

# Hearing the Quality of Care: Using Audio Recordings to Understand the Use of Quality Standards in District Nursing.

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## Abstract

This case study uses a research technique that combines audio recordings, observations, narrative literature study, and document analysis to explore the activities of district nurses. The study examines district nurses' work activities with an emphasis on how well they follow the BPMN Normative Model. Notably, in line with the BPMN Normative Model, the district nurses routinely asked patients how they were feeling and talked about their moods when they visited. A noteworthy finding was that district nurses did not use the loneliness scale provided by the guideline when patients communicated their experiences of loneliness but used parts of it. This study aims to provide an understanding of the care activities that the district nurses perform for the patients, pointing out possible inconsistencies as well as areas where the BPMN Normative Model is inconsistently applied during home care visits.

**Keywords**— District nurses, Activities, Guidelines, Loneliness, Care2Report

## 1 Introduction

Home care is medical care given to patients in their homes by district nurses to improve patients' functional health status and quality of life, it encompasses a variety of activities from preventative health work to hospice treatment (Thomé, Dykes, & Hallberg, 2003). District nurses are involved in various care tasks and are in charge of many duties in a home care environment (Strandberg, Ovhed, Borgquist, & Wilhelmsson, 2007). District nurses frequently perform their jobs alone, without supervision or help from their peers, in patients' homes (Lang, Edwards, & Fleiszer, 2008; McIntosh, 2000).

In the Western world, the amount of paperwork district nurses are expected to handle has increased over the past few decades (Sum & Chebor, 2013; Blair & Smith, 2012). District nurses may only devote about half of their time to direct patient care, with the remainder going into paperwork (Lavander, Meriläinen, & Turkki, 2016). An increase in documentation is undesirable (Paul et al., 2015; T.-T. Lee, 2006; Huryk, 2010; Rykkje, 2009) and can have negative consequences on patient care (Lavander et al., 2016; N. Wang, Hailey, & Yu, 2011), such as less face-to-face interaction (Huryk, 2010). As a result of the usage of digital documentation, nurses had less time to devote to patient care since, on average, district nurses spend more than half of their working hours using computers (Kossmann & Scheidenhelm, 2008).

The practice of nursing requires a combination of clinical and behavioural skills due to its complex nature (Walshe & Luker, 2010). Several terminologies were used to mention a nurse who provides home care. These terminologies are "professional" (Thomé et al., 2003), "home care nurse" (Joren, de Veer, de Groot, & Francke, 2021), "hospital nurse" (Joren et al., 2021), "community nurse", and "district nurse" and are sometimes used interchangeably. However, the terminology for these services is not always consistent (Maybin, Charles, & Honeyman, 2016). In this work, the terminology "district nurse" is used for registered and trained nurses in home care. For nurses in hospitals, "hospital nurse" (Joren et al., 2021) is used.

It is important to understand the activities which are involved in home healthcare for several reasons. It provides a baseline for evaluating the quality of care provided in home settings (Veldhuizen, Hafsteinsdóttir, Mikkers, Bleijenberg, & Schuurmans, 2021). District nurses perform different activities during their work. There are activities that district nurses perform, which include several activities such as continence, toileting, and dressing (van den Bulck et al., 2022; Levy et al., 2016). This thesis aims to provide a comprehensive analysis of the activities carried out by district nurses during their home visits. The study aims to offer an in-depth understanding of the various roles and responsibilities that district nurses have, contributing to a more complete picture of the practices and challenges in home healthcare.

## 1.1 Problem statement and objectives

Existing research has relied heavily on self-reporting by nurses, which can be biased or incomplete (Verloo, Chiolero, Kiszio, Kappel, & Santschi, 2017). This study is part of Care2Report and aims to fill the research gap by using audio recordings to gain insights into district nurses' daily work routines (Maas et al., 2020). Audio recordings allow for uninterrupted observation of nursing practices, providing a more comprehensive and objective understanding of compliance with district nursing quality standards (Walshe, Ewing, & Griffiths, 2012). The research results add to the body of knowledge used to support district nurse practice and offer insights into their decision-making. The research objectives of this project are to uncover the activities of district nurses and to see if the district nurses are compliant with the use of quality standards by using audio recordings to gain insights into the daily work processes of district nurses.

## 1.2 Research questions

Research questions were formulated based on the problem statement and objectives, as described in the previous section. Sub-research questions were formulated to provide an answer to the main research question.

***MRQ:** How can the use of audio recordings and analysis of district nurses' working days contribute to uncovering the differences between the daily tasks and quality standards in home care?*

This research aims to assess district nurses' adherence to quality standards and ultimately improve the standard of care for patients. The project's particular goal is to investigate the possibilities of audio recordings of nurses' workdays to get insightful information about how these recommendations are being put into practice and identify areas that may be enhanced for greater adherence to quality standards.

*SQ1: How can we represent the key standards/protocols of the district nurses in a normative model?*

The first sub-question focuses on identifying and understanding the essential quality standards and protocols that district nurses should follow in their practice. This question seeks to explore the guidelines and protocols that are considered crucial for ensuring high-quality patient care delivery at home by district nurses.

*SQ2: How can audio recordings be translated into process executions that can be checked against the normative model?*

The second sub-question focuses on the translation of audio recordings into process executions, which can be compared to a normative model to ensure accuracy. This involves extracting relevant data from the recordings, such as timestamps, activities, and interactions, and mapping them onto a normative model using process mining techniques (Oliart, Rojas, & Capurro, 2022).

*SQ3: How can the discovered process executions uncover how district nurses organize their patient visits?*

This research question intends to explore the activities that district nurses perform during their visits to patients. The purpose of this research question is to clarify the decision-making procedures, resource distribution, and habits that district nurses employ regularly. To improve the readability of the results and enable a more in-depth investigation, visual aids, such as figures and patterns, will be included.

*SQ4: To what extent does the normative model reflect the daily practice of the district nurses?*

The differences between the normative model, which recommends certain actions, and the real daily routines of nurses are the subject of this research question. The study aims to assess how nurses interact with patients during various tasks, e.g. having a shower, by including questions regarding loneliness in the nursing process. The purpose of this sub-question is to determine if nurses are following guidelines for incorporating questions about loneliness into their routines and to identify the point in caregiving nursing at which these questions are most commonly asked.

### **1.3 Expected contributions**

This empirical study offers valuable insights by transforming audio recordings into clinical workflows. Empirical refers to ‘data, measurements, observations, or descriptions about empirical or real-world phenomena’ (A. S. Lee & Baskerville, 2003). This study uses audio recordings and observations in a home care scenario to uncover the district nurse’s activities and adherence to quality standards. It closes the knowledge gap between the theory of the guidelines and practice.

## 2 Related work

The section on related work shows the important literature on which the study builds. This includes related literature about Nursing Science, Business Process Management, and the use of Artificial Intelligence and is visible in Figure 1.

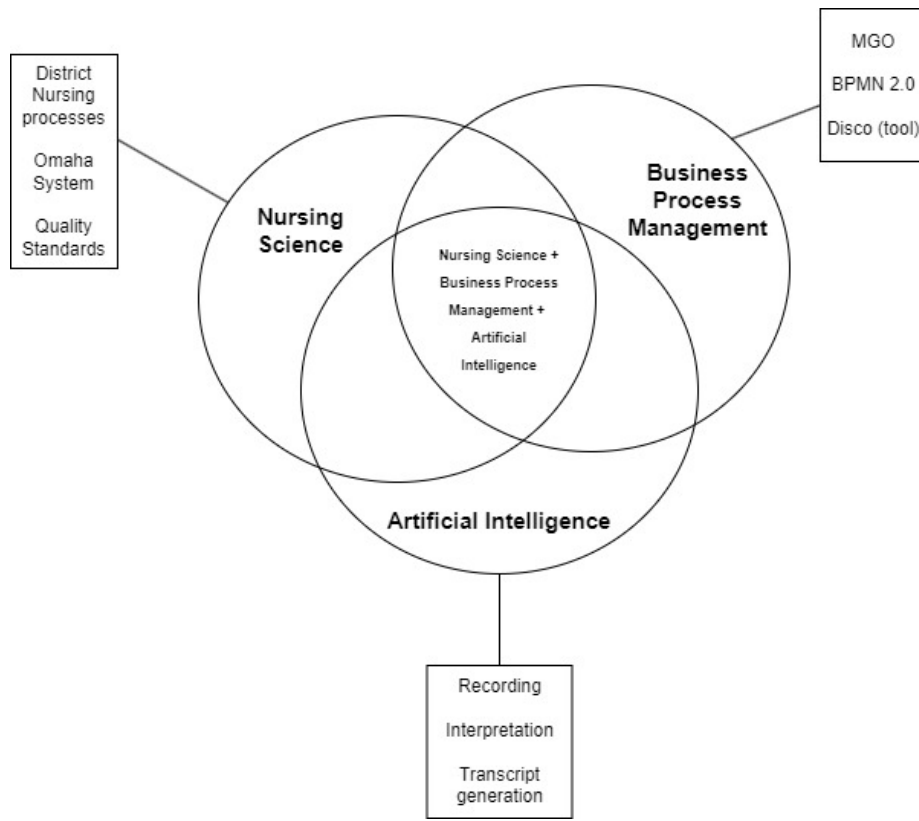


Figure 1: VENN-Diagram. Adapted from (Moktefi & Lemanski, 2022).

### 2.1 Nursing Science

#### 2.1.1 District Nursing processes

The words "community nurse" and "district nurse" are sometimes used interchangeably, although the terminology for these services is not always consistent. A registered nurse who works in the community, with or without a speciality practitioner license, is known as a community nurse. Depending on their degree of experience, registered nurses hold varied levels of seniority within community teams. Nurses who lack the district nursing certification might nonetheless assume managerial roles (Maybin et al., 2016). A registered nurse who holds a district nursing specialized practitioner certificate is referred to as a district nurse. Case management, clinical evaluation,

care coordination, autonomous decision-making, advanced clinical skills, leadership, and team management are among the subjects covered by the specialized practitioner qualification. These nurses frequently work with community nursing teams in senior or managerial roles. Actually, the phrase "district nurse" is frequently used to describe nurses employed by district nursing teams who do not hold a speciality practitioner credential but hold a position designated as "district nurse" (Maybin et al., 2016).

District nurse services provide a variety of nursing interventions to patients, and they are essential for promoting independence, managing chronic ailments, and identifying and treating acute illnesses. Although these services are necessary for a variety of reasons, handicapped persons, elderly people who are fragile and/or have long-term diseases, and people who are approaching the end of their lives frequently require them (Cornwell, 2012; Imison, 2009).

The following services are commonly provided by district nurses: "Advice and support, Bowel care, Continence management, End-of-life care, General nursing care, Health education, Injections (intramuscular/intravenous/subcutaneous), Intravenous therapy, including chemotherapy, Medication administration, Medication reviews, Monitoring/screening, Nasogastric (NG) tube feeding (artificial feeding through a tube inserted into the nose), Pain control, Percutaneous endoscopic gastrostomy (PEG) feeding (artificial feeding through a tube inserted directly into the stomach), Phlebotomy (blood taking), Prescribing, Pressure area care (to prevent the development of pressure ulcers), Referral to other services, risk assessment, Skincare, Urinary catheterisation and ongoing catheter care, and Wound care" (Maybin et al., 2016). These categories are relevant for the research because these activities give insights into the work processes.

