAS: The Edmonton Symptom Assessment Scale; SCL-90: symptom checklist; MMSE: Mini-mental State Examination; AMT: Abbreviated mental test; GHQ: General health questionnaire; GDS: Geriatric depression scale; CES-D: centre for epidemiological studies depression scale; LSI-A: Life Satisfaction Index-version A; CDSES: Chronic Disease Self-Efficacy Scale; ZBI: Zarit Burden Interview; CarerQol: Caregiver quality of life; SSL12: social support list of interactions; PRQ-85: Personal Resource Questionnaire; IDI: Interpersonal dependency inventory; DART: Drug Related Problem Risk Assessment Tool; LHFQ: The Minnesota Living with Heart Failure Questionnaire; CHQ: chronic heart failure questionnaire; EQ-5D: European Quality of Life-5 Dimension; SF-20: Medical Outcomes Study 20-item Short Form Survey Social functioning score; IIQ: Incontinence impact questionnaire; QL-Index: Quality of life index; HUI-Mark3-HRQL: Health Utilities Index Mark 3 health related quality of life.

The outcomes were measured using various instruments. The instruments used in more than two studies were the Groningen Activities Restriction Scale to measure activities of daily living [4, 12, 14]; Short Form-36 to measure functional status [12, 15, 22], mental health [6, 20], general health [21] and quality of life [2, 14]; single item Short Form-36 to measure general health [11, 13, 20, 22]; and the Mini-Mental State Examination to measure cognitive functioning [3, 9, 14, 19]. In nine studies, self-developed instruments were used [2, 5–7, 14, 17–20]. Data registry or claim records were used in 13 studies to measure healthcare utilization [3, 5, 6, 8, 10, 12–14, 16, 18, 19, 21, 22]. Outcomes were measured at various time points, ranging from 1 to 36 months after baseline.

Statistically significant effects of the interventions were found in 27 of the 44 outcomes. Given the variation in the interventions and measured outcomes and to avoid misinterpretation, no effect sizes are provided. Favourable positive statistically significant effects were identified in 16 studies. In seven outcomes, the effect was partial, i.e., the effect was measured within groups instead of between groups or the effect was present at one but not all time points. The outcomes with positive (partial) statistical significance in two or more studies were activities of daily living [4, 19–21], concerns regarding falls [4, 20], knowledge of disease and healthcare [7, 18], hospital readmission [5, 8], quality of life [5, 17, 21], and satisfaction with the care provided [2, 5, 18]. For four outcomes, the effect was unfavourable, i.e., the intervention had a negative statistically significant effect on the outcome; specifically, the participant in the intervention group had higher healthcare utilization regarding home nursing [6, 18] and nursing home admissions [6, 19] and less knowledge of aspects of the disease [21] or used more medications [7] than those in the control group.

Discussion

This is the first systematic review providing an overview of nurse-led interventions conducted by district nurses for community-living older people. A total of 22 randomized controlled trials were identified and described in 24 articles. The studies were highly heterogeneous in methodological quality, the patient population on which the intervention focused, intervention components, and outcome measurements. Therefore, based on the results of this review, it is unclear what interventions are effective for whom and what nurse-sensitive outcomes can be used to show the value of district nursing care.

Our first aim of the review was to provide an overview of interventions evaluated in district nursing care and their effects. The included studies focused on the general population of older people (n=14) and older people with heart failure (n=4) or another specific problem or disease (n=4). This diversity in patient populations reflects district nursing care settings, where nurses perform a wide range of clinical interventions and fulfil a specialist-generalist role in providing care (57). This underlines that district nursing care is a speciality nursing practice requiring specific nursing interventions and competencies.

The nurses in charge of the interventions had a wide range of positions, roles and job titles (e.g., home care (practice) nurses, district nurses, community (home) nurses, home (health) nurses, or (palliative care) nurse case managers). The studies do not clearly describe the roles or educational levels required for the nurses involved in the intervention. Therefore, it is unclear whether there were differences in the tasks and responsibilities of the nurses, making comparisons complicated. The literature shows that the organization of health and social services, including district nursing care, differs both between and within European countries (58). While this variation is needed and inevitable, it is necessary to be transparent about the roles, tasks and responsibilities of those conducting the intervention in district nursing research. Variation in healthcare interventions is common. Most health care interventions are complex, i.e., include several components with possible interactions, leading to a range of potential and variable outcomes (59). There are many challenges in reviewing complex health interventions (59): it involves variations in intervention doses and patient characteristics, interactions between the intervention and context, and various measures of the same construct and outcomes (59,60). Following the study by Pigott and Shepperd (2013), the heterogeneity of the studies included in this review was investigated (60). While some studies made similar comparisons, such as comparing district nursing care to a new intervention or with no care, the intervention components, dosage and delivery of the individual interventions were diverse. None of the intervention components were sufficiently comparable, rendering synthesis of the results using meta-analyses impossible. Based on the statistically significant effects identified, no distinctive features between the interventions with and without effects were identified. Some of the effects were found only within groups instead of between groups, leading to possible overestimation of the outcome. This had also been identified by a review evaluating the effects of fundamental nursing care interventions, which showed frequent attempts to overestimate the outcomes of studies by claiming positive effects based on within-group effects rather than between-group effects (61). Ultimately, the authors decided not to draw any conclusions regarding the effectiveness of the interventions.

The second aim of this review was to identify nurse-sensitive outcomes that are used in studies evaluating district nursing care interventions. The 44 outcomes identified mainly focused on functional health, perceived health, and healthcare utilization. Of the 44 outcomes, 20 were nurse-sensitive, as identified by a Delphi study regarding nurse-sensitive outcomes in district nursing care (19). In contrast, three outcomes were not nurse-sensitive (mortality status, knowledge of the patient, and polypharmacy), and for eight outcomes, it was unclear if the outcomes were nurse-sensitive (Supporting Information Appendix 4). The outcomes with favourable (partial) statistical significance were activities of daily living, concerns about falls, knowledge of disease and healthcare, hospital readmission, quality of life and satisfaction with the care provided. These outcomes are potentially most useful for measuring the effect of district nursing interventions. The outcomes were measured in various ways at various time points using a variety of instruments. Therefore, it is currently unclear how these nurse-sensitive outcomes should be used to measure the quality of delivered district nursing care. The quality of the description of outcome measurements was limited in 19 studies. This may threaten the validity of statistical inferences on the existence and magnitude of the effect determined by the treatment (29). The reliability of the outcome measurements being unclear or not described could be why only weak effects were identified in the studies.

Implications for practice and further research

This review shows that evidence for district nursing care interventions is scarce. This underlines the conclusion by Jarrín et al. (2019), emphasizing the pressing need to develop an evidence base for district nursing care (1). A first step in developing this evidence base is to pay attention to the methodological quality of the conducted studies. In this review, only a small number of randomized controlled trials were identified. Conducting experimental work through effective research programs focusing on the effects of interventions on outcomes is strongly encouraged (62,63). For nursing research in general, Richards et al. concluded that less than 10% of articles reported in nursing journals are randomized controlled trials (61). When interested in the effectiveness of interventions, more attention should be given to setting up intervention trials with experimental designs such as randomized controlled trials, interrupted time series, or a stepped-wedge design (59). We are, however, aware of the challenges researchers testing (district) nursing interventions face, such as difficulties with randomization. When it is not possible to conduct experimental studies, other study designs and statistical methods could be used to examine the effectiveness of interventions (e.g., causal inference in quasi- and nonexperimental studies). It would be valuable to conduct a review of studies investigating the effectiveness of interventions using other designs than those used in the present review. Additionally, it would be relevant to provide insight into other studies conducted in district nursing care (e.g., the experiences with or feasibility of interventions in district nursing care using qualitative or mixed-methods approaches) to provide insight into all evidence available for district nursing care.

In future research, more attention should be given to the reporting of studies. For complex interventions specifically, the criteria for reporting the development and evaluation of complex interventions in healthcare (CReDECI) should be followed (64). It is essential to provide a thorough description of the outcome measurements, as this was the most critical methodological weakness in the included studies. Additionally, a more detailed and transparent description of who delivers what care, including a description of the roles, tasks and responsibilities, is needed to enhance replication. Also, this study shows great variation in how the outcomes were measured. It is important to measure nurse-sensitive outcomes in a systematic, standardized manner to ensure good transparency of the quality of the care delivered. With this, it is possible to provide guidance in quality monitoring and improve district nursing care quality (11). To conclude, a systematic research program guided by a strong theoretical foundation and focusing on interventions and nurse-sensitive outcomes is needed to produce methodologically strong evidence for district nursing care that is reliable, replicable and robust.

Strengths and limitations

This is the first systematic review focusing on nurse-led interventions for community-living older people conducted by district nurses. A strength of this study was that it was conducted systematically following the Joanna Briggs Institute Manual for Evidence Synthesis (29) and advice from information specialists from the Cochrane Centre Netherlands and the University of Applied Sciences Utrecht. Reporting was guided using the Preferred Reporting Items of Systematic reviews and Meta-Analyses (PRISMA) (26). All steps of this review were conducted independently by two reviewers, minimizing selection bias.

To appreciate the findings of this review, some limitations need to be considered. First, although only studies with experimental designs were included in this review, this may potentially have led to missed interventions. In this study, we followed the advice of the Cochrane Effective Practice and Organization of Care (EPOC) group by including only randomized controlled trials, controlled clinical trials, controlled before-and-after studies, and interrupted time-series studies (27). However, studies with other designs, including quasi- and nonexperimental designs with rigorous statistical methods, could potentially provide evidence for the effectiveness of district nursing care. Second, it is possible that interventions were missed because the review focused solely on nurse-led interventions conducted by district nurses in the community. While various job titles for district nurses were included in the search strategy, it is possible that studies were missed due to other job titles being used. This was minimized by building the search strategy in collaboration with information specialists. Also, excluding studies conducted in other settings that could be potentially relevant for district nursing care could have led to an incomplete picture. Third, it was impossible to pool the data into a meta-analysis or synthesis; therefore, only a narrative synthesis was conducted.

Conclusions

This review shows that the evidence for district nursing care interventions following an experimental design is scarce and highly heterogeneous. None of the included studies evaluated the same intervention, and the studies varied in the type of patients, intervention components, and outcome measures, which complicated the comparison of studies. Therefore, evidence regarding the effects of district nursing care interventions is inconclusive. Additionally, it is unclear what outcomes can be used to demonstrate the value of district nursing care. There is a pressing need to produce methodologically strong evidence that is reliable, replicable and robust. Research programs guided by theory and focusing on interventions and nurse-sensitive outcomes in district nursing care are highly needed. It is important to measure nurse-sensitive outcomes in a standardized manner to provide insight into the quality of delivered care and to guide monitoring and improve the quality of district nursing care.

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Supporting Information

Appendix 1

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-6
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	6
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	6
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	7-8
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Appendix
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	8

Appendix 1 *(continued)*

Section/topic	#	Checklist item	Reported on page #
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	8-9
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	7-8, Appendix
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	9
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	9-10
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	NA

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: www.prisma-statement.org.

Appendix 2

Search	Pubmed
#1	("Randomized Controlled Trial"[Publication Type] OR "Randomized Controlled Trials as Topic"[Mesh] OR "Controlled Clinical Trial"[Publication Type] OR "Controlled Clinical Trials as Topic"[Mesh] OR "Controlled Before-After Studies"[Mesh] OR "Interrupted Time Series Analysis"[Mesh] OR Controlled Clinical Trial*[tiab] OR Randomized Controlled Trial*[tiab] OR Randomised Controlled Trial*[tiab] OR Cluster Controlled Trial*[tiab] OR Randomized Trial*[tiab] OR Randomised Trial*[tiab] OR Clinical Trial*[tiab] OR Controlled Before After[tiab] OR Interrupted Time Series[tiab])
#2	(Aged[MeSH] OR Aged[tiab] OR Elder*[tiab] OR Oldest Old[tiab] OR Sexagenarian*[tiab] OR Septuagenarian*[tiab] OR Nonagenarian*[tiab] OR Octogenarian*[tiab] OR Centenarian*[tiab] OR Supercentenarian*[tiab] OR Aging[tiab] OR Ageing[tiab] OR ((Older[tiab]) AND (People[tiab] OR Person*[tiab] OR Adult*[tiab] OR Patient[tiab] OR patients[tiab] OR Individual*[tiab] OR client*[tiab])) OR Geriatric Assessment[MeSH] OR Geriatric Assessment[tiab] OR Frailty[MeSH] OR Frailt*[tiab] OR Pulmonary Disease, Chronic Obstructive[Mesh] OR Chronic Obstructive Pulmonary Disease[tiab] OR COPD[tiab] OR bronchitis[tiab] OR emphysema[tiab] OR "Cerebrovascular Disorders"[Mesh] OR stroke[MeSH] OR stroke[tiab] OR cerebrovascular accident[tiab] OR CVA[tiab] OR Heart Diseases[Mesh] OR heart disease[tiab] OR heart failure[tiab] OR Chronic Disease[Mesh] OR chronic*[tiab] OR geriatric disease[tiab] or age-related disease[tiab] OR diabetes mellitus[Mesh] OR diabetes[tiab] OR diabetic[tiab] OR comorbidity[MeSH] OR comorbid[tiab] OR comorbidit*[tiab] OR multimorbid[tiab] OR multimorbidit*[tiab] OR Neoplasms[MeSH] OR neoplasm*[tiab] OR cancer[tiab] OR malignan*[tiab] OR tumor[tiab] OR tumors[tiab] OR Dementia[MeSH] OR dementia[tiab] OR Alzheimer Disease[Mesh] OR Alzheimer[tiab]
#3	(Community Health Nurses[MeSH] OR Community Health Nursing[MeSH] OR Public Health Nursing[MeSH] OR Public Health Nurses[MeSH] OR Home Nursing[MeSH] OR Community Health Nurs*[tiab] OR Community Care Registered Nurse*[tiab] OR Community Care Nurse*[tiab] OR Public Health Nurs*[tiab] OR Home Health Nurs*[tiab] OR Community Nurs*[tiab] OR District nurs*[tiab] OR Home Nurs*[tiab] OR Visiting nurs*[tiab] OR Neighborhood Nurs*[tiab] OR Neighbourhood Nurs*[tiab] OR Home Care Nurs*[tiab] OR Homecare Nurs*[tiab] OR ((Geriatric Nursing[MeSH] OR Geriatric Nursing[tiab] OR nurs*[tiab]) AND (Home care[tiab] OR community[tiab] OR district[tiab] OR public[tiab] OR house call*[tiab] OR "House Calls"[Mesh] OR Home Care Services [MeSH] OR Home Care Service*[tiab] OR Health Visitor*[tiab])))
#4	Activities of Daily Living[MeSH] OR Activities of daily living[tiab] OR Activity of daily living[tiab] OR ADL[tiab] OR IADL[tiab] OR Mobility Limitation[MeSH] OR Mobility[tiab] OR Mobility Limitation*[tiab] OR ((Ambulation[tiab] OR Ambulatory[tiab]) AND (Difficult*[tiab])) OR Difficulty Walking[tiab] OR Accidental Falls[MeSH] OR Fall*[tiab] OR Frailty[MeSH] OR Frailt*[tiab] OR Frailness[tiab] OR Delirium[MeSH] OR Delirium[tiab] OR Weight Loss[MeSH] OR ((Weight[tiab]) AND (Loss*[tiab] OR Reduction*[tiab])) OR Pain[MeSH] OR Pain[tiab] OR Pressure Ulcer[MeSH] OR ((Pressure[tiab]) AND (Ulcer*[tiab] OR Sore*[tiab])) OR Decubitus[tiab] OR Bedsore*[tiab] OR Fatigue[MeSH] OR Fatigue[tiab] OR Dehydration[MeSH] OR Dehydration[tiab] OR Patient Compliance[MeSH] OR ((Patient[tiab] OR Treatment[tiab]) AND (Compliance[tiab] OR Adherence[tiab])) OR Anxiety[MeSH] OR Anxiet*[tiab] OR Personal Autonomy[MeSH]

	OR Autonomy[tiab] OR Decision Making[MeSH] OR Decision Making[tiab] OR Social Participation[tiab] OR Social Activit*[tiab] OR Caregiver Burden[tiab] OR Quality of Life[MeSH] OR Quality of Life[tiab] OR Life Quality[tiab] OR ((Emergency Medical Services[MeSH] OR Emergency Medical Service*[tiab] OR Medical Emergency Service*[tiab] OR Emergency Health Service*[tiab]) AND (Use[tiab] OR Utilization[tiab] OR Utilisation[tiab])) OR Patient Admission[MeSH] OR Patient Readmission[MeSH] OR Institutionalization[MeSH] OR Health Care Utilization[tiab] OR Healthcare Utilization[tiab] OR Admission*[tiab] OR Readmission*[tiab] OR re-admission*[tiab] OR General Practitioner Visit*[tiab] OR Nursing Home[tiab] OR Institutionalisation*[tiab] OR Institutionalization*[tiab] OR duration[tiab] OR Mortality[MeSH] OR Mortality[tiab] OR Quality of Death[tiab] OR Quality of Dying[tiab] OR "Patient Satisfaction"[Mesh] OR satisfaction[tiab]
#5	#1 AND #2 AND #3 AND #4

Search	Cinahl
#1	((MH "Randomized Controlled Trials+") OR (MM "Controlled Before-After Studies") OR (MM "Interrupted Time Series Analysis") OR (MM "Clinical Trials") OR TI "Controlled Clinical Trial*" OR TI "Randomized Controlled Trial*" OR TI "Randomised Controlled Trial*" OR TI "Cluster Controlled Trial*" OR TI "Randomized Trial*" OR TI "Randomised Trial*" OR TI "Clinical Trial*" OR TI "Controlled Before After" OR TI "Interrupted Time Series" OR AB "Controlled Clinical Trial*" OR AB "Randomized Controlled Trial*" OR AB "Randomised Controlled Trial*" OR AB "Cluster Controlled Trial*" OR AB "Randomized Trial*" OR AB "Randomised Trial*" OR AB "Clinical Trial*" OR AB "Controlled Before After" OR AB "Interrupted Time Series")
#2	((MH "Aged+") OR (MH "Aged, 80 and Over+") OR TI "Aged" OR TI "Elder*" OR TI "Oldest Old" OR TI "Sexagenarian*" OR TI "Septuagenarian*" OR TI "Nonagenarian*" OR TI "Octogenarian*" OR TI "Centenarian*" OR TI "Supercentenarian*" OR TI "Aging" OR TI "Ageing" OR ((TI "Older") AND (TI "People" OR TI "Person*" OR TI "Adult*" OR TI "Patient" OR TI "patients" OR TI "Individual*" OR TI "client*")) OR AB "Aged" OR AB "Elder*" OR AB "Oldest Old" OR AB "Sexagenarian*" OR AB "Septuagenarian*" OR AB "Nonagenarian*" OR AB "Octogenarian*" OR AB "Centenarian*" OR AB "Supercentenarian*" OR AB "Aging" OR AB "Ageing" OR ((AB "Older") AND (AB "People" OR AB "Person*" OR AB "Adult*" OR AB "Patient" OR AB "patients" OR AB "Individual*" OR AB "client*")) OR (MH "Geriatric Assessment+") OR TI "geriatric assessment" OR AB "geriatric assessment" OR (MH "Frailty Syndrome") OR TI "frailt*" OR AB "frailt*" OR (MH "Lung Diseases, Obstructive+") OR (MH "Pulmonary Disease, Chronic Obstructive+") OR TI "Chronic Obstructive Pulmonary Disease" OR TI "COPD" OR AB "Chronic Obstructive Pulmonary Disease" OR AB "COPD" OR TI "bronchitis" OR TI "emphysema" OR AB "bronchitis" OR AB "emphysema" OR (MH "Cerebrovascular Disorders+") OR TI "stroke" OR TI "cerebrovascular accident" OR TI "CVA" OR AB "stroke" OR AB "cerebrovascular accident" OR AB "CVA" OR (MH "Heart Diseases+") OR TI "heart disease" OR TI "heart failure" OR AB "heart disease" OR AB "heart failure" OR (MH "Chronic Disease+") OR TI "chronic*" OR TI "geriatric disease" or TI "age-related disease" OR AB "chronic*" OR AB "geriatric disease" or AB "age-related disease" OR (MH "Diabetes Mellitus, Type 1") OR (MH "Diabetes Mellitus, Type 2") OR TI "diabetes"

	OR TI “diabetic” OR AB “diabetes” OR AB “diabetic” OR (MH “Comorbidity”) OR TI “comorbid” OR TI “comorbidit*” OR TI “multimorbid” OR TI “multimorbidit*” OR AB “comorbid” OR AB “comorbidit*” OR AB “multimorbid” OR AB “multimorbidit*” OR (MH “Neoplasms”) OR TI “neoplasm*” OR TI “cancer” OR TI “malignan*” OR TI “tumor” OR TI “tumors” OR AB “neoplasm*” OR AB “cancer” OR AB “malignan*” OR AB “tumor” OR AB “tumors” OR (MH “Dementia+”) OR TI “dementia” OR AB “dementia” OR (MH “Alzheimer’s Disease”) OR TI “Alzheimer” OR AB “Alzheimer”)
#3	((MH “nurses, community health+”) OR (MH “community health nursing+”) OR (MH “public health nursing+”) OR (MH “nurses, public health+”) OR (MH “home nursing+”) OR TI “community health nurs*” OR AB “community health nurs*” OR TI “community care registered nurse#” OR AB “community care registered nurse#” OR TI “community care nurse#” OR AB “community care nurse#” OR TI “public health nurs*” OR AB “public health nurs*” OR TI “home health nurs*” OR AB “home health nurs*” OR TI “community nurs*” OR AB “community nurs*” OR TI “district nurs*” OR AB “district nurs*” OR TI “home nurs*” OR AB “home nurs*” OR TI “visiting nurs*” OR AB “visiting nurs*” OR TI “neighborhood nurs*” OR AB “neighborhood nurs*” OR TI “neighbourhood nurs*” OR AB “neighbourhood nurs*” OR TI “home care nurs*” OR AB “home care nurs*” OR TI “homecare nurs*” OR AB “homecare nurs*” OR ((MH “Geriatric Nursing+”) OR TI “Geriatric Nursing” OR AB “Geriatric Nursing” OR TI “nurs*” OR AB “nurs*”) AND (TI “home care” OR AB “home care” OR TI “community” OR AB “community” OR TI “district” OR AB “district” OR TI “public” OR AB “public” OR TI “house call*” OR AB “house call*” OR (MH “house calls+”) OR (MH “Home Care Services+”) OR TI “Home Care Service*” OR AB “Home Care Service*” OR TI “health visitor*” OR AB “health visitor*”)))
#4	((MH “Activities of Daily Living+”) OR (MH “Self-Care (Iowa NOC)+”) OR (MH “Self-Care Deficit (Saba CCC)+”) OR TI “Activities of daily living” OR TI “Activity of daily living” OR TI “ADL” OR TI “IADL” OR AB “Activities of daily living” OR AB “Activity of daily living” OR AB “ADL” OR AB “IADL” OR MH “Impaired Physical Mobility (NANDA)+”) OR (MH “Mobility (Iowa NOC)+”) OR TI “Mobility” OR TI “Mobility Limitation*” OR ((TI “Ambulation” OR TI “Ambulatory”) AND (TI “Difficult*”)) OR TI “Difficulty Walking” OR AB “Mobility” OR AB “Mobility Limitation*” OR ((AB “Ambulation” OR AB “Ambulatory”) AND (AB “Difficult*”)) OR AB “Difficulty Walking” OR (MH “Accidental Falls”) OR TI “fall*” OR AB “fall*” OR (MH “Frailty Syndrome”) OR TI “Frailt*” OR TI “Frailness” OR AB “Frailt*” OR AB “Frailness” OR (MH “Delirium”) OR TI “delirium” OR AB “delirium” OR (MH “Weight Loss+”) OR ((TI “Weight”) AND (TI “Loss*” OR TI “Reduction*”)) OR ((AB “Weight”) AND (AB “Loss*” OR AB “Reduction*”)) OR (MH “Pain+”) OR TI “pain” OR AB “pain” OR (MH “Skin Ulcer+”) OR ((TI “Pressure”) AND (TI “Ulcer*” OR TI “Sore*”)) OR TI “Decubitus” OR TI “Bedsore*” OR ((AB “Pressure”) AND (AB “Ulcer*” OR AB “Sore*”)) OR AB “Decubitus” OR AB “Bedsore*” OR (MH “Fatigue+”) OR TI “fatigue” OR AB “fatigue” OR (MH “Dehydration”) OR TI “dehydration” OR AB “dehydration” OR (MH “Patient Compliance+”) OR ((TI “Patient” OR TI “Treatment”) AND (TI “Compliance” OR TI “Adherence”)) OR ((AB “Patient” OR AB “Treatment”) AND (AB “Compliance” OR AB “Adherence”)) OR (MH “Anxiety+”) OR TI “anxiet*” OR AB “anxiet*” OR (MH “Patient Autonomy”) OR TI “Autonomy” OR AB “Autonomy” OR (MH “Decision Making+”) OR TI “Decision Making” OR TI “Social Participation” OR TI “Social Activit*” OR AB “Decision Making” OR AB “Social Participation” OR AB “Social Activit*” OR (MH “Caregiver Burden”)

	OR TI “Caregiver Burden” OR AB “Caregiver Burden” OR (MH “Quality of Life+”) OR TI “Quality of Life” OR TI “Life Quality” OR AB “Quality of Life” OR AB “Life Quality” OR (((MH “Emergency Medical Services+”) OR TI “Emergency Medical Service*” OR TI “Medical Emergency Service*” OR TI “Emergency Health Service*” OR AB “Emergency Medical Service*” OR AB “Medical Emergency Service*” OR AB “Emergency Health Service*”) AND (TI “Use” OR TI “Utilization” OR TI “Utilisation” OR AB “Use” OR AB “Utilization” OR AB “Utilisation”)) OR (MH “Institutionalization+”) OR TI “Health Care Utilization” OR TI “Healthcare Utilization” OR TI “Admission*” OR TI “Readmission*” OR TI “re-admission*” OR TI “General Practitioner Visit*” OR TI “Nursing Home” OR TI “Institutionalisation*” OR TI “Institutionalization*” OR TI “duration” OR AB “Health Care Utilization” OR AB “Healthcare Utilization” OR AB “Admission*” OR AB “Readmission*” OR AB “re-admission*” OR AB “General Practitioner Visit*” OR AB “Nursing Home” OR AB “Institutionalisation*” OR AB “Institutionalization*” OR AB “duration” OR (MH “Mortality+”) OR TI “Mortality” OR TI “Quality of Death” OR TI “Quality of Dying” OR AB “Mortality” OR AB “Quality of Death” OR AB “Quality of Dying” OR (MH “Patient Satisfaction+”) OR TI “satisfaction” OR AB “satisfaction”)
#5	#1 AND #2 AND #3 AND #4

Search	**PSYCH INFO**
#1	((DE “Randomized Controlled Trials”) OR (DE “Randomized Clinical Trials”) OR (DE “Clinical Trials”) OR TI “Controlled Clinical Trial*” OR TI “Randomized Controlled Trial*” OR TI “Randomised Controlled Trial*” OR TI “Cluster Controlled Trial*” OR TI “Randomized Trial*” OR TI “Randomised Trial*” OR TI “Clinical Trial*” OR TI “Controlled Before After” OR TI “Interrupted Time Series” OR AB “Controlled Clinical Trial*” OR AB “Randomized Controlled Trial*” OR AB “Randomised Controlled Trial*” OR AB “Cluster Controlled Trial*” OR AB “Randomized Trial*” OR AB “Randomised Trial*” OR AB “Clinical Trial*” OR AB “Controlled Before After” OR AB “Interrupted Time Series”)
#2	((DE “Aging”) OR TI “Aged” OR TI “Elder*” OR TI “Oldest Old” OR TI “Sexagenarian*” OR TI “Septuagenarian*” OR TI “Nonagenarian*” OR TI “Octogenarian*” OR TI “Centenarian*” OR TI “Supercentenarian*” OR TI “Aging” OR TI “Ageing” OR ((TI “Older”) AND (TI “People” OR TI “Person*” OR TI “Adult*” OR TI “Patient” OR TI “patients” OR TI “Individual*” OR TI “client*”)) OR AB “Aged” OR AB “Elder*” OR AB “Oldest Old” OR AB “Sexagenarian*” OR AB “Septuagenarian*” OR AB “Nonagenarian*” OR AB “Octogenarian*” OR AB “Centenarian*” OR AB “Supercentenarian*” OR AB “Aging” OR AB “Ageing” OR ((AB “Older”) AND (AB “People” OR AB “Person*” OR AB “Adult*” OR AB “Patient” OR AB “patients” OR AB “Individual*” OR AB “client*”)) OR (DE “Geriatric Assessment”) OR TI “geriatric assessment” OR AB “geriatric assessment” OR (DE “Health Impairments” OR DE “Homebound”) OR TI “frailt*” OR AB “frailt*” OR DE “Lung Disorders” OR DE “Chronic Obstructive Pulmonary Disease” OR DE “Cystic Fibrosis” OR DE “Pneumonia” OR DE “Pulmonary Emphysema” OR DE “Pulmonary Tuberculosis” OR TI “Chronic Obstructive Pulmonary Disease” OR TI “COPD” OR AB “Chronic Obstructive Pulmonary Disease” OR AB “COPD” OR TI “bronchitis” OR TI “emphysema” OR AB “bronchitis” OR AB “emphysema” OR DE

	“Cerebrovascular Disorders” OR DE “Cerebral Arteriosclerosis” OR DE “Cerebral Hemorrhage” OR DE “Cerebral Ischemia” OR DE “Cerebral Small Vessel Disease” OR DE “Cerebrovascular Accidents” OR DE “Subarachnoid Hemorrhage” OR TI “stroke” OR TI “cerebrovascular accident” OR TI “CVA” OR AB “stroke” OR AB “cerebrovascular accident” OR AB “CVA” OR DE “Heart Disorders” OR DE “Angina Pectoris” OR DE “Arrhythmias (Heart)” OR DE “Coronary Thromboses” OR DE “Myocardial Infarctions” OR TI “heart disease” OR TI “heart failure” OR AB “heart disease” OR AB “heart failure” OR DE “Chronic Illness” OR DE “Chronic Alcoholic Intoxication” OR DE “Chronic Fatigue Syndrome” OR DE “Chronic Mental Illness” OR DE “Chronic Pain” OR DE “Chronically Ill Children” OR TI “chronic*” OR TI “geriatric disease” or TI “age-related disease” OR AB “chronic*” OR AB “geriatric disease” or AB “age-related disease” OR DE “Diabetes” OR DE “Diabetes Insipidus” OR DE “Diabetes Mellitus” OR DE “Type 2 Diabetes” OR DE “Diabetes Mellitus” OR DE “Gestational Diabetes” OR DE “Type 2 Diabetes” OR DE “Type 2 Diabetes” OR DE “Blood Sugar” OR TI “diabetes” OR TI “diabetic” OR AB “diabetes” OR AB “diabetic” OR DE “Comorbidity” OR TI “comorbid” OR TI “comorbidit*” OR TI “multimorbid” OR TI “multimorbidit*” OR AB “comorbid” OR AB “comorbidit*” OR AB “multimorbid” OR AB “multimorbidit*” OR DE “Neoplasms” OR DE “Benign Neoplasms” OR DE “Breast Neoplasms” OR DE “Endocrine Neoplasms” OR DE “Leukemias” OR DE “Melanoma” OR DE “Metastasis” OR DE “Nervous System Neoplasms” OR DE “Terminal Cancer” OR TI “neoplasm*” OR TI “cancer” OR TI “malignan*” OR TI “tumor” OR TI “tumors” OR AB “neoplasm*” OR AB “cancer” OR AB “malignan*” OR AB “tumor” OR AB “tumors” OR DE “Dementia” OR DE “AIDS Dementia Complex” OR DE “Dementia with Lewy Bodies” OR DE “Presenile Dementia” OR DE “Pseudodementia” OR DE “Semantic Dementia” OR DE “Senile Dementia” OR DE “Vascular Dementia” OR TI “dementia” OR AB “dementia” OR DE “Alzheimer’s Disease” OR TI “Alzheimer” OR AB “Alzheimer”)
#3	(DE “Home Care Personnel” OR DE “Public Health Service Nurses” OR DE “Community Services” OR DE “Community Mental Health Services” OR DE “Community Welfare Services” OR DE “Emergency Services” OR DE “Home Care” OR DE “Home Visiting Programs” OR DE “Public Health Services” OR DE “Community Mental Health Services” OR DE “Community Counseling” OR DE “Public Health Services” OR DE “Public Service Announcements” OR TI “community health nurs*” OR AB “community health nurs*” OR TI “community care registered nurse#” OR AB “community care registered nurse#” OR TI “community care nurse#” OR AB “community care nurse#” OR TI “public health nurs*” OR AB “public health nurs*” OR TI “home health nurs*” OR AB “home health nurs*” OR TI “community nurs*” OR AB “community nurs*” OR TI “district nurs*” OR AB “district nurs*” OR TI “home nurs*” OR AB “home nurs*” OR TI “visiting nurs*” OR AB “visiting nurs*” OR TI “neighborhood nurs*” OR AB “neighborhood nurs*” OR TI “neighbourhood nurs*” OR AB “neighbourhood nurs*” OR TI “home care nurs*” OR AB “home care nurs*” OR TI “homecare nurs*” OR AB “homecare nurs*” OR ((TI “Geriatric Nursing” OR AB “Geriatric Nursing” OR TI “nurs*” OR AB “nurs*”) AND (TI “home care” OR AB “home care” OR TI “community” OR AB “community” OR TI “district” OR AB “district” OR TI “public” OR AB “public” OR TI “house call*” OR AB “house call*” OR TI “Home Care Service*” OR AB “Home Care Service*” OR TI “health visitor*” OR AB “health visitor*”)))

#4 (DE “Activities of Daily Living” OR DE “Functional Status” OR TI “Activities of daily living” OR TI “Activity of daily living” OR TI “ADL” OR TI “IADL” OR AB “Activities of daily living” OR AB “Activity of daily living” OR AB “ADL” OR AB “IADL” OR DE “Physical Mobility” OR TI “Mobility” OR TI “Mobility Limitation*” OR ((TI “Ambulation” OR TI “Ambulatory”) AND (TI “Difficult*”)) OR TI “Difficulty Walking” OR AB “Mobility” OR AB “Mobility Limitation*” OR ((AB “Ambulation” OR AB “Ambulatory”) AND (AB “Difficult*”)) OR AB “Difficulty Walking” OR DE “Falls” OR TI “fall*” OR AB “fall*” OR TI “Frailt*” OR TI “Frailness” OR AB “Frailt*” OR AB “Frailness” OR DE “Delirium” OR TI “delirium” OR AB “delirium” OR DE “Weight Loss” OR ((TI “Weight”) AND (TI “Loss*” OR TI “Reduction*”)) OR ((AB “Weight”) AND (AB “Loss*” OR AB “Reduction*”)) OR DE “Pain” OR DE “Aphagia” OR DE “Back Pain” OR DE “Chronic Pain” OR DE “Headache” OR DE “Myofascial Pain” OR DE “Neuralgia” OR DE “Neuropathic Pain” OR DE “Somatoform Pain Disorder” OR TI “pain” OR AB “pain” OR ((TI “Pressure”) AND (TI “Ulcer*” OR TI “Sore*”)) OR TI “Decubitus” OR TI “Bedsore*” OR ((AB “Pressure”) AND (AB “Ulcer*” OR AB “Sore*”)) OR AB “Decubitus” OR AB “Bedsore*” OR DE “Fatigue” OR TI “fatigue” OR AB “fatigue” OR DE “Dehydration” OR TI “dehydration” OR AB “dehydration” OR DE “Compliance” OR DE “Treatment Compliance” OR ((TI “Patient” OR TI “Treatment”) AND (TI “Compliance” OR TI “Adherence”)) OR ((AB “Patient” OR AB “Treatment”) AND (AB “Compliance” OR AB “Adherence”)) OR DE “Anxiety Disorders” OR DE “Castration Anxiety” OR DE “Death Anxiety” OR DE “Generalized Anxiety Disorder” OR DE “Obsessive Compulsive Disorder” OR DE “Panic Attack” OR DE “Panic Disorder” OR DE “Phobias” OR DE “Separation Anxiety Disorder” OR DE “Trichotillomania” OR TI “anxiet*” OR AB “anxiet*” OR DE “Autonomy” OR DE “Autonomy (Government)” OR DE “Empowerment” OR DE “Independence (Personality)” OR TI “Autonomy” OR AB “Autonomy” OR DE “Decision Making” OR DE “Choice Behavior” OR DE “Group Decision Making” OR TI “Decision Making” OR TI “Social Participation” OR TI “Social Activit*” OR AB “Decision Making” OR AB “Social Participation” OR AB “Social Activit*” OR DE “Participation” OR DE “Athletic Participation” OR DE “Client Participation” OR DE “Group Participation” OR DE “Participative Management” OR DE “Caregiver Burden” OR TI “Caregiver Burden” OR AB “Caregiver Burden” OR DE “Quality of Life” OR DE “Health Related Quality of Life” OR DE “Quality of Work Life” OR TI “Quality of Life” OR TI “Life Quality” OR AB “Quality of Life” OR AB “Life Quality” OR ((DE “Emergency Services” OR DE “Crisis Intervention Services” OR TI “Emergency Medical Service*” OR TI “Medical Emergency Service*” OR TI “Emergency Health Service*” OR AB “Emergency Medical Service*” OR AB “Medical Emergency Service*” OR AB “Emergency Health Service*”) AND (TI “Use” OR TI “Utilization” OR TI “Utilisation” OR AB “Use” OR AB “Utilization” OR AB “Utilisation”)) OR (DE “Institutionalization”) OR (DE “Institutionalization” OR DE “Hospitalization” OR DE “Incarceration” OR DE “Institution Visitation” OR DE “Institutional Release”) OR DE “Hospital Admission” OR DE “Psychiatric Hospital Admission” OR TI “Health Care Utilization” OR TI “Healthcare Utilization” OR TI “Admission*” OR TI “Readmission*” OR TI “re-admission*” OR TI “General Practitioner Visit*” OR TI “Nursing Home” OR TI “Institutionalisation*” OR TI “Institutionalization*” OR TI “duration” OR AB “Health Care Utilization” OR AB “Healthcare Utilization” OR AB “Admission*” OR AB “Readmission*” OR AB “re-admission*” OR AB “General Practitioner Visit*” OR AB “Nursing Home” OR AB “Institutionalisation*” OR AB “Institutionalization*” OR AB “duration” OR DE “Death and Dying” OR DE “Assisted Suicide” OR DE “Child Death” OR DE “Euthanasia” OR DE “Mortality Rate” OR DE “Mortality Risk” OR DE “Parental Death” OR DE “Partner Death” OR DE “Sudden Death” OR TI “Mortality” OR TI “Quality

	of Death” OR TI “Quality of Dying” OR AB “Mortality” OR AB “Quality of Death” OR AB “Quality of Dying” OR MM “Client Satisfaction” OR TI “Client Satisfaction” OR AB “Client Satisfaction”)
#5	#1 AND #2 AND #3 AND #4

Search	**Embase**
#1	(‘randomized controlled trial’/exp OR ‘controlled clinical trial’/exp OR ‘Controlled Clinical Trial*’:ti,ab,kw OR ‘Randomized Controlled Trial*’:ti,ab,kw OR ‘Randomised Controlled Trial*’:ti,ab,kw OR ‘Cluster Controlled Trial*’:ti,ab,kw OR ‘Randomized Trial*’:ti,ab,kw OR ‘Randomised Trial*’:ti,ab,kw OR ‘Clinical Trial*’:ti,ab,kw OR ‘Controlled Before After’:ti,ab,kw OR ‘Interrupted Time Series’:ti,ab,kw)
#2	(‘aged’/exp OR ‘Aged’:ti,ab,kw OR ‘Elder*’:ti,ab,kw OR ‘Oldest Old’:ti,ab,kw OR ‘Sexagenarian*’:ti,ab,kw OR ‘Septuagenarian*’:ti,ab,kw OR ‘Nonagenarian*’:ti,ab,kw OR ‘Octogenarian*’:ti,ab,kw OR ‘Centenarian*’:ti,ab,kw OR ‘Supercentenarian*’:ti,ab,kw OR ‘Aging’:ti,ab,kw OR ‘Ageing’:ti,ab,kw OR ((‘Older’:ti,ab,kw) AND (‘People’:ti,ab,kw OR ‘Person*’:ti,ab,kw OR ‘Adult*’:ti,ab,kw OR ‘Patient’:ti,ab,kw OR ‘patients’:ti,ab,kw OR ‘Individual*’:ti,ab,kw OR ‘client*’:ti,ab,kw)) OR ‘geriatric assessment’/exp OR ‘Geriatric Assessment’:ti,ab,kw OR ‘frailty’/exp OR ‘Frailt*’:ti,ab,kw OR ‘lung disease’/exp OR ‘obstructive airway disease’/exp OR ‘chronic obstructive lung disease’/exp OR ‘Chronic Obstructive Pulmonary Disease’:ti,ab,kw OR ‘COPD’:ti,ab,kw OR ‘bronchitis’:ti,ab,kw OR ‘emphysema’:ti,ab,kw OR ‘cerebrovascular accident’/exp OR ‘stroke’:ti,ab,kw OR ‘cerebrovascular accident’:ti,ab,kw OR ‘CVA’:ti,ab,kw OR ‘heart disease’/exp OR ‘heart disease’:ti,ab,kw OR ‘heart failure’:ti,ab,kw OR ‘chronic disease’/exp OR ‘chronic*’:ti,ab,kw OR ‘geriatric disease’:ti,ab,kw or ‘age-related disease’:ti,ab,kw OR ‘diabetes mellitus’/de OR ‘diabetes’:ti,ab,kw OR ‘diabetic’:ti,ab,kw OR ‘comorbidity’/exp OR ‘multiple chronic conditions’/exp OR ‘comorbid’:ti,ab,kw OR ‘comorbidit*’:ti,ab,kw OR ‘multimorbid’:ti,ab,kw OR ‘multimorbidit*’:ti,ab,kw OR ‘malignant neoplasm’/exp OR ‘neoplasm*’:ti,ab,kw OR ‘cancer’:ti,ab,kw OR ‘malignan*’:ti,ab,kw OR ‘tumor’:ti,ab,kw OR ‘tumors’:ti,ab,kw OR ‘dementia’/exp OR ‘dementia’:ti,ab,kw OR Alzheimer.ti,ab,kw)
#3	(‘community health nursing’/exp OR ‘Community Health Nurs*’:ti,ab,kw OR ‘Community Care Registered Nurse*’:ti,ab,kw OR ‘Community Care Nurse*’:ti,ab,kw OR ‘Public Health Nurs*’:ti,ab,kw OR ‘Home Health Nurs*’:ti,ab,kw OR ‘Community Nurs*’:ti,ab,kw OR ‘District nurs*’:ti,ab,kw OR ‘Home Nurs*’:ti,ab,kw OR ‘Visiting nurs*’:ti,ab,kw OR ‘Neighborhood Nurs*’:ti,ab,kw OR ‘Neighbourhood Nurs*’:ti,ab,kw OR ‘Home Care Nurs*’:ti,ab,kw OR ‘Homecare Nurs*’:ti,ab,kw OR ((‘geriatric nursing’/exp OR ‘Geriatric Nursing’:ti,ab,kw OR ‘nurs*’:ti,ab,kw) AND (‘Home care’:ti,ab,kw OR ‘community’:ti,ab,kw OR ‘district’:ti,ab,kw OR ‘public’:ti,ab,kw OR ‘house call*’:ti,ab,kw OR ‘home visit’/exp OR ‘home care’/exp OR ‘Home Care Service*’:ti,ab,kw OR ‘Health Visitor*’:ti,ab,kw)))

#4	('daily life activity'/exp OR 'instrumental activities of daily living'/exp OR 'Activities of daily living':ti,ab,kw OR 'Activity of daily living':ti,ab,kw OR 'ADL':ti,ab,kw OR 'IADL':ti,ab,kw OR 'patient mobility'/exp OR 'disability'/exp OR 'Mobility':ti,ab,kw OR 'Mobility Limitation*':ti,ab,kw OR (('Ambulation':ti,ab,kw OR 'Ambulatory':ti,ab,kw) AND ('Difficult*':ti,ab,kw)) OR 'Difficulty Walking':ti,ab,kw OR 'falling'/exp OR 'falls'/exp OR 'Fall*':ti,ab,kw OR 'frailty'/exp OR 'Frailt*':ti,ab,kw OR 'Frailness':ti,ab,kw OR 'delirium'/exp OR 'Delirium':ti,ab,kw OR 'body weight loss'/exp OR (('Weight':ti,ab,kw) AND ('Loss*':ti,ab,kw OR 'Reduction*':ti,ab,kw)) OR 'pain'/exp OR 'Pain':ti,ab,kw OR 'skin ulcer'/exp OR (('Pressure':ti,ab,kw) AND ('Ulcer*':ti,ab,kw OR 'Sore*':ti,ab,kw)) OR 'Decubitus':ti,ab,kw OR 'Bedsore*':ti,ab,kw OR 'fatigue'/exp OR 'Fatigue':ti,ab,kw OR 'dehydration'/exp OR 'Dehydration':ti,ab,kw OR 'patient compliance'/exp OR (('Patient':ti,ab,kw OR 'Treatment':ti,ab,kw) AND ('Compliance':ti,ab,kw OR 'Adherence':ti,ab,kw)) OR 'anxiety disorder'/exp OR 'Anxiet*':ti,ab,kw OR 'personal autonomy'/exp OR 'autonomy'/exp OR 'Autonomy':ti,ab,kw OR 'decision making'/exp OR 'Decision Making':ti,ab,kw OR 'Social Participation':ti,ab,kw OR 'Social Activit*':ti,ab,kw OR 'caregiver burden'/exp OR 'Caregiver Burden':ti,ab,kw OR 'quality of life'/exp OR 'Quality of Life':ti,ab,kw OR 'Life Quality':ti,ab,kw OR (('emergency health service'/exp OR 'Emergency Medical Service*':ti,ab,kw OR 'Medical Emergency Service*':ti,ab,kw OR 'Emergency Health Service*':ti,ab,kw) AND ('Use':ti,ab,kw OR 'Utilization':ti,ab,kw OR 'Utilisation':ti,ab,kw)) OR 'hospital admission'/exp OR 'hospital readmission'/exp OR 'institutional care'/exp OR 'Health Care Utilization':ti,ab,kw OR 'Healthcare Utilization':ti,ab,kw OR 'Admission*':ti,ab,kw OR 'Readmission*':ti,ab,kw OR 're-admission*':ti,ab,kw OR 'General Practitioner Visit*':ti,ab,kw OR 'Nursing Home':ti,ab,kw OR 'Institutionalisation*':ti,ab,kw OR 'Institutionalization*':ti,ab,kw OR 'duration':ti,ab,kw OR 'mortality'/exp OR 'Mortality':ti,ab,kw OR 'Quality of Death':ti,ab,kw OR 'Quality of Dying':ti,ab,kw OR 'patient satisfaction'/exp OR 'patient satisfaction':ti,ab,kw)
#5	#1 AND #2 AND #3 AND #4

Appendix 3

	Criteria
Population: older people	INCLUDE Mean age > 60 years EXCLUDE Caregivers
Intervention: care delivered by nurses	INCLUDE intervention is defined as "any treatment based upon clinical judgment and knowledge that a nurse performs to enhance patient outcomes" (NIC). INCLUDE care delivered by a district nurse. Synonyms for district nurse include community health nurse, community nurse, home care nurse or home nurse. INCLUDE intervention with at least one face-to-face moment with the patient. This can be at home or in the hospital only if it is transitional care (hospital to home). Face to face can be conducted using telehealth. INCLUDE interventions delivered by nurses, nurse-led care, nurse coordinated care or care largely delivered by nurses INCLUDE multidisciplinary interventions only if at least 50% of the intervention is delivered by the district nurse. EXCLUDE care delivered by a nurse working from the General Practitioner (e.g., nurse practitioner, advanced practice nurse (APN)) EXCLUDE care delivered by a nurse working from the hospital (e.g., liaison nurse, specialized nurse). EXCLUDE if it is unclear if the nurse providing the intervention is a district nurse. EXCLUDE Studies focusing on educational interventions directed solely at other healthcare providers
Comparator	INCLUDE all comparators
Outcomes	INCLUDE At least one of the used outcomes should be nurse-sensitive for district nursing care: Activities for daily living (ADL), Mobility, Falls, Frailty, Pain, Decubitus, Fatigue, Unintentional weight loss, Dehydration, Anxiety, Compliance, Delirium, Autonomy, Decision making, Participation with social activities, Burden informal caregiver, Quality of life, Satisfaction with district nursing care, Meaningful life, Unplanned hospital admission, Unplanned hospital readmission, Emergency department or service use, Duration of district nursing, Intensity of district nursing, Place of death, Quality of dying and death.
Setting	INCLUDE home and community care in a primary care setting. EXCLUDE hospital setting EXCLUDE general practitioner setting EXCLUDE if the setting is unclear

Appendix 3 *(continued)*

	Criteria
Design	INCLUDE randomized controlled trials (RCTs) (including small RCTs like pilot studies, as long as they used randomization), controlled clinical trials (CCT), controlled before-and-after studies (CBAs) and interrupted time series studies (ITS) EXCLUDE secondary data analyses using trial data when it does not focus on nursing interventions. EXCLUDE Studies with only observational data used to describe the work of community care nurses. EXCLUDE quasi-experimental design without randomization EXCLUDE Qualitative study designs. EXCLUDE Process evaluation, study protocols EXCLUDE Systematic review
Language	INCLUDE articles in English or Dutch
Publication date	INCLUDE all publication dates
Country	INCLUDE all countries

Appendix 4

Outcomes identified in the systematic review	Is the outcome included in the Delphi study by Veldhuizen et al.?	Is the outcome assessed as nurse-sensitive in the Delphi study?
Functional health		
Activities of daily living, disability, impairment in mobility, self-care agency	Yes: ADL, mobility	Yes, nurse-sensitive
Functional status	Yes: ADL; mobility	Yes, nurse-sensitive
Gait and balance	Yes: mobility	Yes, nurse-sensitive
Self-care adherence	Yes: ADL, compliance	Yes, nurse-sensitive
Handicap	No	NA
Physiologic health		
Cognitive functioning	Yes: cognitive functioning	Unclear
Number of medications	Yes: polypharmacy	Not nurse-sensitive
Potentially inappropriate medications, excessive use of psychotropic, anticholinergic and serotonergic load, drug-drug interactions	No	NA
Blood pressure (systolic and diastolic)	No	NA
Episodes of urine loss	Yes: bladder continence,	Unclear
Micturition frequency	Yes: bladder continence,	Unclear
Urine loss severity in grams	Yes: bladder continence,	Unclear
Psychosocial health		
Mental health, emotional well-being, psychological state	Yes: signs of depression, anxiety	Signs of depression: unclear Anxiety: Yes, nurse-sensitive
Depressive complaints, affect	Yes: signs of depression	Unclear
Loneliness	Yes: loneliness	Unclear
Social support	No	NA
Social functioning	Yes: participation in social activities	Yes, nurse-sensitive
Self-esteem	No	NA
Coping style	No	NA
Morale	No	NA

Appendix 4 *(continued)*

Outcomes identified in the systematic review	Is the outcome included in the Delphi study by Veldhuizen et al.?	Is the outcome assessed as nurse-sensitive in the Delphi study?
Health knowledge and behaviour		
Knowledge about aspects of disease and about contact with local community, desire for information	Yes: knowledge of the patient	Not nurse-sensitive
Self-efficacy, locus of control, locus of authority in decision making	Yes: autonomy	Yes, nurse-sensitive
Number of falls	Yes: falls	Yes, nurse-sensitive
Concerns about falls and avoidance of activity, fear of falling	Yes: falls	Yes, nurse-sensitive
Health behavior	Yes: compliance, problem behavior	Yes, nurse-sensitive
Independence to manage health	Yes: autonomy, decision making	Yes, nurse-sensitive
Perceived ability to manage health	Yes: autonomy decision making	Yes, nurse-sensitive
Perceived health		
General health (self-rated)	No	NA
Quality of life	Yes: quality of life, meaningful life, quality of dying and death	Yes, nurse-sensitive
Satisfaction with care provided	Yes: satisfaction with district nursing care	Yes, nurse-sensitive
Symptom intensity/burden, health complaints, physical complaints	No in general, but decubitus, dehydration, fatigue, pain, and weight loss were measured	decubitus, dehydration, fatigue, pain, and weight loss were measured: Yes, nurse-sensitive
Health problems, changes in self-reported problems,	No in general, but decubitus, dehydration, fatigue, pain, and weight loss were measured	decubitus, dehydration, fatigue, pain, and weight loss were measured: Yes, nurse-sensitive
Quality adjusted life years (QALY)	No	NA

Appendix 4 *(continued)*

Outcomes identified in the systematic review	Is the outcome included in the Delphi study by Veldhuizen et al.?	Is the outcome assessed as nurse-sensitive in the Delphi study?
Family health		
Caregiver burden	Yes: informal caregiver burden	Yes, nurse-sensitive
Death		
Mortality status, time until death, mortality rate, mortality	Yes: Death	No, not nurse-sensitive
Healthcare utilization		
Health care utilization: (time to) hospital readmission (in days)	Yes, unplanned hospital (re)admission.	Yes, nurse-sensitive
Healthcare utilization: (time to) community nursing	Yes: duration and intensity of district nursing care	Yes, nurse-sensitive
Health care utilization: (time to) institutionalization to nursing home / care home	Yes, nursing home admission	Unclear
Healthcare utilization: physician visits during and after hours	Yes, general practitioner visit	Unclear
Healthcare utilization: emergency care attendance	Yes: emergency department or service use	Yes, nurse-sensitive
Health care utilization: number of days in hospital wards, hospital stay	No	NA
Health care utilization: outpatient clinics	No	NA
Healthcare utilization: physiotherapy contacts	No	NA
Aids and modifications to the home	No	NA

5

Nurse-sensitive outcomes in district nursing care: A Delphi study

Veldhuizen JD, van den Bulck AO, Elissen AM, Mikkers MC,
Schuurmans MJ, Bleijenberg N.

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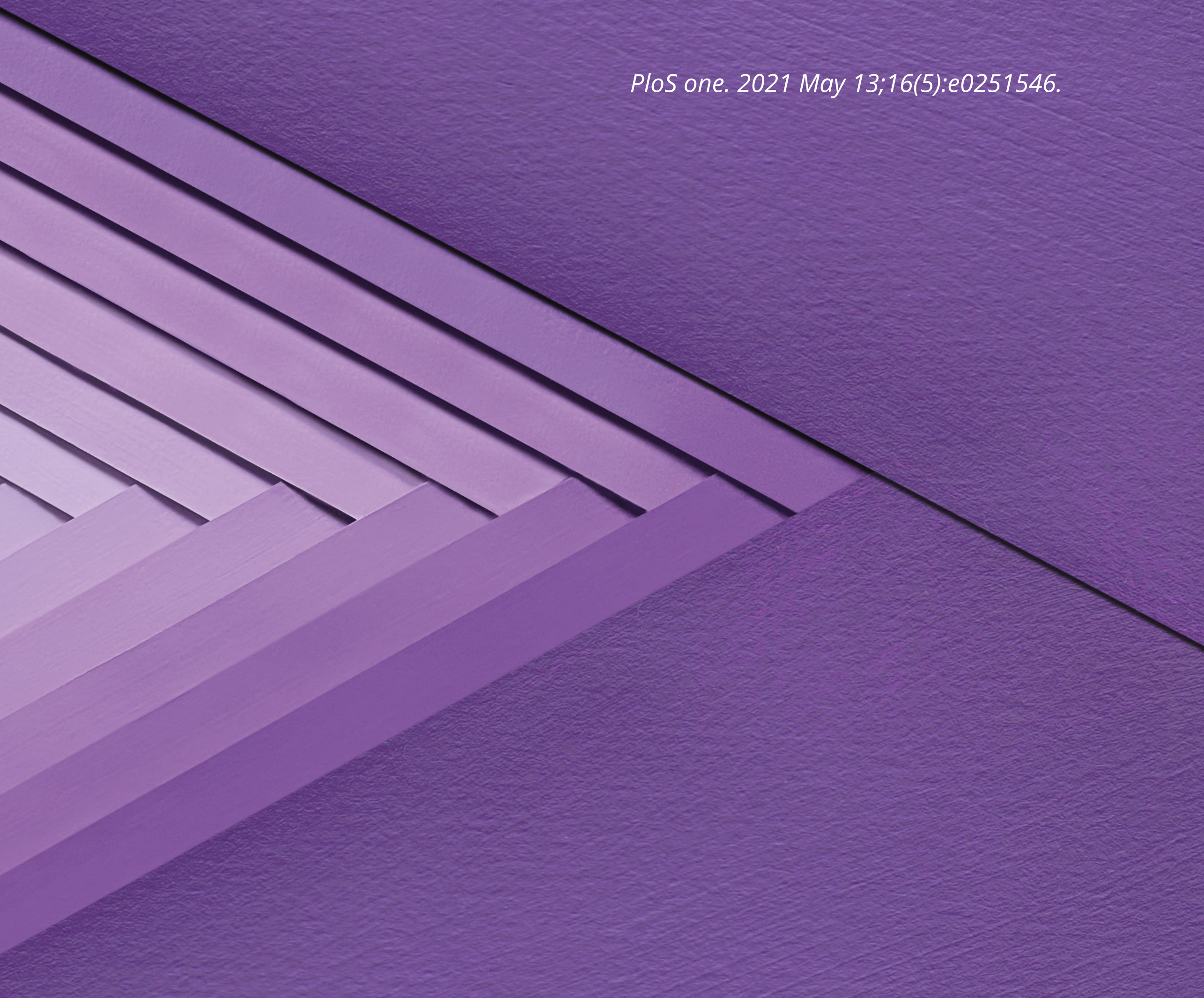

Abstract

Objectives: To determine nurse-sensitive outcomes in district nursing care for community-living older people. Nurse-sensitive outcomes are defined as patient outcomes that are relevant based on nurses' scope and domain of practice and that are influenced by nursing inputs and interventions.

Design: A Delphi study following the RAND/UCLA Appropriateness Method with two rounds of data collection.

Setting: District nursing care in the community care setting in the Netherlands.

Participants: Experts with current or recent clinical experience as district nurses as well as expertise in research, teaching, practice, or policy in the area of district nursing.

Main outcome measures: Experts assessed potential nurse-sensitive outcomes for their sensitivity to nursing care by scoring the relevance of each outcome and the ability of the outcome to be influenced by nursing care (influenceability). The relevance and influenceability of each outcome were scored on a nine-point Likert scale. A group median of 7 to 9 indicated that the outcome was assessed as relevant and/or influenceable. To measure agreement among experts, the disagreement index was used, with a score of <1 indicating agreement.

Results: In Delphi round two, 11 experts assessed 46 outcomes. In total, 26 outcomes (56.5%) were assessed as nurse-sensitive. The nurse-sensitive outcomes with the highest median scores for both relevance and influenceability were the patient's autonomy, the patient's ability to make decisions regarding the provision of care, the patient's satisfaction with delivered district nursing care, the quality of dying and death, and the compliance of the patient with needed care.

Conclusions: This study determined 26 nurse-sensitive outcomes for district nursing care for community-living older people based on the collective opinion of experts in district nursing care. This insight could guide the development of quality indicators for district nursing care. Further research is needed to operationalise the outcomes and to determine which outcomes are relevant for specific subgroups.

Introduction

Worldwide, healthcare services are challenged by the rapidly growing ageing population (1). Moreover, the majority of older people desire to continue living at home, resulting in a rise in the total number of community-living older people. In Europe, the majority of older people live independently at home, either alone or with a spouse or other family members (2). However, with increasing age, adverse consequences such as frailty, disability, chronic diseases, and multiple complex long-term conditions are present among these community-living older people (3,4). Because of these adverse consequences, community-living older people often need assistance with their daily life activities to be able to live at home as long as possible. Professional care assistance at home is provided through district nursing care, next to other healthcare professionals such as the general practitioner and other (paramedic) professionals in primary care (5). The funding, organisation, definition, and delivery of district nursing care vary between countries worldwide (6–8). For the purpose of this paper, district nursing care is defined as any technical, medical, supportive or rehabilitative nursing care and the provision of assistance with personal care (7). This definition is in line with the definition used for community care nursing in Europe (7,9) and reflects district nursing care in the Netherlands (10).

In many European countries, the quality of care at home is under pressure, as demands on district nursing care are increasing due to the ageing population, the increase in care complexity, and the shortage of district nursing care professionals (11,12). Therefore, it is crucial to monitor the quality of district nursing care in terms of patient outcomes. Insight into patient outcomes is necessary to measure the effect of healthcare services on patient health and wellbeing (13,14). However, patient outcomes to measure the quality of district nursing care in clinical practice on patients' health status and wellbeing are currently scarce (15).

For district nursing care, it is necessary to determine nurse-sensitive outcomes, i.e., patient outcomes that are *relevant* based on nurses' scope and domain of practice and that are *influenced* by nursing inputs and interventions (16). The Nursing Outcome Classification (NOC) provides a set of nursing outcomes that can be used across the care continuum to assess the outcomes of care following nursing interventions (17). However, in this overview, it is unclear what outcomes are relevant for district nursing care. Two studies, one by the International Consortium for Health Outcomes Measurement (ICHOM) (18) and the other by Joling et al. (15) have already been conducted on outcomes that are potentially relevant to district nursing care. The ICHOM developed a set of standard health outcome measures to guide the improvement of the quality of care for the general population of older people (18). While this study provided a meaningful overview of relevant outcomes for this population, it remains unclear whether these outcomes are nurse-sensitive outcomes specifically for district nursing care because they were developed by teams of physician leaders, researchers and patient advocates (18). The systematic review by Joling et al. (15) identified 567 quality indicators for older people in the community care setting (i.e., primary care and district nursing care). Most of these indicators refer to care processes (80%), while only 33 indicators focus on 18 unique patient outcomes regarding health status and wellbeing (5.8%) (15). However, it is unclear which of the proposed outcomes in the literature could be used as nurse-sensitive outcomes for district nursing care. Before quality indicators can be developed and operationalized, it is necessary to determine what outcomes are relevant to measure.

The aim of this study was to determine nurse-sensitive outcomes for district nursing care for community-living older people. Measuring nurse-sensitive outcomes for district nursing care is important because it can contribute to understanding the internal quality of teams and organisations. It provides insight into the quality of delivered care, which consequently could guide monitoring and improve the quality of district nursing care. Moreover, public transparency regarding outcomes allows patients to compare and choose a desired organisation. Finally, insight into nurse-sensitive outcomes could guide health insurers in contracting district nursing care organisations based on the quality of delivered care.

Materials and methods

Design

A Delphi study following the RAND/UCLA Appropriateness Method (RAM) (19) was performed. The objective of the RAM is to detect when experts agree rather than to reach consensus among experts (19). The RAM is focused on combining available scientific evidence with the collective judgement of experts to provide a statement regarding the appropriateness of delivered care (19). This focus fits the aim of this study to determine nurse-sensitive outcomes for district nursing care based on the collective opinion of national experts. Because of the specific national context of district nursing care, this study focused on the situation in the Netherlands. To enhance the robustness of this study, the guidance on conducting and reporting Delphi studies (CREDES) was followed (20). In accordance with the RAM, the following steps were conducted: questionnaire development, identification of experts, two rounds of data collection (an online questionnaire and an expert panel meeting including a paper questionnaire), and data analysis after both rounds. Attrition bias due to the exhaustion of the experts was prevented by limiting the number of Delphi rounds to two rounds.

Questionnaire development

The questionnaire was developed by reviewing the literature. Scientific and grey literature were searched using the following keywords and their accompanying synonyms: “patient outcomes,” “district nursing care,” and “quality indicators.” For scientific literature, MEDLINE/PubMed and CINAHL/EBSCO were searched. For grey literature, international and national websites and reports of governments and research institutions were searched. Additionally, Dutch reports on what older people find important in the care that they receive at home were identified and analysed to include the patient perspective and guide the identification of important patient outcomes for district nursing care (21,22). The literature was reviewed until no new outcomes for district nursing care were identified. In total, 41 patient outcomes were identified. The 41 outcomes were clustered following the domains used in the nursing outcomes classification by Moorhead et al. (17): Functional health (n = 4), physiologic health including neurocognitive health (n = 16), psychosocial health (n = 4), health knowledge and behaviour (n = 6), perceived health (n = 2), and family health (n = 1). Additionally, the domains death (n = 2) and healthcare utilization (n = 6) were added. These outcomes were extracted from systematic reviews; peer-reviewed scientific publications, including those from the ICHOM; and reports on potentially preventable complications (see S1 Appendix). Different references were used for defining the outcomes. The outcomes were defined based on the definition used by one references or–in case definitions were incomplete, inconsistent between references, or not suitable for district nursing practice–a combination of multiple references. Because the participants were from the Netherlands, mostly Dutch literature has been used. Because the study aims to determine what outcomes are nurse-sensitive to district nursing care rather than developing and operationalizing quality indicators, the definitions of the outcomes were not constructed as quality indicators.

To determine the sensitivity of the identified outcomes to nursing care, the relevance and influenceability of the outcomes were scored. Relevance was operationalised as “being a relevant patient outcome to measure the quality of district nursing care,” and influenceability was operationalised as “the extent to which district nursing care has an influence on the patient outcome.”

At the beginning of the developed questionnaire, information was provided about the study. The background information of the participants regarding their age, sex, years of experience in district nursing care, and area of work was collected. Next, all 41 potential nurse-sensitive outcomes were presented along with their definitions. Participants were asked to score both the relevance and influenceability of each outcome on a 9-point Likert scale, with 1 being completely not relevant/ influenceable and 9 being completely relevant/influenceable. An example question is shown in S2 Appendix. Participants had the opportunity to propose additional outcomes in case outcomes had been omitted. The complete questionnaire is available upon request.

Identification of experts

A purposive sample of national participants was selected for the expert panel of this Delphi study. To ensure the diversity of the district nursing care professionals, the following inclusion criteria were used: 1) the participant had current or recent clinical experience as a district nurse, and 2) the participant had experience in research, teaching, practice, or policy with regard to district nursing care. The aim was to purposively create a balance between people currently working in district nursing care and those with recent experience in practice yet currently fulfilling a role in research, teaching, practice or policy regarding district nursing care. With the requirement of the nurses to have an (additional) role in research, teaching, practice, or policy, it was assumed that the nurses would be accustomed to critical thinking and reflection, which was necessary given the challenges of defining outcomes of care (16). Participants (hereafter referred to as experts) from a diversity of organisations across the Netherlands were selected. Based on the RAM, the aim was to include a panel of 10–15 experts, which would allow the expert panel to have sufficient diversity while also ensuring that all experts would have a chance to participate (19). To take into account the possible decline in participation during the multiple rounds, a total of 20 experts were approached via the Dutch nurses' association and the researchers' networks. Experts were informed about the study and invited to participate by email.