### 2.1.2 Omaha System

The Omaha System is a standardized, research-based terminology, framework, and tool used in healthcare for documenting and communicating patient care. It is primarily used by nurses and other healthcare professionals to assess, plan, intervene, and evaluate the care provided to individuals (K. S. Martin, Marques, Grenier-Renoud, & Sobral, 2021):

- **Assessment and Documentation:** District nurses can document patient needs by using the Omaha System, which provides standardized words and codes for holistic patient health assessment covering physical, psycho-social, environmental, and cultural variables;
- **Care Planning:** By utilizing evaluation data, the Omaha System assists in the development of individualized care plans. It provides a framework for selecting interventions, identifying goals, and defining outcomes, allowing for customized, patient-centered care planning;
- **Communication and Collaboration:** The Omaha System's uniform language assists district nurses in communicating with one another and promotes productive teamwork among interdisciplinary teams. It simplifies the exchange of patient data, facilitates communication about treatment plans, and organizes interventions;
- **Data Analysis and Research:** The Omaha System makes it possible to gather and analyze organized data, which supports medical research and raises standards of



care. It supports the development of evidence-based practice and healthcare best practices by enabling the identification of trends and areas for care improvement;

- **Evaluation and Outcomes:** The Omaha System utilizes defined codes to systematically examine patient outcomes and intervention effectiveness. This approach illustrates the value of nursing care, promotes quality assurance by tracking changes in health, and assists in decision-making (Holt et al., 2020).

The Omaha System promotes comprehensive, person-centred care planning, enhances communication and collaboration, supports research and data analysis, and enables the evaluation of patient outcomes (Holt et al., 2020). The district nurses of this study also use the Omaha System to document their documentation. In an Electronic Medical Records (EMR) report, district nurses summarize medical consultations into four primary parts: subjective notes from the patient (subjective), objective observations (objective), an assessment of the medical condition (assessment), and an action plan (plan) (Cameron & Turtle-Song, 2002).

### 2.1.3 Quality Standards

**V&VN** In The Netherlands, the V&VN makes guidelines for district nurses. Each patient should receive individualized care and care is customized to a patient's particular circumstances. At the same time, it is crucial that a specific standard can be set nationwide to which care must adhere. In the guidelines, this criterion is outlined. Then, with the aid of guidelines, district nurses should follow these guidelines in their activities, and those receiving care are aware of what to anticipate (V&VN, 2023b). A guideline is a record that offers recommendations to help healthcare providers and patients, to improve the quality of care. These recommendations are based on systematic summaries of scientific research, assessments of the benefits and drawbacks of various care options, and the knowledge and experience of both healthcare providers and patients (Zorginstituut, 2021).

**NIC / NOC** According to (Castelpietra, Salvador-Carulla, Almborg, Fernandez, & Madden, 2017), the Nursing Interventions Classification (NIC) is a categorization system that targets broad patient populations and is used as an international application. The NIC is a standardized language that covers both direct and indirect care. It is claimed to apply to all nursing specialities and healthcare settings. The NIC contains a total of 565 interventions grouped into 30 groups under seven domains (Bulechek, Butcher, Dochterman, & Wagner, 2012). To facilitate computerization, each intervention has a unique number, a description, and a comprehensive set of steps detailing the steps the nurse takes to implement the intervention (Othman, Shatnawi, Alrajabi, & Alshraideh, 2020). A thorough, uniform classification of patient outcomes is provided by the Nursing Outcomes Classification (NOC) (Othman et al., 2020).

## 2.2 Business Process Management

### 2.2.1 Business Process Model and Notation

A collection of actions is intended to be carried out in a self-contained, chronological, and logical order known as a business process model. A process model typically outlines what must be done and when (control flow), who will do each task (resources), and what it is currently working on (data). Business Process Model and Notations (BPMN) is the formal language used in Business Process Management (BPM), a discipline that is regularly used to model and analyze business processes (Allweyer, 2016; Amantea, Robaldo, Sulis, Boella, & Governatori, 2021). If the real-world process is compliant with the guideline, the process is compliant. If the real-world process is not compliant, it is made red. It denotes an absence or several lack of necessary controls or actions. In this situation, they will also be defined. They will be identified by names found in the vocabulary and by the absence of regulation in the written legislation. If a process may not be compliant, the colour will be orange. This could become through a process that is not in the right order (Amantea et al., 2021). The file extension .BPM can be used by other tools (Amantea et al., 2021). This study will utilize the BPMN process structure to demonstrate adherence of district nursing to guidelines.

### 2.2.2 Ontology

The BPMN of the previous section is used to show the process flows of actions. This process requires an ontology to provide a detailed overview. An ontology is a formal depiction of the concepts in a domain and the connections between these concepts (L. Zhou, 2007).

Medical Guideline Ontology (MGO) is a domain ontology that provides a machine-processable representation of a medical recommendation. The MGO provides the appropriate patient's anatomy, signs, findings, evaluation, and recommended therapies in the context of the under-consideration guideline. Keep in mind that whereas observations are objective abnormalities found, symptoms are subjective abnormalities that the patient perceives (LeBlond et al., 2015). In Figure 2, the MGO's schema is depicted (ElAssy, de Vendt, Dalpiaz, & Brinkkemper, 2022).

There are five (sub)ontologies in the MGO. The human anatomical features and functions are shown (within the context of the recommendation) by the Patient Anatomy Ontology (PAO). The complaints and abnormalities (symptoms) that a patient may report are represented by the Patient's Symptoms Ontology (PSO). All observations of a patient's state are represented by the Patient Observations Ontology (POO). The Patient Diagnosis Ontology (PDO) represents the disease that has been diagnosed in a patient. The Patient Treatment Ontology (PTO), which also includes medications with prescriptions, instructions, referrals, and extra medical testing, summarizes all of the therapies that doctors recommend for their patients (ElAssy et al., 2022).

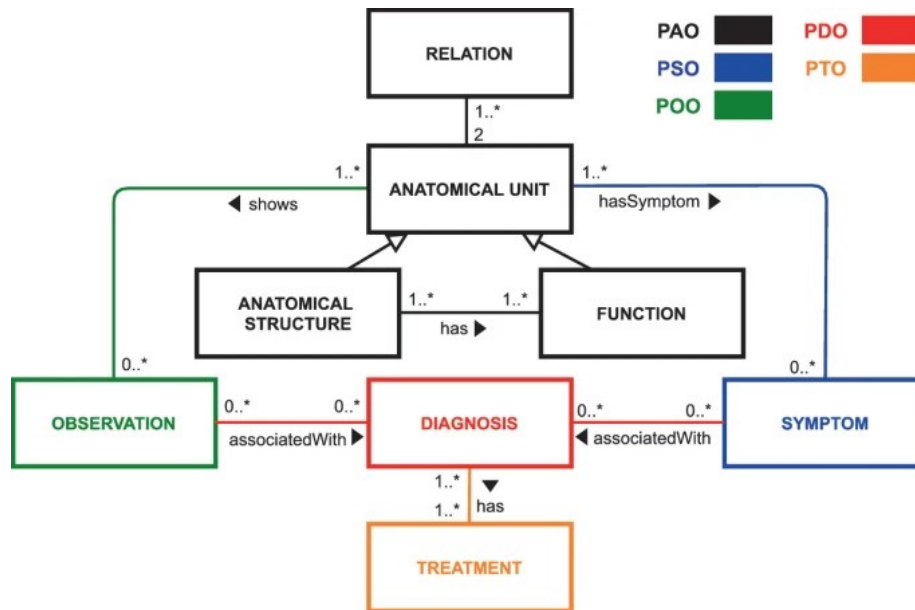


Figure 2: Medical Guideline Ontology. Retrieved from (ElAssy et al., 2022).

### 2.2.3 Disco (tool)

Disco is a process mining software program that may be used for project management, performance optimization, deviation control, and variation exploration. It has useful features like automatic process discovery, process map animation, comprehensive insights in cases, and filters to filter on different attributes (Dolak, 2019). Dealing with big event logs and intricate models is made simpler by the Disco, especially CSV files can be analyzed via this tool (Porouhan, 2022).

## 2.3 Artificial Intelligence

The Care2Report platform enables the submission of audio files, and it uses advanced speech-to-text translation software to transcribe the audio content accurately. It guarantees that the information gathered is as precise as possible and that no details are overlooked. To guarantee excellent accuracy, Care2Report's transcribing service makes use of sophisticated algorithms (Maas et al., 2020).

### 3 Research methods

The study aims to use audio recordings to gain objective insights into the daily work processes of district nurses and evaluate the daily tasks with the quality standards in home care. Several research methods were explored that were used to achieve the research objectives, including a narrative literature review, document analysis, observations via audio recordings, and observation of nurses' work in the district. By using a variety of research methods, the study aims to gain a comprehensive understanding of the adherence to quality standards in district nursing.

#### 3.1 Empirical Cycle

Design science is the study of things in context and their design. The artefacts that could be examined are made to interact with a problematic situation to improve some aspect of it (Wieringa, 2014). The research goal is to offer scientific knowledge further than the current knowledge and to publish about it. This study does not improve existing theories but conducts an observational study to see the activities of district nurses in a specific context (at home) through audio recordings and to see how coherent district nurses are to quality standards which can be useful in advising on the decision making (Wieringa, 2014). Therefore, this new study is unique in the field and wants to achieve insights into the district nurses' workflows by applying the Empirical Cycle which is shown in Figure 3. Wieringa (2014) mentioned that it is not necessary to use every step of the Empirical Cycle and that the researcher does not become involved in observational research and only measures things occurring inside the study's subject (Wieringa, 2014).

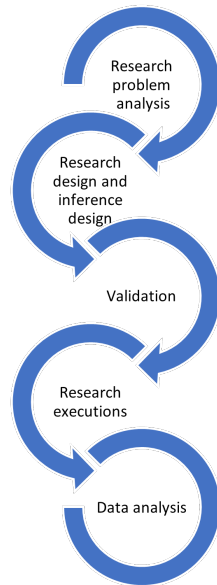


Figure 3: The Empirical Cycle. Adapted from (Wieringa, 2014).

### **3.2 Phase 1: Research problem analysis**

The research context of this study is district nursing, which refers to the provision of healthcare services to individuals in their homes. District nurses provide a range of healthcare services, including health promotion, disease prevention, and management of acute and chronic health conditions (Halcomb et al., 2020). The study focuses on the adherence to quality standards in district nursing, specifically the loneliness guideline of V&VN, the Dutch professional nursing association. The researcher chose the loneliness guideline because of its importance and applicability in district nursing and home care. Elderly loneliness is a common problem, especially in the ageing population that frequently needs home care services (J. Wang, Mann, Lloyd-Evans, Ma, & Johnson, 2018). The V&VN loneliness guideline covers this crucial part of treatment and offers direction to district nurses on how to recognize and successfully treat the loneliness of their patients (V&VN, 2021).

### **3.3 Phase 2: Research & inference design**

For the case study, audio recordings from 3 different district nurses were gathered in a time frame from 12 September 2023 until 8 December 2023 in several home care settings. These nurses were actively involved in giving care to 27 patients. Some patients appeared multiple times in the records as they were scheduled for visits on the days the district nurses made their rounds. For the case/pilot study, a comprehensive picture of the daily work and interactions between district nurses and their patients was sought. The study aims to give a thorough picture of the variety of work within district nursing practice by involving several nurses ( $n = 3$ ) and a reasonable amount of patients ( $n = 27$ ). The researcher collaborated with a home care organisation that has three locations in the Utrecht region. Every division was located in a distinct region within the Utrecht region. The research questions are linked to the method(s) in Table 1.

Table 1: Research methods applied per research/knowledge question.

#	Sub Research question	Activity / Method
1	How can we represent the key standards/protocols of the district nurses in a normative model?	Document Analysis, Narrative Literature Study
2	How can audio recordings be translated into process executions that can be checked against the normative model?	Audio recordings, Observations, Transcripts, Event log, Inductive coding
3	How can the discovered process executions uncover how district nurses organize their patient visits?	Event log, Process mining
4	To what extent does the normative model reflect the daily practice of the district nurses?	Transcript, Observations, Event log, BPMN Normative Model, Ontology

### 3.4 Phase 3: Validation

During the validation phase of this research, a case study approach was adopted to ensure the credibility of the results. The approach involved conducting a detailed analysis of the practices of three district nurses, each representing different divisions of a single care organization. The study aimed to capture a wide range of practices and experiences by selecting participants from different divisions, thus improving the generalizability of the findings.

The validation process was reinforced by multiple district nurses and a substantial patient sample, contributing to the credibility of research outcomes. The research study involved selecting three district nurses to explore their approaches to patient care, providing valuable insights into the topic. By using a case study methodology, the research aimed to validate observed patterns and identified activities across multiple contexts within the same organization.

A total of 27 patient visits were recorded, providing a diverse range of activities and patient interactions to study. This patient sample aimed to enhance the validity of the findings by ensuring that the identified activities and patterns were representative of the broader patient population under the care of these district nurses.

## 3.5 Phase 4 & 5: Research executions & Data Analysis

### 3.5.1 Sub Question 1

For document analysis of **SQ1**, several official documents were examined such as policy documents, guidelines, and reports. This method is used to analyze the loneliness guideline of V&VN. Due to the importance and relevance of the V&VN loneliness guideline<sup>1</sup> in the field of district nursing and home care, it has been selected for this study. Loneliness is a major and pervasive problem, especially for older people receiving home care (J. Wang et al., 2018). This could give an increased chance of Alzheimer’s disease (Wilson et al., 2007). The V&VN guideline offers healthcare professionals, especially district nurses, evidence-based suggestions and best practices for identifying and treating patients’ loneliness.

The guideline is pertinent because it covers a critical component of patient care that greatly impacts elderly people’s health and quality of life. Depression, anxiety, and poorer general health are just a few of the issues that loneliness is linked to physical and mental health (J. Wang et al., 2018). The research intends to help improve patient outcomes because it addresses a crucial issue for the elderly population getting home care. The researcher obtained copies of these documents from the relevant authorities and analyzed them using the so-called ”baseline questions” about what a district nurse should and should not do (V&VN, 2021). Via the baseline questions, a BPMN process model was made to show the preferred steps that a district nurse should take.

These baseline questions were made under the direction of a project group, two working groups (A and B) and an advisory committee were coordinated. The project group works with outside partners and creates suggestions based on data from both working groups. The working groups and advisory committee have been tasked with reviewing and providing feedback on these proposals. The project group also ensures that V&VN has authorized the quality standard and encourages the adoption of the guidelines in nursing education (V&VN, 2021).

A narrative literature study was conducted to see which other guidelines and protocols district nurses should adhere to. The narrative literature study method makes sure that not only document analysis is applied, but also a range more sources such as Google Scholar, Scopus and PubMed to answer **SQ1**.

### 3.5.2 Sub Question 2

The next sub-question is **SQ2**, this sub-question examines how audio recordings can be translated into process executions that can be checked against the normative model. The research design for this research question contains multiple approaches (Figure 4).

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<sup>1</sup><https://www.venvn.nl/richtlijnen/alle-richtlijnen/richtlijn-eenzaamheid/>



Figure 4: The steps of SQ2.

**(A) Audio recordings** Each district nurse was recorded for four working days. The researcher accompanied and observed each district nurse for one day, and for the last three days, the nurses walked alone with an audio set. The transcripts are stored on a secured database at a hospital in the Utrecht area. The following inclusion criteria were used for the district nurses and patients:

- Patients receiving home care from district nurses are included in the study.
- Patients who can communicate clearly with the district nurses while receiving care and speak Dutch fluently.
- District nurses working in home care are included in the study. These district nurses treat patients at home.
- District nurses who are working for a district nursing organization in the area of Utrecht and are working with the Omaha system, to create a uniform environment for the study.
- District nurses and patients consent to participation.

**(B) Observations** On the first recording day for each district nurse, the researcher made observational records of the visits. To maintain uniformity, a standardized form was used of (Šinik, Beerepoot, & Reijers, 2023) for the observation. The categories which were used were based on a category list from (Maybin et al., 2016), which is called the "Services commonly provided by district nursing services" (Maybin et al., 2016). The category, activities, and sub-activities from section "D) Event logs." are used. The standardized observation form is adapted for this research (Šinik et al., 2023):

- Time - The start time of the activity;
- Category - The category of the activity (e.g., General nursing care);
- Activity - The actual activity (e.g., Showering);
- Sub-activity - Detail information of the activity (e.g., Back washing);
- Medium - The place of the activity (e.g., in-house);
- Participants - The colleague with whom the district nurse communicated with during the working day;
- Initiated - The person who started the activity;
- Duration - The duration of the activity;
- District nurse - The code of the district nurse;
- Patient - The code of the patient;
- Field notes - The field notes of the researcher (Šinik et al., 2023).



**(C) Transcripts** The district nurse used a wireless microphone to capture the district nurse-patient interaction. After the audio recordings, the audio recordings were translated into transcripts with the following format: HH-MM-SS DN or HH-MM-SS P. After the DN or P, the number of the district nurse (DN) or patient (P) was placed. The translation of the audio fragment to a text document was done via the Care2Report website (Maas et al., 2020). Colour coding was applied for analyzing the symptom (blue), observation (green), and treatment (yellow) based on the ontology of (ElAssy et al., 2022). The visit list, which includes the codes of the participants, the days, and the start- and end times of the visits can be found in Appendix B.

**(D) Event logs** After the audio recordings were transcribed, event logs were made to show the: categories, activities, and sub-activities. A category list of categories that district nurses apply is used by (Maybin et al., 2016). The categories were enhanced with descriptions from other literature because the category list of (Maybin et al., 2016) did not contain descriptions.

1. **Advice and support** Providing direction and assistance is an essential part of district nursing, especially in situations such as prescription errors. For patient safety and efficient care, this function is essential (Hughes, 2008).
2. **Bowel care** Indicators of the quality of care given to older patients who have digestive symptoms regularly (Spinzi, 2007).
3. **Continence management** This category covers a wide range of activities, from toilet care and stoma care to conversations about continence (Cave, 2016). Given the complexity of continence care, the service includes fitting incontinence wear and dealing with constipation problems (Wallace, Jensen, Ahern, & Rasmussen, 2023; Mandelstam, 2013).
4. **End-of-life care** Current terminologies used to describe end-of-life care, such as palliative care, hospice care, and terminal care, are constrained in their ability to describe diagnosis and prognosis and are grounded in a medical model (Izumi, Nagae, Sakurai, & Imamura, 2012).
5. **General nursing care** This area encompasses a wide range of activities, from routine care such as washing hands, showering, and undressing and dressing patients. The position also entails administrative duties including writing visit reports (Walker, 2022).
6. **Health Education** The purpose of health education is to educate people on the causes and nature of health problems and to evaluate their risk factors based on lifestyle choices. Health education aims to influence people's attitudes, values, and beliefs to promote behavioural modifications in circumstances where they could be more vulnerable to illness, disease, or disability (Whitehead, 2004).
7. **Injections (intramuscular/intravenous/subcutaneous)** Giving injections is a common yet important procedure that has to be done carefully and precisely (Walker, 2022).
8. **Intravenous therapy, including chemotherapy** Entails giving medication directly into the bloodstream while district nurses supervise, keep an eye out for any negative effects, and make sure that all procedures are followed to the letter to provide the best possible care for patients (Sanguinetti et al., 2021; Oros et al., 2021).

9. **Medication administration** This involves keeping careful documentation of the medications that have been taken by the patient, ensuring that the orders of the doctor are followed (Luokkamäki, Härkänen, Saano, & Vehviläinen-Julkunen, 2021).
10. **Medication reviews** Reviewing the medication that is given to the patient (Lagerin, Lundh, Törnkvist, & Fastbom, 2020).
11. **Monitoring/Screening** Frequent screening and monitoring of patients is essential for the early identification and treatment of health problems (De Brouwer et al., 2020).
12. **Nasogastric (NG) tube feeding** Patients receiving feeding through nasogastric tubes are given liquid feed that contains the essential liquids and minerals (Cannaby, Evans, & Freeman, 2002).
13. **Pain control** District nurses use a multimodal approach to pain control that includes patient education, medication management, and holistic care to enhance the quality of life for home care patients who are in pain (Montgomery & McNamara, 2016).
14. **Percutaneous endoscopic gastrostomy (PEG) feeding** Competent care and support for patients who need to be fed via a tube, including technical expertise, and all-encompassing treatment to guarantee their general and nutritional health (L. Martin, Blomberg, & Lagergren, 2012).
15. **Phlebotomy** District nurses have a crucial role in controlling chronic illnesses like diabetes, as evidenced by their performance of tasks like blood sugar testing and insulin administration (Matzek et al., 2022).
16. **Prescribing** District nurses are essential in the treatment of patients' health since they are permitted to prescribe drugs in specific areas (Downer & Shepherd, 2010).
17. **Pressure area care** This preventive service is essential in avoiding the development of pressure ulcers, a common concern in immobile patients (Reddy, Gill, & Rochon, 2006).
18. **Referral to other services** To provide patients with complete treatment, district nurses serve as a link to other healthcare providers such as the doctor.
19. **Risk assessment** This entails assessing any health concerns and putting mitigation plans in place (Dowding, Russell, Trifilio, McDonald, & Shang, 2020).
20. **Skincare** The comprehensive approach to maintaining skin health encompasses a wide range of activities, from applying lotions and ointments to providing specialized care such as monitoring for skin abnormalities (Lichterfeld-Kottner, Lahmann, Blume-Peytavi, Mueller-Werdan, & Kottner, 2018).
21. **Urinary catheterisation and ongoing catheter care** Nurses are responsible for inserting and maintaining urinary catheters (Benny, Idiculla, Kunjumon, George, & Sequera, 2020). Catheter care is charted and the date of placement of the urinary catheter is recorded (Gyesi-Appiah, Brown, & Clifton, 2020).
22. **Wound care** Activities such as administering ointments and monitoring a wound, are vital for patient healing and comfort (BUILDERS, JOSEPH, & BASSI, 2020).

Two categories were missing from the existing category list, namely Administrative duties and Social interaction insights. These categories were manually added to the list to enrich it. The inclusion of these two categories was necessary to provide a more complete understanding of the roles and responsibilities of district nurses.