Data collection

Delphi round one: Online questionnaire

The first Delphi round started with an online questionnaire using the online tool Qualtrics (23). The experts received a personal invitation to the questionnaire by email. A letter including information about the study and providing consent for the study was provided within the questionnaire. The experts were asked to complete the questionnaire within two weeks. Two reminders were sent to increase the response rate. After the deadline, the online questionnaire was closed, and the results were analysed. New outcomes proposed by the experts were reviewed by a part of the research team (JDV, NB, MJS). The team discussed if the outcomes focused on patient outcomes or were relevant for measuring the quality of care. Decisions were made based on the expertise of the research team. Five outcomes were included in the next round: a meaningful life, duration of district nursing care, the intensity of district nursing care, total time at home, and quality of dying and death. Two outcomes focusing primarily on process or structure of care (providing preventive care and accessibility of district nursing team) were not included. The newly added outcomes were defined using the literature and by insights of the experts. (S1 Appendix).

Delphi round two: Expert panel meeting and paper questionnaire

After the analysis of the results of round one, the content from the online questionnaire was supplemented with the five newly added outcomes in a paper questionnaire. In the second Delphi round, the experts participated together in a three-hour face-to-face expert meeting. During this meeting, the findings from the questionnaire from round one regarding the relevance and influenceability of the outcomes were discussed, with special attention to the outcomes that lacked agreement (disagreement index (DI) ≥1), the outcomes that had an uncertain rating (group median 4–6), and the newly added outcomes. Additionally, the definitions of the newly added outcomes, formulated by the research team were discussed and concluded with the experts in the second Delphi round to assure that this corresponded to what the experts initially meant. After discussion of the outcomes in the expert meeting, the paper questionnaire was completed. In this questionnaire, the experts' individual scores from the first round; the group median score; and the DI, as an indication of the level of agreement, were provided (S2 Appendix). After the analysis of the results of round two, a draft of the results was shared with the participating experts as a member check to confirm the credibility of the results.

Data analysis

All analyses were guided by the RAM. The relevance and influenceability of each potential nurse-sensitive outcome was scored on a nine-point Likert scale. For each outcome, a group median score was calculated to determine the degree of relevance and influenceability, and the DI was calculated to determine the level of agreement. As described in the RAM, the DI is the ratio between the interpercentile range (IPR) and the IPR adjusted for symmetry (IPRAS), which can be calculated following the equation in S3 Appendix (19). A DI <1 indicates agreement, with a score closer to zero indicating stronger agreement. A group median score of 1–3 with agreement (DI<1) indicated that the outcome was not relevant/influenceable, a lack of agreement (DI≥1) and/or a group median score of 4–6 with agreement (DI<1) on an outcome indicated that the relevance/influenceability of the outcome was uncertain, and a group median of 7–9 with agreement (DI<1) indicated that the outcome was relevant/influenceable (19). Scores were analysed using SPSS version 24.

Ethical considerations

The experts were informed that participation was voluntary and that all data would be processed anonymously and only for research purposes. The experts' consent was assumed upon their return of the completed questionnaires. Because participants in this study were not subjected to physical and/or psychological procedures, no approval was needed according to the Dutch Medical Research Act (WMO). This study was conducted in accordance with the principles of the Declaration of Helsinki, and data were handled according to the General Data Protection Regulation.

Results

Demographics of the expert panel

In total, 16 of the 20 contacted experts (80%) agreed to participate, 15 of whom completed the online questionnaire in round one (93.8%) (Table 1). Of the experts who completed the questionnaire in round one, 11 were able to participate in the expert meeting and questionnaire in round two (73.3%). In both rounds, seven experts indicated that they worked in multiple areas of district nursing care. Reasons for non-response were a lack of time for participation and illness.

Table 1. Characteristics of the expert panel.

	Delphi round 1 N=15	**Delphi round 2 N=11**
Response rate, n (%)	15/16 (93.8)	11/15 (73.3)
Age in years, mean (minimum-maximum; sd)	40.3 (27-65; 12.2)	35.5 (27-53; 9.2)
Female, n (%)	13 (86.7)	9 (81.8)
Years of clinical experience in district nursing care, mean (minimum-maximum; sd)	12.3 (3-20; 6.4)	10.3 (3-20; 6.0)
Current area of work[A]		
District nurse, n (%)	7 (46.7)	7 (63.6)
Researcher, n (%)	5 (33.3)	3 (27.3)
Teacher in a bachelor of nursing program, n (%)	5 (33.3)	4 (36.4)
Practice or policy (manager, professional association), n (%)	7 (46.7)	6 (54.5)

[A] The percentages do not add to 100% because some experts worked in multiple area

Delphi round one

The 41 potential nurse sensitive outcomes identified in the literature were assessed by the experts in round one. The group median scores and DIs for the relevance and influenceability of the potential nurse-sensitive outcomes are provided in Table 2. Based on the median scores and DIs <1, the experts assessed 22 outcomes as relevant (53.7%) and two outcomes as not relevant (multimorbidity and planned hospital admission) (4.9%). For the remaining 17 outcomes (41.5%), there was uncertainty; for four of these outcomes, the uncertainty was due to a lack of agreement among experts.

Table 2. Median scores and DIs of the relevance and influenceability of outcomes per Delphi round.

	Relevant		Influenceable	
	Round 1 Group median (DI)[A]	Round 2 Group median (DI)[A]	Round 1 Group median (DI)[A]	Round 2 Group median (DI)[A]
Functional health				
Activities of daily living	8 (0)	8 (0)	6 (0.21)	7 (0)
Frailty	7 (0)	7 (0.22)	6 (0.22)	7 (0)
Instrumental activities of daily living	7 (0.13)[D]	7 (0.16)	6 (0.72)	6 (0.21)
Mobility	7 (0.32)	7 (0.16)	6 (0.21)	7 (0)
Physiologic health including neurocognitive health				
Bladder continence	6 (1.36)[B]	4 (0.97)	4 (0.32)	4 (0.32)
Bowel continence	5 (0.93)	4 (0.52)	4 (0.32)	4 (0.32)
Cognitive functioning	6 (0.95)	4 (0.97)	5 (0.32)	5 (0.32)
Communication	6 (0.86)	4 (0.21)	5 (0.72)	6 (0.85)
Decision making	8 (0.13)	8 (0)	7 (0.16)	8 (0.16)
Decubitus	8 (0.16)	8 (0)	7 (0.16)	7 (0.16)
Dehydration	8 (0.33)	8 (0)	7 (0.22)	7 (0)
Delirium	6 (0.86)	7 (0.16)	5 (0.97)	7 (0.21)
Dyspnoea	6 (0.95)	6 (0.52)	5 (0.85)	6 (0)
Fatigue	6 (0.18)	7 (0.16)	6 (0.32)	7 (0)
Fracture and wounds other than decubitus	6 (0.52)	7 (0.22)	6 (0.25)	6 (0)
Infection	7 (0.22)	7 (0)	6 (0)	6 (0)
Multimorbidity	3 (0.33)	2 (0.16)	2 (0.16)	2 (0.16)
Pain	7 (0.16)	7 (0.16)	7 (0.22)	7 (0)
Polypharmacy	5 (1.70)[B]	3 (0.37)	4 (0.98)	4 (0.32)
Unintentional weight loss	7 (0.33)	8 (0.16)	6 (0.45)[D]	7 (0.37)
Psychosocial health				
Anxiety	6 (0.52)	7 (0.32)	5 (0.52)	7 (0.22)
Loneliness	7 (0.22)	7 (0)	5 (0.86)	6 (0.22)
Participation in social activities	7 (0.22)[D]	7 (0)	6 (0.18)	7 (0.22)
Signs of depression	6 (0.52)	6 (0.51)	5 (0.72)	6 (0.22)

Table 2. *(continued)*

	Relevant		Influenceable	
	Round 1 Group median (DI)[A]	Round 2 Group median (DI)[A]	Round 1 Group median (DI)[A]	Round 2 Group median (DI)[A]
Health knowledge and behaviour				
Autonomy	8 (0)	8 (0)	7 (0.13)	8 (0.16)
Compliance	8 (0.16)	8 (0.16)	7 (0.13)	8 (0.16)
Falls	7 (0.32)	8 (0.16)	6 (0.52)	7 (0.21)
Knowledge of the patient	6 (0.49)	2 (0.16)	5 (0.72)	4 (0.52)
Problem behaviour	5 (0.85)	4 (0.21)	5 (0.72)	5 (0.32)
Substance use	4 (0.97)[D]	3 (0.16)	4 (0.32)	4 (0)
Perceived health				
Quality of life	8 (0.16)	8 (0.16)	6 (0.22)[D]	7 (0)
Satisfaction with district nursing care	8 (0.23)	8 (0)	8 (0.16)	8 (0.16)
Meaningful life[C]	-	8 (0)	-	7 (0.16)
Family health				
Informal caregiver burden	8 (0)	8 (0)	7 (0.16)	7 (0)
Death				
Death	5 (1.36)[B]	3 (0.16)	4 (0.86)	3 (0)
Place of death	8 (0.16)	8 (0.16)	7 (0)	7 (0.16)
Quality of dying and death[C]	-	8 (0)	-	8 (0.16)
Healthcare consumption				
Emergency department or service use	7 (0.37)	7 (0)	6 (0.42)	7 (0)
General practitioner visit	5 (0.85)	5 (0.52)	6 (0.72)	6 (0.52)
Nursing home admission	6 (2.38)[B]	5 (0.96)	6 (0.93)	7 (0)
Planned hospital admission	2 (0.37)	2 (0)	3 (0.59)[D]	3 (0)
Unplanned hospital admission	8 (0.65)	8 (0.16)	6 (0.32)	7 (0)
Unplanned hospital readmission	8 (0.33)	8 (0)	6 (0.22)	7 (0.22)
Duration of district nursing care[C]	-	7 (0.22)	-	7 (0.16)
Intensity of district nursing care[C]	-	7 (0.22)	-	8 (0.16)
Total time at home[C]	-	5 (0.96)	-	6 (0.22)

Notes: ADL: activities of daily living; IADL: instrumental activities of daily living
🟩 Indicates the outcome is relevant/influenceable based on a median score between 7-9 and a DI <1.
🟧 Indicates the uncertainty of the relevance/influenceability of the outcome based on a median score between 4-6 and/or a DI ≥1.
🟥 Indicates the outcome is not relevant/influenceable based on a median score between 1-3 and a DI <1.

[A] DI: disagreement index, with a DI <1 indicating agreement.
[B] No agreement based on a DI ≥1.
[C] Newly added outcomes after Delphi round one.
[D] In an additional analysis, the median scores and DIs of round 1 with all experts (N=15) were compared to those of round 1 with only the experts who participated in the expert meeting (N=11). This comparison revealed the following deviating results for N=11 compared to N=15, as described in this table:

- IADL: DI 1.61 (uncertain relevance)
- Substance use: median 3 (not relevant)
- Participation in social activities: median 6 (uncertain relevance)
- Unintentional weight loss: median 7 (influenceable)
- Quality of life: median 7 (influenceable)
- Planned hospital admission: median 4 (uncertain influenceability)

Regarding influenceability, the experts assessed nine outcomes as influenceable (22.0%) and two outcomes as not influenceable (multimorbidity and planned hospital admission) (4.9%). The remaining 30 outcomes were assessed as uncertain (73.2%), with none lacking expert agreement. After round one, the following five outcomes were added as new outcomes: meaningful life, duration of district nursing care, intensity of district nursing care, total time at home, and quality of dying and death.

Delphi round two

After the face-to-face discussion in round two, the experts assessed 30 of 46 outcomes as relevant (65.2%), which were mainly distributed among the domains of functional health (4/4), perceived health (3/3), family health (1/1), psychosocial health (3/4), and outcomes regarding death (2/3). (Table 2). Six outcomes were assessed as not relevant (13.0%). The remaining 10 outcomes were assessed as uncertain (21.7%), of which none lacked expert agreement. The discussion during the expert meeting led to changes in the assessment of the relevance of eight outcomes. Regarding influenceability after Delphi round two (Table 2), the experts assessed 27 outcomes as influenceable (58.7%), which were mainly distributed among the domains of perceived health (3/3), family health (1/1), functional health (3/4), healthcare consumption (6/9), and outcomes regarding death (2/3). Three outcomes were assessed as not influenceable (6.5%), and 16 outcomes were assessed as uncertain (34.8%). The expert meeting discussion led to changes in the assessment of the influenceability of 15 outcomes.

To determine whether the different compositions of the experts in the two rounds resulted in deviating overall results regarding the relevance and influenceability of the variables, the median scores and DIs of round 1 with all experts (N = 15) were compared to those of round 1 with only the experts who participated in the expert meeting (N = 11). This comparison revealed deviating results for the following six variables: the relevance of instrumental activities of daily living (IADL), substance use, and participation in social activities and the influenceability of unintentional weight loss, quality of life and planned hospital admission. The relevance of IADL and participation in social activities changed from relevant to uncertain, and that of substance use changed from uncertain to not relevant; the influenceability of unintentional weight loss and quality of life changed from uncertain to influenceable, and that of planned hospital admission changed from not influenceable to uncertain. All other variables (92.6%) had minor changes that did not influence the overall results.

In total, the experts agreed that 26 outcomes (56.5%) were nurse-sensitive, i.e., both relevant and influenceable. From high to low, the nurse-sensitive outcomes were distributed among the following domains: perceived health (3/3), family health (1/1), functional health (3/4), death (2/3), healthcare utilization (5/9), health knowledge and behavior (3/6) psychosocial health (2/4), and physiologic health (7/16). Table 3 shows an overview of the nurse-sensitive outcomes, listed in order of most relevant and influenceable (left column) to least relevant and influenceable (right column) based on the group median and the overall DI. The nurse-sensitive outcomes with the highest median scores were the autonomy of the patient, the patient's ability to make decisions regarding the provision of care, the patient's satisfaction with delivered district nursing care, the quality of dying and death, and the compliance of the patient with needed care (i.e., the extent to which the behaviour of a patient matches the established care).

Table 3. Nurse-sensitive outcomes according to district nursing care experts.

Outcomes with a group median score of 8 for both relevance and influenceability (N=5)	Outcomes with a group median score of 8 for relevance and 7 for influenceability (N=12)	Outcomes with a group median score of 7 for both relevance and influenceability (N=9)
• Autonomy • Decision making • Satisfaction with district nursing care • Quality of dying and death • Compliance	• ADL • Dehydration • Informal caregiver burden • Decubitus • Meaningful life • Quality of life • Unplanned hospital readmission • Falls • Unplanned hospital admission • Place of death • Unintentional weight loss • Intensity of district nursing care[A]	• Emergency department or service use • Pain • Mobility • Fatigue • Participation in social activities • Frailty • Delirium • Anxiety • Duration of district nursing care

Notes: ADL: activities of daily living; [A] Median score of 7 for relevance and 8 for influenceability

Discussion

This study is the first to provide insight into nurse-sensitive outcomes for district nursing care based on the collective opinion of experts who represent the district nursing profession. After two Delphi rounds, the experts determined that 26 of 46 outcomes (56.5%) were nurse-sensitive outcomes for district nursing care. The nurse-sensitive outcomes that were assessed as the most relevant and influenceable (i.e., with a median of 8 and a DI between 0 and 0.16) were patient autonomy, the ability of the patient to make decisions regarding the provision of care, the patient's satisfaction with delivered district nursing care, the quality of dying and death, and the compliance of the patient with needed care.

In the comparison of our results to the outcomes of care for district nursing care described by previous studies by Joling et al. (15) and the ICHOM (18), similarities were found in 14 of the 26 nurse-sensitive outcomes. Activities of daily living, falls, pain, participation in social activities, and informal caregiver burden were considered important outcomes by all three studies. Additionally, overlap with Joling et al. (15) was found for outcomes including decubitus, unintentional weight loss, emergency department or service use, and unplanned hospital (re)admissions. Additionally, overlap was found with the ICHOM study in relation to outcomes including autonomy, frailty, decision making, and place of death (18). An important difference was that the experts agreed that polypharmacy and mortality were not suitable as nurse-sensitive outcomes for district nursing care. A possible explanation for the differences between our study and those by Joling et al. (15) and the ICHOM (18) lies in the focus of this Delphi study on nurse-sensitive outcomes. The other two studies did not study the relevance of these outcomes to measure the quality of district nursing care specifically and the influence nurses could or could not have on these patient outcomes. Additionally, our Delphi study determined 12 additional nurse-sensitive outcomes that were considered important and that were added by the experts after round one or were mentioned in other relevant literature on patient-reported outcomes for adults in general (24), home care quality indicators (25), or effect measures for primary care (26). All outcomes identified in our study as nurse-sensitive outcomes for district nursing care are available as nurse outcomes in the nursing outcome classification, except for the outcomes regarding healthcare utilization, which are not included in this classification (17). In our study, healthcare utilization was used as an outcome following other literature (15,18).

Strengths and limitations

To enhance the robustness of this study, the RAM and the guidance on CREDES were followed (19,20). An important strength was the high response rates for both rounds (93.8% and 73.3%). The differences in characteristics between the experts in the two rounds were minimal, and additional analyses showed that these differences did not influence the results for 92.6% of the variables. Additionally, the member check did not result in any comments. Furthermore, through the inclusion of experts who had clinical experience as district nurses and who had fulfilled additional roles in research, teaching, practice, or policy, the full scope of the district nursing care profession were reflected. In the interpretation of the results, some limitations should be considered. First, only Dutch experts were included in this study because of the specific district nursing context in the Netherlands. This approach limits the generalisability of the results. Second, patients were not included as experts because of the challenges regarding defining outcomes of care (16). To incorporate their meaningful views, however, we included Dutch reports on what patients find important in receiving care at home (21,22). Last, the identification and definitions of the outcomes have some limitations. It is possible that outcomes and quality indicators were missed since no systematic review has been conducted. This risk was minimised by letting experts add and define missing outcomes. However, the definitions by the experts may not be comprehensive and requires further research. Additionally, the outcomes used in this study focus on older people which may limit application in district nursing care which also include care for children and middle-aged people. However, 75% of the people receiving district nursing care in The Netherlands is 67 years or older, and the mean age of the people receiving district nursing care is 75 years (27).

Conclusion and implications

This study provides insight into nurse-sensitive outcomes based on the collective opinion of experts who represent the district nursing profession. In total, 26 nurse-sensitive outcomes were identified that could guide the development of quality indicators for district nursing care. Measuring nurse-sensitive outcomes provides insight into the impact of district nursing care, which is a first step in monitoring and improving the quality of care. This contributes to the major call to action internationally on prioritizing the development of the evidence base for district nursing care (6). At the national level, policy makers, the Dutch Nurses Association and healthcare organizations are working together to define quality indicators for district nursing care. The results of this study contribute to this development by determining 26 nurse-sensitive outcomes. To use nurse-sensitive outcomes as quality indicators, outcomes should be made measurable in a way that is feasible for current practice. Although the outcomes were defined based on the literature, they were not operationalized as quality indicators with a denominator and numerator. Making these nurse-sensitive outcomes measurable as quality indicators requires further research and development before their implementation in practice. In addition, the nurse-sensitive outcomes may differ between different groups of patients in various types of district nursing care, such as palliative care, rehabilitative care, and chronic care. The distinction between these groups and the accompanying relevant and influenceable outcomes for the quality of district nursing care require further research. Lastly, careful consideration is needed regarding the influenceability of the outcomes. None of these outcomes was assessed as completely relevant or influenceable (median 9), the uncertainty of the influenceability of the outcomes is relatively high (34,8%) and the overall medians of the influenceability of the outcomes are lower compared to the assessment of the relevance. This could be explained by the multidisciplinary role of district nurses in practice. Care for community-living older people is not only provided by district nurses, but also by the general practitioner and other (paramedic) professionals in primary care. Most of the outcomes are indeed often not completely influenceable by the delivered district nursing care. Coordinated care by interdisciplinary teams is associated with better outcomes regarding hospitalizations, emergency department visits, and long-term care admissions in community-living people (5). Therefore, close collaboration between professionals in district nursing practice is needed to influence and achieve the best possible outcomes for people receiving district nursing care.

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Data Availability: Data regarding the characteristics of the participants/experts cannot be shared publicly because they may be traceable, because the group is small and there are not many experts regarding this subject. Data are available from the University of Applied Sciences Institutional Data Access (contact via onderzoekssupport@hu.nl) for researchers who meet the criteria for access to confidential data. All other data underlying the results presented in the study are available from a public repository at the Open Science Framework (OSF) via the following URL: https://osf.io/pws8r/.

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Supporting information

S1 Appendix: Overview of identified potential nurse-sensitive outcomes, corresponding definitions and references.

Identifying nurse-sensitive outcomes

Potential nurse-sensitive outcomes for district nursing were identified using the following literature:

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Defining nurse-sensitive outcomes

Different references were used for defining the outcomes. For most outcomes, multiple references were combined to one definition. Because all experts were from the Netherlands, mostly Dutch literature has been used.

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Newly added outcomes after round 1 were defined by the experts and checked by researchers from the research group (JDV, NB, MJS).

Outcome	Definition	Source
Functional health		
Activities of daily living (ADL)	The extent to which the patient (together with the people around the patient) is independent in carrying out activities of daily living (ADL) such as washing / showering, external care, dressing and undressing, eating, and visiting the toilet.	van den Bulck
Frailty	The extent to which the patient is frail, whereby frailty is defined as a process of accumulating physical, psychological and/or social deficits in functioning that increases the chance of negative health outcomes. Frailty is characterized by the weak position that the patient has in society and/or the risk that the patient runs of not catching up with society, getting into social isolation or experiencing deterioration in terms of physical, mental or social functioning.	Bakker

Outcome	Definition	Source
Instrumental activities of daily living (IADL)	The extent to which the patient (together with the people around the patient) is independent in carrying out instrumental activities of daily living (IADL) such as housework, shopping, preparing meals, and making telephone calls.	van den Bulck
Mobility	The ability to move purposefully in one's own environment (indoors and outdoors), possibly with the help of (walking) aids. Think of climbing stairs, moving from a standing position to a sitting position, mobility in and around the bed, moving in or out of a bath/shower; movements in or out of the car, movements on foot, by bicycle or public transport.	van den Bulck; Moorhead
Psysiologic health including neurocognitive health		
Bladder continence	The extent to which the patient has control over the excretion of urine.	van den Bulck
Bowel continence	The extent to which the patient has control over the excretion of faeces.	van den Bulck
Cognitive functioning	The extent to which the patient is able to record, process, reproduce and apply information based on his cognitive functions, such as intelligence, memory, attention and concentration, orientation ability, language and communication, decision making, and problem solving ability.	van den Bulck
Communication	The extent to which the patient is able to communicate effectively by being able to receive, interpret and express spoken, written or non-verbal messages. This also concerns the extent to which the patient has the skills to perform this (such as eye contact, speaking, articulating thoughts, forms of sentences and words, selective attention, and using body language and facial expressions).	van den Bulck; Herdman; Moorhead
Decision making	The extent to which the patient is able to make decisions regarding the provision of care, by making an assessment and choosing between two or more alternatives.	Herdman; Moorhead
Decubitus (Pressure ulcers)	The presence of decubitus, where decubitus is defined as damage to the skin and tissues under the skin as a result of local action of pressure or shear forces.	Bakker, Herdman

Outcome	Definition	Source
Dehydration	The presence of dehydration in the patient, where dehydration is defined as a condition in which there is a lack of bodily fluid. There is an unbalanced fluid balance and composition of the patient’s body fluids, characterized by a relative lack of fluid in the body, which is not sufficient to meet the physiological needs.	van den Bulck; Bakker
Delirium	The presence of delirium in the patient, where delirium is defined as a reversible disorder in consciousness and cognition that develops within a short period of time.	Moorhead
Dyspnoea	The degree to which the patient experiences dyspnoea, where dyspnoea is defined as a situation where the balance between oxygen uptake and carbon dioxide release in the lungs is disturbed, which is accompanied by a feeling of shortness/lack of breath.	Achterberg
Fatigue	The extent to which the patient experiences long-term general fatigue, which leads to reduced capacity for physical and mental exertion at the usual level.	Moorhead
Fracture and wounds other than decubitus	The presence of new fractures and injuries, where injuries are defined as injuries to the skin (for example, damaged epidermis and / or dermis, such as skin tears, cuts or wounds from burns). Note: decubitus is included as a separate outcome.	Herdman
Infection	The presence of infections caused by bacteria, virus or parasite, regardless of the location of the inflammation. For example: urinary tract infection, respiratory tract infection, pneumonia, wound infection.	Beers
Multimorbidity	The presence of multimorbidity, defined as the presence of more than one (chronic) disease in the patient at the same time.	van den Bulck
Pain	The extent to which the patient experiences pain, where pain is defined as an unpleasant, sensory, and emotional experience, which can be subjective, continuous/recurrent, and sudden/slow-induced, caused by actual/imminent tissue damage, with every possible intensity (from mild to severe).	van den Bulck; Bakker
Polypharmacy	The presence of polypharmacy, defined as the chronic use of five or more medications at the same time.	Bakker

Outcome	Definition	Source
Unintentional weight loss	The presence of unintended weight loss in the patient, where unintended weight loss is defined as a weight loss of more than 10% in the last six months or more than 5% in the last month.	Bakker
Psychosocial health		
Anxiety	The extent to which the patient experiences a feeling of unease or insecurity with a source that is usually unclear or unknown to the patient.	van den Bulck
Loneliness	The extent to which the patient experiences loneliness, whereby loneliness is defined as the subjective experience of an unpleasant or unacceptable lack of (quality of) certain relationships. This may involve emotional loneliness (lack of an emotionally close bond and/or intimate relationship) or social loneliness (lack of meaningful relationship with a wide circle of people).	Bakker
Participation in social activities	The extent to which the patient participates in society in a way that is meaningful to the patient, such as (un)paid work, following education, and participation in sports activities and other leisure activities.	van den Bulck
Signs of depression	The extent to which the patient experiences periods of reduced, (seriously) depressed mood, characterized by, among other things, loss of interest or pleasure in activities, less energy, insomnia, and reduced self-esteem and self-confidence.	van den Bulck
Health knowledge and behaviour		
Autonomy	The extent to which the patient has control over his own life in various areas of life (such as living, working and social contacts) and any support therein.	van den Bulck
Compliance	The extent to which the behaviour of a patient matches the established therapy or the health promotion plan.	Herdman
Falls	The presence of fall incidents, where a fall incident is defined as an unintended change of body position that results in a fall on the ground or another lower level.	van den Bulck; Bakker
Knowledge of the patient	The ability of the patient to remember and interpret information.	Martin

Outcome	Definition	Source
Problem behaviour	The extent to which the patient exhibits behaviour that has or may have a negative impact on his own health, well-being and/or (the relationship with) other people such as verbal or physical violence, distrust or hallucinations, compulsions or astray.	van den Bulck
Substance use	The extent to which the patient absorbs psychoactive substances in a harmful or dangerous way, including alcohol and (illegal) drugs.	World Health Organization
Perceived health		
Quality of life	The extent to which the patient values his or her quality of life, whereby quality of life is defined as a positive experience of one's own current living conditions.	Moorhead
Satisfaction with district nursing care	The extent to which the patient is satisfied with the care provided by district nursing care.	
Meaningful life	Living from what is really important to a person.	Experts
Family health		
Informal caregiver burden	The extent to which the informal caregiver of the patient experiences a balance in burden/ vulnerabilities (load) and the resources of the caregiver to carry the burden (capacity).	van den Bulck
Death		
Death	The patient has died.	NZa
Place of death	The patient has died at the desired place of death.	Akpan
Quality of dying and death	Discuss timely the options and take care of counselling in the palliative and terminal phase.	Experts
Healthcare consumption		
Duration of district nursing	Total duration that a patient receives district nursing care (e.g., in weeks).	NZa; Experts
Emergency department or service use	The patient makes use of the emergency department or emergency service (out of office general practitioner visit).	NZa
General practitioner visit	The patient has visited the doctor or the doctor has visited the patient at home during office hours.	NZa
Intensity of district nursing	Total number of minutes of care per week that a patient receives district nursing care.	NZa; Experts

Outcome	Definition	Source
Nursing home admission	The patient has an admission to a nursing home with no prospect of returning home (no first-line residence or rehabilitation).	NZa
Planned hospital admission	The patient has been scheduled to be admitted or treated at the hospital. The patient has stayed in the hospital for at least one night.	NZa; ICHOM
Total time at home	Total time that a patient lives independently at home (e.g., in months or days per year).	Experts
Unplanned hospital admission	The patient has been admitted to hospital or treated at the hospital unplanned. The patient has stayed in the hospital for at least one night.	NZa; Akpan
Unplanned hospital readmission	Within three months of a previous hospital visit, the patient has been admitted to hospital or treated unplanned. The patient has stayed in the hospital for at least one night.	NZa

S2 Appendix: Examples of questionnaire questions round one and round two

Round one example question on relevance and influenceability of mobility as an outcome

Please fill in how relevant you think this outcome is as a measurement for the quality of district nursing care

Please fill in how influenceable you think this outcome is by your work in a district nursing team.

Mobility

Definition: The ability to move purposefully in one's own environment (indoors and outdoors), possibly with the help of (walking) aids. Think of climbing stairs, moving from a standing position to a sitting position, mobility in and around the bed, moving in or out of a bath / shower; movements in or out of the car, movements on foot, by bicycle or public transport.

Completely **NOT** **relevant**										Completely **relevant**	Completely **NOT** **influenceable**									Completely **influenceable**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	

Round two example question on relevance and influenceability of mobility as an outcome

Please fill in how relevant you think this outcome is as a measurement for the quality of district nursing care.

Mobility	
Individual score	
Median (group score)	7
Disagreement Index (Score <1 = agreement)	0,37

Completely **Not relevant**				Neutral				Completely **relevant**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐	☐	☐	☐	☐	☐	☐	☐	☐

Please fill in how influenceable you think this outcome is with your work in a district nursing team.

Mobility	
Individual score	
Median (group score)	6
Disagreement Index (Score <1 = agreement)	0,22

Completely **Not influenceable**				Neutral				Completely **influenceable**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐	☐	☐	☐	☐	☐	☐	☐	☐

S3 Appendix: Equation to calculate disagreement index (DI)

Lower Limit IPR = 30th percentile of the series of ratings
Upper Limit IPR = 70th percentile of the series of ratings
IPR = (Upper Limit IPR) – (Lower Limit IPR)
IPRCP (Central Point of IPR) = Average of Upper Limit IPR and Lower Limit IPR
Asymmetry Index = 5* – (IPRCP)
IPRAS = 2.35* + (1.5* · Asymmetry Index)
Disagreement Index (DI) = IPR/IPRAS

*Notes: IPR=Interpercentile Range; IPRCP=interpercentile Range Central Point; IPRAS = Interpercentile Range Adjusted for Symmetry. *Numbers determined by RAND/UCLA Appropriateness Method (16)*

S4 Appendix: CREDES checklist

Theme	Recommendations	Checklist	Page manuscript
Rationale for the choice of the Delphi technique			
	Justification. The choice of the Delphi technique as a method of systematically collating expert consultation and building consensus needs to be well justified. When selecting the method to answer a particular research question, it is important to keep in mind its constructivist nature.	✓	Page 1
Planning and design			
	Planning and process. The Delphi technique is a flexible method and can be adjusted to the respective research aims and purposes. Any modifications should be justified by a rationale and be applied systematically and rigorously	✓	Page 6
	Definition of consensus. Unless not reasonable due to the explorative nature of the study, an a priori criterion for consensus should be defined. This includes a clear and transparent guide for action on (a) how to proceed with certain items or topics in the next survey round, (b) the required threshold to terminate the Delphi process and (c) procedures to be followed when consensus is (not) reached after one or more iterations	✓	Page 6
Study conduct			
	Informational input. All material provided to the expert panel at the outset of the project and throughout the Delphi process should be carefully reviewed and piloted in advance in order to examine the effect on experts' judgements and to prevent bias	✓	Page 9-11
	Prevention of bias. Researchers need to take measures to avoid directly or indirectly influencing the experts' judgements. If one or more members of the research team have a conflict of interest, entrusting an independent researcher with the main coordination of the Delphi study is advisable	✓	Competing interests (added to submission of article, not in manuscript)
	Interpretation and processing of results. Consensus does not necessarily imply the 'correct' answer or judgement; (non)consensus and stable disagreement provide informative insights and highlight differences in perspectives concerning the topic in question	✓	Page 6

S4 Appendix *(continued)*

Theme	Recommendations	Checklist	Page manuscript
	External validation. It is recommended to have the final draft of the resulting guidance on best practice (in palliative care) reviewed and approved by an external board or authority before publication and dissemination	✓	Page 11
Reporting			
	Purpose and rationale. The purpose of the study should be clearly defined and demonstrate the appropriateness of the use of the Delphi technique as a method to achieve the research aim. A rationale for the choice of the Delphi technique as the most suitable method needs to be provided	✓	Page 6
	Expert panel. Criteria for the selection of experts and transparent information on recruitment of the expert panel, sociodemographic details including information on expertise regarding the topic in question, (non) response and response rates over the ongoing iterations should be reported	✓	Page 9, Page 13
	Description of the methods. The methods employed need to be comprehensible; this includes information on preparatory steps (How was available evidence on the topic in question synthesised?), piloting of material and survey instruments, design of the survey instrument(s), the number and design of survey rounds, methods of data analysis, processing and synthesis of experts' responses to inform the subsequent survey round and methodological decisions taken by the research team throughout the process	✓	Page 6-12
	Procedure. Flow chart to illustrate the stages of the Delphi process, including a preparatory phase, the actual 'Delphi rounds', interim steps of data processing and analysis, and concluding steps	x	NA
	Definition and attainment of consensus. It needs to be comprehensible to the reader how consensus was achieved throughout the process, including strategies to deal with non-consensus	✓	Page 6

S4 Appendix *(continued)*

Theme	Recommendations	Checklist	Page manuscript
	Results. Reporting of results for each round separately is highly advisable in order to make the evolving of consensus over the rounds transparent. This includes figures showing the average group response, changes between rounds, as well as any modifications of the survey instrument such as deletion, addition or modification of survey items based on previous rounds	✓	Page 14, Page 17-19
	Discussion of limitations. Reporting should include a critical reflection of potential limitations and their impact of the resulting guidance	✓	Page 21-22
	Adequacy of conclusions. The conclusions should adequately reflect the outcomes of the Delphi study with a view to the scope and applicability of the resulting practice guidance	✓	Page 20-24
	Publication and dissemination. The resulting guidance on good practice in palliative care should be clearly identifiable from the publication, including recommendations for transfer into practice and implementation. If the publication does not allow for a detailed presentation of either the resulting practice guidance or the methodological features of the applied Delphi technique, or both, reference to a more detailed presentation elsewhere should be made (e.g., availability of the full guideline from the authors or online; publication of a separate paper reporting on methodological details and particularities of the process (e.g., persistent disagreement and controversy on certain issues)). A dissemination plan should include endorsement of the guidance by professional associations and health care authorities to facilitate implementation	✓	Page 22-24

6

Exploring nurse-sensitive patient outcomes in Dutch district nursing care: A survey study

Veldhuizen JD, Schuurmans MJ, Mikkers MC, Bleijenberg N.