The category "Administrative duties" was introduced to address a particular aspect that was not adequately covered by the existing categories. While Medication Administration focused solely on administering medications, Administrative Duties were added to encompass a broader range of administrative responsibilities that district nurses might undertake.

The category "Social interaction insights" was introduced as a standalone category, separate from the general nursing care activities. This decision was made to acknowledge that social interaction is a multifaceted and critical aspect of patient care that extends beyond routine nursing tasks. This approach ensures that the category list reflects the diverse and intricate nature of district nursing activities, allowing for a nuanced analysis of this category.

1. **Administrative duties** Accurate documentation of every facet of patient care, such as assessment results, care plans, and treatments (Maas et al., 2020).
2. **Social interaction insights** Social interaction insights in nursing care describe a range of activities and treatments that entail interpersonal relationships, communication, and participation between patients and district nurses (Pratt, Moroney, & Middleton, 2021).

The researcher included the categories of (Maybin et al., 2016) in the research which is called "deductive coding". The next step was to use "inductive coding" where the researcher created activities and sub-activities based on the transcripts and matched the activities to the categories. The researcher then analyzed the activities and sub-activities in a process model in Disco through data-driven interpretations. As this is an exploratory study, it is essential to note that new knowledge will be gained, and the free-form of this approach will provide a broader view of the activities performed by district nurses.

**(E) Normative model** The BPMN Normative Model of **SQ1** is used in **SQ2**. This normative model is a BPMN process flow and shows the flow of the activities of the district nurses. BPMN processes are a traditional approach and only show the processes instead of the whole situation (Vugec, Tomicic-Pupek, & Vuksic, 2018). Therefore, an ontology was made to mention the observations, symptoms, assumptions, and treatments (ElAssy et al., 2022). In the work of (ElAssy et al., 2022), the terminology "diagnosis" was used. For this research, district nurses can only make assumptions and therefore this section of the ontology was changed to "assumption". For this BPMN process flow and ontology, the researcher accompanied one day per district nurse to observe their work. This method is used to gain insights into the daily work processes of district nurses and their adherence to quality standards. The researcher accompanied the district nurses on their rounds and made field notes to document their work processes that cannot be captured by audio (Šinik et al., 2023).

### 3.5.3 Sub Question 3

For the data collection of **SQ3**, every home visit is visualized via the event log. The activities of the event log are turned into a comma-separated values (CSV) file. This CSV file is loaded into Disco, a tool for analyzing processes. Creating a dynamic visual representation of the nurses' workflows is made possible by this tool. Disco's visualisation maps the sequences and frequencies of various activities, providing insights into both regular patterns and unusual occurrences in the nurses' patient visits. This Disco visualization is a Directly-Follows Graphs (DFG) which emphasizes direct relations between activities as the name implies (Van Der Aalst, 2019). For example, showering followed by body lotion. The absolute frequency was added, and a second metric called case frequency. Using this qualitative analysis technique, patterns, themes, and categories emerge naturally from the data, providing a genuine and accurate understanding of the work activities of nurses. An activity list was also created based on inductive coding that represented the activities which were linked to the categories that took place during the visit.

### 3.5.4 Sub Question 4

**SQ4** is about finding out how well district nurses' daily actions and the normative model match with each other, especially when it comes to providing home care and treating patients' psychological needs, with a particular emphasis on mood. A thorough research strategy that combines ontological and qualitative methodologies has been used to accomplish this. The transcripts and observations were analyzed and the observation and symptom of the patient, but also the treatment of the district nurse were analyzed. The BPMN Normative Model is first analyzed, and the steps of the BPMN Normative Model are matched to the actual steps in the transcript. It will be determined who initiated the conversation about the mood. During the discussion, they talked about the patient's mood. The mood conversation could be about the following activities: Social interaction, Doctor referral, or Mental Health Education. The mood after this step is discussed and there may be a need for professional support. While discussing loneliness, the loneliness guideline could be used to measure loneliness, if the loneliness scale is applied. This contains measurements like emptiness, dependence on social support, trust, abandonment feelings, and conversations, and about close relatives. The last step is to seek professional support and make an appointment with the professionals.

After analyzing the BPMN Normative Model, the study also analyzed the ontology. The study analyzed the patient's mood by comparing the observation, symptom, assumption, and treatment metrics with the transcript and observation data against the ontology. This helped to identify which observations, symptoms, and treatments were used and their effectiveness. In addition to determining the degree of alignment, the study intends to consider the consequences of any discrepancies for improving the normative model and streamlining routine nursing procedures. This comprehensive technique offers a strong foundation for understanding the intricate interactions that district nurses encounter in the delivery of psychosocial care between normative expectations and actual realities.

## **3.6 Ethical considerations**

This study was subjected to a comprehensive Ethics and Privacy Quick Scan to ensure that the highest ethical standards and privacy protection measures were followed for all participants. The research methodology included strict checks and adherence to predetermined ethical criteria, which established an adherence to ethical standards.

## **3.7 Threats to validity**

Threats to validity in this research project could arise from various factors that may impact the accuracy and generalizability of the findings. Wohlin et al. list four different challenges to validity: conclusion validity, internal validity, construct validity, and external validity (Wohlin et al., 2012).

### **3.7.1 Conclusion validity**

Conclusion validity is a threat to the reliability and correctness of the inferences made from the data analysis concerning the conclusion's validity (X. Zhou, Jin, Zhang, Li, & Huang, 2016). A conclusion validity in this study is the limited number of district nurses and patients who are willing to participate. To cover this, a poster was made to show the purpose of the research to the district nurses. This brought attention to the study and generated enthusiasm to participate. This made it easier to say yes to participating in the study. This increased the appropriateness and did not cost the district nurse extra time.

### **3.7.2 Internal validity**

Internal validity aims to demonstrate a relationship of causation, whereby one set of circumstances is thought to cause another circumstance (X. Zhou et al., 2016). Standardization is important in the study. The study should work to make the gathering and examination of audio recordings more uniform by using a standard category list but adding two more categories to have a complete category list. To maintain consistency and minimize any bias in the interpretation of the results, this entails that the explicit steps for recording, transcribing, and coding the data must be described.

### **3.7.3 Construct validity**

Construct validity is the degree to which the research properly assesses the target constructs or variables under inquiry is referred to as construct validity (Wohlin et al., 2012). By looking at the quality standards and the adherence of the district nurses, the differences in practice and normative models can be seen.

### **3.7.4 External validity**

The generalizability or application of the study results to larger populations, situations, or contexts beyond the particular sample and study conditions is referred to as the external validity of this research (Wohlin et al., 2012). The external validity of this study can be increased by conducting a similar investigation in a different home care setting or with a different population of patients. The results are different because every patient visit is different. The adherence to quality standards is also not always consistent with the district nurse because the work setting and patient are different.

## 4 Results

### 4.1 How can we represent the key standards/protocols of the district nurses in a normative model?

#### 4.1.1 Key standards/protocols

District nurses should adhere to different key standards and protocols. In The Netherlands, district nurses use the key standards and protocols from the V&VN organisation (V&VN, 2023b). The conditions that nurses must fulfil to identify and schedule care are outlined in a standard framework, called "Normenkader", this framework contains six parts: autonomy, competent care, patient empowerment, nursing process, reporting guidelines, and a transfer standard (V&VN, 2024). The district nurse must follow the protocols of the standard framework to give the best possible care (V&VN, 2024).

District nurses must be well-known with several documents, such as the Indication Process Toolbox, the Working Document Quality Framework for District Nursing, the Nursing and Care Reporting Guideline, the Area of Expertise of the District Nurse, and the Framework of Standards and Terms for Indication Process (V&VN, 2020). A list of guidelines that are known by the district nurses was made visible in the district nurse framework of (V&VN, 2024). The guidelines from the framework were analysed and created by (Geense, Koppelaar, Rosendal, van der Sande, & de Bont, 2013). The following guidelines were adopted: "Decubitus, Medication and safety, care of miracle, hygiene, palliative sedation, fall prevention, blemishes, euthanasia, MRSA, malnutrition, dementia, COPD, cytostatics, delirium, incontinence, infection prevention, heart failure, oncology, depression, bereavement, personality disorders, other guidelines, and schizophrenia." (V&VN, 2024; Geense et al., 2013).

District nurses should follow the guidelines from the standard framework in their daily practice (V&VN, 2024). There are different steps that a district nurse should take in their work, the first stage of the care process is collecting medical history (anamnesis). After gathering data through observation and interviews, the second stage involves diagnosing the patient's problem, if the district nurse collects all the necessary data, a district nurse diagnosis could be made. The third step is to identify and describe the desired outcomes, while the fourth step is to create an intervention plan. Writing down the implementation plan is the fifth step, followed by creating helpful evaluations in the sixth and final step (V&VN, 2023a).

The 2014 standard framework, which is still being used by V&VN, aimed to create a guideline on "loneliness" (V&VN, 2024). The district nurse department of V&VN has formulated a guideline for loneliness. District nurses are required to adhere to this standard as well as the standards of other departments (standard framework). This loneliness guideline is part of two divisions, namely the district nurse division and the Advanced Practice Nurses & Practice Support Workers division. These guidelines are to be followed for every step of the process, starting from making the care plan (anamnesis) to evaluating the care, as shown in Figure 5.

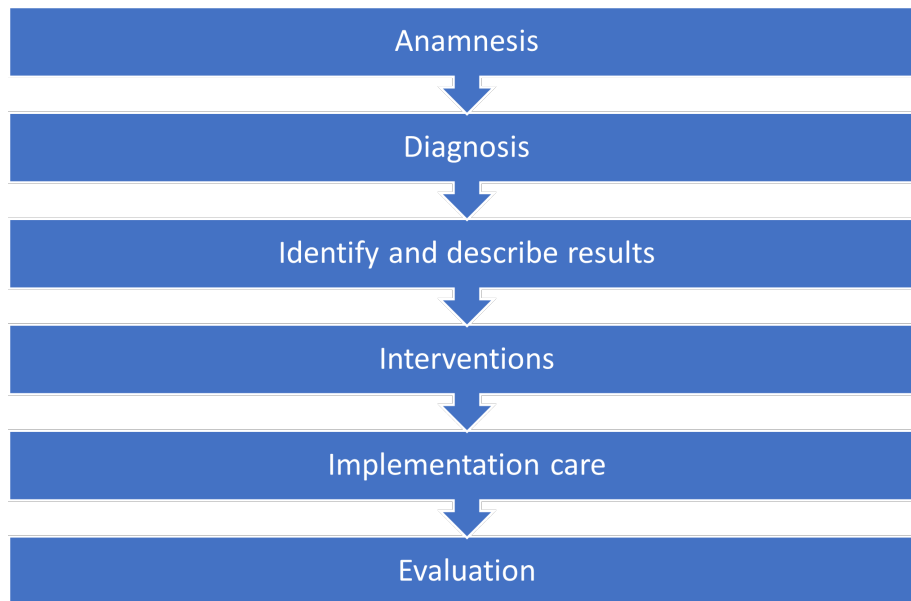


Figure 5: District nursing steps (V&VN, 2023b).

#### 4.1.2 BPMN Normative Model

The different sections of the guideline were analyzed and a normative model was made based on the guideline. There are several baseline questions in the loneliness guideline on what the district nurse should and should not do:

1. Identify Loneliness - Do;
2. Screening for loneliness - Do not;
3. Discuss loneliness and help - Do (V&VN, 2021).

Based on the steps of the baseline questions, a normative model for the loneliness guideline was made and is visible in Figure 6. The first baseline question of the guideline is to identify loneliness. During a visit, the district nurse can ask for the patient's mood or ask about the mood of the patient. The mood can be anything, for example, the district nurse asks if the patient previously went outside early because of the good weather. The mood must be about the personal mood of the patient, and not asking about the mood of others. This emphasizes that questions should only be about the patient's state of mind and social life with others. Asking about others to the patient or asking about some medical usage is not the same as asking about the patient's state of mind. Then, the mood is discussed and if there is a desire for professional support, professional support will be discussed and the De Jong Gierveld loneliness scale (6-item version) will be discussed. If professional support is necessary, an appointment can be scheduled to assist the patient (V&VN, 2021).

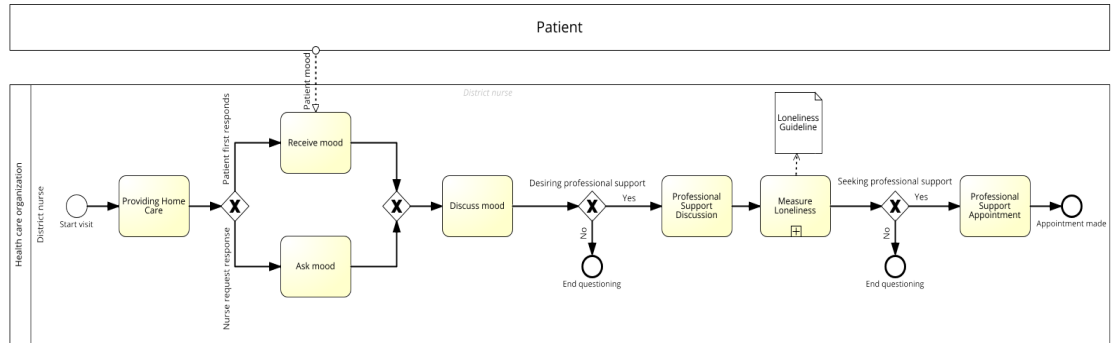


Figure 6: BPMN Normative Model of the loneliness guideline.

In the "Loneliness scale", which is in the document icon "Loneliness Guideline" in the BPMN Normative Model, there are sub-tasks that the district nurse can follow to measure how lonely a patient is. If professional support was discussed, a loneliness scale must be applied which discusses the experience of emptiness, falling back on people, trusting people, missing people, talking about closely related people, and feelings of abandoning. When the scale is completed, the following responses can be expected for every symptom if the district nurse and patient fill in the loneliness scale: Yes!; Yes; More or less; No; No! (V&VN, 2021).

### 4.1.3 Ontology

A BPMN process model alone is insufficient for presenting the metrics that guide the analysis of transcripts. Therefore, the loneliness guideline was expressed in an ontology. This ontology was based on the medical ontology of (ElAssy et al., 2022). In the ontology, there are several parts. A patient can have feelings and could have symptoms such as emptiness or feeling abandoned (baseline question: identify loneliness). The researcher made observations on the first day with the district nurse. After the first observation day, the district nurses worked alone with the audio recording and could observe the patients, such as seeing that the patient lives alone and talks about a partner's death. Based on these observations, an assumption can be made by the district nurse. As a result, the district nurse can provide treatment such as providing a meeting opportunity or facilitating a social interaction (baseline question: discuss loneliness and help). SNOMED CT is among the largest and most reliable ontologies. SNOMED CT is a multi-hierarchical ontology that allows ideas to be connected in addition to serving as a coding system for words (Chang & Mostafa, 2021).

The terminology "loneliness" is less detailed in the international edition of SNOMED CT. The following terminologies are connected to loneliness: Feeling lonely (finding), Feeling lonely, Loneliness, and Lonely (SNOMED-CT, 2023a). The Dutch edition adds more detailed symptoms of loneliness (in Dutch "eenzaamheid"): feeling lonely, subjectively experiencing an unpleasant or unacceptable lack of (quality of) certain social relationships, feelings of loneliness e.g. due to lack of contact with others & lack of work situation or other obstacles to participating in social life, loneliness, and lone-



liness (finding) (SNOMED-CT, 2023b). The ontology of Figure 7 shows observations and symptoms similar to SNOMED CT’s ”Loneliness”. The ontology consists of:

**(A) Patient and Feelings** A patient is a person receiving home care, which is visible at the bottom of Figure 7. This patient could have one or more symptoms. The patient could be observed by a researcher or district nurse to identify things the patient is struggling with, such as living alone. The district nurse could treat the patient to help him or her.

**(B) Observations** In the loneliness guideline of V&VN, there are risk factors which are associated with loneliness. The guideline used these risk factors from the literature gathered by (Dahlberg & McKee, 2014; van Tilburg & Klok, 2018). Understanding loneliness requires recognizing the differences between proximal and distal risk factors. Sociocultural and demographic aspects are examples of distal factors that have an indirect impact on loneliness, whereas the size and functionality of social networks are examples of proximal factors that directly affect loneliness. Although the more immediate risk factors are the main focus of loneliness interventions, a comprehensive strategy takes into account both proximal and distal factors for successful prevention strategies (V&VN, 2021). The following list shows which items are observed with a description (Dahlberg & McKee, 2014).

1. **Living Alone** This metric evaluates people’s living situations and gives special attention to those who live alone, without family or friends around (Hoe, Trickey, & McGraw, 2023).
2. **Poverty** By identifying those who live in poverty, this parameter assesses each person’s economic status. Access to healthcare, necessities, and general quality of life are all impacted by poverty, which is a major determinant of health (Rowley, Richards, Carduff, & Gott, 2021).
3. **Poor health** This measure concentrates on a person’s overall health state, which includes both mental and physical health issues. Inadequate health can significantly impede social engagement, career advancement, and involvement in local affairs, consequently affecting an individual’s overall quality of life (National Academies of Sciences, Medicine, et al., 2020).
4. **Death of partner** The observation metric takes into account the impact of losing a partner, as it can result in emotional distress and loneliness. This is important because it can lead to significant changes in support networks. (Benzein, Johansson, & Saveman, 2004).
5. **Loss of meaning** The purpose or meaning of a person’s life is assessed by this metric. A crucial element in mental health, a loss of meaning can affect motivation, attitude, and activity participation (Aroogh & Shahboulaghi, 2020).
6. **Psychological traits** A person’s behaviour and interactions with their surroundings can be influenced by a variety of psychological and personality traits. Resilience, optimism, and introversion/extroversion are a few examples of traits (Shi, Hua, Tang, Xu, & Xu, 2021).
7. **Lack of self-confidence** Self-esteem and confidence are measured by this metric, and they have a big influence on how people interact with others, how open they are to try new things, and how happy they are with their lives (Ryu et al., 2021).

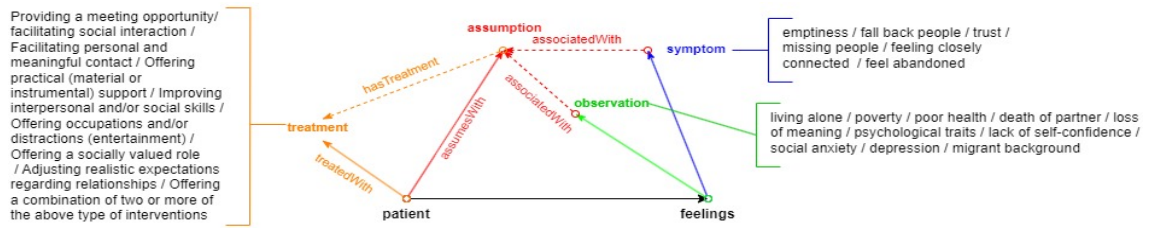


Figure 7: Ontology. Adapted from (ElAssy et al., 2022).

8. **Social anxiety** This variable quantifies the degree of social anxiety, a disorder that can make it difficult for a person to interact with others and increase feelings of loneliness (Lieberz et al., 2022).
9. **Depression** Depression is a mental illness that significantly impacts mood, energy levels, and day-to-day functioning. This metric focuses on identifying symptoms of depression (Brown et al., 2004).
10. **Migrant background** The particular difficulties and experiences that people with a history of migration encounter—such as difficulties integrating into society, language hurdles, and cultural adaptation—are taken into account in this observation (Lebano et al., 2020).

**(C) Symptom** These symptoms illustrate the intricate and dynamic character of human emotions and relationships, emphasizing the significance of social ties, trust, and a sense of belonging to one’s overall well-being.

1. **Emptiness** A pervasive sensation of inner emptiness or absence, which is frequently connected to feelings of loneliness or the perception that something important is missing from one’s life (Nilsson, Lindström, & Nåden, 2006).
2. **Falling back on people** This is a coping strategy in which people go to other people for aid and support when things get hard. It illustrates the necessity for a social network (Wenger, 2021).
3. **Trust** Relationships are built on trust, which is a conviction in the dependability, integrity, and kindness of others. Building and sustaining strong connections need trust (Steindal et al., 2020).
4. **Missing People** This symptom denotes a craving or longing for the presence of certain people, signifying a need for camaraderie and connection (Tomstad, Sundsli, Sævareid, & Söderhamn, 2021).
5. **Feeling closely connected** Experiencing a strong sense of intimacy and connection with people is reflected in the good emotional state of “feeling closely connected.” It stands in contrast to emotions of isolation or loneliness (Fast, Keating, Otfinowski, & Derksen, 2004).
6. **Feel Abandoned** Patients who have the experience of being abandoned or unsupported, which exacerbates vulnerable and distressing sentiments (de Guzman et al., 2012).

**(D) Assumption** There is a prevailing belief that loneliness is a complex illness that may have a substantial negative influence on a patient's general health and well-being rather than just being a symptom. It is said to be a condition that affects both the physical and mental aspects of health. Due to their frequent patient encounters, district nurses are frequently in a unique position to recognize indicators of loneliness that other people might not notice right away.

**(E) Treatment** The treatments section of the ontology focuses on strategies that district nurses use to combat loneliness when providing home care. These interventions are customized to meet each patient's unique needs and situation.