Health & Social Care in the Community. 2022 Nov;30(6):e5624-36.

Abstract

There is a lack of evidence to guide district nurses in using nurse-sensitive patient outcomes as it is unclear how these outcomes are currently used in daily district nursing practice. Therefore, we aimed to explore 1) which nurse-sensitive patient outcomes are measured and how these outcomes are measured, 2) how district nurses use the outcomes to learn from and improve current practice and 3) the barriers and facilitators to using outcomes in current district nursing practice. An exploratory cross-sectional survey study was conducted. The survey was distributed online among nurses working for various district nursing care organisations across the Netherlands. The responses from 132 nurses were analysed, demonstrating that different instruments or questionnaires are available and used in district nursing care as outcome measures. The nurse-sensitive patient outcomes most often measured with validated instruments are pain using the Numeric Rating Scale or Visual Analogue Scale, delirium using the Delirium Observation Scale, weight loss using the Short Nutritional Assessment Questionnaire and caregiver burden using the Caregiver Strain Index or a Dutch equivalent. Falls and client satisfaction with delivered care are most often measured using unvalidated outcome measures. The other nurse-sensitive outcomes are measured in different ways. Outcomes are measured, reported and fed back to the nursing team multiple times and in various ways to learn from and improve current practice. In general, nurses have a positive attitude towards using nurse-sensitive outcomes in practice, but there is a lack of facilitation to support them. Because insight into how nurses can and should be supported is still lacking, exploring their needs in further research is desirable. Additionally, due to the high variation in the utilisation of outcomes in current practice, it is recommended to create more uniformity by developing (inter) national guidelines on using nurse-sensitive patient outcomes in district nursing care.

What is known about this topic and what this paper adds

- Nurse-sensitive patient outcomes are vital to improving the quality and (cost) effectiveness of care. However, it is unclear how nurses use outcomes in current district nursing practice.
- The study revealed that uniform measures are used only for a small number of outcomes. Outcomes are used in various ways to measure and learn from.
- In general, nurses have a positive attitude regarding using outcomes but lack knowledge, support and facilitation on an organisational and national level.
- The variation in using outcomes in current district nursing practice is high, and more uniformity is vital to ease comparisons across district nursing organisations to learn from and improve practice.

Introduction

Measuring patient outcomes in district nursing care is crucial for quality control, quality improvements as well as research regarding (cost)effectiveness of care (1–4). Insight into patient outcomes is needed to guide nurses in learning from their care deliverance and subsequently improving the quality of the delivered care (3). Additionally, outcomes provide optimal information to assess the effectiveness and efficiency of care (3). Insights in outcomes can be supportive in decision-making regarding the provision and organisation of nursing care, including the funding of care at home, and are therefore relevant for patients, care providers, health insurers and healthcare inspectorates. For nursing care in general, the focus should be on nurse-sensitive patient outcomes (hereinafter referred to as nurse-sensitive outcomes). Nurse-sensitive outcomes are patient outcomes that are *relevant* based on the nurses› scope and domain of practice, and where nursing inputs and interventions have an *influence* on the patient outcomes (3,5). The relevance and influenceability are vital for nurse-sensitive outcomes to account for the actions of the district nurse. Since the demands on district nursing care in many European countries are rising due to the ageing population, the increasing care complexity and the shortage of district nursing care professionals (6–8), insight into nurse-sensitive outcomes is needed.

In nursing, outcomes are often developed for the acute care or hospital setting (9–11). These outcomes may not be relevant to the scope of district nursing care. For district nursing care, there is a lack of evidence to guide district nurses in using outcomes to measure and learn (7,12). A potential reason for this absence of evidence is the worldwide variation in the organisation, delivery and funding of district nursing care (7,13,14). A recent Delphi study was conducted to identify what nurse-sensitive outcomes are relevant for district nursing care (15). The Delphi study identified 46 potentially nurse-sensitive patient outcomes for district nursing care in the literature, of which 26 were assessed as nurse sensitive by various experts in district nursing care (15). However, it is unclear which of these 26 nurse-sensitive outcomes are currently being measured in district nursing care and how these outcomes are used to learn from and improve district nursing practice.

Using outcome data is part of a learning healthcare system, which focuses on collecting data to generate knowledge and applying it to learn from and improve practice (16). In the most recent report, the cycle relies on three main steps: data being derived from practice (i.e., practice to data), knowledge being generated from the data (i.e., data to knowledge) and knowledge being transferred back into practice (i.e., knowledge to practice) (17). In a learning healthcare system, outcomes and experience are continually improved by ‘applying science, informatics, incentives and culture to generate and use knowledge in the delivery of care’ (17). The learning healthcare system provides tools, models and frameworks to guide healthcare systems, and therefore fits district nursing care. It coincides with the widely used, stepwise cyclical nursing process, which includes assessing needed care, nursing diagnosis, planning of care, outcome setting, implementation of interventions and evaluating care (18,19).

To decide how district nursing care should measure nurse-sensitive outcomes and use these outcomes to learn and improve, a better understanding of current practice should be gained. Analysing current practice is a necessary step in successfully implementing change (20,21). Therefore, this study aims to explore the use of nurse-sensitive outcomes in current district nursing practice. This is the first step to selecting appropriate solutions and facilitation to help district nursing care implement nurse-sensitive outcomes. The following research questions guided this study:

- Which of the 26 nurse-sensitive outcomes, previously identified by experts (15), are currently measured in Dutch district nursing practice, and how are these outcomes measured?
- How are nurse-sensitive outcomes used to learn and improve current practice?
- What are the barriers and facilitators of using nurse-sensitive outcomes in district nursing care?

Materials and methods

Study design

This exploratory survey study employed a cross-sectional design to explore the use of nurse-sensitive outcomes in current district nursing practice in the Netherlands.

Participants and setting

A survey was developed and distributed among Dutch nurses working in district nursing care nationwide in the Netherlands. The organisation, delivery and funding of district nursing care vary worldwide (7,13,14). In this study, district nursing care is referred to as all technical, medical, supportive and rehabilitative nursing care interventions or assistance with personal care for (older) people living at home (14). This definition reflects district nursing care in the Netherlands (22) and aligns with the definition used for community-care nursing in Europe (14,23). District nursing care in the Netherlands comprises district nurses, vocational nurses, nurse assistants and basic care assistants. In 2018, 28,508 nurses worked in district nursing care in the Netherlands, of which 16,108 as a vocational nurse (vocationally trained registered nurse, Dutch Qualification Framework [NLQF] and European Qualification Framework [EQF] level 4) and 12,400 as a district nurse (bachelor prepared registered nurse, NLQF/EQF level 6) (24). Next to nurses, 41,799 nurse assistants (NLQF/EQF level 3) and 4759 basic care assistants (NLQF/EQF level 1 and

2) provided care at home to people in need of district nursing care (24). Because this study focuses on measuring outcomes in district nursing care, which is mostly done by the district nurse or vocational nurse, the target population of this study included all 28,508 nurses working in district nursing care. Nurse assistants and basic care assistants were excluded. Convenience sampling was used to approach all nurses working in district nursing care at various organisations across the Netherlands.

The Dutch district nursing outcomes (DDNO) survey

The Dutch district nursing outcomes (DDNO) survey was developed and validated for this study and consisted of four parts: (1) background characteristics; (2) measuring nurse-sensitive outcomes in current practice; (3) learning from nurse-sensitive outcomes in current practice; (4) barriers and facilitators of using nurses-sensitive outcomes in general (Supporting Information). In the survey introduction, an explanation of the used terminology was provided. In this study, *using outcomes* in daily district nursing practice was operationalised by dividing it into two main parts, which comprehend the three main steps of the learning healthcare system. The first part is *measuring* outcomes, which focuses on collecting data by measuring outcomes (‘Practice to Data’ step of the learning healthcare system). In this, outcomes can be measured by the patient, by a (lay-)observer or by a professional in clinical practice (25). Outcome measures are the tools or instruments to measure outcomes (26). The second part is *learning* from the measured outcomes, which includes analysing and feeding back the measured outcomes to change and improve daily practice (‘Data to Knowledge’ and ‘Knowledge to Practice’ steps of the learning healthcare system). In the survey explanation to the nurses, the steps of the learning healthcare system were not explicitly mentioned.

The development of DDNO survey

Background characteristics: The following background information was collected: age, sex, education, job title in district nursing care, total hours working in district nursing care per week, years of working experience in district nursing care and other job positions in addition to working in district nursing care, and the geographical area (province) they are working.

Measuring nurse-sensitive outcomes in current practice: To describe the current practice, we focused on gaining insight into which of the 26 relevant nurse-sensitive outcomes are measured in district nursing practice and how these are measured. The 26 nurse-sensitive outcomes were derived from a previous study (15) and were arranged into the following categories based on the Nursing Outcome Classification (3): functional health, physiologic health, psychosocial health, health knowledge and behaviour, perceived health and family health. The Nursing Outcome Classification is a widely applied classification system in nursing (27), using standardised nursing terminology to describe patient outcomes sensitive to nursing interventions (3). The categories of death and healthcare consumption were added following previous research (28). Of each of the 26 outcomes was asked if this outcome is measured in current district nursing practice (yes; no). If yes, respondents were asked via an open question how the outcome is measured, using what questionnaire, instrument or method. If no, an open question was asked about why the outcome is not measured. Subsequently, two closed questions were asked about when nurse-sensitive outcomes, in general, are measured and where this information is recorded. In addition, two open-ended questions were asked concerning the (potential) barriers and facilitators of measuring outcomes in district nursing practice.

Learning from nurse-sensitive outcomes to improve current practice: To identify how nurses learn from nurse-sensitive outcomes to improve current practice, respondents were asked if measured outcomes are fed back to the district nursing team and, if yes, how the results are fed back. In addition, two open-ended questions were asked about the (potential) barriers and facilitators of learning from outcomes in district nursing practice.

Barriers and facilitators to using nurses-sensitive outcomes in general: To identify the barriers and facilitators of using nurse-sensitive outcomes in district nursing care, 16 statements concerning potential barriers and facilitators were presented. These statements were derived from two validated questionnaires regarding barriers and facilitators (29,30). Only relevant statements to identify the barriers and facilitators among district nurses were selected from these questionnaires, following other research (31). Statements regarding prevention and the implementation of interventions were removed because these were not applicable. For other statements, slight changes in wording were made to fit with the district nursing context in the Netherlands (e.g., ‘using outcomes can easily be abused in medical disciplinary law’ was changed to ‘using outcomes can easily be abused or misused in the funding of district nursing care’). In some cases, multiple statements focusing on the same subject were combined into one statement. The statements focus on the following domains from the Theoretical Domain Framework (32): knowledge, skills, attitude and role of the professional, beliefs about capabilities and consequences, intentions to use outcomes and environmental context and resources. The nurses had to indicate to what extent they agreed or disagreed with the statement on a five-point Likert scale, ranging from completely disagree (1 point) to completely agree (5 points).

Validation of the DDNO survey

The first version of the DDNO survey was provided with feedback by Dutch Nurses’ Association in The Netherlands (V&VN) and by stakeholders from the Dutch Patient Federation, Utrecht University and Tilburg University. The DDNO survey was then distributed to five district nurses and three last-year nursing students (NLQF level

6) to assess its readability, usability and face validity. To assess readability and usability, telephone interviews were conducted, in which a number of questions were asked about the wording used in the introduction, instruction and questions of the DDNO survey, the length of the sentences and the structure of the survey. They were also asked about the time investment and its acceptability. All questions to test readability and usability were based on the methodology of prior research (33,34). To assess the face validity, the nurses and nursing students were asked whether they thought the test was appropriate to measure the experiences of using outcomes in district nursing care ('Do you think the DDNO survey is suitable for measuring the experiences or expectations of using outcomes in district nursing care?') using a 10-point Likert scale (1 = not appropriate at all; 10 = completely appropriate). A mean score of 5.5 or higher was deemed acceptable. The eight participants who assessed the survey were generally positive. Based on their comments, minor changes were made regarding the DDNO instructions (*n* = 6), punctuation (*n* = 1), answer options (*n* = 4), unclear terminology (*n* = 1), sentence structure (*n* = 1) and layout (*n* = 2). The face validity was deemed acceptable, with a mean score of 7.75 (range 6–10).

Pilot testing

Before the nationwide distribution, the DDNO survey was pilot tested within one district nursing care organisation in the province of South Holland. The DDNO was distributed online via Qualtrics, an online survey platform (35). It was sent to 92 nurses, of which 24 nurses (26.1%) opened the survey. Of these, six nurses (25%) finished the survey completely and one nurse partially. The remaining 17 nurses (70.8%) only completed the background information questions. Because data were collected anonymously, we were unable to identify the reasons for dropout. The DDNO survey was shortened and made more user-friendly to improve the response rate by removing irrelevant information in the instructions and changing the questions' order. Additionally, the readability of the survey was further enhanced by letting a Dutch language specialist examine and adjust it on wording level, sentence level and text level. This led to minor changes.

Data collection

The DDNO survey was distributed nationwide using Qualtrics, an online survey platform. The DDNO survey was openly available for all district nurses working for various organisations in the Netherlands. Convenience sampling was used to approach nurses. To reach a large population of district nurses across the Netherlands, a link to the survey was published in the newsletter of the subdivision 'public health' of the Dutch Nurses' Association (V&VN) and spread via e-mail to the members of the National scientific collaboration for district nursing care (in Dutch: Wetenschappelijke Tafel Wijkverpleging), via the intranet of various large district nursing care organisations, via the researchers' network and social media (Twitter and LinkedIn). Data were collected between 1 July and 19 October 2020.

Data analysis

Descriptive statistics (absolute numbers and percentages) were calculated for all quantitative data. A median and interquartile range were calculated to describe non-normal distributed baseline characteristics. Following prior research (30,36), a mean and standard deviation were calculated to represent the 16 statements concerning potential barriers and facilitators. All quantitative data were analysed using IBM SPSS Statistic version 27. Because of the explorative nature of his study, no sample size calculations or significance tests were conducted. Instead, the baseline characteristics (age and sex) were compared to available data on the district nursing workforce (24). The open-ended questions, in which the nurses filled in the outcome measures they use to measure the nurse-sensitive outcomes, were summarised and arranged into subcategories. To decide whether the outcome measures mentioned by the nurses were validated instruments, the literature was searched using the name of the assessment tool or its abbreviation and search terms as 'validation'. All open-ended questions were analysed following a thematic analysis (37).

Ethics statement

Participation in the study was voluntary. The survey's introduction provided information on the study's reason, goals and content. Because the nurses were not subjected to any actions, no ethical approval was needed under the Dutch law on medical research (WMO). Consent to participate in this study was provided by the nurses by ticking a corresponding box which was included in the survey. The data were stored and analysed per the Dutch personal data protection act (AVG). Any personal details were removed from the survey data to assure anonymity of the data.

Results

Baseline characteristics

In total, 302 district nurses responded to the online survey, which is 1% of the total population of district nurses (Table 1) (24). Of the 302 district nurses who started the DDNO survey, 170 (56.3%) had stopped the survey after finishing the baseline characteristics. The remaining 132 nurses continued the survey; only the results of these nurses were included in this study. The nurses who continued the questionnaire were mostly district nurses (59.8%) and female (92.4%). The background characteristics of those continuing the survey concerning sex and age were similar to the available population characteristics (24). The years of experience in district nursing care ranged from 1 to 44, with a median of 10 years. With between 1 and 29 nurses per province, all 12 provinces of the Netherlands were represented.

Table 1. Baseline characteristics of nurses (self-reported)

	Total, N = 132
Age	
Median (IQR)	50 (23)
Min–max	21–67
Missing, n (%)	2 (1.5)
Gender	
Male, n (%)	8 (6.1)
Female, n (%)	122 (92.4)
Other, n (%)	1 (0.8)
Missing, n (%)	1 (0.8)
Years of experience working in district nursing care	
Median (IQR)	10 (14.25)
Min–max	1–44
Missing, n (%)	2 (1.5)
Education	
In-service education[a], n (%)	8 (6.1)
Secondary vocational education, n (%)	14 (10.6)
Bachelor at university of applied sciences, n (%)	88 (66.7)
Bachelor at university, n (%)	9 (6.8)
Master at university of applied sciences or university, n (%)	12 (9.1)
Missing, n (%)	1 (0.8)
Job title in district nursing care	
Vocationally trained registered district nurse (EQF lv 4), n (%)	27 (20.5)
Bachelor prepared registered district nurse (EQF lv 5/6), n (%)	79 (59.8)
Specialised nurse (EQF lv 6), n (%)	6 (4.5)
Advanced nurse practitioner (EQF lv 7), n (%)	0 (0)
Other (e.g., nursing student, teacher, researcher), n (%)	19 (14.4)
Missing, n (%)	1 (0.8)
Contract size (in hours per week) working in district nursing care	
Median (IQR)	25 (12)
Min–max	1–40
Missing, n (%)	2 (1.5)

Table 1. *(continued)*

	Total, N = 132
Other job position, in addition to working in district nursing care	
No, n (%)	71 (53.8)
Yes, teaching, n (%)	6 (4.5)
Yes, research, n (%)	2 (1.5)
Yes, policy, quality and/or safety, n (%)	18 (13.6)
Other (e.g., extra tasks or roles within the organisation, working as a nurse in a different setting, functions other than working as a nurse), n (%)	35 (26.5)
Missing, n (%)	1 (0.8)

Notes: Abbreviations: EQF: European qualification framework.

[a] In-service education was the education for nurses in the Netherlands until 1997, in which people were trained as nurses within one practice (e.g., hospital, nursing home). Since 1972, this education has been replaced by secondary vocational and bachelor education (38).

Nurse-sensitive outcomes measured in district nursing care

The nurse-sensitive outcomes that were measured most frequently (≥70%) were pain, satisfaction with delivered district nursing care, unintentional weight loss, informal caregiver burden, falls and delirium (Table 2). The least often measured outcomes (≤30%) were emergency department or service use, unplanned hospital (re)admission, fatigue, decision-making and meaningful life. Of the nurses who answered positive about measuring the outcome, 53–77% responded about how they measured it.

Table 2. An overview of nurse-sensitive patient outcomes currently measured in district nursing care; total *N* = 132 (self-reported)

	Outcome is not measured, n (%)	**Outcome is measured, n (%)**	**Description provided how outcome is measured, n (%)[a]**	**Missing, n (%)**
Functional health				
Activities of daily living	66 (50)	62 (47.0)	46 (74.2)	4 (3)
Frailty	55 (41.7)	71 (53.8)	50 (70.4)	6 (4.5)
Mobility	65 (49.2)	61 (46.2)	44 (72.1)	6 (4.5)

Table 2. *(continued)*

	Outcome is not measured, n (%)	Outcome is measured, n (%)	Description provided how outcome is measured, n (%)[a]	Missing, n (%)
Physiological health, including neurocognitive health				
Decision-making	86 (65.2)	35 (26.5)	27 (77.1)	11 (8.3)
Decubitus	35 (26.5)	91 (68.9)	66 (72.5)	6 (4.5)
Dehydration	73 (55.3)	51 (38.6)	35 (68.6)	8 (6.1)
Delirium	29 (22)	95 (72)	70 (73.7)	8 (6.1)
Fatigue	98 (74.2)	27 (20.5)	19 (70.4)	7 (5.3)
Pain	10 (7.6)	117 (88.6)	88 (75.2)	5 (3.8)
Unintentional weight loss	17 (12.9)	106 (80.3)	81 (76.4)	9 (6.8)
Psychosocial health				
Anxiety	76 (57.6)	48 (36.4)	33 (68.8)	8 (6.1)
Participation in social activities	71 (53.8)	50 (37.9)	34 (68.0)	11 (8.3)
Autonomy	78 (59.1)	43 (32.6)	33 (76.7)	11 (8.3)
Compliance	71 (53.8)	51 (38.6)	36 (70.6)	10 (7.6)
Falls	29 (22)	98 (74.2)	73 (74.5)	5 (3.8)
Perceived health				
Quality of life	78 (59.1)	44 (33.3)	28 (63.6)	10 (7.6)
Satisfaction with delivered care	10 (7.6)	112 (84.8)	85 (75.9)	10 (7.6)
Meaningful life	80 (60.6)	39 (29.5)	28 (71.8)	13 (9.8)
Family health				
Informal caregiver burden	25 (18.9)	98 (74.2)	71 (72.4)	9 (6.8)
Death				
Preferred place of death	71 (53.8)	53 (40.2)	35 (66.0)	8 (6.1)
Quality of dying and death	74 (56.1)	49 (37.1)	32 (65.3)	9 (6.8)
Healthcare consumption				
Emergency department/ service use	104 (78.8)	15 (11.4)	8 (53.3)	13 (9.8)
Unplanned hospital admission	102 (77.3)	18 (13.6)	10 (55.6)	12 (9.1)

Table 2. *(continued)*

	Outcome is not measured, n (%)	Outcome is measured, n (%)	Description provided how outcome is measured, n (%)[a]	Missing, n (%)
Unplanned hospital readmission	102 (77.3)	18 (13.6)	11 (61.1)	12 (9.1)
Duration of district nursing care	56 (42.4)	66 (50)	48 (72.7)	10 (7.6)
Intensity of district nursing care	49 (37.1)	71 (53.8)	53 (74.6)	12 (9.1)

Notes: [a] Percentage is calculated from the group of people who measure the outcome.

The nurse-sensitive outcomes were measured using validated instruments (310 times in 19 outcomes) or unvalidated outcome measures (349 times in 23 outcomes) (Table 3). Other methods to measure and report outcomes that were mentioned were observations of the client or conversation and collaboration with the client, colleagues or other professionals (112 times in all 26 outcomes), intake and evaluation assessments (127 times in 24 outcomes), through care-planning and reporting in the electronic health record (121 times in 24 outcomes), and by using a classification system, information system or the internet (178 times in all 26 outcomes) (supporting Information Table S1). In these other methods, questionnaires or other measures could be used, but the nurse did not specify these. The nurses gave unclear answers 41 times related to 18 outcomes (e.g., the nurse did not answer the question of how the outcomes were measured but instead described when the outcomes were measured, stated that the outcome was not applicable, or asked questions and/or additional comments related to the outcome).

Table 3. An overview of validated and unvalidated outcome measures in district nursing care. Total *N* = 132 (self-reported)

	Validated instruments	Unvalidated or unspecified outcome measures	Other[a]
Functional health			
Activities of daily living; n	9; SRM = 3; Barthel =2; GFI = 2; Katz = 1; GARS = 1	9; NOC = 1; TRAZAG = 1; Risk analysis = 1; Other = 6	32
Frailty; n	28; GFI = 21; TFI = 5; SRM = 2	11; Risk analysis = 4; TRAZAG = 3; NOC = 1; Other = 3	14
Mobility; n	7; GFI = 4; Barthel = 1; GARS = 1; SRM = 1	17; Risk analysis = 5; NOC = 1; Other = 11	22

Table 3. *(continued)*

	Validated instruments	Unvalidated or unspecified outcome measures	Other[a]
Physiological health, including neurocognitive health			
Decision-making; n	1; USD = 1	0	26
Decubitus; n	14; Bradenscale = 12; GFI = 1; Time model = 1	31; Risk analysis = 11; Unspecified = 3; Other = 17	25
Dehydration; n	1; USD = 1	23; Water intake list = 22; Skinfold measure = 1	15
Delirium; n	54; DOS = 53; DASS = 1	10; Risk analysis = 2; NOC = 1; Unspecified = 1; Other = 6	8
Fatigue; n	3; USD = 3;	4; NOC = 1; TRAZAG = 1; Other = 2	13
Pain; n	52; NRS/VAS = 45; PACSLAC = 5; REPOS = 2;	35; Non-specified pain score = 27; Risk analysis = 3; NOC = 1; Other = 4	11
Unintentional weight loss; n	40; SNAQ(65) = 39; GFI = 1	41; Weighting scale/list/curve = 20; Unspecified = 10; Risk analysis = 9; Intake list = 2	12
Psychosocial health			
Anxiety; n	9; USD = 3; 4DSQ = 2; DASS = 1; GDS = 1; SCEGS = 1; GFI = 1	13; Risk analysis = 6; Unspecified = 6; NOC = 1	16
Participation in social activities; n	5; SRM = 3; ACIS = 1; GFI = 1	6; Risk analysis = 1; Other = 5	27
Autonomy; n	6; SRM = 6;	3; Other = 3	25
Compliance; n	0	19; BEM = 12; Risk analysis = 2; NOC = 1; Other = 4	22
Falls; n	2; GFI = 2	58; MIC/VIM = 29; Risk analysis = 23; Unspecified = 5; NOC = 1	24
Perceived health			
Quality of life; n	5; SRM = 1; GFI = 1; EQ5D = 1; USD = 1; PREM = 1	7; Positive health = 3; Risk analysis = 1; Other = 3	20

Table 3. *(continued)*

	Validated instruments	Unvalidated or unspecified outcome measures	Other[a]
Satisfaction with delivered care; n	27; PREM = 27	30; Unspecified = 26; Kiwa questionnaire = 2; CQI = 2	37
Meaningful life; n	1; GDS-15 = 1	5; Positive health = 2; Other = 3	22
Family health			
Informal caregiver burden; n	45; CSI = 26; EDIZ = 14; SRB = 4; GFI = 1	10; Unspecified = 9; Risk analysis = 1	23
Death			
Preferred place of death; n	0	6; Care path = 2; Other = 4	30
Quality of dying and death; n	1; USD = 1	7; Care path = 5; Other = 2	28
Healthcare consumption			
Emergency department or service use; n	0	1	7
Unplanned hospital admission; n	0	0	10
Unplanned hospital readmission; n	0	0	11
Duration of district nursing care; n	0	2	47
Intensity of district nursing care; n	0	1	53

Notes: Abbreviations: 4DSQ, four-dimensional symptom questionnaire; ACIS, assessment of communication and interaction skills; Barthel, barthel index; BEM, Beoordeling Eigen beheer Medicatie (assessment of self-management in medication); CQI, consumer quality index; CSI, caregiver strain index; DASS, depression anxiety stress scale; DOS, delirium observation screening scale; EDIZ, Ervaren Druk door Informele Zorg (self-perceived burden from informal care); EQ5D, European Quality of life index 5D; GARS, *Groningen Activity Restriction Scale*; GDS, Geriatric Depression Scale; GFI, groninger frailty index; Katz, Katz index of independence in (instrumental) activities of daily living; MIC, Meldingen Incidenten Cliënten (reports of incidents to clients questionnaire); NOC, nursing outcome classification; NRS, numeric rating scale; PACSLAC, pain assessment checklist for seniors with limited ability to communicate; PREM, patient reported experience measure; REPOS, Rotterdam elderly pain observation scale; SCEGS, somatisch, cognitief, emotioneel, gedragsmatig, sociaal (somatic, cognitive, emotional, behaviour, social); SNAQ, short nutritional assessment questionnaire; SRB, self-rated burden; SRM, self-reliance matrix; TFI, tilburg frailty index; TRAZAG, TRAnsmurale Zorg Assessment Geriatrie (Transmural Care Assessment Geriatrics)*;* USD, Utrecht symptom diary; VAS, visual analogue scale; VIM, veilig incidenten melden (report incidents safely).

[a] A complete overview of the other methods used to measure outcomes can be found in Supporting Information Table S1.

The following validated instruments were used most often to measure the outcomes: Delirium Observation Scale (DOS) to measure delirium (*n* = 53), Numeric Rating Scale (NRS) or Visual Analogue Scale (VAS) to measure pain (*n* = 45), Short Nutritional Assessment Questionnaire (SNAQ[65]) to measure weight loss (*n* = 39), the Caregiver Strain Index (CSI) (*n* = 26) and the self-perceived burden from informal care questionnaire (in Dutch: Ervaren Druk door Informele Zorg; EDIZ) (*n* = 14) to measure informal caregiver burden, Groninger Frailty Index (GFI) to measure frailty (*n* = 21), the Dutch Self-Reliance Matrix (SRM) (*n* = 16) or the Utrecht Symptom Diary (USD) (*n* = 10) to measure multiple outcomes simultaneously, and the Braden scale to measure decubitus (*n* = 12) (Table 3). Validated instruments were often used to measure outcomes in the domains of functional health, physiological health, including neurocognitive health, and family health.

The most often used unvalidated instruments were the reports of incidents to clients questionnaire (in Dutch: Meldingen Incidenten Cliënten, MIC) (*n* = 29) to measure falls or other incidents, the Dutch Patient-Reported Experience Measure (PREM) to measure satisfaction with delivered care (*n* = 26), assessment of self-management in medication (in Dutch: Beoordeling Eigen beheer Medicatie, BEM) to measure compliance in medication use (*n* = 12).

Outcomes were measured at multiple moments during the care delivery: at the start of the care delivery (*n* = 103), when care is evaluated during care delivery (*n* = 114), at the end of the care delivery (*n* = 95), and whenever it is needed during care delivery at no fixed moment (*n* = 111) (Supporting Information Table S2). The outcomes were reported in various ways: in the care plan (*n* = 93), in the daily care reports (*n* = 90) or elsewhere in the electronic care report (*n* = 109).

Learning from outcomes in district nursing care

To contribute to learning and development in district nursing care, the outcomes measured were always fed back (at fixed moments) (*n* = 35, 26.5%) or partly fed back (only when needed) (*n* = 62, 47%) (Supporting Information Table S3). In 16.7%, outcomes measured were not fed back to the team. Outcomes were most often fed back during team meetings (*n* = 90), via an online dashboard (*n* = 32) or by e-mail (*n* = 24). The outcomes were fed back in various ways: orally (*n* = 59), via text (*n* = 55), via graphs, figures or diagrams (*n* = 49) or tables with numbers (*n* = 36).

Barriers and facilitators for using nurse-sensitive outcomes in district nursing care

The statements that have the highest scores were ‘using outcomes is part of my work as a district nurse’, ‘I am confident that I am able to use outcomes’, ‘I have a positive attitude towards using outcomes’, ‘I find it important to use outcomes’ and ‘as a district nurse, it is my responsibility to use outcomes’ (Table 4). The statements with the lowest scores were: ‘I am trained to use outcomes correctly’, ‘there were good networks between the parties involved to support using outcomes’, and ‘using outcomes is facilitated within my team and/or organisation’.

The results of the four open-ended questions focusing on barriers and facilitators of measuring and learning from nurse-sensitive outcomes revealed various influencing factors, such as motivation, knowledge and skills, work pressure, supporting information systems and the support by health insurers and organisations.

Table 4. Barriers and facilitators for using outcomes in district nursing care (*n* = 132)

Statements	Answers, in percentage[a]	Mean score (SD)[b]	Missing n
Knowledge			
I am familiar with using outcomes		3.7 (0.9)	17
I would like to learn more about using outcomes before I decide to implement it		3.7 (1.1)	17
Skills			
I am trained to use outcomes correctly		2.8 (1.2)	17
I have the skills to use outcomes		3.4 (1.1)	18
Attitude			
I have a positive attitude towards using outcomes		4.0 (0.9)	18
I find it important to use outcomes		4.0 (1.0)	17
Social/professional role and identify			
Using outcomes is a part of my work as a district nurse		4.2 (0.9)	17
As a district nurse, it is my responsibility to use outcomes		4.0 (0.9)	17
Beliefs about capabilities			
I am confident that I am able to use outcomes		4.1 (0.9)	18
Beliefs about consequences			
There is a risk that the use of outcomes will be abused in the funding of district nursing care		3.5 (1.0)	17
Intentions			
I will definitely use outcomes in 2020		3.6 (0.9)	17

Table 4. *(continued)*

Work environment			
Using outcomes is facilitated within my team and/or organisation		3.2 (1.1)	17
Patient			
Using outcomes helps me to provide better care to clients in community nursing		3.8 (1.0)	18
Resources			
There are good networks between the parties involved to support using outcomes.		2.9 (0.9)	17
Using outcomes is too time-consuming		3.5 (1.1)	17
The system (e.g., EHR) in which I work makes using outcomes convenient for use.		3.4 (1.1)	18
			

Abbreviation: EHR, electronic health record.

[a] ⬜ = completely disagree, ░ = (partly) disagree, ▒ = do not agree nor disagree, ▓ = (partly) agree, ■ = completely agree.

[b] Total range: 1 point (completely disagree) to 5 points (completely agree).

Discussion

This study is the first, to the best of the authors' knowledge, which explored how the 26 relevant nurse-sensitive outcomes are currently used in daily district nursing practice and what barriers and facilitators are experienced in using outcomes in Dutch district nursing care. Different instruments or questionnaires are available and used in district nursing care as outcome measures. Of the 26 previously identified nurse-sensitive outcomes for district nursing care, the most measured outcomes using validated outcome measures were pain using the NRS or VAS, delirium using DOS, weight loss using the SNAQ/SNAQ-65 and caregiver burden using the CSI or Dutch EDIZ. Falls and satisfaction are other often measured outcomes using unvalidated outcome measures. For the other outcomes, there is a high variation in outcome measures used. The outcomes are measured multiple times and reported in various ways. The outcomes are most often partly fed back to the district nursing teams (i.e., only when needed). Regarding the facilitators of using outcomes in daily district nursing care practice, most nurses see using outcomes as their responsibility and an important part of their work, are confident that they can use outcomes and have a positive attitude towards outcomes. Barriers are the lack of training to using outcomes, the lack of networks between parties involved to support using outcomes and the lack of facilitation within the team and/or organisation.

The results of our study show that different instruments or questionnaires are available and used in district nursing care as outcome measures. Often, multiple outcome measures were reported to measure the same outcome: Four or more instruments were used to measure ADL, frailty, mobility, pain, anxiety, quality of life and informal caregiver burden. A systematic review focusing on evidence-based interventions and outcomes in district nursing care showed similar variation in outcome measures to measure nurse-sensitive outcomes in intervention trials in district nursing care (39). The availability of health-related questionnaires could explain the variation: In the Netherlands, 446 validated Dutch questionnaires are available in the healthcare sector. There are no national agreements about which instrument to use, and organisations or nurses are free to decide what outcome measure to use. This could potentially explain the variation. Next to the variation in nurse-sensitive outcome measures, there is variation in how outcomes are fed back to the team to learn from. This identified variation in the use of outcome measures and how to learn from them can be explained by the organisation of district nursing practice in the Netherlands, which is fragmented over more than 3070 different care organisations (40). At the time of this study, every organisation can decide what they measure, how they measure and what information is fed back to the professionals. They often use different electronic health records and information systems to record and view outcome measures. The lack of uniformity in outcome measurements has been seen in other healthcare-related systematic reviews as well

(41–44). Achieving a standardised collection of outcome measurements in practice is challenging (45). Internationally, there is a call to action to standardise outcome measurements, as this standardisation allows care providers to collect and share data efficiently, providing comparisons to accelerate care improvements (46). For research, standardised outcome measurements are a necessity in clinical trials and systematic reviews to make adequate comparisons (47).

The nurses included in this study often have a positive attitude regarding using nurse-sensitive outcomes. This is in line with previous research, which identified using outcomes as one of the top three most desired themes to further develop within district nursing care in the Netherlands (48). Our study revealed that most of the participating nurses are willing to use outcomes in their work. Still, they are insufficiently prepared to do so and insufficiently supported by the organisation and other parties involved. Two systematic reviews focusing on (allied health) professionals' experiences on outcome measures in healthcare also identified the lack of knowledge, education and support as important barriers (1,45). Both systematic reviews focused on a mixture of healthcare professionals in different settings, which did not include nurses or district nursing care. While we identified current barriers and facilitators towards using outcomes in district nursing care, it remains unclear what is needed to prepare and support nurses to follow the steps of the learning healthcare system in their daily practice. Further exploration of the identified influencing factors following the open questions is required. The answers provided by the nurses were very brief and not detailed enough, causing an insufficient understanding of the barriers and facilitators. To gain a better understanding of the barriers and facilitators, a different research method with qualitative design is needed, for example, by using in-depth (group) interviews with nurses.

Strengths and limitations

To our knowledge, this is the first study exploring the current practice regarding using nurse-sensitive outcomes in Dutch district nursing care. The participating nurses provided detailed information. Another strength of this study was that the survey was developed thoroughly; the DDNO survey was based on previous research regarding nurse-sensitive outcomes in district nursing care, used validated instruments to identify barriers and facilitators and was developed with the help of district nurses, nursing students and Dutch specialists, and pilot tested in a district nursing care organisation. While the response number is in line with other surveys distributed among district nurses and nursing assistants (49,50), the low response rate and high dropout rate are significant limitations. The 302 district nurses who started the survey represent 1% of the total Dutch population of nurses. While the DDNO survey was thoroughly developed and tested, the dropout rate was high. A possible explanation for this could be the length of the DDNO, which was relatively long, in combination with little time available in district nursing care due to COVID-19 pandemic and pressing workforce shortages (7,51,52). It may be helpful for the next study with a lengthy survey to use (financial) incentives for participation, which effectively improves the response rate (53). Another solution is splitting the survey into two separate surveys. The background characteristics of those continuing the survey concerning sex and age are similar to the available population characteristics (24) and comparable to a recent survey including 1007 district nurses (54). In general, selection bias might be an issue, in which only those interested in outcomes filled in the questionnaire. Furthermore, because the study was self-reported and anonymous, there was unfortunately no space to ask further questions about their responses. The overlap and sometimes unclear reactions in the open questions of the survey may give an incomplete overview of the outcome measures. It may be relevant to view the available registered data in, for example, care plans and see what is recorded in terms of outcome measurements.

Recommendations

The results of this study underline the importance of measuring nurse-sensitive patient outcomes in district nursing care. Using outcomes is a crucial building block in a learning healthcare system, which focuses on collecting data to generate knowledge and applying it to improve practice (16). Outcomes are also essential to the nursing process to assess and evaluate the nursing care provided (18,19). However, this study identified important barriers and variations in how the outcomes are used to learn and improve. This underlines that further investments to prepare and support nurses are highly needed. First, it is necessary to create more uniformity nationwide in the measuring and reporting outcomes to make comparisons between and within organisations possible (46). In this, attention to a feasible collection of relevant data is needed (55). Next to measuring new data, it should be considered to use data already available in district nursing care. A lot of data are available on long-term care in the Netherlands, but it is insufficiently used (56). Because of the high proportion of unvalidated outcome measures, it is recommended to develop and implement validated outcome measures. The need for (inter)national uniformity in measuring outcomes, using existing data and using validated outcome measures is in line with the key recommendations by the Organisation for Economic Co-operation and Development (OECD) (57). Looking at important barriers to use outcomes, the results of our study showed a lack of organisational and national networks and that the nurses are insufficiently facilitated to use nurse-sensitive outcomes in district nursing care. Therefore, it is needed to support nurses and organisations in using these outcomes. Because it remains unclear what is specifically needed to prepare and support nurses to follow the steps of the learning healthcare system in their daily practice, additional research is required to gain a better understanding of the factors influencing the implementation of the learning healthcare system and to identify what nurses need towards using nurse-sensitive outcomes in district nursing care. Subsequently, implementing the steps of the learning healthcare system to facilitate greater use and reporting of outcome measures are highly recommended. To support nurses and organisations, (inter)national guidelines regarding the use of outcomes in district nursing care are desirable to achieve a greater uniformity on an (inter) national level. These insights could potentially be relevant on an international level as well, as this study is the first to the best of the authors' knowledge to focus on using outcomes in district nursing care.

Conclusion

This study is the first that identified current Dutch practice regarding the use of nurse-sensitive outcomes in district nursing care. Most participating nurses have a positive attitude towards using outcomes, but there is a lack of facilitation to support nurses in doing so. The high variation in the use of nurse-sensitive outcomes shows a lack of uniformity. Therefore, it is recommended to create more uniformity by developing guidelines regarding the use of nurse-sensitive outcomes in district nursing care. Insight into how nurses should be supported to use the outcomes within all steps of the learning healthcare system is still lacking. Further research on the barriers, facilitators and needs of nurses and nurse assistants in using nurse-sensitive outcomes in district nursing care is needed to create practical guidelines and (inter)national policy.

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Supporting Information

The Dutch District Nursing Outcome (DDNO) Survey

Part 1. Background characteristics

Question	Answer options
What is your current job title in district nursing care?	Vocationally trained registered district nurse Bachelor prepared registered district nurse Specialised nurse Advanced nurse practitioner Other <open field>
How many hours per week do you work in district nursing care?	<open field>
How many years of working experience do you have in district nursing care?	<open field>
Do you have other job positions in addition to working in district nursing care?	No Yes, teaching Yes, research Yes, policy, quality and/or safety Other <open field>
What is your educational level?	In-service education Secondary vocational education Bachelor at university of applied sciences Bachelor at university Master at university of applied sciences or university
What is your gender?	Male Female I’d rather not say
What is your age?	<open field>
In what geographical area (province) are you working?	Groningen Friesland Drenthe Overijssel Flevoland Gelderland Utrecht Noord-Holland Zuid-Holland Zeeland Noord-Brabant Limburg

Part 2. Measuring nurse-sensitive outcomes in current practice

	Do you measure this outcome in your district nursing team?		Explanation	
	Yes	No	If the answer was yes: how is the outcome measured? What measures do you use?	If the answer was no: why is the outcome not measured?
Functional health				
Activities of daily living			<open field>	<open field>
Frailty			<open field>	<open field>
Mobility			<open field>	<open field>
Physiological health including neurocognitive health				
Decision making			<open field>	<open field>
Decubitus			<open field>	<open field>
Dehydration			<open field>	<open field>
Delirium			<open field>	<open field>
Fatigue			<open field>	<open field>
Pain			<open field>	<open field>
Unintentional weight loss			<open field>	<open field>
Psychosocial health				
Anxiety			<open field>	<open field>
Participation in social activities			<open field>	<open field>
Autonomy			<open field>	<open field>
Compliance			<open field>	<open field>
Falls			<open field>	<open field>
Perceived health				
Quality of life			<open field>	<open field>
Satisfaction with delivered care			<open field>	<open field>
Meaningful life			<open field>	<open field>
Family health				
Informal caregiver burden			<open field>	<open field>

Part 2. *(continued)*

	Do you measure this outcome in your district nursing team?		Explanation	
	Yes	**No**	**If the answer was yes: how is the outcome measured? What measures do you use?**	**If the answer was no: why is the outcome not measured?**
Death				
Preferred place of death			<open field>	<open field>
Quality of dying and death			<open field>	<open field>
Healthcare consumption				
Emergency service use			<open field>	<open field>
Unplanned hospital admission			<open field>	<open field>
Unplanned hospital readmission			<open field>	<open field>
Duration of district nursing care			<open field>	<open field>
Intensity of district nursing care			<open field>	<open field>

Question	Answer options
When are the outcomes measured?	At the start of the care delivery When care is evaluated during care delivery When care is evaluated at the end of care delivery Whenever it is needed (no fixed moment) Other <open field>
Where are the outcomes reported?	Care plan Electronic care report Daily reporting Other <open field>

Part 3. Learning from nurse-sensitive outcomes in current practice

Question	Answer options
Are outcomes fed back to the team?	Yes, always (at fixed moments) Yes, partly (only when needed) No
In what way are the outcomes fed back?	Via online dashboard Via e-mail In the working office of the district team Fed back and discussed during team meetings Other <open field>
How are the outcomes fed back?	In tables with only numbers In-text with words (recap) In graphs, figures of diagrams During meetings Other

Part 4. Barriers and facilitators of using nurses-sensitive outcomes in general

Statements	Completely disagree	(Partly) disagree	Agree nor disagree	(Partly) agree	Completely agree
Knowledge					
I am familiar with using outcomes					
I would like to learn more about using outcomes before I decide to implement it					
Skills					
I am trained to use outcomes correctly					
I have the skills to use outcomes					
Attitude					
I have a positive attitude towards using outcomes					
I find it important to use outcomes					
Social / professional role and identify					
Using outcomes is a part of my work as a district nurse					
As a district nurse, it is my responsibility to use outcomes					
Beliefs about capabilities					
I am confident that I am able to use outcomes					

Part 4.*(continued)*

Statements	Completely disagree	(Partly) disagree	Agree nor disagree	(Partly) agree	Completely agree
Beliefs about consequences					
There is a risk that the use of outcomes will be abused in the funding of district nursing care					
Intentions					
I will definitely use outcomes in 2020					
Work environment					
Using outcomes is facilitated within my team and / or organisation					
Patient					
Using outcomes helps me to provide better care to clients in community nursing					
Resources					
There are good networks between the parties involved to support using outcomes.					
Using outcomes is too time-consuming					
The system (e.g., EHR) in which I work makes using outcomes convenient for use.					

Table 1. Overview of outcome measures (self-reported)

	Validated instruments	Unvalidated or unspecified (risk analysis) outcome measures	Observation, conversation and/ or collaboration with client, other professionals or colleagues †	Anamnesis, evaluation and other non-specified assessments‡	Reporting / care plan §	Electronic health record / classification or information system / web¶	Unclear*	Total
Functional health								
Activities of daily living; n	9	9	8	4	4	15	1	46
Frailty; n	30	11	4	2	2	3	3	50
Mobility; n	7	17	7	3	3	9	0	44
Physiological health, including neurocognitive health								
Decision making; n	1	0	7	4	6	5	4	27
Decubitus; n	14	31	4	1	14	3	3	66
Dehydration; n	1	23	5	3	2	4	1	35
Delirium; n	54	10	2	1	4	1	0	70
Fatigue; n	3	4	4	1	3	1	4	20
Pain; n	52	35	1	2	0	6	2	88
Unintentional weight loss; n	40	41	2	2	4	4	0	81
Psychosocial health								
Anxiety; n	9	13	4	1	4	5	2	33
Participation in social activities; n	5	6	3	12	6	6	0	34

Table 1. *(continued)*

	Validated instruments	Unvalidated or unspecified (risk analysis) outcome measures	Observation, conversation and/ or collaboration with client, other professionals or colleagues †	Anamnesis, evaluation and other non-specified assessments‡	Reporting / care plan §	Electronic health record / classification or information system / web¶	Unclear*	Total
Autonomy; n	6	3	5	6	5	5	4	34
Compliance; n	0	19	5	1	9	6	1	36
Falls; n	2	58	2	4	9	6	3	73
Perceived health								
Quality of life; n	5	7	5	7	4	4	0	28
Satisfaction with delivered care; n	27	30	1	25	0	10	1	85
Meaningful life; n	1	5	4	11	5	2	0	28
Family health								
Informal caregiver burden; n	45	10	2	7	5	6	3	71
Death								
Preferred place of death; n	0	6	14	7	5	2	2	35
Quality of dying and death; n	1	7	11	11	3	2	1	32

Table 1. *(continued)*

	Validated instruments	Unvalidated or unspecified (risk analysis) outcome measures	Observation, conversation and/ or collaboration with client, other professionals or colleagues †	Anamnesis, evaluation and other non-specified assessments‡	Reporting / care plan §	Electronic health record / classification or information system / web¶	Unclear*	Total
Healthcare consumption								
Emergency department or service use; n	0	1	1	1	2	2	1	8
Unplanned hospital admission; n	0	0	2	0	4	4	0	10
Unplanned hospital readmission; n	0	0	3	0	4	4	0	11
Duration of district nursing care; n	0	2	4	3	6	32	2	48
Intensity of district nursing care; n	0	1	2	8	8	31	4	53

Notes: **†** the outcomes are measured by observation with the client or in conversation and collaboration with the client and/or other professionals or colleagues. This includes team meetings, advanced care planning and shared decision-making. No specific questionnaire was mentioned. **‡** the outcome is measured during the anamnesis conversation at the start of the care period or evaluation moments during or at the end of the care period. The nurses could use a questionnaire, but this was not specified. **§** the outcome is reported in the care plan and/or the daily reports. It is unclear how outcomes are measured. No specific questionnaire was mentioned. **¶** the outcome is measured using an electronic health record, classification or information system, or the internet. Some organisations have questionnaires available within their electronic health record, classification- or information system, and others use questionnaires available on the internet. The nurses mentioned using their electronic health record, system or the internet but did not specify any questionnaires. * Following the district nurse's answer, it was unclear how the outcomes were measured.

Table 2. When outcomes are measured in district nursing care and where they are reported (self-reported, N=132)

When are the outcomes measured? †	
At the start of the care delivery; n	103
When care is evaluated during care delivery; n	114
When care is evaluated at the end of care delivery; n	95
Whenever it is needed (no fixed moment); n	111
Other; n	16
Missing; n	4
Where are the outcomes reported? †	
Care plan; n	93
Electronic care report; n	109
Daily reporting; n	90
Other; n	18
Missing; n	6

Notes: † Multiple answers were possible

Table 3. how outcomes are fed back to the district nursing team (self-reported, N=132)

Are outcomes fed back to the team?	
Yes, always (at fixed moments); n (%)	35 (26,5)
Yes, partly (only when needed); n (%)	62 (47)
No; n (%)	22 (16,7)
Missing; n (%)	13 (9,8)
In what way are the outcomes fed back? †	
Via online dashboard; n	32
Via e-mail; n	24
In the working office of the district team; n	3
Fed back and discussed during team meetings; n	90
Other; n	30
Missing; n	27
How are the outcomes fed back?†	
In tables with only numbers; n	36
In-text with words (recap); n	55
In graphs, figures of diagrams; n	49

Table 3. *(continued)*

Are outcomes fed back to the team?	
During meetings; n	59
Other; n	9
Missing; n	30

Notes: † Multiple answers were possible

7

Exploring the barriers, facilitators and needs to use patient outcomes in district nursing care: A multi-method qualitative study

Veldhuizen JD, Van Wijngaarden F, Mikkers MC, Schuurmans MJ, Bleijenberg N.

Under review.

Abstract

Aim and objectives: To provide an in-depth insight into the barriers, facilitators and needs of (district) nurses and nurse assistants on using patient outcomes in district nursing care.

Design: A descriptive multi-method qualitative study

Methods: Open-ended questions of a survey study were supplemented with in-depth online focus group interviews involving district nurses and nurse assistants in the Netherlands. Data were analyzed using thematic analysis.

Results: Different barriers, facilitators and needs were identified and compiled into sixteen preconditions to use outcomes in district nursing care. These preconditions were subsequently summarized into six overarching themes: make it possible to follow the steps of a learning healthcare system; provide patient-centered care; promote the professional’s autonomy, attitude, knowledge and skills; enhance shared responsibility and collaborations within and outside organizational boundaries; prioritize and invest in the use of outcomes; and boost the unity and appreciation for district nursing care.

Conclusion: The preconditions provided in this study can facilitate nurses, care providers, policymakers, and payers in implementing the use of patient outcomes in district nursing practice. Further exploration of appropriate implementation strategies is needed for a successful implementation.

Implications for the profession: Findings from this study build on existing literature on implementing the use of patient outcomes via a learning healthcare system. This study is the first step towards its implementation in district nursing care.

Impact: Other research primarily focuses on improving patient outcomes in hospitals and general practitioner settings, neglecting the potential benefits for district nursing care. This study identifies sixteen key preconditions grouped into themes such as a learning healthcare system, patient-centered care, professional autonomy, collaboration, and unity. It offers valuable insights for implementing a learning healthcare system in district nursing that emphasizes measuring and learning from patient outcomes.

Reporting method: Consolidated criteria for reporting Qualitative research (COREQ) guidelines.
Patient of public contribution: No Patient or Public Contribution.
Keywords: community health nursing, home care services, learning health system, qualitative research, patient-reported outcome measures, value-based health care.

What does this paper contribute to the wider global clinical community?

- The paper offers valuable guidance for implementing a learning healthcare system that focuses on the systematic measurement and learning from patient outcomes in district nursing care.
- This paper strengthens the evidence base for district nursing care worldwide, helping to improve its practice and enhancing the development of policies informed by evidence

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Introduction

Worldwide, substantial societal challenges are faced as the population ages, chronic diseases and care complexity increase, and the shortage of healthcare professionals grows. Because of these challenges, health systems are pressured to provide high-quality care that is safe, effective and responsive to patient needs (1). However, significant gaps in knowledge hinder a comprehensive understanding and enhancement of care delivery in general (2) and at home (3). Better information on the value and outcomes of care is needed (2), especially in district nursing care with its rising demands (3,4). Systematically measuring and subsequently learning from outcomes and other data, corresponding to the steps of a learning healthcare system, is vital to improving healthcare practice. For Dutch district nursing care, measuring and continuously improving outcomes is insufficiently done at the moment of this writing (5). It is currently unclear what is needed in district nursing care to support nurses in using outcomes, which subsequently could assist them in improving their daily practice. To enhance the future adoption and implementation of measuring and continuously improving outcomes in district nursing care, insight into the influencing barriers, facilitators and needs to use outcomes in district nursing care is needed.

Background

Measuring and improving outcomes as part of value-based healthcare

Measuring and continuously improving outcomes in district nursing care in the Netherlands is held back by the main focus of organizations on the hours of delivered care (volume) instead of the outcomes of care (value). In most Western countries, including the Netherlands, the most common healthcare payment system is the fee-for-service system, which rewards volume instead of value (6). To shift the focus of healthcare organizations from volume to value, value-based healthcare is currently receiving more attention worldwide (7). In value-based healthcare, the objective is to continuously improve delivered health outcomes to patients for the money spent (7). By measuring, tracking and improving health outcomes systematically, health systems pursue to 1) deliver better patient outcomes and overall population health more consistently, 2) identify and disseminate best practices, 3) control the total healthcare costs more effectively, and 4) rebuild the trust and motivation of health professionals (7). Larsson et al. state that value-based healthcare is relevant for patients, care providers and payers, such as the government, health insurers or municipalities. Our study primarily focuses on nursing professionals' experiences and needs in systematically measuring and learning from patient outcomes to improve district nursing care (described in this paper as "using outcomes").

A learning healthcare system to improve outcomes

Measuring and learning from outcomes are in accordance with a Learning Healthcare System. The idea of a learning healthcare system was initially proposed by the Institute of Medicine (2007) and then further developed by various other organizations (8). The core of the learning healthcare system concept is the significance of information in continually enhancing health outcomes through iterative “learning cycles” (8), achieved by “applying science, informatics, incentives and culture to generate and use knowledge in the delivery of care” (9). A learning healthcare system does not primarily look at outcomes but focuses on collecting all available information or data to generate knowledge (8) and follows a three-step cycle: collect data from practice (i.e., Practice to Data), generate knowledge from the data via analyses and interpretation of data (i.e., Data to Knowledge), and transfer knowledge back into practice (i.e., Knowledge to Practice) (9). This cycle aligns with the stepwise nursing process, involving assessment, diagnosis, planning, outcome setting, intervention implementation, and care evaluation (10), making it suitable for district nursing practices.

Implementing a Learning Healthcare System with a focus on patient outcomes in district nursing care

To achieve a patient-centered focus in using health outcomes, there is growing importance on the inclusion of patient-reported outcome measures and patient-reported experience measures (2). Prior research on how patient outcomes are currently used in district nursing practice showed that nurses have a positive attitude towards using outcomes, but there is a lack of facilitation to support nurses (5). It is currently unclear how district nurses can be supported to use patient outcomes to improve their daily practice. Measuring and learning from outcomes can be seen as a new way of working that requires solid implementation. Before implementation, it is recommended to study the context, including the barriers and facilitators (11). However, there is a lack of insight into the barriers and facilitators for district nursing care, as the literature on value-based healthcare, learning healthcare systems, and patient-reported outcome measures often focuses on the hospital setting or the general practitioner in primary care instead of district nursing care (12,13). Additionally, because district nursing care has a specific organization and financing, this study focuses on Dutch district nursing care to better understand the context and enhance future implementation.

The study

This study aimed to provide an in-depth insight into the barriers, facilitators and needs of (district) nurses and nurse assistants on using patient outcomes in district nursing care. These insights are of great value for informing care providers, policymakers and payers to organize the needed preconditions to enhance the future adoption and implementation of a learning healthcare system in which patient outcomes are used to improve district nursing care.

Methods

Design and theoretical framework

A descriptive multi-method qualitative study was conducted, following a thematic analysis approach within a contextualist framework (14). This framework acknowledges how individuals make meaning of their experiences whilst recognizing how broader social contexts influence those meanings (14). Data was generated using input from the open-ended questions of a survey study, supplemented with in-depth online focus group interviews involving district nurses and nurse assistants in district nursing care in the Netherlands.

Study setting

This study focused on district nursing care in the Netherlands, in which district nursing care is defined as all medical, technical, rehabilitative and supportive nursing care interventions or assistance with personal care for (older) people living at home (15). In the Netherlands, district nurses, vocational nurses, nurse assistants and basic care assistants deliver district nursing care. The latest available figures from 2018 indicate that 12,400 district nurses (bachelor prepared registered nurse, European Qualification Framework (EQF) level 5 and 6) worked in district nursing care, together with 16,108 vocationally trained nurses (EQF level 4), 41,799 nurse assistants (EQF level 3) and 4759 basic care assistants (EQF level 2). Together, they provided care to 585,200 people in the Netherlands in 2021 (16).

Participants and recruitment

A nationwide survey study was conducted from July to October 2020 among district nurses in the Netherlands. Details about the method of this study have been published elsewhere (5). The survey was conducted to understand better how district nurses use nurse-sensitive patient outcomes to learn from and improve district nursing practice. The target population of the survey study comprised all nurses (EQF level 4-6) working in district nursing care. Convenience sampling was used to approach nurses. The survey was distributed nationwide via an online survey platform and was openly available to all district nurses working for various organizations in the Netherlands. Subsequently, online focus group interviews were conducted from March to June 2021. These focus groups involved district nurses, vocational nurses, and nurse assistants (EQF level 3-6). The latter were additionally included as participants, as the survey study revealed that nurse assistants had a role in measuring outcomes in district nursing practice. For the focus groups, purposive sampling was used to recruit nurses and nurse assistants throughout the Netherlands. Nurses and nurse assistants were approached via the professional network of the researchers via e-mail, social media (LinkedIn and Twitter), and the Dutch Association of Nurses and Nurse Assistants. We aimed for maximum variation by selecting participants with various years of working experience, gender, age, and working across multiple district nursing organizations across the Netherlands. To enhance readability, district nurses, vocational nurses and nurse assistants are described as "nurses" from this point onward unless otherwise specified.

Data collection

Survey

The survey study followed a cross-sectional design, in which a survey was specially developed to explore how nurse-sensitive patient outcomes are used in Dutch district nursing practice. The survey comprised open and closed questions and consisted of four parts: 1) background characteristics; 2) measuring nurse-sensitive patient outcomes in current practice; 3) learning from nurse-sensitive patient outcomes in current practice; 4) barriers and facilitators of using nurse-sensitive patient outcomes. A more detailed description of the development and validation of the survey and the results of the closed questions is described elsewhere (Veldhuizen et al., 2022). The following background characteristics were measured: sex, age, education, job title, total hours working in district nursing care per week, years of working experience in district nursing care, other job positions, and the geographical working area (i.e., province). The study included four open-ended questions about (potential) barriers and facilitators to measuring and learning from nurse-sensitive patient outcomes: two questions focused on measurement, and two on learning from outcomes.

Focus group interviews

A first analysis of the open-ended questions of the survey resulted in numerous barriers and facilitators on how to use outcomes in their practice, such as measuring outcomes, analyzing outcomes, interpreting outcomes, carrying out interventions, as well as the involved levels around the use of outcomes, such as the individual level (patient and nurse), team level, organizational level and national level (Supporting Information A). Because these results were sometimes unclear (i.e., imprecise or ambiguous answers), additional online focus groups were carried out to provide a more in-depth understanding of the barriers, facilitators and needs. The identified barriers and facilitators from the survey were checked in the focus groups for recognizability and completeness. In the focus group, more emphasis was placed on what is needed in district nursing practice to overcome the barriers and promote the identified facilitators.

After verbal consent to participate, the study participants received a digital questionnaire two weeks prior to the interview to provide written consent for participation and to answer questions about their background characteristics (sex, age, education, job title, total hours working in district nursing care per week, years of working experience in district nursing care, other job positions, and the geographical working area). Each focus group started with an introduction of the researchers and participants, and an explanation of the study. An interview guide based on the first findings of the survey study was used to structure the interviews (Supporting Information B). During the interview, participants were encouraged to interact with each other and invited to reflect on their perceived barriers and facilitators. Due to covid-19 measures, the focus groups were conducted via Microsoft Teams. Participants were either at their homes or workplaces. During the interview, which lasted 90 minutes, participants could use the "raise your hand" function or chat in Teams to respond to each other. Field notes were written down throughout the interview, and the audio was recorded via a digital voice recorder. Directly after each focus group, two researchers discussed the findings to check if the participants mentioned new information. A priori was expected that three focus groups would be sufficient to reach data saturation, as the focus groups were additional to the survey. This expectation was met as the last focus group interview did not identify any new topics.

Data analysis

Thematic analysis was conducted to analyze both the open-ended questions of the survey and the focus group interviews. The thematic analysis by Braun and Clarke (2012) comprehends six iterative phases: 1) familiarize with the data; 2) generate initial codes; 3) search for themes; 4) review themes; 5) define and name themes; 6) produce the report. The data were analyzed using an iterative and stepwise process; the researchers moved between the data sets, the developed codes and subthemes during the analysis to define and refine the final overarching themes.

The survey was analyzed prior to the focus group interviews to develop the interview guide. The data of the open-ended questions of the survey study was uploaded to ATLAS.ti 22 and was fully read. Subsequently, codes were generated by one researcher and checked by a second researcher. Then, themes were searched, reviewed, defined and named by one researcher and discussed with the research team.

All focus group responses were transcribed verbatim and uploaded in ATLAS.ti 22. Both researchers read and reread the responses and transcriptions in the first phase. In the next phase, codes were generated; two researchers coded the focus groups separately. These codes were compared, discussed and revised to test the consistency in coding between both researchers. In the third phase, themes were searched by forming code groups and placing these groups within themes. In phase four, themes were reviewed after a discussion between the researchers. In the fifth phase, the themes from the survey study and focus groups were combined and finalized by defining and naming them. In this final step, the results related to the three steps of a learning healthcare system (practice to data; data to knowledge; knowledge to practice) were described as such, using the learning healthcare system as an existing framework by Foley et al. (2021). The results that diverged from the learning healthcare system steps but addressed broader or overarching issues were delineated as distinct themes. By placing a part of the results into an existing framework, a hybrid approach of inductive and deductive analysis was applied: inductive as codes and themes were generated from the data based on the participants' experiences; deductive as a framework was used to work out a part of the identified themes and to render issues that participants did not explicitly express (17). The descriptive statistics of the participants' demographics were calculated in R version 4.1.3.

Rigor and reflexivity

The concept of trustworthiness can be divided into credibility, transferability, dependability and confirmability (18,19). To enhance the credibility of our study, document triangulation (survey + focus groups) and researcher triangulation were used throughout the analysis. Also, a discussion of the identified themes of the survey study and the focus group interview themes by the team of authors improved the credibility. Lastly, the identified themes were debriefed with peers not involved in the study. The transferability was enhanced by providing insight into the setting (in the method section) and characteristics of the participants (in the result section). To strengthen the dependability, ATLAS.ti was used to document all steps of thematic analysis. An overview of the results of the analysis of the survey and focus groups is provided in Supporting Information A. Additionally, reporting guidelines were followed to provide transparent reporting. To increase confirmability, verbatim statements made by the participants were included in the results. More information about the training, experience and participant relationship of the interviewer is described in Supporting Information C.

Ethical considerations

Ethical approval for this study was granted by the Ethical Committee Research of the University of Applied Sciences Utrecht. They classified this research as not subject to the Dutch Medical Research Involving Human Subjects Act and permitted it to proceed (reference number 133-000-2020).

Participation in this qualitative study was voluntary. In the survey study, nurses were informed about the study's reasons, goals, and content in its introduction. Consent to participate in this study was administered by letting participants tick a corresponding box in the survey. In the focus groups, the participants received a digital questionnaire two weeks before the interview to provide information about the study and administer written consent for participation. During the interview, verbal consent was additionally asked. All data were stored and analyzed per the General Data Protection Regulation (GDPR). Any personal details were removed from the survey data to ensure the anonymity of the data.

Findings

Participant characteristics

In total, 132 nurses finished the survey; these nurses were mainly female (92.4%) and worked as district nurses (59.8%) (Table 1). Three focus groups were held with three, eleven, and twelve participants, each lasting approximately two hours. Focus groups mainly consisted of female participants (96%) and district nurses (58%). The background characteristics concerning the sex and age of the participating nurses were similar to the available population characteristics (20).

Table 1. Participant characteristics of the survey and focus group interviews

	Survey (N=132)	**Focus groups (N=26)**
Gender, n (%)		
Female	122 (92.4)	25 (96)
Male	8 (6.1)	1 (4)
Other	1 (0.8)	0 (0)
Missing	1 (0.8)	-
Age, median (IQR)	50 (35-58)	39 (30-53)
Years of experience working in district nursing care, median (IQR)	10 (6-20)	7 (5-12)
Contract size (in hours per week) working in district nursing care, median (IQR)	25 (20-32)	29 (25-32)
Job title in district nursing care, n (%)		
Nurse assistant (EQF 3)	-	4 (15)
Nurse (EQF 4)	27 (20.5)	2 (8)
District nurse (EQF 5 & 6)	79 (59.8)	15 (58)
Specialized Nurse (EQF 7)	6 (4.5)	3 (12)
Other (nursing student, teacher)	19 (14.4)	2 (8)
Missing	1 (0.8)	-
The number of provinces represented	12/12	10/12

Abbreviations: IQR Interquartile range; EQF European Qualification Framework.

Identified themes

The identified barriers, facilitators and needs were compiled into 16 preconditions to use outcomes in district nursing care (Table 2), which were subsequently summarized into six overarching themes: 1) make it possible to follow the steps of a learning healthcare system; 2) provide patient-centered care; 3) empower nurses to strengthen their professional autonomy, attitude, knowledge and skills; 4) enhance shared responsibilities and collaborations within and across organizational boundaries; 5) prioritize and invest in the use of outcomes on the organizational level; and 6) boost the unity and appreciation for district nursing care on the national level.