1. **Providing a Meeting Opportunity** The intervention entails giving people chances to socialize and engage with others. This could entail planning social gatherings or helping people connect inside the neighbourhood (Dahlberg & McKee, 2014; van Tilburg & Klok, 2018).
2. **Facilitating Social Interaction** Understanding the need for consistent interaction in preventing loneliness, district nurses actively promote and support social contacts (Dahlberg & McKee, 2014; van Tilburg & Klok, 2018).
3. **Facilitating Personal and Meaningful Contact** The importance of deep connections is emphasized by this intervention. District nurses strive to build and maintain connections with people that are very meaningful to each individual (Dahlberg & McKee, 2014; van Tilburg & Klok, 2018).
4. **Offering Practical Support** District nurses offer more than just emotional support; they can also offer material or instrumental aid. To reduce emotions of loneliness, this can entail attending to practical requirements (Dahlberg & McKee, 2014; van Tilburg & Klok, 2018).
5. **Improving Interpersonal and/or Social Skills** - Enhancing a person's ability to engage in constructive interaction is the main goal of this type of treatment (Dahlberg & McKee, 2014; van Tilburg & Klok, 2018).
6. **Offering Occupations and/or Distractions** Providing entertainment and activities help people pass the time, deflecting their focus from loneliness and promoting satisfaction (Dahlberg & McKee, 2014; van Tilburg & Klok, 2018).
7. **Offering a Socially Valued Role** District nurses understand how important it is to provide people responsibilities in the community so that they can feel valued and have a purpose (Dahlberg & McKee, 2014; van Tilburg & Klok, 2018).
8. **Adjusting Realistic Expectations Regarding Relationships** To create reasonable expectations about relationships, redefining perceptions on social interactions might be one way to achieve this (Dahlberg & McKee, 2014; van Tilburg & Klok, 2018).
9. **Offering a Combination of Two or More of the Above Types of Interventions** Due to the complexity of loneliness, district nurses usually employ multiple treatments, combining different treatments to address patients' diverse requirements (Dahlberg & McKee, 2014; van Tilburg & Klok, 2018).

## 4.2 How can audio recordings be translated into process executions that can be checked against the normative model?

### 4.2.1 Audio recordings

Three different district nurses from various districts in the area of Utrecht took part in the study, which involved recording a total of 27 audio files. District Nurse 01 (DN01) recorded nine audio files, while the researcher observed four visits made by the nurse in the morning. District Nurse 02 (DN02) was observed four times and recorded 14 visits. Except for one audio file, which was recorded on October 14, 2023, at 21:46, all recordings were made in the morning. The researcher observed the first visit, while District Nurse 03 (DN03) recorded four visits, all of which took place in the morning. The audio recordings were removed from the audio recorder after making the transcript. Appendix B provides a list of all visits.

### 4.2.2 Observations

During the study, the district nurses were observed by the researcher who made notes of their activities. As mentioned in the "Audio recordings" section of the research methods, nine observations were made. For the first two observations, it was observed that the patients were living alone. The researcher observed the overall activities such as showering, reviewing medicines, and social conversations. However, some activities such as those during the showering could not be observed, but they can be found in the transcript. Aspects such as "living alone", "grandson is born", and "loss of meaning" were seen in the observations. The observations are available in Appendix C.

### 4.2.3 Transcripts

The 27 transcripts resulting from the audio recordings have been securely archived in a database located within the Utrecht hospital area. This storage system guarantees the accessibility, confidentiality, and integrity of the important research data. The transcripts are protected by strong ethical and privacy norms, ensuring the privacy and anonymity of district nurses and research participants. The transcripts were analyzed by looking line by line to see how the normative model was applied in the real world, by looking at who started talking about the mood and if the mood can be linked with the normative models. For the BPMN model, the transcript text has been analyzed and the "mood" of the patients is analyzed. Figure 8 and Figure 9 show how the transcripts were analyzed.

09:46:22 DN02: Anders ja oh ja ja nee, want je kan niet alles aan hè. En toch aan de andere kant denk ik dat zij bedoeld heeft van kijk: u bent hier wel nog hè. En u doet toch elke dag uw ding dus in dat opzicht kan nu het wel dragen, maar aan de andere kant heeft u het natuurlijk ook heel zwaar, hè?  
**Want u mist uw man heel erg, ja. Voelt u zich alleen?**

09:46:46 P22: **Vaak wel.**

09:46:47 DN02: **Vaak wel ja.**

Figure 8: Observation (green) and symptom (blue) of P22 based on transcript.

09:47:52 DN02: Oh ja, dus uw kleindochter is zwanger. Dus u gaat een achterkleinkind krijgen.  
 09:47:57 P22: Voor de eerste keer ja.  
 09:47:58 DN02: Eerste keer.  
 09:47:59 P22: Een rijkdom hè.  
 09:48:00 DN02: Dat wou ik net zeggen. Dat is ook wel weer iets moois.  
 09:48:03 P22: Er hangt ook een foto waar ze zitten met z'n drieën.  
 09:48:06 DN02: Ja, dat is ook wel weer iets om dankbaar voor te zijn, toch?  
 09:48:08 P22: Als het een meisje was, dan krijgen we er vier.

Figure 9: Treatment (yellow) of P22 based on transcript.

#### 4.2.4 Event log

After the transcript step, an event log was made based on the transcript, and observation. During the translation of audio into transcriptions, comments were placed at the sections in the transcripts where activities happened which could not be seen in the transcript but heard in the audio. Such activity is, for example, Nurse washing hands. The activity "Dressing" was made with different sub-activities, such as putting on a shirt or putting on shoes, which is visible in Figure 10.

DN	Patient	Category	Activity	Sub-Activity	Timestamp start	Timestamp end
DN02	P07	General nursing care	Nurse washing hands		13.10.2023 10:15:38	13.10.2023 10:15:50
DN02	P07	General nursing care	Showering	Putting on shower shoes	13.10.2023 10:17:48	13.10.2023 10:26:10
DN02	P07	General nursing care	Showering	Turning on the shower	13.10.2023 10:17:48	13.10.2023 10:18:00
DN02	P07	General nursing care	Showering	Showering hair	13.10.2023 10:18:46	13.10.2023 10:19:12
DN02	P07	Social interaction insights	Social interaction	Weather conversation	13.10.2023 10:23:04	13.10.2023 10:23:53
DN02	P07	General nursing care	Showering	Showering legs	13.10.2023 10:23:54	13.10.2023 10:26:10
DN02	P07	General nursing care	Showering	Drying the patient	13.10.2023 10:26:11	13.10.2023 10:27:37
DN02	P07	General nursing care	Dressing patient	Putting on shoes	13.10.2023 10:30:14	13.10.2023 10:30:14
DN02	P07	General nursing care	Dressing patient	Combing hair	13.10.2023 10:30:26	13.10.2023 10:32:21
DN02	P07	General nursing care	Dressing patient	Putting on a shirt	13.10.2023 10:32:22	13.10.2023 10:32:30
DN02	P07	Social interaction insights	Social interaction	Television conversation	13.10.2023 10:32:33	13.10.2023 10:36:19
DN02	P07	Continance management	Stoma care	Apply gauze	13.10.2023 10:36:20	13.10.2023 10:39:37
DN02	P07	Skincare	Lubricating ointment	Bill ointment	13.10.2023 10:39:38	13.10.2023 10:42:20
DN02	P07	General nursing care	Compression stockings	Putting on compression stockings	13.10.2023 10:40:58	13.10.2023 10:42:29
DN02	P07	Social interaction insights	Social interaction	Holiday conversation	13.10.2023 10:42:31	13.10.2023 10:43:42
DN02	P07	General nursing care	Dressing patient	Putting on socks and slippers	13.10.2023 10:44:10	13.10.2023 10:45:10
DN02	P07	General nursing care	Eye dripping		13.10.2023 10:47:39	13.10.2023 10:48:02
DN02	P07	Skincare	Shaving face	Shaving beard	13.10.2023 10:48:03	13.10.2023 10:53:26
DN02	P07	General nursing care	Nurse washing hands		13.10.2023 10:53:46	13.10.2023 10:53:15
DN02	P07	Social interaction insights	Social interaction	Actrose conversation	13.10.2023 10:54:46	13.10.2023 10:58:08

Figure 10: Event log with the focus on DN02 and P07.

#### 4.2.5 Check against normative model

To assess the patient's emotional state, it is recommended to examine the event logs of the "Social conversation" activity. This will provide insight into activities that the patient has engaged in, including family conversations and going outside. The "Mental health education" activity contains the sub-activity "Mental health conversation". Here, the district nurse explicitly asks the patient how the patient is feeling inside, and if the patient needs help with personal questions about the mood and feelings. If professional support is needed, the activity "Doctor Referral" can be seen in the event log or if other professional support is needed, this could be added. Another method is colour coding, the transcripts were colour-coded for the symptom (blue), observation (green), assumption (red), and treatment (yellow).

### 4.3 How can the discovered process executions uncover how district nurses organize their patient visits?

Now the observational data, transcript, and event log have been described, it is shown how audio recordings can be made visible in process executions. Every process execution of the district nurse and patient interaction can be combined and can be shown in Disco (Figure 11), a tool for showing the processes in a sequence with absolute frequency per activity and with the second metric in brackets: case frequency.

#### 4.3.1 Activities district nurses

**Activities Sequence Analysis** District Nurse 1 (DN01) usually began the visit with a social interaction, this social interaction was about how the patient slept or discussing the weather. However, in some cases, DN01 started by putting on gloves or washing hands. After that, DN01's most common activity is dressing, which occurs in six out of nine cases. Showering was applied in five out of nine cases and reviewing medicines, compression stockings, and nurse washing hands were applied in four out of nine cases.

District Nurse 2 (DN02) usually began the visit with a social interaction with the patient, which DN02 did in eight out of 14 cases. In one case, DN02 had to support a patient who took the wrong medication. DN02's follow-up activities were diverse and included putting on gloves, wound care, and conducting continence conversations. However, unlike DN01, DN02 only had one showering activity. Before the wound care took place, the district nurse drank a cup of coffee with the patient. This creates a good bond and everything can be discussed in a relaxed atmosphere. When treating the wound, zinc ointment and vaseline were used. DN02 also applied ointment as part of her duties, this was applied to blemish spots. DN02 frequently washed their hands at the end of the visit.

District Nurse 3 (DN03) began the visit two out of four times with social interaction and two out of four times with a continence conversation. DN03 asks whether the patient slept well in two out of three cases and whether the patient has already received news from the hospital in one out of four cases. In one out of four cases, the first conversation revolved around the topic of continence. The activities of the patients from DN03 are similar to each other. In three out of four cases, the patients were showered. DN03 also gave the care to help with brushing teeth, three out of four times. In one case out of four, the patient said that the patient would do it downstairs independently because the toothbrush was downstairs.

**Event log** It is essential to understand that the diagram presented in Figure needs to be acknowledged as a crucial process map 11 places more emphasis on broader activities than on going into depth about the sub-activities. Sub-activities add to the workflow's total complexity, but the visualization emphasizes simplicity and clarity, highlighting the key activities for a more understandable interpretation. In the next section, the activities are described in detail.

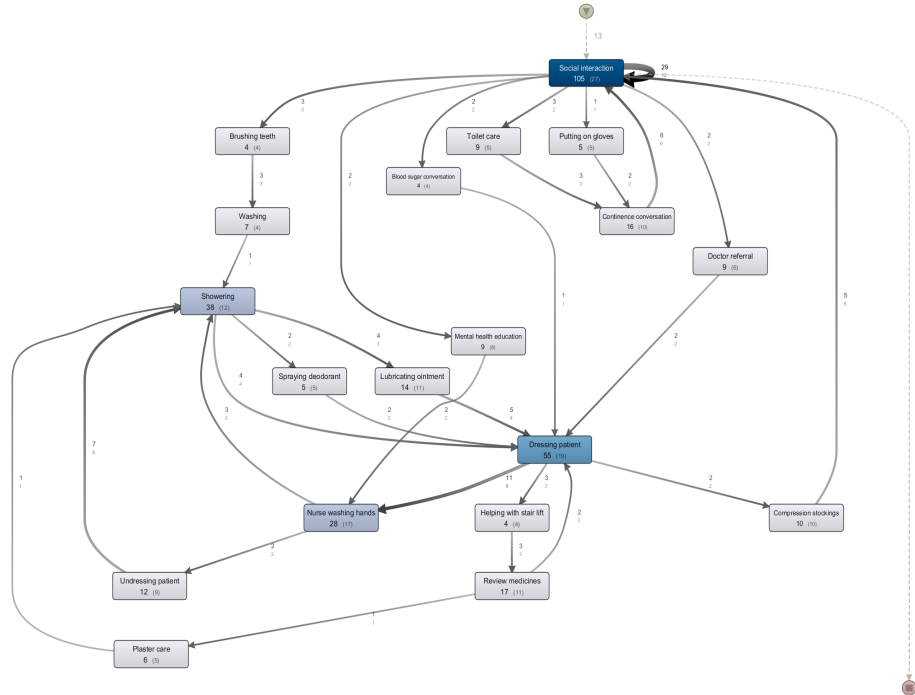


Figure 11: District nurses' activities and interactions with patients.