Table 2. An overview of the themes and preconditions as subthemes to use outcomes in district nursing care, complemented with illustrative quotes

Themes	**Preconditions as subthemes**	**Illustrative quote**
Make it possible to follow the steps of a learning healthcare system	Clearly define and operationalize patient outcomes for district nursing care (as part of Practice to Data)	Definition: *"I think it should also be clear what is meant by working with outcomes. This may seem abstract, but I think working with outcomes is part of the nursing care process" District nurse 18, focus group 3 (chat)* Operationalization: *"I think that nationally is simply not feasible because there are such huge differences between patients in Rotterdam or the heart of Zeeland. Those are such different people who often have vastly different outcomes". District nurse 20, focus group 3*
	Simplify the measurement of outcomes (as part of Practice to Data)	*"Ease of use (it should not be much), a clear and easy overview of where and for what purpose you can use the measurement instruments and what the added value is." District nurse, survey*
	Acknowledge relevant registrations as a part of good care instead of an administrative burden (as part of Practice to Data)	*"I don't really see why you would lose more time if you're working with outcomes? Maybe it works the other way around, that you waste even less time." District nurse 13, focus group 3* *"If you have the right one, then it's not a burden but a pleasure." District nurse 2, focus group 2*
	Promote the analysis and interpretation of outcomes (as part of Data to Knowledge)	Analyzing outcomes: *"Clinical reasoning is giving meaning to observations. I think that's exactly what you're doing here: How do you give meaning to those numbers? […] only we can give that meaning. It's never just about those numbers, but about the meaning behind it, that story behind it, and we have to tell that." District nurse 2, focus group 2* Visualization and interpretation: "*Provide an easy, unambiguous way of displaying results and link these with tools on how to work with them." District nurse, survey*

Table 2. *(continued)*

Themes	**Preconditions as subthemes**	**Illustrative quote**
	Make it easy to carry out interventions (as part of Knowledge to Practice)	*"Also, there should be one place for guidelines, research, measurement instruments, etc. for district nursing. So that knowledge is bundled and ultimately becomes expertise." District nurse; quality nurse, survey*
	Provide a supporting information system	*"I believe that the system should indeed be facilitating and supportive. And I think it will make it easier to work with [outcomes]" District nurse 21, focus group 3*
Provide patient-centered care	Focus on the patient as the center of nursing care	*"If outcomes also outweigh the patient's well-being, then we must ask ourselves whether this is the right path to take. That would be a challenge for me*." District nurse 5, focus group 2
Empower nurses to strengthen their professional autonomy, attitude, knowledge, and skills	Maintain the nurses' professional autonomy to deviate from the norm	*"People who go from a 2 to a 3 can also be quite a step forward in quality for that person. Then it is not: "you didn't get to a 5, so it was a failure". So you shouldn't get hung up on those numbers. It's purely about the story behind it; from a 2 to a 3 can also be a story of success" District nurse 10, focus group 2*
	Adopt a positive attitude and increase motivation towards using outcomes	Positive attitude: *"You want to have those outcomes. You want to evaluate them, you want to be able to monitor them. That's what it's all about, those results. That's what makes you proud. That's the value of you as a district nurse" District nurse 2, focus group 2* Negative attitude: "*Outcomes are not important! It is about providing warm care, tailored to the person's personal needs. [It is important to] provide more attention to clients instead of measuring everything." Nurse, survey* Increase motivation by sharing the added value of using outcomes: *"I think if that goes for, well, most nurse-assistants: if you understand why you're doing it, you're much more motivated." Nurse assistant 1, focus group 1* *"I think that also very much depends on how people are informed and whether they, therefore, have the will to and see the added value [to use outcomes]." District nurse 21, focus group 3*

Table 2. *(continued)*

Themes	Preconditions as subthemes	Illustrative quote
	Increase the knowledge and skills of team members	*"Isn't it also that there is a great unfamiliarity concerning outcomes? Also, among nurses?" District nurse 12, focus group 2 (chat)*
Enhance shared responsibilities and collaborations within and across organizational boundaries	Enhance shared responsibility and professional leadership within the team	Shared responsibility: *"The nurse assistants are sometimes quite afraid to take responsibility. [...] There is still quite a lot of checking in with the district nurse, like: "is this really okay"?" District nurse 1, focus group 1* Professional leadership: *"My experience is that, as soon as you try to remove the hierarchy as much as possible, and yes, it is a cliché, you try to empower people, especially nurse assistants, and encourage autonomy and thus also leadership, that people then automatically prioritize those outcomes." District nurse 13, focus group 3*
	Enhance organizational, regional, and national collaborations	*"I also strongly believe in looking beyond the boundaries of your organization. So indeed, with different organizations, we also look at: what problems are there, which interventions do we carry out and what works" District nurse 15, focus group 3*
Prioritize and invest in the use of outcomes on organizational level	Prioritize necessary care to manage the lack of time and high work pressure	*District nurse 2: "so we'll keep this situation going if we just keep doing what we always do. It's time to set priorities and make the profession attractive again".* *District nurse 11: We will certainly keep it going if we continue in this way district nurse 2, but a staff shortage and the actual patient care will still come "first". Even though we are busy scaling down [the care that we deliver] and looking at goals, then always registering everything, I must be honest, sometimes really falls short." District nurse 2 & district nurse 11, focus group 2 (chat)*

Table 2. *(continued)*

Themes	Preconditions as subthemes	Illustrative quote
	Focus less on (financial) productivity and invest more in using outcomes of care	Productivity: *"You don't want to put too much [time] into it because then you get comments from above like: your productivity is going down". District nurse 1, focus group 1* Trust: *"Our dream is, of course, simply that you measure yourself what you want to measure and will do with the results, but the reality is that health insurers and the government also have wishes. And that is very difficult." District nurse 9, focus group 2* Support: *"If managers and policy officials do not support it, it is often difficult to motivate district nursing professionals to have outcomes measured" District nurse; project manager, survey*
Boost the unity and appreciation for district nursing care on the national level.	Achieve more unity in the district nursing profession	*"You should, in any case, start with one vision that everyone has, that the health insurers support, the organizations support, the inspectors support [...]. That everyone knows: this is it, we are going to work with this, and this is what we want with it." District nurse 1, focus group 1*
	Boost the appreciation for district nursing care	*"The moment we are valued much more in that society for what we are really worth, our own appreciation will also increase. So, as far as I'm concerned, there is also an enormous role for the government, for health insurance, for the professional association, whoever can influence this. How we as a society look at district nursing as a whole." District nurse 2, focus group 2*

Make it possible to follow the steps of a learning healthcare system

Clearly define and operationalize patient outcomes for district nursing care (as part of Practice to Data)

An important barrier to using outcomes is the lack of definition and operationalization of patient outcomes for district nursing care. "Outcomes" is a broad concept that participating nurses interpret in different ways: as a result of delivered care at the patient level, as a quality indicator on a national level, or a combination of both. Some nurses mention that this lack of definition and operationalization hinders them from using outcomes and following the steps of a learning healthcare system. In deciding what outcomes should be measured, participating nurses find that outcomes should be relevant for the patient, sensical for district nursing care and able to be influenced by district nurses. Another barrier to using outcomes in district nursing care is the different viewpoints of the participating nurses about the level at which outcomes should be measured. Some nurses find focusing on nationwide outcomes challenging due to regional differences in Dutch inhabitants, while others advocate for streamlined use of outcomes nationwide. Other nurses expressed that outcome measurements should differ per intended purpose on different levels (i.e., patient, team, organizational, regional or national level) or for different specialistic care groups (e.g., palliative care, dementia).

Simplify the measurement of outcomes (as part of Practice to Data)

In measuring patient outcomes, the availability and accessibility of (validated) questionnaires were raised as an essential issue that enables the measurement of outcomes. According to the nurses, questionnaires should be combined or bundled in one place, preferably in the electronic health record. Questionnaires should be user-friendly to administer and register in the electronic health record. Additionally, it facilitates nurses if questionnaires are short, simple, and unambiguous in use. Barriers to measuring outcomes are the unawareness of and unfamiliarity with questionnaires or having too many questionnaires available. Some nurses experience that care delivery is hindered by too much focus on obligatory questionnaires and checklists to measure outcomes, increasing the administrative burden. Additionally, the nurses point out that an accurate registration and interpretation of the data is challenging due to ambiguity and variation in current outcome measurements and definitions.

Acknowledge relevant registrations as a part of good care instead of an administrative burden (as part of Practice to Data)

The administrative burden within the district nursing organizations is experienced as high, and some nurses fear that measuring outcomes will further increase this burden. However, other nurses state that it is not an administrative burden if relevant outcomes are used that are part of the daily nursing process. It was mentioned that good care requires good registration. According to the nurses, the experienced administrative burden could be decreased by supporting information systems and using already available nursing documentation and other data in the electronic health record.

Promote the analysis and interpretation of outcomes (as part of Data to Knowledge)

A facilitator of analyzing outcomes is to have the analysis preferably carried out by someone with affinity and experience regarding outcomes and data analysis. Help with the analysis from someone from the organization (e.g., IT specialist) would be advantageous. However, nurses feel the analysis should never be done solely by an IT specialist. An essential enabling factor is to leave the interpretation of the measured outcomes to the nursing teams. Additionally, it would be valuable to have someone from the organization (e.g., quality officer) look at the bigger picture on an organizational, regional, or national level.

The nurses emphasized that the visualization of data is crucial for interpreting outcomes. The current lack of insight into measured outcomes is experienced as challenging. The nurses mentioned different forms of data visualization to be helpful, such as using graphics, tables, and pictures. Hindering factors were too much or complicated information or only using text to share the results of the measured outcomes. Regularly discussing the outcomes within team meetings was described as a facilitating factor in interpreting the outcomes.

Make it easy to carry out interventions (as part of Knowledge to Practice)

It is a facilitating factor when nurses feel free to choose what interventions should be carried out. However, some nurses experience insufficient information on what to do in the event of a finding. Mentioned facilitating factors are an overview of what interventions could be carried out per outcome, the availability of national guidelines, care pathways, and other relevant evidence-based knowledge.

Provide a supporting information system

Nurses indicate that a supporting information system is essential to make it possible to follow the steps of a learning healthcare system. It is helpful if the system facilitates or supports the analysis and display of the data, favorably automatically and within the electronic health record, in the form of a dashboard. Currently, the extent to which the system is supportive varies between organizations.

Provide patient-centered care

Focus on the patient as the center of nursing care

The nurses stated that using outcomes in practice should first and foremost be focused on the patient’s health and well-being. It should serve nurses to provide holistic, patient-centered care. Some nurses worry that too much focus on only measuring outcomes could lead to a technical, business-focused, and impersonal relationship with the patient, potentially missing important information that cannot be measured with questionnaires. However, others see outcomes as essential to their daily nursing clinical reasoning process.

Empower nurses to strengthen their professional autonomy, attitude, knowledge and skills

Maintain the nurses' professional autonomy to deviate from the norm

The nurses want to maintain their professional autonomy to decide whether measuring outcomes and carrying out interventions have added value for the particular patient. They feel there should be room to deviate from the norm and tailor the outcome measurements and interventions to the specific patient situation, making choices based on their knowledge and skills aligned with the patient's needs.

Adopt a positive attitude and increase motivation towards using outcomes

The attitudes towards the use of outcomes among participants vary. The nurses participating in the focus group interviews mainly had a positive attitude towards patient outcomes and were motivated to use them in their work. The nurses explained that outcomes contribute to delivering good care as they create awareness and insight into the effectiveness of care delivery. Nurses stated they could use the outcomes to substantiate their actions and show their worth. They see patient outcomes as an essential part of the nursing process they apply in their daily work and are confident that outcomes can be used to learn from and improve their practice. Other nurses are motivated to use outcomes but feel insufficiently supported by other team members. They find it challenging to get the whole team involved in using outcomes in district nursing practice; other team members have a negative attitude and are not interested in or motivated to measure outcomes as they often do not see the necessity, benefits, and usefulness of doing so. Additionally, some nurses participating in the survey showed a negative attitude towards using outcomes in practice. These nurses indicated that currently, enough outcomes are measured, and no further attention is needed for measuring outcomes in district nursing care. Others are afraid that outcomes are measured solely for the sake of measuring them. Nurses express that measuring outcomes should not become a goal in itself. To adopt a positive attitude and increase motivation, an often mentioned helping factor is knowing the added value of using outcomes in daily practice on the organizational, regional and national levels. Explaining and showing the added value to team members in a clear, low-key, and easy way would be facilitating.

Increase the knowledge and skills of team members

Nurses face insufficient knowledge and skills as a barrier to using outcomes. The difference in knowledge between nurses, nurse assistants and basic care assistants hinders the adoption of using outcomes. Teaching knowledge and skills through (online) training were raised as essential to enable the use of outcomes in district nursing practice. It would be favorable if the training were provided at all levels within and outside the teams (i.e., nursing students, nurse assistants, nurses, and managers).

Enhance shared responsibilities and collaborations within and across organizational boundaries

Enhance shared responsibility and professional leadership within the team

An often-mentioned facilitating factor is having a team member (district nurse, first-responsible nurse or nurse assistant) responsible for implementing the steps of a learning healthcare system to use patient outcomes. The nurses express the importance of collaborating and creating a shared responsibility within the team. However, within a team, some nurse assistants are afraid to take responsibility, are not actively involved in new developments, or do not think it is their job to work with outcomes. To improve the shared responsibility, nurses explain that it would be helpful to involve the whole nursing team and others from the organization (e.g., manager, quality officer) early in the process. Nurse assistants feel the nurses could empower them more by providing more responsibilities to them. The nurses underline the importance of showing professional leadership. They find it essential to stand up and take a pioneering role to convince and motivate their team members, as well as their organizations, involved health insurers and other stakeholders concerning the relevance of using outcomes. However, participating nurses feel they have limited influence.

Enhance organizational, regional, and national collaborations

Nurses and nurse assistants generally want to collaborate in using outcomes in district nursing care. It would be valuable for teams to work towards and adhere to unambiguous agreements regarding the use of outcomes. A helping factor is to work together as one team by focusing on the same goals. However, the nurses specify that basic care assistants often do not want to be involved in new developments regarding outcomes. To enhance the collaboration within the team, nurses share that basic care assistants, nurse assistants and nurses could be linked to each other to work together. On a regional level, some nurses commented that collaborating within and between district nursing organizations through peer consultation and interprofessional cooperation is valuable. An additional facilitating factor, according to the nurses, is sharing outcomes and other relevant data with other district nursing organizations, general practitioners, and hospitals to compare with and learn from.

Prioritize and invest in the use of outcomes on organizational level

Prioritize necessary care to manage the lack of time and high work pressure

A strong theme emerging from the data was the lack of time among nurses to use outcomes in their daily practice. In addition, nurses experience high work pressure caused by a high workload and a staff shortage as significant barriers. To address time constraints and high workload, some nurses emphasize the need to prioritize essential patient care tasks while acknowledging patient care as the top priority. While they also highlight the importance of dedicating time to measure and learn from outcomes, this is not always feasible within their daily tasks.

Focus less on (financial) productivity and invest more in using outcomes of care

Another important barrier is that nurses feel that finances are the top priority for district nursing organizations and health insurers, as they primarily look at the number of hours of patient care delivered per team (i.e., productivity). This excessive focus on productivity hinders nurses' ability to make time to use outcomes and adhere to the learning healthcare system approach. Also, a few nurses experience (anxiety about) being punished for mistakes or too low productivity by their organization. Good agreements between the district nursing organization and health insurer are mentioned as a facilitating factor. Some nurses feel the health insurer's lack of support and trust limits them. They also worry that the influence of health insurers is greater than desired and are afraid they will bring additional requirements regarding outcome utilization. A lack of investment and interest in using outcomes by the district nursing organization is experienced as a barrier. It would be helpful if organizations support teams to use outcomes and the learning healthcare system approach. Some nurses experience a lack of openness in their organization to discuss outcomes. Additionally, some nurses often experience insufficient time, space, and resources to use outcomes while others are given enough space to use outcomes.

Boost the unity and appreciation for district nursing care on the national level

Achieve more unity in the district nursing profession on using outcomes

Nurses emphasize the importance of a unified vision and policy for outcome utilization in district nursing care, backed by all stakeholders (teams, organizations, health insurers, inspectorate, government), while allowing flexibility to tailor specifics to team, organizational, or regional contexts. At the national level, insufficient unity within the district nursing profession is a constraining factor. The presence of diverse district nursing care organizations with varying outcome measurements underscores the nurses' desire for a better nationwide organization of district nursing care.

Boost the appreciation for district nursing care

Nurses sense a lack of recognition for the value that district nursing care brings, which contributes to their feeling of underappreciation at the national level. Some nurses expressed that outcomes contribute to substantiating the added value of their care delivery, subsequently increasing the appreciation for district nursing care. It would support nurses if the societal appreciation on a national level for district nursing increased. Enhanced national societal appreciation for district nursing would facilitate nurses, and they see the government, health insurance companies, and the National Nursing Care Association as responsible for this.

Discussion

The study revealed barriers, facilitators and needs that influence the use of patient outcomes in district nursing care, as discussed by nurses and nurse assistants. The findings were compiled into sixteen preconditions to use outcomes in district nursing care, which can be summarized in six overarching themes: the steps of a learning healthcare system; patient-centered care; the nurses' professional autonomy, attitude, skills and knowledge; responsibilities and collaboration within and across organizational boundaries; prioritizing and investing in the use of outcomes; and unity and appreciation for district nursing care on the national level.

The first theme focuses on integrating the steps of a learning healthcare system to improve practice. The importance of continuously improving healthcare practice using outcome data is underlined by literature on value-based healthcare (7,13), learning healthcare systems (9,21), and patient-reported outcome measures (12). Our study identified multiple needs for measuring (e.g., clear definition, unambiguous operationalization and simplified measurement), analyzing (e.g., professional help with the analysis of the data), and interpreting outcomes (e.g., clear data visualization), as well as carrying out interventions (e.g., national guidelines), which is described by other literature as well (12,13). The essential need for a supporting information system has been underlined by the literature, stating that inadequate data systems are bothersome and hinder the implementation of outcomes in practice (12,13). A central concern for participating nurses was the administrative burden. While some expressed that measuring outcomes as part of the nursing process does not enlarge the burden, as underlined by the literature (22), they stressed the need to minimize administrative complexity and prioritize accurate registration. Good documentation is essential to support the clinical decision-making of nursing staff and to influence patient outcomes (23).

The second theme describes the necessity to put the patient at the center of nursing care and to focus on outcomes that matter to patients. Using outcomes that make sense for patients is also the main focal point of value-based healthcare (7,13), a core value in a learning healthcare system (9,24), and an essential factor influencing the implementation of the use of patient-reported outcome measures (12,21). Outcomes must be flexible to adapt to the patient's particular setting, selecting outcomes based on the needs of patients (12).

The third theme underlines the importance of strengthening the nurses' autonomy, attitude, knowledge, and skills. Despite their current perception of limited influence, the nurses in this study want to take leadership roles and preserve their professional autonomy, including the flexibility to deviate from norms. The importance of taking a leadership role and deviating from professional standards has also been identified by the systematic review by Van Engen et al., (2022) and Foster et al., (2018). This study also identified both positive and negative attitudes towards the importance of using outcomes, similar to the systematic review by Van Engen et al. (2022) on the professionals' roles and behavior in pursuing value-based healthcare. An explanation for the negative attitudes identified in our study is that nurses are afraid to measure meaningless outcomes and experience high administrative burdens and a lack of time. This aligns with the study by Foster et al. (2018), which describes the importance of measuring outcomes that are beneficial for patients and that a high workload and insufficient time hinders the implementation of outcome measures in healthcare. Regarding knowledge and skills, nurses are currently insufficiently trained to use outcomes in district nursing care (5). Participating nurses in our study recognize the lack of knowledge and skills in going through all steps of a learning healthcare system. Other literature also revealed deficits in knowledge, skills and experience among healthcare professionals (13) and the importance of good training and clear guidance (12).

The fourth theme showed the need for shared responsibilities and collaborations. Participating nurses stress the need for shared responsibility by involving all professionals early in the process and showing them the added value of using outcomes. Literature indeed shows that involving healthcare professionals and patients early in the outcome process (i.e., bottom-up engagement) and discussing the value in practice facilitates the implementation process (12,13). Additionally, our study showed that it is necessary to intensify the collaborations within and outside the team on regional and national levels, which has also been pointed out by others, emphasizing the importance of having a positive team culture (12), working in teams and collaborating (13).

The fifth theme focuses on the urgency to prioritize the use of outcomes. The nurses desire more organizational commitment and investment, comparable to the professionals' needs described in the review by Van Engen et al., (2022) and Foster et al., (2018). The nurses in our study experienced that organizations and health insurers focus too much on financial productivity instead of patient outcomes. This financial focus is likely due to the organization of Dutch healthcare, as it is financed through the Health Insurance Act and funded on a fee-for-service basis. In fee-for-service, insurers pay for delivered care, leading to the incentive to provide care, regardless of its value for the patient (6).

The sixth theme underlines the importance of boosting the appreciation for district nursing care and creating more unity on a national level. To boost the appreciation, this study underlines the importance of using outcomes to show the added value of district nursing care. Other research has also underlined the importance of demonstrating the value of district nursing care via patient outcomes (3). Our study identified the wish for more unity in outcome measurements in district nursing care. Creating more unity in measurements is needed to (re)use routinely collected healthcare data to manage patient care, organizations, and medical and health service research (25). This study identified a variation between health record systems and inconsistent recording using different coding and thesauruses in primary care (25). Additionally, the lack of unity in measuring outcomes is also described in a systematic review of reviews on nursing documentation, which identified a wide range of terminologies and categorizations to be used in nursing practice (26).

Strengths and limitations of the work

To our knowledge, this is the first study providing an in-depth insight into barriers, facilitators and needs to use patient outcomes as part of a learning healthcare system in district nursing care. While this study focused on the Dutch context, the described preconditions are broad in nature and, therefore, interesting for other countries. The multi-method design enhanced the study's trustworthiness. Conducting the focus groups after the survey made it possible to check the survey study results. We suppose that this had a positive effect on the transferability of the study. Next, while assumption bias may be a potential problem as the principal researcher conducted previous studies on this subject, attempts have been made to avoid this by analyzing the data together with someone not familiar with the subject and by checking every step with the whole research team.

To appreciate the findings of this study, some limitations need to be considered. Selection bias may be a potential problem in this study. The sample size of the survey study is relatively small, as also addressed in more detail in our previous study (5). Additionally, the focus group interview participants were not a reliable representation of those working in district nursing care. While every effort has been made to compose a sample that reflects district nursing care, it has not succeeded, as the age of the participants is much lower, and the group of nurse assistants included in these interviews is smaller than the national average. This could influence the results of our study; it is possible that participants in the focus group interviews were more positive and more motivated regarding using outcomes in their daily work. The participants in the focus groups all had positive attitudes, while negative attitudes were identified in the survey study. This may affect the transferability of the study.

Recommendations for further research

Translating the barriers, facilitators and needs into various preconditions is a first step towards the implementation of measuring and continuously improving outcomes in district nursing practice. While our study addressed general barriers and facilitators in district nursing care, there's a need for more in-depth exploration. Nilsen & Bernhardsson (2019) highlight that successful implementation requires a deep understanding of the context. Tailoring implementation strategies to the specific organizational context is essential, as settings, individuals, and contextual factors are highly heterogeneous (27). Currently, there is a limited specification of strategies for the implementation of patient-reported outcome measures (28), value-based healthcare (29), and a learning healthcare system (30). It is of utmost importance to further study how the use of outcomes and the steps of a learning healthcare system can be implemented in district nursing care and integrated with other sectors like primary care and hospital settings. In this, the sixteen preconditions described in this study should be considered for an effective implementation on an organizational and national level. Next, this study did not detail the nurses' current knowledge. Therefore, further research is needed to identify the current knowledge and skills and how to fill in the knowledge gaps, so nurses are prepared to work with outcomes and follow the steps of a learning healthcare system. Following this, developing education for nurses, nurse assistants, and nursing students requires further exploration.

Implications for policy and practice

It is recommended to shift the focus from productivity based on hours of delivered care to patient outcomes. This requires a major transformation of the organization and funding of healthcare, including potentially changing the payment model from a fee-for-service to one focusing on outcomes. In this transformation, it is recommended to take an evolutionary approach (7). To take the first steps to integrate the use of outcomes in district nursing care, it is necessary to encourage payer-provider collaborations and to create space for the nursing professionals to experiment with outcomes to learn and improve. Nurses need to be supported with opportunities, appreciation and resources by their organizations, policymakers, and payers.

Conclusion

This qualitative multi-method study revealed barriers, facilitators and needs on how district nursing care professionals can be supported to use patient outcomes to learn from and improve district nursing practice. The overview of preconditions can aid care providers, policymakers and payers in organizing district nursing care, with as main requirements: integrate the steps of a learning healthcare system when implementing the use of outcomes; keep the patient at the center of care; promote professional autonomy, positive attitudes, knowledge and skills of the nurses; enhance shared-responsibilities and collaborations within and outside nursing teams; prioritize the importance of using of outcomes to promote the value of district nursing care; and boost the unity and appreciation for district nursing care on the national level. However, further exploration of appropriate implementation strategies is needed to successfully implement patient outcomes within district nursing care.

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CRediT Author Contributions Statement

JDV: conceptualization, methodology, validation, formal analysis, investigation, data curation, writing—original draft, writing—review and editing, visualization, project administration; FWG: methodology, formal analysis, investigation, data curation, writing—original draft, writing—review and editing, visualization; MCM: conceptualization, methodology, supervision, writing—review and editing; MJS: conceptualization, methodology, supervision, writing—review and editing; NB: conceptualization, methodology, resources, supervision, writing—review and editing

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Supporting information A: results of the survey and focus group interviews’ qualitative analysis

Identified themes and subthemes after analysing the survey *Oktober - December 2020*
Influencing factors on individual level
Patient at center of care
Perception on using outcomes
Motivation and added value
Influencing factors on team level
time, administration and work pressure
Knowledge and education
Working in a team
Influencing factors on organisational and national level
Role of organisation and insurer on finances
Support by organisation
Using outcomes: a cyclical process
Step 1: measuring outcomes using questionnaires
Step 2: learning from outcomes by analysing outcomes

→

Themes and subthemes as discussed in focus group interviews *February – June 2021*
Mapping out experiences and opinions
The current experience with using outcomes
The importance of measuring and learning from outcomes in district nursing care
The added value of outcomes for district nursing care
Increasing motivation and support to using outcomes
Individual level
Keep a holistic view on the patient
Team level
Using outcomes during a lack of time
Limiting administrative burden when using outcomes
Increasing knowledge regarding outcomes
Organisational and national level
Experiencing enough time and professional autonomy
Barriers and facilitators on organisational and national level
The cyclical process
Who measures outcomes
What outcomes should be measured

→

Final version of the identified themes and subthemes after analysing the focus group interviews in combination with insights from the survey *August 2022 – June 2023*
Make it possible to follow the steps of a learning healthcare system
Clearly define and operationalise patient outcomes for district nursing care (Practice to Data)
Simplify the measurement of outcomes (Practice to Data)
Acknowledge relevant registrations as a part of good care instead of an administrative burden (Practice to Data)
Promote the analysis and interpretation of outcomes (Data to Knowledge)
Make it easy to carry out interventions (Knowledge to Practice)
Provide a supporting information system
Provide patient-centred care
Focus on the patient as the centre of nursing care
Empower nurses to strengthen their professional autonomy, attitude, knowledge and skills
Maintain the nurses’ professional autonomy to deviate from the norm
Adopt a positive attitude and increase motivation towards using outcomes
Increase the knowledge and skills of team members
Enhance shared responsibilities and collaborations within and across organisational boundaries
Enhance shared responsibility and professional leadership within the team
Enhance organisational, regional and national collaborations

Supporting information A: results of the survey and focus group interviews' qualitative analysis *(continued)*

Step 3: learning from outcomes by interpreting and reflecting on outcomes	→	Who returns and interprets the outcomes	→	**Prioritise and invest in the use of outcomes on organisational level**
Step 4: learning from outcomes by carrying out interventions.		How to discuss outcomes		Prioritise necessary care to manage the lack of time and high work pressure
		How to correctly interpret outcomes		Focus less on (financial) productivity and invest more in using outcomes of care
		How to carry out interventions		
		How to learn from outcomes		
	→	**Validation of previous found results**	→	**Boost the unity and appreciation for district nursing care on the national level.**
		Missing barriers, facilitators and needs		Achieve more unity in the district nursing profession
		Where action should be taken first		Boost the appreciation for district nursing care

Supporting information B: interview guide focus group interviews

Introduction

Introducing the researchers and participants
Introduction to the research topic

- Q1: Who is familiar with working with outcomes in district nursing?
- Q2: Do you agree or disagree with the following statement: To measure and learn from outcomes is vital to district nursing.

Part one: Mapping out perceptions, opinions

- Q3: When does working with outcomes add value to district nursing for you?
- Q4: What will help to increase the motivation and support to use outcomes?

Part two: Individual level

- Q5: An important outcome of previous research is that professionals are afraid to focus too much on measuring outcomes and filling in questionnaires, leading to a technical, business-focused and impersonal relationship with the patient, potentially missing important information that cannot be measured with questionnaires. Do you recognise this?
- Q6: How can we ensure a holistic view of the patient?

Part three: Team level

- Q7: Do you experience a lack of time to use outcomes in practice? If yes, how can we use outcomes when there is a lack of time?
- Q8: Do you experience a high administrative burden to use outcomes in practice? If yes, how can we limit the administrative burden of working with outcomes?
- Q9: A previous study showed a need to increase knowledge about working with outcomes. What kind of knowledge do you miss? In what way should this knowledge be increased?

Part four: Organisational level and national level

- Q10: Do you experience enough time and professional autonomy to work with outcomes? What helps or hinders you on organisational and national levels in this?

Part five: The cyclical process

Measuring outcomes

- Q11: Which professional needs to measure outcomes?
- Q12: Who decides what needs to be measured? And on what level (organisational, regional, national)?

Analysing and interpreting outcomes

- Q13: Who needs to analyse, return and interpret the outcomes?
- Q14: In what way should the outcomes be discussed?
- Q15: How can it be ensured that outcomes are interpreted in the right way?

Carrying out interventions

- Q16: How can it be ensured that the right interventions will be carried out? What will help in this?

In general

- Q17: On what level does learning from outcomes should be organised (organisational, regional, national)?

Part six: Validation of previously found results

- Q18: Are there any preconditions or other additions for working with outcomes not discussed today?
- Q19: Which of the topics that we discussed today should be firstly taken action on?

Supporting information C: participant-interviewer relationship, training and experience of researchers conducting the focus group interviews

Both researchers (JV; female, FvW; male) involved in analysing the survey study and focus group interviews had a nursing background and scientific background in nursing science. The research team conducting the focus group interviews consisted of one researcher with a bachelor's degree in nursing, a master's degree in nursing sciences and a master's degree in clinical epidemiology (JDV), and one researcher with a bachelor's degree in nursing who was a student at the master of nursing sciences at the time of the study (FvW). JDV conducted this study as part of her professional doctorate (PhD), in which more studies focused on patient outcomes in district nursing care. FvW conducted this study as part of his master of nursing sciences and was not formerly involved in other studies. Both researchers had basic training regarding qualitative studies and focus groups during their masters, and one researcher had former experiences conducting focus group interviews before (JDV). There was no relationship established before study commencement; however, some participants were known to the researchers because they had previously participated in other studies or worked together in the past. The researchers introduced themselves to the participants at the start of the focus groups. No other persons were involved next to the researchers and the participants.

8

General Discussion

Introduction

The quality, accessibility and affordability of district nursing care are increasingly challenged by the rapidly ageing population with complex healthcare needs, who prefer ageing at home (1–3), alongside a growing shortage of care professionals at home (4,5). Furthermore, the absence of compelling evidence poses a significant obstacle to understanding and improving the quality of district nursing care (6). One way to guide and enable nurses to learn from their care delivery and improve care quality is by providing insight into patient outcomes. The use of outcomes to steer healthcare quality is not a novel concept. Donabedian developed a three-part approach for assessing care quality, explaining that structural measures influence process measures, which subsequently impact outcome measures (7). Measuring patient outcomes is essential to gain insight into the effects of the nurses' care delivery on individuals receiving care (8). Additionally, measuring patient outcomes becomes crucial in the face of multiple challenges to ensure the delivery of high-quality, safe, effective, and patient-responsive district nursing care (9). While in district nursing practice, the focus generally centres on organisational (structural) measures and care delivery (process) measures, this doctoral thesis concentrates on patient outcomes, which signify the impact of care on the health status of patients and populations.

Learning and improving based on insights from patient outcomes can be done following the Learning Healthcare System literature. A learning healthcare system continually gathers patient data, analyses this information, and uses the insights to inform and improve healthcare practices, fostering a continuous cycle of learning and improvement (10–13). Using patient outcomes in daily nursing practice is not a new concept but a core element of the nursing clinical reasoning process (14,15). Additionally, the use of outcomes for learning and improvement has a long history, as illustrated by the story of Florence Nightingale below.

Florence Nightingale, a British social reformer and the founder of modern nursing, revolutionised healthcare practices by emphasising collecting data to learn from and improve practice. The description below is derived from the portrayal of Florence Nightingale's legacy in the Encyclopaedia Britannica (16) *and translated to measuring and learning from outcome data.*

During the Crimean War, she meticulously collected statistics and documented information to understand the underlying causes of poor health outcomes. Through her data-driven approach and innovative visual representations, Nightingale revealed that preventable infections and poor sanitation practices, rather than battlefield injuries, were the primary causes of deaths in military hospitals. Her insightful analysis of the data challenged existing medical practices and led her to advocate for improved hygiene and sanitation measures.

Florence Nightingale recognised the power of numerical data in understanding healthcare outcomes and used statistical methods to support her findings. She laid the foundation for data-driven decision-making in healthcare and beyond, establishing her legacy as a pioneering figure in both nursing and statistics. She was not only innovative in measuring health outcomes and using statistics and visualisation, but she was also able to interpret the data and carry out the needed interventions based on the data. In this, she embodied the steps of a learning health system in person.

However, outcomes are currently not being sufficiently used in district nursing care for learning and improvement (17). This is potentially due to the lack of evidence available for district nursing care that supports nurses in their care delivery. Therefore, the first part of this thesis aims to strengthen the evidence base for the delivery of district nursing care. These insights aim to stimulate a more profound comprehension and substantiation of district nursing care, which can contribute to advancing district nursing care. Another significant barrier hindering the use of outcomes in district nursing is the absence of well-defined patient outcomes for district nursing care (18,19) and uncertainty regarding how outcomes can be used for learning and improving practice. Consequently, the second part of this thesis aims to explore the use of outcomes to learn from and improve district nursing care, alongside strengthening the evidence for district nursing care. The objectives of this thesis were as follows:

- Part 1: To examine the current delivery of district nursing care and explore its challenges during the COVID-19 pandemic.
- Part 2: To explore which nurse-sensitive patient outcomes are relevant for district nursing care, how these outcomes are measured in current practice, and what is needed to use patient outcomes in district nursing care to learn from and improve district nursing practice.

Summary of main findings

Part 1: The current delivery of district nursing care and its challenges during the COVID-19 pandemic

Chapter 2 explores the predictors for the use of district nursing care for community-living (older) people using a nationwide healthcare claims dataset on the patient level. For the population of people *aged 75+ years*, the most important predictors were older age and (high) costs for general practitioner consultations, aid devices costs (e.g., oxygen delivery devices or compression stockings), pharmaceutical care costs, ambulance transportation costs and occupational therapy costs. The most important predictors for the *total population*, including all ages, were older age and high costs for pharmaceutical care and aid devices. This study shows that people needing district nursing care visit the general practitioner more often and use more (expensive) medications and aid devices. Therefore, the results of this study underline that close collaboration between the district nurse, general practitioner and community pharmacist is essential.

Chapter 3 describes a mixed methods study on the impact of COVID-19, from the perspectives of district nurses, on older patients living at home, district nursing teams and their organisations, as well as the needs of district nurses regarding future COVID-19 outbreaks. The study shows that the COVID-19 pandemic substantially impacted patient care and district nursing teams. During the first outbreak, nurses played a crucial role in organising care differently and worked under high pressure, leading to exhaustion, tiredness, and psychosocial problems, including fear of infection. A year later, nurses reported being better prepared to provide COVID-19 care, but problems regarding work pressure and mental complaints remained. Nurses stated that more support and appreciation are needed regarding trust and appropriate policies at the organisational and national levels.

Part 2: The use of patient outcomes for learning and improving in district nursing care

Chapter 4 describes a systematic review of interventions and outcomes in district nursing care, identifying inadequate evidence of effective interventions in this setting. The identified experimental studies (n=22) focusing on district nursing interventions were highly heterogeneous regarding patient population and interventions. Additionally, various outcome measurements were used in the included literature. Based on this systematic review, it remains unclear which interventions are effective and what outcomes should be used to substantiate district nursing care effectiveness. This study shows that evidence for district nursing care is scarce, underlining the importance of producing methodologically strong evidence.

Chapter 5 describes a Delphi study, which identified nurse-sensitive patient outcomes in district nursing care for community-living older people. In total, 46 outcomes were assessed by district nurses on I) the *relevance* of the patient outcomes for district nursing care and II) the extent to which district nursing care *influences* the patient outcomes. Ultimately, 26 outcomes were determined as nurse-sensitive. The nurse-sensitive outcomes with the highest scores on relevance and influenceability were the patient's autonomy, the patient's ability to make decisions regarding the provision of care, the patient's satisfaction with delivered district nursing care, the quality of dying and death, and the compliance of the patient with needed care. Because these outcomes are influenced by district nursing care *and* other health professionals in primary care, close collaboration between these professionals is needed to influence and achieve the best possible patient outcomes.

Chapter 6 describes a nationwide survey study exploring the use of nurse-sensitive patient outcomes in district nursing care. It identified a high variation in how outcomes are used in current practice. The nurse-sensitive patient outcomes that were most often measured with validated instruments are pain using the Numeric Rating Scale or Visual Analogue Scale, delirium using the Delirium Observation Scale, weight loss using the Short Nutritional Assessment Questionnaire and caregiver burden using the Caregiver Strain Index or a Dutch equivalent. Falls and patient satisfaction with delivered care are often measured using unvalidated outcome measures. Other nurse-sensitive outcomes are barely measured or measured in different ways. Due to the high variation in the measurement and use of outcomes in current practice, this study recommends creating more uniformity by developing (inter)national guidelines on using nurse-sensitive patient outcomes in district nursing care.

Chapter 7 describes a multi-method qualitative study exploring the barriers, facilitators and needs of district nurses on using outcomes in district nursing care. Via open-ended survey questions and online focus group interviews, barriers, facilitators and needs were discussed, which were then translated into sixteen preconditions to use outcomes in district nursing care. The preconditions were then summarised into six overarching themes: follow the steps of a learning healthcare system; provide patient-centred care; promote the professional's autonomy, attitude, knowledge, and skills; enhance shared responsibility and collaborations within and outside organisational boundaries; prioritise and invest in the use of outcomes; and boost the unity and appreciation for district nursing care. While the identified preconditions can facilitate nurses, organisations, policymakers, and payers in implementing the use of patient outcomes in district nursing practice, further exploration of appropriate implementation strategies is needed.

Reflections on main findings and future perspectives

This thesis is dedicated to strengthening the evidence base for district nursing care, primarily focusing on exploring the use of outcomes for learning and improving district nursing care. Therefore, this reflection on the main findings primarily focuses on using patient outcomes in district nursing care.

Addressing challenges for successful use of outcomes in district nursing care

The findings extracted from the studies presented in **Chapters 4 to 7** collectively indicate that district nursing practice is not ready to incorporate patient outcomes in their daily practice for learning and improving for various reasons. The key challenges that require attention are the ambivalence in attitudes towards the use of outcomes, in outcome measurement, and in the priorities of stakeholders, and the inadequate understanding of outcome measurement, analysis, and utilisation.

The ambivalence in attitudes towards the use of outcomes

The studies described in **Chapters 6 and 7** identified that nurses have contradictory attitudes towards the use of outcomes in district nursing care. Participating nurses showed both negative (e.g., experienced administrative burden) and positive (e.g., adds value to patient care and the profession) attitudes towards using outcomes. Nurses also explain that there were varying attitudes between the different district nursing professionals within their teams (**Chapter 7**). This ambivalence in attitudes from professionals aligns with the literature on value-based healthcare (VBHC). A systematic review of the professionals' roles and behaviour in pursuing VBHC also identified both positive attitudes (e.g., convincement, enthusiasm) and negative attitudes (e.g., critique, resistance) towards using outcomes (20). Other literature indicates that the values and beliefs of healthcare professionals regarding the utilisation of outcomes influence the implementation of these practices (21). Therefore, it is crucial to pay extra attention to the attitudes and beliefs of nurses regarding the use of outcomes in district nursing care. In the following paragraphs, the central attitudes and beliefs are discussed.

"Using outcomes increases the administrative burden and workload"

The participating nurses who expressed a more negative or critical attitude towards the use of outcomes shared concerns over the high administrative burden (**Chapters 6 and 7**). They shared that mandatory questionnaires and checklists increase administrative tasks, hindering their daily care delivery. These nurses also expressed that they experience a high workload and lack of time, in which administrative burden and staff shortage play a role (**Chapters 6 and 7**). The considerable workload and the feeling of insufficient time to provide care within district nursing is a longstanding issue. It was evident even before the onset of the COVID-19 pandemic (11), and during the pandemic, district nurses continued to grapple with elevated work pressure (**Chapter 4**). This heightened workload can be attributed to the growing population living at home, the escalating complexity of care demands, and the shortage of district nursing professionals (6,22). The literature reveals a comprehensive connection among workload, time management, administrative documentation, and staffing (23). Implementing patient outcome measures can face obstacles due to high workload and inadequate time (21). Therefore, proactive management of administrative documentation and workload distribution is necessary for effectively implementing outcome measures. The information system can play a vital role in this. An information system in healthcare facilitates the processing of data, information, and knowledge within the healthcare setting (24). The electronic health record, which typically incorporates all of a patient's health information (25), plays a central role within an information system.

Additionally, an information system may include a planning system, a management system, or a knowledge and guideline-based system (26). One way to reduce the administrative burden is to use already available nursing documentation and other data in the electronic health record (27). However, this is not yet done in Dutch district nursing care, as a study shows that data is currently collected and registered for no other purpose than supporting the care itself (28). To make the re-use of nursing documentation data successful, further enhancements related to uniform measurements, the quality of the data registration and the information system needs to be examined.

"Using outcomes is part of daily nursing practice"
On the other hand, some nurses believe that measuring outcomes does not create an extra administrative burden, emphasising that patient outcomes are integral to their daily nursing practice (**Chapters 6 and 7**). This aligns with findings from the literature, which indicate that documentation closely linked to the care of individual patients is perceived as essential and valuable in delivering qualitative good nursing care (29). The measurement and recording of objective data, including healthcare outcomes, is one of the professional ethical principles for providing quality care to the healthcare recipient, as outlined in the nursing code of ethics (30). Professional guidelines also emphasise that documenting data, including outcomes, is essential for effective nursing care (31,32). Outcomes are essential to the nursing clinical reasoning process; by evaluating patient outcomes, nurses can assess the impact of their care delivery on the patient's health and well-being, guiding nurses in adapting and refining the decision-making processes and care plans (14,15). Therefore, nurses must recognise that measuring and recording outcomes is highly relevant to the nursing profession and an essential part of their daily work.

"Using outcomes is relevant to demonstrate effectiveness and enhance appreciation"
Insight into the effectiveness of district nursing care delivery is needed to validate their care delivery and enhance appreciation (**Chapter 7**). However, the systematic review described in **Chapter 4** demonstrate insufficient evidence that focuses on the effect of district nursing care interventions on patient outcomes. A solid evidence base for district nursing care stays behind (6), and recent reviews confirm the lack of evidence for district nursing care in general, primarily due to the low number of studies conducted in district nursing care and the restricted methodological quality of the studies available (33–38). More evidence is needed on the effect of interventions on specific patient outcomes to substantiate the effectiveness of the nurses' care delivery.

As the insight into the effectiveness of district nursing care increases, the recognition and appreciation for such care might also grow. Some of the participating nurses experience too little appreciation for their work in district nursing care in general and during the COVID-19 pandemic (**Chapters 3 and 7**). The nurses sense a lack of acknowledgement of the value of district nursing care, which contributes to their sense of being underappreciated nationally (**Chapter 7**). Regrettably, this became evident during the COVID-19 pandemic; nurses expressed that the shortage of knowledge, guidelines, and essential materials in the early months led to district nurses feeling less recognized or valued (**Chapter 3**). The lack of attention and support for district nursing care has been evident over the past decade, before and during the COVID-19 pandemic (39,40). Other literature also underlines the importance of demonstrating the value of district nursing care by improving outcomes for patients, their families and society at large (6,41). Insight into the effects of district nursing care delivery on patient outcomes could help increase the appreciation as it demonstrates the value of district nursing care.

"Using outcomes is relevant for learning and improving practice"
Chapter 7 suggests that outcomes can offer valuable insights for continuous learning and improvement in district nursing care. The literature underlines that insight into patient outcomes enables healthcare professionals to learn from their care delivery and improve their practices (42–45). **Chapter 7** also shows that following the steps of a learning healthcare system (LHS) can be helpful. As defined by the Institute of Medicine, an LHS aims to use the best evidence for collaborative patient-professional care decisions and ensures innovation, quality, safety and value in healthcare (11). Information is central in an LHS, and learning cycles are crucial for enhancing health outcomes (10,13). However, because nurses are insufficiently facilitated (**Chapters 6 and 7**), it is necessary to facilitate and train professionals to follow and implement the steps of an LHS to use patient outcomes for learning and improving.

To conclude, some nurses experience the measurement and use of outcomes as an administrative task, which comes on top of their professional work (**Chapters 6 and 7**). However, organisational tasks such as administrative work should be seen as an intrinsic part of professionalism (46); especially the use of patient outcomes should be seen as an integral part of district nursing care as it is part of the nursing clinical reasoning process, and can be used to demonstrate effectiveness, to enhance appreciation, and to enable nurses to learn from their care delivery to improve the care for their patients.

Ambivalence in outcome measurements: individualised approach versus standardisation

Two crucial aspects were identified in deciding what outcomes should be measured and on what level. On the one hand, maintaining an individualised approach (i.e., measuring specific outcomes relevant to a specific patient) is crucial (**Chapter 7**). On the other hand, standardisation (i.e., measuring generic outcomes for all persons of a specific patient group) appears equally important (**Chapters 4, 5 and 6**). These two aspects seem somewhat counterintuitive but can go hand-in-hand.

An individualised approach

The significance of placing the individual at the centre of care and considering their unique circumstances is emphasised by nurses, advocating for an individualised approach (**Chapter 7**). In measuring outcomes, concerns arise that outcomes and other data might become overly prominent, overshadowing the person (**Chapter 7**). As one of the nurses stated: "*Outcomes are not important! It is about providing warm care, tailored to the person's personal needs. [It is important to] provide more attention to clients instead of measuring everything".* In line with this, a recent report by the Dutch Council for Public Health & Society states that looking beyond the outcomes measures is desirable, especially when complex care is delivered, which often is the case in the home situation (47). However, *not* measuring outcomes is not an option, as these are an integral part of the nursing clinical reasoning process and essential to gaining insight into the quality of care.

Standardisation

Chapter 5 identified various outcomes that are potentially valuable for district nursing care. This study has reached a consensus about which outcomes are relevant for district nursing. Looking at how patient outcomes are currently measured in district nursing care, **Chapters 4 and 6** uncovered substantial variation in outcome measures used in current district nursing care. Due to the variation in outcome measurements and definitions, the interpretation of the outcome data is challenged (**Chapter 7**). The literature also describes a variation in registration as not all (district) nurses use standardised terminologies in the electronic health records, and different terminologies are implemented in various ways within electronic health records (48,49). According to the literature, outcome measurements must be clearly defined, operationalised and measured, and the validity of outcome measures should be well documented (50). Dutch research and policy initiatives emphasise the lack of clarity in outcome measurement, necessitating the development of patient outcome measures (i.e., quality indicators) in district nursing care (17,19). Divergent approaches in measuring outcomes hinder comparative analysis and impede knowledge sharing (51). Therefore, adopting a more uniform and standardised approach to outcome measurement is desirable to enable effective learning from one another.

Standardised measurement can be achieved through generic outcomes that apply to all individuals and specific outcomes for relevant subgroups (**Chapter 5**). An example is the International Consortium for Health Outcomes Measurement (ICHOM), which has already developed various outcome sets categorised by conditions (e.g., COPD) or life stages (e.g., paediatrics, older persons). However, standardised measurement carries risks as not everyone neatly fits into predefined categories. For example, Mintzberg warns of the pitfall of diagnostic categories, as “an illness can fall beyond the disease category, it can cut across multiple categories, and effective treatment requires going beneath the categories” (52). In choosing how outcomes should be measured, it is crucial to acknowledge that many significant aspects cannot be easily measured. Health is a notable example of a complex and multifaceted concept that poses challenges in quantification (47,53,54).

Finding a balance between an individualised approach and standardisation

These abovementioned reflections illustrate that practice cannot do without measuring outcomes, but that standardised measurement is not always suitable for everyone. Hence, the question arises: How can this tension between individualised approaches and standardised practices be reconciled? A comprehensive approach is needed, with attention to generic, specific, and individual components, all of which must be placed in the perspective of the patient’s story. It is key to measure generic outcomes that are relevant to everyone (e.g., quality of life), along with specific outcomes for relevant target groups (e.g., pain for persons who rehabilitate after surgery) and personalised outcomes on an individual level (e.g., the patient can administer insulin independently within three weeks). In all of these measurements, one should maintain ongoing dialogue, actively listen, incorporate the individual’s narrative alongside the data, and discuss the data with the individual (51). Additionally, it is worth noting that measurements should be used to inform and describe rather than solely explain, as evidence and numbers can complement the nurses’ professional judgement but not entirely replace it (52). By embracing this comprehensive approach, individualisation and standardisation in outcome measurement can be balanced.

Ambivalence in stakeholder priorities: productivity versus patient outcomes

The participating district nurses often experience a lack of support and commitment from their organisations and involved payers (e.g., health insurers, governments, and municipalities) to facilitate and finance the use of outcomes (**Chapters 6 and 7**). Nurses perceive an ambivalence between the priorities of organisations and payers, who prioritise financial and productivity aspects (i.e., the number of delivered care hours per team) (**Chapter 7**). In contrast, the nurses participating in the study described in **Chapter 7** advocate for prioritising patient outcomes. This ambivalence may stem from divergent stakeholder priorities in district nursing care, with patients, nurses, organisations, payers, and governments holding different priorities (55–57). Patients might prioritise their quality of life, nurses their personal or professional development, organisations the health of their care personnel, payers the savings in care claims, and the government the population’s health (56,58). Value-based healthcare, as advocated by Porter and Teisberg (2004) and recently updated by Larsson et al. (2022), integrates the perspectives of patients, professionals, organisations, and payers, aiming to systematically enhance health outcomes, share best practices, manage costs effectively, and rejuvenate healthcare professionals' trust and motivation (59). Although value-based healthcare gains global attention (59,60), it is met with scepticism due to concerns about an excessive focus on costs and measurement (52,61,62). While monitoring care costs amid societal challenges is needed to provide insight into the affordability of care, the spotlight should be on achieving optimal patient outcomes and the necessary resources to do so (63). Aligning the priorities of all stakeholders is crucial to concentrate on the patient's care needs and outcomes while also supporting nursing professionals in delivering the required care.

Inadequate understanding of outcome measurement, analysis, and utilisation

Although this thesis did not extensively delve into the existing knowledge among nurses concerning outcomes, the aforementioned chapters highlight a substantial gap in knowledge on two specific domains: the quality of data registration in measuring outcomes and the lack of skills and knowledge regarding the analysis and interpretation of outcome data on a higher level.

Measuring outcomes: the quality of data registration

The district nurses see themselves as having a clear role in measuring the outcomes, and they acknowledge that providing good care requires good registration of the correct information (**Chapter 7**), which the literature underlines (64–66). The literature shows that poor healthcare quality data have led to poor quality of care in the past (65) and that using standardised nursing terminologies can positively affect patient outcomes (67). Challenges related to healthcare data quality are, among other things, the lack of uniformity in terminology, the lack of a supporting information system and the lack of knowledge concerning the registration of information (65,66). The reliability of data is contingent upon how it is measured and by whom; the measured outcomes are only as good as the quality of the input ("garbage in, garbage out") (68). It is necessary to have data that is relevant, accurate, credible, timely, accessible, interpretable and coherent to obtain meaningful results (69). Nurses should know that the reliability of measured outcomes is directly tied to the quality of the data they enter through the documentation of (patient) information. It is necessary for nurses to proactively establish agreements within their team and organisation regarding the standardisation of documentation.

Analysis and interpretation of outcome data on a higher level: the lack of skills and knowledge

The surveyed nurses acknowledge a lack of proper training to use outcomes (**Chapter 6**). The insights from the focus group interviews reveal that inadequate knowledge, expertise, and experience within the district nursing team among nurses, nurse assistants, and basic care assistants further hinders the broader integration of outcomes (**Chapter 7**). Additionally, **Chapter 7** points out that when outcomes are used, this primarily occurs at the patient level. However, district nurses might lack sufficient skills and knowledge in analysing and interpreting outcomes at a higher level (i.e., on a team, organisational or regional level). Notably, outcomes can yield profound insights, especially when examined at a higher level, as highlighted by the long-lasting legacy of Florence Nightingale. A potential reason for the lack of skills and knowledge is that it is not a part of the current nursing curricula in the Netherlands (70). Other studies have also shown that the basic knowledge of nursing students in higher vocational education appears to be low to moderate in dealing with data and information systems (71,72). Since this thesis did not address the precise knowledge requirements to use outcomes in district nursing care, further research is necessary.

Measuring, analysing and interpreting outcome data: the need for support
Nurses may need help analysing outcomes and other relevant data from someone with more expertise (**Chapter 7**), such as a data scientist or nurse-scientist. However, in *interpreting* the analysed outcomes, nurses find it very important to be in the lead for an appropriate interpretation of the outcomes and choosing suitable interventions in agreement with the patient, which fits the patient's situation (**Chapter 7**). Evidently, nursing informatics training is needed (71–74). The question is whether the district nurses should also be able to analyse the data. Because district nurses are currently not trained to analyse data and experience an incredible workload and shortage of time, extra support from persons with expertise in analysing (outcome) data may be helpful. A chief nursing information officer (CNIO) in district nursing care could potentially support district nursing teams in following these steps of analysing, interpreting, and implementing interventions on the higher levels. In the Netherlands, the CNIO is a nurse committed to connecting the nursing teams and the developments regarding information technology applications and information systems (75). A CNIO could help bridge the gap between the data and district nursing professionals, although this needs further exploration.

Evolving district nursing: bridging the gap from fragmented to integrated care

While the primary focus of this reflection on the main findings lies in using patient outcomes, the thesis identified another vital topic to advance district nursing care: the need for more collaboration with other professionals and stakeholders, moving towards integrated care.

Looking beyond the role of district nurses within their organisation, district nurses closely collaborate with other professionals and stakeholders outside the organisation (**Chapters 2, 5 and 7**). Older people receiving district nursing care incur higher costs for general practitioner appointments, assistive devices, and pharmaceutical services compared to older people not receiving district nursing care (**Chapter 2**). This indicates that district nursing is closely linked with other professionals, such as general practitioners, pharmacists, and stakeholders, such as insurance companies. In the context of using outcomes for learning and improving, **Chapter 5** underscores the significance of collaborating with other healthcare professionals, highlighting that district nursing professionals partially impact nurse-sensitive outcomes for district nursing care as the engagement of other healthcare professionals also notably affects patient outcomes. Furthermore, **Chapter 7** highlights the significance of solid collaboration between organisations and stakeholders at regional and national levels. The importance of multidisciplinary collaborations is underlined in the literature, demonstrating positive or neutral effects on patients (76). District nursing is primarily complementary to other healthcare services, such as general practitioner and hospital care (77), advocating for a more integrated approach. In integrated care, care is provided over the different levels and sites of care within and beyond the health sector, following the patient through their life course (78). A systematic review examining the impact of integrated care reveals that integrated care may enhance patient satisfaction, perceived quality of care, and access to services (79). Integrated care, particularly for (older) people with chronic health conditions, is widely accepted as an approach to improve health outcomes and system efficiency (80). It is often proposed as the future development of healthcare systems internationally (55,80–83). In the Netherlands, providing integrated care is one of the essential values for future-oriented primary care (47). However, obstacles hinder close collaborations and the implementation of integrated care. Among these obstacles, the most prominent, following the insights described in **Chapters 3, 6, and 7**, pertains to the organisation and financing of the Dutch healthcare system.

Obstacle to work in an integrated manner: the organisation and financing of care

During the COVID-19 crisis, collaborations within and between district nursing organisations and other healthcare organisations were temporarily strengthened; nevertheless, sustaining these collaborations was challenging (**Chapter 3**). The reasons for the receding collaborative initiatives after the COVID-19 pandemic were difficulties in the organisation and financing of care (**Chapter 3**). Other literature also shows that the COVID-19 pandemic triggered the speeding up of the integration of healthcare (84,85). However, the literature shares concern about how competing priorities and limited (financial) resources might impede collaborations when COVID-19 became less pressing (85). Additionally, **Chapter 6** highlights the lack of good networks between the involved stakeholders in district nursing care to use outcomes. Subsequently, **Chapter 7** emphasises the necessity to strengthen collaborations among all stakeholders on both regional and national scales to make the use of outcomes in district nursing care successful. The current organisation and financing of the Dutch healthcare system creates a challenge in achieving integrated care as it hinders collaborations between nurses and other professionals. The importance of taking proactive steps to establish clear organisational structures and improve financial resources that support the integration of care for older people in the community has been highlighted in various reports and studies (3,80,85–87). A promising initial move in this direction is seen in the recent response of Dutch ministers to an advisory report focused on enhancing collaborations in primary healthcare across the Netherlands (47). Their intention to strengthen regional integrated cooperation (88) marks a positive starting point. However, it is pivotal to move beyond policy statements and theoretical discussions and engage in concrete actions.

Methodological considerations

A comprehensive examination of the use of outcomes in district nursing care

This thesis employs various research methods, including a systematic review, a Delphi study, a nationwide survey, and a multi-method qualitative investigation. This comprehensive approach contributed to a more rigorous and reliable exploration of the use of outcomes in district nursing care. The research triangulation in this thesis strengthened the overall validity of the research as multiple perspectives and data sources were conducted (89). Additionally, this thesis was conducted as part of the scientific consortium between Utrecht University, Maastricht University, Tilburg University and the Dutch Healthcare Authority (NZa) to enhance methodological rigour and remain responsive to national developments (90). Throughout the project, regular consortium meetings were held to exchange knowledge and discuss findings from scientific partners, relevant policy, and national developments. However, two studies (**Chapters 4 and 6**) were not as comprehensively conducted as desired. The survey study (**Chapter 6**) had a low response rate and high dropout rate, potentially due to the COVID-19 pandemic and pressing workforce shortages. The systematic review (**Chapter 4**) had a clear scope but an exceptionally narrow focus, primarily restricted to randomised controlled trials and similar designs. By strictly adhering to this criterion, the review potentially missed valuable insights from other research designs (e.g., non-experimental or qualitative studies) (91). A more comprehensive approach, incorporating a wider range of study designs, might have resulted in a more diverse and nuanced comprehension of the topic (92). Recent systematic reviews in district nursing care show limited randomized controlled trials (33–35) with a predominance of non-experimental quantitative, qualitative, or mixed-methods studies, though still lacking in quantity and quality (36–38). This limitation sheds light on the state of research in district nursing care, acknowledging the significance of conducting studies of various research designs to fill the existing gaps in knowledge and contribute to evidence-based practices in district nursing care.

The involvement of nursing professionals, patients, and other stakeholders

One of the thesis's strengths lies in its close alignment with real-world district nursing practice by actively engaging district nurses, nurse assistants, and nursing students. Through collaborative research efforts with these key stakeholders, the thesis gains valuable insights and expertise, enhancing its practical relevance and potential for effective implementation (93,94). However, a limitation of this thesis is its one-sided focus, primarily centred on the perspectives and experiences of nurses and nurse assistants in district nursing care. As a result, the thesis lacks a comprehensive approach, with a deficiency in incorporating other perspectives from patients and stakeholders (e.g., organisational managers, policymakers, payers, and healthcare professionals). The following two paragraphs delve deeper into the impact of this limited scope.

The lack of active involvement of patients in the research, despite its focus on patient outcomes, is a notable limitation. While the studies in this thesis focus on the perspective of the nurses, including patient perspectives would have been a valuable addition. In **Chapter 5,** insights from patients were incorporated via numerous reports about patient preferences and by undergoing verification by the Dutch Patients' Federation. However, direct patient participation was absent in all studies. The limited patient involvement potentially hampers the representation and understanding of research findings, especially concerning patient-related aspects. Active patient participation in research on patient outcomes is crucial for gaining a holistic understanding of their experiences, preferences, and needs, thereby enhancing the relevance and practicality of the study results (95–97).

Although this practice-oriented research focused on capturing firsthand experiences from the nurses, including perspectives from other stakeholders could have provided a broader understanding of the subject matter and enriched the overall conclusions. The other stakeholders, such as organisational managers, policymakers, healthcare insurers, or other healthcare professionals, play a crucial role in the district nursing care context. In **Chapters 5 and 6**, organisational managers, policymakers and nursing association representatives were informed or consulted (e.g., participating as an expert in **Chapter 5** or providing feedback on the developed survey in **Chapter 6**), but this is acknowledged as the weaker form of stakeholder participation in research, as a researcher preferably wants to involve with, collaborate with or empower stakeholders in conducting research (98,99). Additionally, the lack of involvement of other healthcare professionals presents a significant limitation, especially considering the increasing demand for interprofessional collaborations and integrated care in the home setting (3,83,100) (**Chapter 2**).

Implications for practice, policy, education, and research

Practice and policy

Boost research in district nursing care

The priority for organisations and payers should shift towards patient outcomes and how to use them for learning and improving, with the steps of a learning healthcare system potentially assisting in this. Because district nurses frequently face challenges when using patient outcomes (**Chapters 6 and 7**), the recommendation for district nursing organisations and policymakers is to foster an environment and solid infrastructure for exploring, researching, and implementing patient outcomes in district nursing practice. Conducting practice-based research is vital to align organisational and financial changes to the unique district nursing care context. To boost (practice-based) research in district nursing care, introducing a nurse-scientist role in district nursing practice may be feasible, as best practices in other sectors show positive results (101,102). Additionally, it is recommended that practice and policy developments concerning the development of patient outcomes for district nursing care, for example, the national working group for developing quality indicators for district nursing care (17,103), align their policies with recent literature and collaborate with researchers.

Reconfiguring the organisation and funding of home-based care

The current orientation of district nursing care organisations and payers towards productivity (**Chapter 7**) may be attributed to the existing ‘fee-for-service’ financing model, prioritising the quantity of district nursing care provided. Shifting the focus from productivity to patient outcomes requires changing the current organisation and funding of care towards an outcome-based funding model (104). A first step towards change is developing a new case-mix-based prospective payment system for Dutch district nursing care (105,106). However, more is needed to work towards outcome-based funding. In the Netherlands, the funding for various healthcare professionals in primary care is fragmented, hindering effective collaborations (47,104,107). Financial room is needed to collaborate and deliver integrated care, for example, through regional integrated cooperations (104). One potential solution to enhance integrated care across settings and facilitate value-based healthcare delivery is transitioning to a cross-domain funding model, such as bundled payments (108), including multiple aspects of primary care, including general practitioner services, district nursing, and social work. Ideally, these two funding transitions would converge to establish an outcome-focused, cross-domain funding model for primary care. An initiative to explore this further is detailed under the “research” section.

Establishing uniform outcome measurement

The variation in outcome measurements is notably high within district nursing care (**Chapters 4 and 6**), which hinders the ability to compare and learn from each other at the regional or national level. Considering that district nursing primarily cares for (older) persons with complex healthcare needs and multiple medical conditions, standardised measurement (i.e., presenting a fixed set of questions) is often impractical due to the person's unique situation (52). Nevertheless, there is potential to move towards a more uniform measurement of outcomes relevant for all persons (e.g., experience with delivered care) or a significant concern in district nursing (e.g., caregiver burden). It is strongly recommended that both the practice of district nursing care and policy initiatives actively promote uniform outcome measurements. In this regard, starting with a modest approach is advisable, focusing on patient outcomes and outcome measurement tools that nurses are already familiar with. In this, two key aspects should be considered. First and foremost, nurses play a crucial role in taking the lead, embracing leadership, and preserving their professional autonomy. This involves collaborating with the patient to identify which specific outcomes are significant. Additionally, it is necessary to integrate the individual's narratives alongside the numerical information when interpreting outcome data because measurements are valuable tools primarily meant for informing and describing rather than providing absolute explanations (52,53,59).

Optimising information systems

Currently, the information systems in district nursing care are not adequately designed to effectively measure, analyse, and visualise outcome data, hindering the process of learning and improvement (**Chapters 6 and 7**). While some organisations are pioneering with data analysis and visualisations through dashboards (109), the focus often remains on tracking which care is provided to patients or the team's productivity rather than gaining insights into patient outcomes. One potential explanation may lie in the design of electronic health records and the choice of standardised nursing terminologies for assessing and documenting patient-related information. In the Netherlands, the majority of district nursing organisations (>80%) employ the Omaha System (110), a standardised nursing terminology and healthcare framework used for assessing, documenting, and categorising client-specific problems, interventions, and outcomes in (home) healthcare settings (111). The Omaha System translates patient outcomes into a "problem rating scale for outcomes", in which the categories "knowledge", "behaviour", and "status" can be scored on a five-point scale (111). However, the scoring scales within the Omaha System are frequently underutilised or inaccurately completed in district nursing practice (110). There is a lack of uniform and validated outcome measurement that can easily be linked to other sectors or used in research. It is needed to align existing electronic health records with international standards, such as the "Nursing Process-

Clinical Decision Support System" (112). This standard underlines the importance of integrating the nursing process into electronic health records, in which nurse-sensitive patient outcomes are one of the central focuses. Adopting such a standard can ensure consistency and reliability in recording patient outcomes (112). It is strongly recommended to explore strategies for enhancing the measurement and documentation of outcomes within the electronic health record, particularly within the Omaha System, to enhance its effectiveness as a tool for practical learning and continuous improvement in district nursing care.