**Activities** Social interaction is the activity that occurs the most with an absolute frequency of 105 and in brackets the case frequency of all the cases. This is an activity that occurs during the visit, especially during showering. There is a loop of 29 times because the following sub-activity of social interaction followed some sub-activities of social interaction. The district nurses converse with patients about their daily routines, activities and social interactions. If a specific conversation was done, for example about continence, the activity is "Continence conversation" and falls under the category "Continence management". The full activity list can be seen in Table 2.

During the activity of dressing and undressing a patient, several sub-activities were performed. When undressing, the patient's trousers, outerwear, socks, underwear, and shoes or slippers are removed. On the other hand, dressing involves more tasks. While dressing, the patient applies body lotion or ointment to take care of their skin. Other activities, such as reviewing medicines, are common activities in home care. This involves checking if patients are taking prescribed medication regularly. The process includes tasks such as taking medication out of bags, placing it on a tray, and giving it to patients with water. Different medicines like oxycodone, pregabalin, and antidepressants with varying strengths are given. It is noted that patients taking antidepressants may not experience immediate benefits. Recently, DN02 spoke to P06 about the use of antidepressants and whether they were working for P06. However, P06

reported that they have not noticed any changes yet, more observations are needed.

**Non-nursing activities** There is a limitation in the approach used for gathering data when certain activities are performed, like altering roller blinds, which cannot be caught through voice recording alone. It is necessary to observe the activities to show a broad view of the activities. A non-nursing activity, collecting mail, was carried out by the district nurse at P08. The district nurse saw that there was mail at the door. This meant that P08 didn't have to pick up the mail and therefore P08 didn't have to bend over. On the one hand, picking it up can be seen as a non-nursing activity, but on the other hand, it can also be said that P08 did not have to bend down to do this and that is care. The phone and doorbell rang during different visits. P01 was called because her great-grandchild was born, while the hairdresser came to P02, and the bell rang at P04 because a friend came.

**Sub-activities** Various sub-activities were identified by analyzing the transcript and event logs. The transcript contained comments on activities that were gathered while transcribing the audio to text such as whispering, which helped to create a comprehensive visualization of the sub-activities that occurred during the visits. The most frequent sub-activities were highlighted. The sub-activities are visible in Figure 12 and the following list describes the sub-activities which were seen three times or more:

1. Conversation about family (16 times) - Having a conversation with the patient about the patient's family regarding events, updates, and general health.
2. Conversation about weather (10 times) - Talking about the current weather or weather-related topics.
3. Conversation about the hospital (9 times) - Talking about hospital-related topics, such as past or upcoming visits.
4. Conversation about sleep (6 times) - Discussing the quality of sleep, sleep patterns or other related concerns.
5. Conversation about birthdays (4 times) - Talking about birthdays, those of the patient or their relatives.
6. Conversation about the holiday (4 times) - Talking about upcoming or past holidays, plans and experiences.
7. Conversation about going outside (3 times) - Discussion about plans or experiences related to going outside, such as walks, trips or outdoor activities.
8. Conversation about dietician (3 times) - Conversations on dietary issues, possibly with nutritional advice or discussions on diet plans.
9. Conversation about supermarket (3 times) - Discussion about grocery shopping or supermarket-related topics.
10. Conversation about football (3 times) - Starting discussions about football.
11. Conversation about pedicure (3 times) - This might involve talking about foot health, advising on how to take care of the patient's feet, and taking into account the current foot problems.



Table 2: Categories with activities

<b>Category</b>	<b>Activity</b>
Administrative duties	Writing report of visit, Checking report of previous visit
Continence management	Continence conversation, Constipation care, Putting on incontinence trousers, Stoma care, Toilet care, and Urine conversation
General nursing care	Brushing teeth, Compression stockings, Dressing patient, Eye dripping, Helping with stair lift, Nurse washing hands, Plaster care, Putting on gloves, Undressing patient, Showering, Washing, Weighing patient
Health education	Mental health education
Medication administration	Medical usage documentation
Medication review	Review medicines
Phlebotomy	Blood conversation, Blood poisoning conversation Blood sugar conversation, Blood sugar testing
Referral to other services	Doctor referral
Skincare	Bandage care, Blemish spots, Checking abdominal fold, Checking groin, Checking itch, Checking skin, Blemish spots, Scratching spots, Checking skin cancer, Lubricating ointment, Cleaning ointment, Legs ointment conversation, Lubricating ointment, Scratching spots, Shaving face, Spraying deodorant
Social interaction insights	Calling with colleague, Social interaction
Urinary catheterisation and ongoing catheter care	Catheter care conversation, Catheter care
Wound care	Apply gauze, Rinsing the wound, Wound care conversation, Wound ointment, Wound treatment

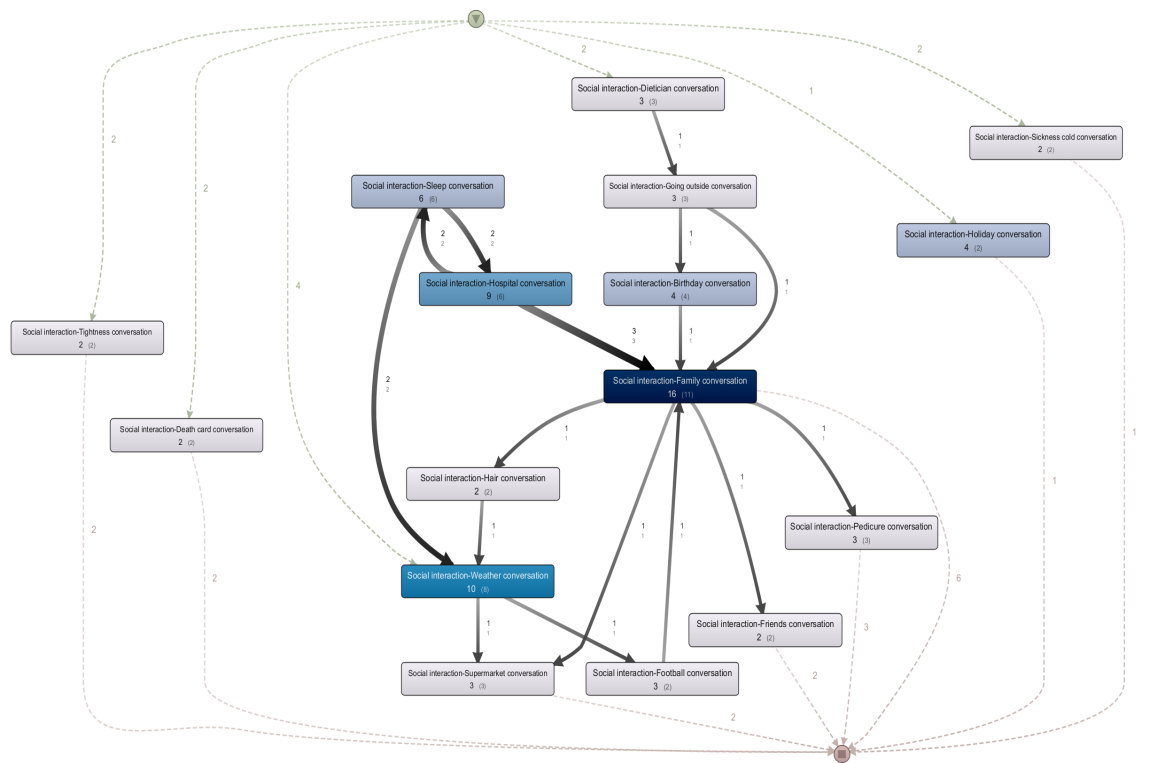


Figure 12: The sub-activities of social interactions.

### 4.3.2 Findings

The results of this study provide a detailed insight into the everyday activities of district nurses and illustrate the complex interplay between social contacts, clinical processes and the small dynamics that impact patient care.

#### Patterns

- General nursing care: Undressing, Showering, Dressing, Nurse washing hands, and Reviewing medicines are important activities that frequently happen during the visits, particularly for patients who have cognitive or mobility problems.
- Lotion/Ointment: Sometimes a patient receives Body lotion, Vaseline, Zinc ointment, or Wound ointment. It is not clear if zinc ointment and wound ointment are the same. After these ointments, the district nurse washed her hands.
- Wound care patients: The district nurse often shares a coffee with patients during wound care, indicating a blend of social interaction and clinical care. This occurred during the visits of DN02 at P08, and P23. After the wound care of P23, catheter care was applied.
- Showering: The showering routine happens by different district nurses and different patients. Washing specific body parts alone is less common, P05, P24, P25, and P26 were washed instead of showered.

**Hidden activities** Certain activities that are essential to the process of district nurses during patient visits are not well-documented in textual transcripts. Hand washing is a perfect example of such an activity. Since it does not usually result in a spoken record and is not a verbal exchange or an overt caregiving task, it is often not recorded in transcripts. However, hand washing is crucial to maintain cleanliness and prevent the spread of illnesses while providing nursing care. There were 30 nurses washing hands activities not found in the transcripts, those activities were documented as a comment during transcribing. There was one time when the district nurse washed her hands under the shower.

By closely studying the routines and behaviours of district nurses, the researcher was able to verify the regular occurrence of nurses washing hands at crucial points in the visit, such as the start, after applying body lotion or ointment, and at the end of the visit. The same means for brushing teeth, which was sometimes mentioned but it could be heard via the audio recording. Thus, by triangulating the transcripts, audio recordings, and observational data, it is possible to obtain a more complete picture of the nurses' practices, ensuring that even crucial but nonverbal actions like hand washing were sufficiently recorded and taken into account in the analysis.

Some activities like starting the shower, undressing the patient, dressing the patient, taking off the shower cap, and putting on/off compression stockings are not always caught in the transcript because the district nurse or patient did not mention it. As such, it becomes difficult to put an end timestamp on these tasks using transcript data alone. To correctly capture these times, it is important to make notes during the transcribing of audio to the transcript, to describe the hidden activities. While the visual data provides a context for understanding events, audio recordings are essential for discerning activity through sound.

## 4.4 To what extent does the normative model reflect the daily practice of the district nurses?

### 4.4.1 Agreements with BPMN Normative Model

This section evaluates how closely district nurses follow the created BPMN normative mode while interacting with their patients and with the created ontology. The BPMN Normative Model can be found in Figure 7 and the Ontology can be found in Figure 6. The observational data, which the researcher collected is visible in Appendix C.