Education

Nurses often face challenges regarding their knowledge and skills in utilising outcomes for learning and improving (**Chapters 6 and 7**). To address this, it is highly recommended to equip current and future nursing professionals with the competencies to thrive in an outcome-based learning healthcare system. This can be achieved by strengthening knowledge transfer, primarily through enriching vocational and higher education curricula. Moreover, it is recommended to establish nationwide initiatives to ensure the ongoing professional development of nurses currently in practice. In addition to essential knowledge about uniform outcome measurement, as discussed previously, other critical topics to incorporate into the education of nursing students and nursing professionals include embracing outcomes as integral to nursing practice and understanding the components of a learning healthcare system to bring it into district nursing practice.

Education on embracing outcomes as integral to nursing practice

There is a pressing need to emphasise the importance of measuring patient outcomes and related data in nursing education. Not all practising nurses see the added value or fully appreciate the significance of outcome measurement for learning and improving district nursing care (**Chapters 6 and 7).** It is vital to communicate that patient outcomes are fundamental to the nursing process and should be systematically documented. Integrating the measurement of patient outcomes into nursing care should be an integral part of providing high-quality nursing care rather than an extra burden. As one nurse in the study described in the focus group interview on measuring outcomes (**Chapter 7**): *"If you have the right ones, then it's not a burden but a delight… Those outcomes, that's what you want, what you want to evaluate. You want to be able to monitor them; that's what it's all about, those results. You take pride in them. That's your value as a district nurse"*. Because not all practising nurses and nurse assistants see the added value or fully appreciate the significance of outcome measurement, a shift in motivation, attitudes, and behaviours among nursing professionals at all educational levels is essential.

Education on applying a learning healthcare system in practice

An integral component of nursing education should involve practical guidance on applying the steps of a Learning Healthcare System. First and foremost, there is a need to teach nurses and nursing students the importance of high-quality data registration and documentation, as the reliability of outcome data analysis depends on the quality of recorded data (68). Education should not per se focus on data analysis, as that may be a role for a data scientist, nurse-scientist or chief nursing information officer (CNIO). However, nurses should have the knowledge and skills to interpret the analysed data effectively and implement fitting interventions into district nursing care practice. In all of this, establishing a robust information system capable of seamless data registration, analysis, and visualisation is imperative to facilitate this process.

Research

Chapter 4 highlights the need for more comprehensive research, deepening our understanding of district nursing care and underscoring its significance. Building upon the studies outlined in this thesis, two key areas warrant further exploration: developing an outcome-based learning healthcare system in real-world healthcare settings at home and exploring the potential role that a CNIO can play in driving forward these initiatives.

Explore the implementation of an outcome-based learning healthcare system

Before changes can be made regarding the payment and policy in district nursing care, it is recommended to conduct research, in collaboration with practice, policy, and payers, on how outcomes can be effectively used to learn from and improve practice, following the steps of a learning healthcare system (i.e., outcome-based learning healthcare system). It is recommended to explore this on a small scale and conduct research that focuses on five key steps: 1) select one or a few core patient outcomes to start experimenting with, 2) determine the quality and feasibility of these outcomes, 3) prepare teams and organisations for an outcome-based learning healthcare system, 4) experiment with an outcome-based learning healthcare system and test for feasibility in practice, and 5) share findings and further develop the outcome-based learning healthcare system. It is needed to start small, for example, with small-scale pilot projects within an organisational or regional context. A gradual approach allows for a solid foundation before scaling up to a broader level (i.e., “walk before you run”). Another step worth exploring is an outcome-based learning healthcare system beyond district nursing care, extending to primary care or other domains. In conducting the recommended research, the objective is to improve the quality and relevance of care in collaboration with patients, district nurses, healthcare professionals, and payers. To achieve this, the use of participatory action research is advocated, where emphasis is put on involving all stakeholders to develop this system tailored to their specific contexts.

Explore the role of the chief nursing information officer

To effectively support nurses in working per an outcome-based learning healthcare system, clarifying the responsibilities and roles at various levels within district nursing care is crucial. A role that can be considered in this context is the CNIO, which is relatively new to district nursing but highly valued in other settings as it serves as a vital bridge between information technology and nursing practice (113). In the Netherlands, the CNIO role has existed since 2014, primarily within hospital settings (114). Research on CNIOs remains scarce in the broader context and, more notably, within district nursing care. A comprehensive understanding of these roles and their specific functions is significant for optimising the high-quality delivery of district nursing care. Therefore, it would be helpful to research how CNIOs can best support teams with measuring, analysing, and interpreting outcomes. This would make it easier to move towards an outcome-based learning healthcare system.

Conclusion

This thesis focuses on strengthening the evidence for district nursing care and exploring the use of outcomes for learning and improving. The conducted studies identified gaps and obstacles, underscoring the need for a transformative approach to advance district nursing care. To bridge the existing gaps and obstacles in district nursing care, it is necessary to enrich the evidence base, embrace patient outcomes as central to nursing practice, and commit to a culture of continuous learning and improvement. To truly advance district nursing care, this journey requires reconfiguring the organisation and funding of care, establishing uniform outcome measurement, optimising information systems, and empowering nursing professionals through education and a culture of outcomes-driven care. Taking proactive steps can pave the way for a more integrated, evidence-based, and patient-centred future, ultimately advancing district nursing care.

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Appendices

Samenvatting

Dankwoord

List of publications and presentations

About the author

Samenvatting

De kwaliteit, toegankelijkheid en betaalbaarheid van de zorg, waaronder de wijkverpleging, staan onder hoge druk: het aantal thuiswonende ouderen groeit en heeft meer complexe zorgbehoeften naast dat er een groeiend tekort is aan zorgprofessionals in de wijkverpleging. Gegeven deze omstandigheden is het een uitdaging om de kwaliteit van zorg op peil te houden. Het ontbreken van kennis en inzichten in de resultaten van de geleverde zorg vormt een aanzienlijke belemmering voor het begrijpen en verbeteren van de kwaliteit van zorg in de wijkverpleging. Een manier om wijkverpleegkundige zorgprofessionals in staat te stellen te leren van hun zorgverlening en de kwaliteit van de zorg op peil te houden en te verbeteren, is door inzicht te bieden in de resultaten van de geleverde zorg via patiëntenuitkomsten[1]. Voorbeelden van patiëntenuitkomsten zijn ervaren gezondheid, dagelijks functioneren, participatie of pijn. Het meten van patiëntenuitkomsten is essentieel om inzicht te krijgen in de effecten van de wijkverpleegkundige zorgverlening. Zo kan bijvoorbeeld pijn een belangrijke indicator zijn voor infectie of andere complicaties, waarbij het monitoren waardevolle informatie biedt voor het nemen van passende maatregelen. Leren en verbeteren op basis van inzichten uit patiëntenuitkomsten kan worden gedaan volgens de stappen van een lerend zorgsysteem, waarin patiëntenuitkomsten en andere relevante data wordt verzameld. Na dataverzameling worden deze gegevens geanalyseerd en geïnterpreteerd, waarna de nieuwe inzichten worden gebruikt om de gezondheidspraktijken te informeren en te verbeteren. Hierdoor ontstaat een continue cyclus van leren en verbeteren.

Voor verpleegkundigen is het gebruiken van zorgresultaten in de dagelijkse praktijk niets nieuws: het is een kernonderdeel van het klinisch redeneerproces. Desondanks worden uitkomsten momenteel onvoldoende gebruikt in de wijkverpleging om van te leren en verbeteren. Dit komt mogelijk door het gebrek aan beschikbaar wetenschappelijk bewijs voor de wijkverpleging dat verpleegkundigen ondersteunt bij hun zorgverlening. Daarom heeft het **eerste deel** van dit proefschrift tot doel een beter begrip van de wijkverpleging te krijgen: welke factoren voorspellen het gebruik van de wijkverpleging en welke impact had de COVID-19 pandemie op de wijkverpleging? Een andere belangrijke belemmering voor het gebruik van zorgresultaten in wijkverpleging is het ontbreken van helder gedefinieerde patiëntenuitkomsten voor de wijkverpleging en onduidelijkheid over hoe zorgresultaten kunnen worden gebruikt voor leren en verbeteren. Daarom wordt

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[1] In deze Nederlandse samenvatting verwijst ‘patiëntenuitkomsten’ naar de gezondheidsresultaten van individuen die zorg ontvangen. In de wijkverpleging wordt vaak gesproken over cliënt, klant, zorgvrager of individu met een (preventieve) zorgvraag. Voor de leesbaarheid is gekozen voor ‘patiëntenuitkomsten’ om aan te sluiten bij internationale literatuur.

in het **tweede deel** van dit proefschrift het gebruik van patiëntenuitkomsten voor het leren en verbeteren in de wijkverpleging verkent. Concreet zijn de doelstellingen voor dit proefschrift als volgt:

- Deel 1: Het gebruik van de wijkverpleging onderzoeken en de uitdagingen binnen de wijkverpleging tijdens de COVID-19-pandemie verkennen.
- Deel 2: Onderzoeken welke verpleeg-sensitieve patiëntenuitkomsten relevant zijn voor de wijkverpleging, hoe deze uitkomsten momenteel worden gemeten in de praktijk, en wat er nodig is om zorgresultaten in de wijkverpleging te gebruiken voor leren en verbeteren van de praktijk.

Deel 1: het huidig gebruik van wijkverpleging en uitdagingen tijdens de COVID-19-pandemie

Hoofdstuk 2 onderzoekt de voorspellers voor het gebruik van wijkverpleging voor thuiswonende (oudere) mensen. Hiervoor is gebruik gemaakt van een predictie-onderzoek met secundaire data-analyse, waarvoor landelijke gezondheidsclaims-data op persoonsniveau is gebruikt. De belangrijkste voorspellers voor de totale bevolking waren: hoge leeftijd en hoge kosten voor farmaceutische zorg en hulpmiddelen. Voor de populatie van mensen van 75 jaar en ouder waren de belangrijkste voorspellers: hoge leeftijd en (hoge) kosten voor huisartsconsulten, hulpmiddelen (bijv. zuurstofapparaten of compressiekousen), farmaceutische zorg, ambulancevervoer en ergotherapie. Dit onderzoek toont aan dat mensen die wijkverpleging nodig hebben, vaker (kostbare) zorg ontvangen van de huisarts meer (kostbare) medicijnen en hulpmiddelen gebruiken. Daarom benadrukken de resultaten van dit onderzoek dat nauwe samenwerking tussen de wijkverpleging, huisarts en openbare apotheker essentieel is.

Hoofdstuk 3 beschrijft een *mixed methods* onderzoek naar de impact van COVID-19. Dit onderzoek is uitgevoerd vanuit het perspectief van wijkverpleegkundigen uit verschillende regio's in Nederland. Er is onderzoek gedaan onder wijkverpleegkundigen naar de impact van COVID-19 op de zorg voor de thuiswonende oudere patiënt, wijkverpleegkundige teams en hun organisaties. Daarnaast zijn ook de behoeften van wijkverpleegkundigen met betrekking tot toekomstige COVID-19 uitbraken verkend. Het onderzoek toont aan dat de pandemie aanzienlijke gevolgen had voor de patiëntenzorg en de wijkverpleegkundige teams. Tijdens de eerste uitbraak speelden verpleegkundigen een cruciale rol bij het anders organiseren van de zorg en werkten onder hoge druk, wat leidde tot uitputting, vermoeidheid en psychosociale problemen, waaronder angst voor besmetting. Een jaar later gaven verpleegkundigen aan beter voorbereid te zijn om COVID-19-zorg te bieden, maar dat problemen met betrekking tot werkdruk en mentale klachten bleven bestaan. Verpleegkundigen gaven aan dat meer ondersteuning, waardering, vertrouwen en passend beleid op organisatorisch en nationaal niveau ten tijde van een pandemie nodig zijn.

Deel 2: Het gebruik van patiëntresultaten voor leren en verbeteren in wijkverpleging

Hoofdstuk 4 beschrijft een systematische review, waarin een overzicht is gecreëerd van interventies en uitkomsten die zijn getest in experimentele studies in de wijkverpleging. De geïdentificeerde experimentele studies (n=22) die zich richtten op interventies binnen de wijkverpleegkundige context waren zeer heterogeen wat betreft patiëntenpopulatie en type interventies. Bovendien werden verschillende uitkomstmaten gebruikt in de geïdentificeerde literatuur. Op basis van deze systematische review blijft onduidelijk welke interventies effectief zijn en welke uitkomsten gebruikt kunnen worden om de effectiviteit van de wijkverpleging te onderbouwen. Dit onderzoek toont aan dat het bewijs voor wijkverpleging schaars is en benadrukt het belang van het genereren van methodologisch sterk wetenschappelijk bewijs.

Hoofdstuk 5 beschrijft een Delphi-studie, waarin verpleeg-sensitieve patiëntenuitkomsten voor thuiswonende ouderen in de wijkverpleging werden geïdentificeerd. In totaal werden 46 resultaten beoordeeld door wijkverpleegkundige experts op I) de relevantie van patiëntenuitkomsten voor de wijkverpleging en II) de mate waarin wijkverpleegkundige professionals invloed hebben op patiëntenuitkomsten. In totaal werden 26 resultaten vastgesteld als verpleeg-sensitief. De verpleeg-sensitieve uitkomsten met de hoogste scores op relevantie en beïnvloedbaarheid zijn de autonomie van de persoon met een zorgvraag, het vermogen van de persoon om beslissingen te nemen over de zorgverlening, de tevredenheid van de persoon over de geleverde wijkverpleegkundige zorg, kwaliteit van sterven, en de naleving van de benodigde zorg door de persoon. Omdat deze resultaten niet alleen worden beïnvloed door wijkverpleging maar ook door andere gezondheidsprofessionals in de eerstelijnszorg, is nauwe samenwerking tussen deze professionals nodig om de best mogelijke patiëntenuitkomsten te bereiken.

Hoofdstuk 6 beschrijft een landelijk vragenlijst-onderzoek naar het gebruik van verpleeg-sensitieve patiëntenuitkomsten in de wijkverpleging. Er werd een grote variatie geïdentificeerd in hoe resultaten momenteel worden gemeten en gebruikt in de praktijk voor leren en verbeteren. Verpleeg-sensitieve patiëntenuitkomsten die het vaakst werden gemeten met gevalideerde meetinstrumenten of vragenlijsten zijn pijn met behulp van de Numerieke Beoordelingsschaal (NRS) of de Visuele Analoge schaal (VAS), delirium met behulp van de Delirium Observatieschaal (DOS), gewichtsverlies met behulp van de Short Nutritional Assessment Questionnaire (SNAQ) en de belasting van de mantelzorger met behulp van de Caregiver Strain Index (CSI) of een Nederlands equivalent. Vallen en tevredenheid van de persoon met geleverde zorg worden vaak gemeten met niet-gevalideerde vragenlijsten. Andere verpleeg-sensitieve uitkomsten worden nauwelijks of op verschillende manieren gemeten. De patiëntenuitkomsten worden op verschillende manieren teruggekoppeld naar de teams en in de meeste gevallen maar deels gebruikt om van te leren en de praktijk te verbeteren. Vanwege de hoge variatie in de beschikbare meetinstrumenten en hoe patiëntenuitkomsten worden gebruikt voor leren en verbeteren in de huidige praktijk, beveelt deze studie aan meer uniformiteit te creëren door (inter)nationale richtlijnen te ontwikkelen rondom het gebruik van verpleeg-sensitieve patiënten-uitkomsten in de wijkverpleging.

Hoofdstuk 7 beschrijft een kwalitatieve *multi-method* studie die de bevorderende factoren, belemmerende factoren en behoeften van wijkverpleegkundige professionals onderzoekt bij het gebruik van patiëntenuitkomsten in de wijkverpleging. Via de analyse van open vragen uit een vragenlijstonderzoek en online focusgroep interviews werden deze factoren en behoeften geïdentificeerd, die vervolgens werden vertaald naar zestien voorwaarden voor het meten van uitkomsten en het gebruiken van uitkomsten voor leren en verbeteren in de wijkverpleging. Deze voorwaarden werden vervolgens samengevat in zes overkoepelende thema's: volg de stappen van een lerend gezondheidssysteem; zet de persoon met een zorgvraag centraal in de zorgverlening; bevorder de kennis, houding, vaardigheden en autonomie van de wijkverpleegkundige zorgprofessional; verbeter de gedeelde verantwoordelijkheid en samenwerking binnen en buiten wijkverpleegkundige organisatorische grenzen; geef prioriteit aan en investeer in het gebruik van patiëntenuitkomsten; en stimuleer de eenheid in en waardering voor de wijkverpleging. Hoewel de geïdentificeerde voorwaarden wijkverpleegkundige zorgprofessionals, organisaties, beleidsmakers en betrokken zorgverzekeraars kunnen faciliteren bij het implementeren van het gebruik van patiëntenuitkomsten in de wijkverpleegkundige praktijk, is verder onderzoek naar geschikte implementatiestrategieën nodig.

In **hoofdstuk 8**, de algemene discussie, is gereflecteerd op de belangrijkste resultaten van de verschillende onderzoeken en een aantal methodologische overwegingen. Daarnaast zijn de implicaties en aanbevelingen voor de zorgpraktijk, beleid, onderwijs en toekomstig onderzoek uiteengezet.

Concluderend, dit proefschrift draagt bij aan het versterken van het wetenschappelijk bewijs voor de wijkverpleging en het ontdekken hoe patiëntenuitkomsten kunnen worden gebruikt om te leren en verbeteren in de wijkverpleegkundige praktijk. Uit het proefschrift blijkt dat het wetenschappelijk bewijs voor de wijkverpleging schaars is. Dit benadrukt het belang van het genereren van methodologisch sterk wetenschappelijk bewijs. Daarnaast laat het proefschrift zien dat patiënten-uitkomsten zeer beperkt worden gebruikt voor leren en verbeteren. Dit pleit ervoor om patiëntenuitkomsten centraal te stellen en een cultuur van continu leren en verbeteren te creëren. Om hiertoe te komen is het nodig om patiëntenuitkomsten te operationaliseren en uniform te meten, informatiesystemen te optimaliseren voor leren en verbeteren, wijkverpleegkundige zorgprofessionals te faciliteren en vertrouwen te geven, samenwerkingen tussen professionals en stakeholders te versterken en integrale zorg te vergroten. Dit vereist heroverweging van de huidige organisatie en financiering van zorg. Door proactief het wetenschappelijk bewijs voor wijkverpleging te versterken, patiëntenuitkomsten integraal onderdeel te maken van de zorgverlening, en het continu leren en ontwikkelen te bevorderen, kan de kwaliteit van zorg in de wijkverpleging worden geborgd, nu en in de toekomst.

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Yes, team snelkookpan! Deze slow cooker is dan ook ein-de-lijk klaar hoor! Lieve **Anne,** wat ben jij door je promotietraject gevlogen zeg! Ik heb bewondering hoe je jouw grote project hebt uitgevoerd met al die verschillende partijen, daar heb ik veel van mogen leren. Je enthousiasme en vrolijkheid werken aanstekelijk. Bedankt voor wie je bent! Lieve **Kim,** jou ontmoette ik ook al 10 jaar geleden tijdens de opleiding verplegingswetenschap. Dat we beide uit de wijkverpleging kwamen schepte gelijk een band (want er waren er destijds niet zo veel!). Ik bewonder jouw leiderschap waarmee je op de barricade durft te staan en namens de wijkverpleging durft te spreken. Bedankt voor onze koffie/lunchdates waarin we heerlijk kunnen kletsen. Fijn dat onze eerste officiële samenwerking is gestart, nu duimen voor die subsidie ;-).

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Ook wil ik de mede-auteurs **Bianca Buurman en Sandra Zwakhalen** bedanken voor alle hulp, de fijne samenwerking en het kritisch meeschrijven bij de COVID paper. Wat fijn dat onze wegen blijven kruisen, en ik kijk er naar uit om onze samenwerkingen voort te zetten in de toekomst!

Lieve **Angela, Anke, Annemieke, Christa, Christien, Cora, Els, Geke, Gonnie, Hettie, Marja, Miranda, Pauline, Susanne, Wiltiene,** (oud) collega's van team

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Gaandeweg heb ik ook mensen ontmoet die van waarde zijn geweest voorafgaand of tijdens het promotietraject. Allereerst **Ria den Hertog-Voortman**. Als jij tijdens het afstudeeronderzoek op de HBO-V mij niet had gevraagd: “is verplegingswetenschap niet iets voor jou?” had ik het waarschijnlijk nooit ontdekt. Dank voor het zien van mijn potentie! **Roy Haex** ook al spraken we elkaar heel af en toe, het voelde altijd weer vertrouwd! Mooi om te zien dat je doet waar je blij van wordt.

Tijdens het promotietraject hebben ook verschillende studenten meegewerkt aan gepubliceerde en ongepubliceerde onderzoeken: **Alieke, Annemay, Durk, Eelco, Elise, Esther, Jessie, Jonne, Lilian, Lucy, Minke, Renske, Risalet, Pieternel, Yara, Zoë.** Al deze studenten wil ik bedanken, van ieder van jullie heb ik weer wat mogen leren! In het bijzonder noem ik **Frans van Wijngaarden** die ik heb mogen zien ontwikkelen tot verplegingswetenschapper. We hebben fijn samengewerkt, op naar die publicatie! **Manôn Schuurman,** cum laude afstuderen en honours student van het jaar. Je doorzettingsvermogen is onbeschrijfelijk en wat ben jij voor mij een inspiratie. **Ester de Jong,** wat heb je een tof en belangrijk onderzoek opgezet binnen de wijkverpleging – zet hem op!

Ik kan het niet over mijn hart krijgen jullie niet te noemen: alle geweldige leden van **slagwerkgroep Excelsior**. Tijdens het promotietraject heb ik bij jullie mijn ontspanning gevonden. Bedankt voor alle muzikale en gezellige avonden, ik kijk er naar uit ooit weer terug te komen!

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Lieve grote broer en zus **Albrand en Ingrid** en trouwe aanhang **Tirza en Rémon,** heerlijk hoe we in onze app-groep eindeloos over niets kunnen appen. Hoe bijzonder dat we alle drie in een halfjaar tijd onze eerste kinderen kregen en dat we dat met elkaar kunnen delen. Albrand, ik heb bewondering voor de ontspannenheid waarmee je door het leven vaart (speciaal voor jou: een woordgrap! ;-)). Ingrid, wat fijn dat we zo dicht naar elkaar zijn gegroeid. Dank je wel dat je altijd voor ons klaarstaat. Ik geniet van onze theetjes terwijl de kinderen het huis verbouwen. Zullen we nu dan echt een keer samen met ma naar het Eurovisie Songfestival gaan?

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Liefste **Felien en Jonas,** jullie werden beide geboren tijdens het promotietraject; Felien in een prachtig voorjaar in 2019 en Jonas op een koude winterdag eind 2021, een dag nadat ik de revisie van de COVID paper had ingediend. Wat zijn jullie een fijne afleiding, bedankt dat jullie mij écht los kunnen maken van het werk. Ik geniet van alle momenten samen met jullie. Jullie laten mij zien dat er meer is in het leven dan werk en betekenen alles voor mij. Mijn lieve konijntje en aapie, *you are my sunshines.* Mama houdt van jullie.

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List of publications and presentations

Scientific international publications

- **Veldhuizen JD**, Schuurmans MJ, Mikkers MC, Bleijenberg N. Exploring nurse-sensitive patient outcomes in Dutch district nursing care: A survey study. Health & Social Care in the Community. 2022 Sep 11.
- **Veldhuizen JD,** Zwakhalen S, Buurman BM, Bleijenberg N. The Impact of COVID-19 from the Perspectives of Dutch District Nurses: A Mixed-Methods Study. International Journal of Environmental Research and Public Health. 2021 Dec 16;18(24):13266.
- **Veldhuizen JD**, Hafsteinsdóttir TB, Mikkers MC, Bleijenberg N, Schuurmans MJ. Evidence-based interventions and nurse-sensitive outcomes in district nursing care: A systematic review. International Journal of Nursing Studies Advances. 2021 Nov 1;3:100053.
- **Veldhuizen JD**, Mikkers MC, Schuurmans MJ, Bleijenberg N. Predictors of district nursing care utilisation for community-living people in the Netherlands: an exploratory study using claims data. BMJ open. 2021 Sep 1;11(9):e047054.
- **Veldhuizen JD**, van den Bulck AO, Elissen AM, Mikkers MC, Schuurmans MJ, Bleijenberg N. Nurse-sensitive outcomes in district nursing care: A Delphi study. PloS one. 2021 May 13;16(5):e0251546.
- Rieckert A, Schuit E, Bleijenberg N, Ten Cate D, de Lange W, de Man-van Ginkel JM, Mathijssen E, Smit LC, Stalpers D, Schoonhoven L, **Veldhuizen JD**. How can we build and maintain the resilience of our health care professionals during COVID-19? Recommendations based on a scoping review. BMJ open. 2021 Jan;11(1):e043718.
- Herber OR, Bradbury-Jones C, Böling S, Combes S, Hirt J, Koop Y, Nyhagen R, **Veldhuizen JD**, Taylor J. What feedback do reviewers give when reviewing qualitative manuscripts? A focused mapping review and synthesis. BMC medical research methodology. 2020 Dec;20:1-5.
- **Veldhuizen JD**, Schuurmans MJ, Bleijenberg, N. Predicting Functional Decline in Community-Living Older People with a Low Socioeconomic Status [Abstract publication]. Innovation in Aging. 2017. 1(suppl_1), 899-899.

Other publications

- **Veldhuizen JD**, Schuurman M, Zwakhalen SMG, Buurman BM, Bleijenberg N. Kritisch bekeken: Covid-19 in de wijkverpleging. Verpleegkunde in praktijk en wetenschap (TvZ). 2022 Sep 07.
- Rieckert A, Schuit E, Bleijenberg N, Ten Cate D, De Lange W, De Man-Van Ginkel JM, Mathijssen E, Smit LC, Stalpers D, Schoonhoven L, **Veldhuizen JD**, Trappenburg JCA. Behoud van korte en lange termijn fysieke/mentale gezondheid en inzetbaarheid van zorgprofessionals blootgesteld aan COVID-19 crisis werkomstandigheden. Praktische aanbevelingen op basis van bevindingen uit

systematisch literatuuronderzoek bij de Covid-19 en vergelijkbare virusuitbraken en interviews met experts en ervaringsdeskundigen. 2 april 2020.

Presentations

- A value-based and learning healthcare system in district nursing care? Preconditions on measuring and continuously improving patient outcomes. Oral presentation at Nordic Conference in Nursing Research (NCNR). Reykjavik, Iceland. 2023.
- Poster presentation: Value-based healthcare at home? Exploring the barriers, facilitators, and needs to use patient outcomes in district nursing care. Poster presentation at ICHOM conference. Barcelona, Spain. 2023.
- Evidence-based interventions and nurse-sensitive outcomes in district nursing care: a systematic review. Oral poster presentation at European Nursing Congress (ENC). The Netherlands [online]. 2022.
- The impact of covid-19 from the perspective of Dutch district nurses: a mixed methods study. Oral presentation at European Nursing Congress (ENC). The Netherlands [online]. 2022.
- Identifying nurse-sensitive outcomes in district nursing care: a Delphi study. Patient-Centred Healthcare and the Value-Based Approach. Poster presentation at ICHOM conference series (Online). 2020.
- Oral poster presentation: Identifying Nurse-Sensitive Outcomes for District Nursing Care: From Nursing Research to Policy Development. Oral poster presentation at Winter E-summit European Academy of Nursing Science (EANS). Maroussi, Greece [Online]. 2021.
- The impact of covid-19 on district nursing care: a nationwide follow-up study. Oral presentation at EANS-DPG summer conference. Cologne, Germany [online]. 2021.
- Identifying Nurse-Sensitive Outcomes for District Nursing Care: From Nursing Research to Policy Development. Oral poster presentation at EANS-DPG summer conference. Cologne, Germany [online]. 2021.
- Uniformity and professionality in district nursing care. Wijkverpleging.org. Online oral presentation and panel discussion. The Netherlands. 2021.
- Developments in district nursing care and research on district nursing care. Learning network district nursing. Utrecht, The Netherlands. 2017.
- Relevant and influenceable outcomes for district nursing care. Workshop at Dutch Healthcare Authority Event. Utrecht, The Netherlands. 2018.
- Best leaders are born, not bred. Debate speaker European Academy of Nursing Sciences (EANS) Summer school. Ghent, Belgium. 2018.
- Building a career as a nurse, combining research, education, and clinical practice. Oral presentation for exchange nursing students from Norway and the Netherlands. Utrecht, The Netherlands. 2018.

- Predictors of functional decline in community-living older people with a low socioeconomic status: research proposal. Oral presentation at Winter Summit European Academy of Nursing Science (EANS). Utrecht, The Netherlands. 2016.
- Working on Quality and Outcomes of District Nursing Care. Oral presentation at District Nursing in the Leading Role Congress, Dutch Healthcare Authority. Utrecht, The Netherlands. 2019.
- High-quality district nursing care and its embedding in education and practice. Symposium Vernieuwing in Vergrijzing. Utrecht, The Netherlands. 2018.
- Relevant and influenceable outcomes for district nursing care. Poster presentation at National District Nursing Convention. Dutch professional organization for nurses (V&VN). Utrecht, The Netherlands. 2018.

Awards

- Prize for best poster presentation about “Evidence-based interventions and nurse-sensitive outcomes in district nursing care: a systematic review”. European Nursing Congress (2022). The Netherlands [online].
- Prize for best poster presentation about “Identifying Nurse-Sensitive Outcomes for District Nursing Care: From Nursing Research to Policy Development”. EANS-DPG summer conference (2021). Cologne, Germany [online].

About the author

Jessica was born on March 26th, 1991, in Bunschoten-Spakenburg, The Netherlands. After finishing her secondary education (VWO), she pursued nursing studies. Following an unsuccessful internship in the hospital, she found her way to district nursing care. It was here that she discovered her passion for district nursing care, providing and organising care for (older) people living at home. Right after completing her Bachelor of Nursing, she began working as a district nurse in Nijkerk at Beweging 3.0. Quickly realising her interest in research and improving the quality of care, she decided to further her development by pursuing a Master's in Nursing Sciences at Utrecht University.

During her studies, she developed a fondness for quality improvement, policy, and particularly for conducting research. When an opportunity arose to conduct research regarding the effectiveness of district nursing – something that deeply resonated with her – she applied for a position and began as a PhD candidate and lecturer in October 2016 at the research group "proactive care for older individuals living at home" at the University of Applied Sciences Utrecht, in collaboration with the Dutch Healthcare Authority, Tilburg University and Maastricht University.

Throughout her doctoral research, Jessica completed various courses and trainings, including a Master's in Epidemiology at Utrecht University. She also worked as a lecturer and served as the chair of the department "prevention, self-management, and district nursing care" at the University of Applied Sciences Utrecht to enhance education in district nursing care. During her doctoral research, Jessica continued her work as a district nurse until 2020. She made the decision to stop working in this role after the birth of her daughter, Felien, and later, her son, Jonas, to focus on her family and her academic pursuits.

With a passion for district nursing care, Jessica is determined to continue her work in conducting research in this field to improve education, policy, ultimately **advancing district nursing care**.

Education, training and courses

2023	Bias Training, University Utrecht, The Netherlands
2023	Supervising PhD candidates, Graduated School of Life Sciences, University Utrecht, The Netherlands
2021	eBROK, The Netherlands Federation of University Medical Centres (Nederlandse Federatie van Universitair Medische Centra) (NFU), The Netherlands
2018-2022	Didactics courses: designing, developing, conducting and examining education, University of Applied Science Utrecht, The Netherlands
2017-2021	European Academy of Nursing Sciences Summerschool, Sweden, Belgium, Germany.
2017-2021	Master Epidemiology (Postgraduate, Online), Elevate and University Utrecht, The Netherlands
2017	Cambridge First, Utrecht, The Netherlands
2014	Vakbekwaam indiceren in de wijkverpleging. Stichting Bevordering Wijkverpleging, The Netherlands
2013-2016	Master Clinical Health Sciences. Specialisation. Nursing sciences. University Utrecht, The Netherlands
2009-2013	Bachelor of nursing, University of Applied Science (CHE), Ede, The Netherlands
2003-2009	Pre-university education (VWO), Guido de Bres, Amersfoort, The Netherlands

Positions and employment

2022-present	Lecturer Premaster Clinical Health Sciences, University Utrecht, The Netherlands
2016-present	Doctoral Student, Research Group Care for Older People,University of Applied Sciences Utrecht, The Netherlands. In collaboration with Dutch Healthcare Authority, Utrecht, The Netherlands and University Maastricht, The Netherlands, as part of the Scientific Program District Nursing Care.
2016-present	Lecturer Bachelor of Nursing, University of Applied Sciences Utrecht, The Netherlands
2013-2020	Registered District Nurse, Beweging 3.0 Nijkerk, The Netherlands
2008-2013	Nursing Assistant Nursing Home, De Haven, Bunschoten-Spakenburg, The Netherlands

Boards and professional memberships

2022-present	Member of the Dutch scientific table of home care nursing (in Dutch: Wetenschappelijke Tafel Wijkverpleging).
2022-present	Member of Rho Chi at-Large Chapter, Sigma Theta Tau International Honor Society of Nursing
2021-present	Expert Netwerk Nursing (Expert Netwerk Verpleegkunde), initiative of Nursing and TVZ
2018-present	Chairman of Department “prevention, self-management and district nursing care”, Bachelor Nursing Studies, University of Applied Sciences Utrecht, the Netherlands
2018-present	Member of the Dutch professional nurses organization (V&VN) department for “science in practice” and “society and public health”
2017-present	(Student) member of the European Academy of Nursing Science (EANS)
2014-2016	Member of the program committee (in Dutch: opleidingscommissie (OC)), Master Clinical Health Sciences. Spec. Nursing sciences. University Utrecht, The Netherlands
2014-2016	Member of the works council (in Dutch: Ondernemingsraad (OR)), Beweging 3.0, Amersfoort, the Netherlands