**P01** DN01 initiated a conversation with P01 to inquire about P01's recent outdoor activities (Activity: Social interaction; Sub-activity: Going outside conversation) and about the family (Activity: social interaction; Sub-activity: Family conversation). A discussion started and P01 revealed to DN01 that the prevailing heat had deterred them from going outside. However, P01 expressed a willingness to consider venturing outdoors before noon, when the intensity of the sun's rays is comparatively milder. Furthermore, P01 divulged concerns about a declining mobility issue about a family member, either a child or grandchild (Activity: social interaction; Sub-activity: Family conversation). In response to this, DN01 proposed the potential benefit of utilizing a home trainer for P01 (Activity: Social interaction; Sub-activity: Home trainer conversation). This suggestion was met with acceptance from P01, indicating a degree of openness to exploring new avenues for maintaining physical activity. The discussion regarding P01's mood and outdoor activities concluded the process. This exchange exemplifies the patient-centred approach in nursing, where dialogues about lifestyle choices and physical well-being are integral to care strategies. The researcher observed this visit and mentioned that P01 was living alone and that P01's grandchild was born.

By looking at the ontology, a broader understanding of the visit can be shown. DN01's suggestion to use a home trainer is consistent with the ontology's treatment categories under the 'providing practical support' category, according to an evaluation of the discussion between DN01 and P01. The observing researcher noted important details about P01's situation throughout this interaction, most notably that P01 was living alone. This insight is relevant since it directly affects the ontology's 'living alone' category. This analysis highlights the relationships between practical nursing interventions, the patient's living circumstances, and important life events. It also demonstrates the intricate interactions between the patient's unique conditions, the district nurse's practical care recommendations, and the comprehensive framework of the ontology.

**P02** P02 initiated a conversation centred on their current moving condition, specifically discussing an upcoming birthday celebration (Activity: Social interaction; Sub-activity: Birthday conversation). P02 elaborated on plans to travel to Limburg for a family gathering, a detail which aligns with the 'falling back on people' metric of the loneliness scale. This aspect of the discussion reflects P02's reliance on familial support and social connections as a means to mitigate feelings of loneliness. However, it is noteworthy that within the confines of this conversation, as captured in the transcript, there was no explicit reference to or request for professional support. This absence highlights the importance of family and social networks in P02's coping mechanism for loneliness and also indicates a potential area for further exploration in terms of

professional intervention or support. The researcher observed this visit and mentioned that P02 was living alone and that P02 got a hairdresser to cut P02's hair.

Upon examining the transcript in light of the ontology, a little but significant detail became apparent in the conversation between DN01 and P02. The 'fall back on people' symptom in the ontology is consistent with P02's statement of intentions to spend a birthday with relatives. This symptom indicates a dependence on social support systems, frequently seen in families, to provide emotional and social assistance. Concurrently, as the researcher watched this visit exchange closely, the researcher documented an important feature of P02's living situation: P02 lives alone. In the ontology, this observation falls within the "living alone" category. This understanding is significant because it may affect how P02's social support requirements and actions are evaluated and understood.

**P04** P04 disclosed their reluctance to engage in outdoor activities, attributing this disinclination to being preoccupied with laundry tasks. Additionally, P04 revealed experiencing symptoms of diarrhoea, which further influenced their decision to remain indoors (Activity: Contenance conversation; Sub-activity: Diarrhea conversation). DN04, responding to this information, proposed a visit to the shopping mall as a potential activity. This suggestion was based on P04's habitual preference for visiting the mall and engaging with others, which aligns with social interaction and routine behaviour. However, DN04 also acknowledged that the realization of this plan was contingent upon a decrease in the severity of P04's diarrheal symptoms. This recommendation indicates DN04's consideration of P04's physical health conditions alongside their social needs, emphasizing a holistic approach to care. The researcher observed this visit and mentioned that P04 was not living alone and a guest rang the doorbell at the door at the end of the visit.

In examining the transcript through the lens of ontology, a detailed reflection emerges on the interaction between DN02 and P04. The discourse between them revealed a specific instance of nursing intervention where DN02 proposed a treatment for P04: visiting the shopping mall to see people if the diarrhoea calmed down because P04 had friends there. This suggestion is categorized within the ontology as 'providing a meeting opportunity', which is a form of treatment aimed at facilitating social engagement and thereby potentially enhancing the patient's psychological well-being. Simultaneously, during this interaction, the researcher made a crucial observation about P04's living circumstances. Contrary to living alone, which often necessitates a different approach to care due to the heightened risks associated with social isolation, P04 was living with P04's son. This observation is significant as it provides context to the patient's social support structure, which is an essential aspect in understanding and planning comprehensive patient care.

**P06** During the interaction, DN02 inquired about how P06 was feeling (Activity: Mental health education; Mental health conversation) and how P06 was feeling about the use of antidepressants (Activity: Review medicines). In response, P06 conveyed a lack of discernible effects from the prescribed antidepressants. DN02 proceeded to provide information, informing P06 that the efficacy of antidepressants typically becomes noticeable after six weeks. This exchange reflects a dialogue between the district nurse and the patient concerning the expectations and timeline for the therapeutic effects

of the prescribed medication. The researcher observed P06 living alone. The district nurse washed their hands and spoke about antidepressants during the medication review.

By looking at the ontology, a broader understanding of the visit can be shown. During the visit that was observed by the researcher, it was noticed that P06 was using antidepressants, which is a clear indication of an underlying problem of depression. Since depression is an important metric in the ontology, this symptom is significant. Antidepressant medication is a traditional way of treating depression, as it recognizes the medical importance of treating a patient's mental health. Furthermore, the district nurse's educational outreach about the effectiveness of antidepressants enhances the treatment process by providing useful guidance. The statement made by DN01, that antidepressants usually take about six weeks to work, is not only factual but also a critical treatment. It provides comfort and knowledge to the patient, allowing them to set reasonable goals and providing them with a time frame for potential improvements. This kind of transparency is essential for increasing patient satisfaction and ensuring adherence to prescribed medication schedules.

**P08** DN02 asked P08 about P08's husband during giving wound care. P08's said that P08's husband was hospitalized (Activity: Social interaction; Sub-activity: Hospital conversation). P08 was uncomfortable because DN08's husband was in the hospital, which went along with the 'missing people' part of the loneliness scale, but the loneliness scale was not applied during this visit. The discussion went further about how the husband is getting a smartphone so that the patient and husband could call each other. After this conversation, the normal wound care continued.

By looking at the ontology, a broader understanding of the visit can be shown. P08 said that P08 was uncomfortable that P08's husband was in the hospital and that P08 missed the husband, this is a symptom of missing people of the ontology. DN02 suggested that P08 could call P08's husband, especially because P08's husband was going to receive a new smartphone that would make communication simpler. The researcher observed this visit and mentioned that P08 was living alone, and P08's husband was in the hospital.

**P10** P10 said at the beginning of the visit that P10 was experiencing hallucinations, attributing them to a previous operation (Activity: Social interaction; Sub-activity: Mental health conversation). In response, DN02 reassured P10 that the hallucinations were not real and advised against unnecessary concern. This interaction addressed the patient's concerns and provided reassurance.

The analysis of the interaction between district nurse DN01 and patient P10 unveiled significant aspects in line with the ontology. The observation of hallucination, categorized under psychological traits, underscored potential mental health challenges. DN01's response, asserting the hallucination was fake, demonstrated a practical support approach in the treatment strategy. This interaction highlights the model's utility in addressing psychological aspects during home care, ensuring a more comprehensive and informed caregiving process.

**P14** P14 informed DN02 about feeling unwell and having a scheduled COVID-19 vaccination appointment. Expressing uncertainty about attending the vaccination location, P14 sought guidance from DN02. In response, DN02 recommended discussing the matter with the doctor (Activity: Doctor referral) and providing a course of action for the patient’s dilemma.

By looking at the ontology, a broader understanding of the visit can be shown. In the documented interaction between district nurse DN02 and patient P14, the conversation centred around P14’s health status. The patient’s disclosure of feeling sick, classified under the observation category of ‘poor health’, was a critical aspect of this dialogue. Concurrently, P14 mentioned an upcoming COVID-19 appointment. In response, DN02’s suggestion to discuss these health concerns with a doctor was categorized as ‘offering practical support’ within the treatment part of the ontology. This instance exemplifies the model’s application in guiding nurses towards practical, health-oriented advice, reflecting a systematic approach to addressing health-related issues in home care settings.

**P15** During a routine skin care check (Activity: Scratching spots; Sub-activity: Check Scratching spots), P15 said that P15 was attending a theatre play and liked it. Acknowledging P15’s occasional feelings of being lonely (Activity: Mental health education; Sub-activity: Mental health conversation), DN02 complimented the initiative to socialize at the theatre, highlighting the benefits of such activities. Subsequently, DN02 inquired about the effectiveness of P15’s antidepressant medication, observing that P15 did not exhibit severely negative thoughts. P15’s engagement in self-care activities such as making cards, conversing with others, and maintaining friendships was noted. However, an incident at the supermarket where P15 was labelled as an ‘old person’ negatively impacted P15’s trust in others, a factor relevant to the loneliness scale, particularly concerning the aspect of trusting people.

By looking at the ontology, a broader understanding of the visit can be shown. In the interaction between district nurse DN02 and patient P15, the visit revealed significant aspects of P15’s social and emotional well-being. DN02’s recommendation for P15 to engage in social activities such as attending theatre with friends was identified as a treatment strategy of ‘offering a socially valued role’. This recommendation aligns with therapeutic approaches aimed at mitigating feelings of loneliness, which P15 occasionally experienced. However, an incident at the supermarket where P15 was labelled as an ‘old person’ negatively impacted P15’s trust in others, a factor relevant to the observation of the ontology, particularly concerning the observational aspect of lack-of-self-confidence.

Furthermore, the incident in the supermarket could affect P15’s sense of trust. This incident has been categorized under the observation of ‘social anxiety’ and identified as a symptom of bad trust. Such incidents highlight the multifaceted challenges faced by elderly patients, encompassing not just physical health but also social and psychological dimensions. This instance underscores the importance of comprehensive care strategies that address the broader spectrum of elderly patients’ needs, including their social interactions.

**P17** DN02 initiated a conversation with P17, inquiring about his well-being. P17 expressed feelings of boredom, this was a starting point for the discussion (Activity: Mental health education; Sub-activity: Mental health conversation). DN02 highlighted P17's active social life and extensive family interactions (Activity: Social interaction; Sub-activity: Family conversation). P17 shared that P17's granddaughter had called P17 that morning, revealing additional information about having adopted children. Interestingly, P17 conveyed a reluctance to maintain contact with these adopted children, indicating a nuanced perspective on family relationships. This conversation discussed how maintaining distance from closely related people can reflect on the loneliness scale. The reason for this could be a desire to avoid perpetual expressions of gratitude from the adopted child, according to P17.

By looking at the ontology, a broader understanding of the visit can be shown. P17 said that P17 was bored, and the observation of loss of meaning was here seen. DN02 said that P17 was making a joke that P17 is never bored and that P17 has a lot of family meeting P17. This treatment by the district nurse was 'offering a socially valued role'. P17 said that the granddaughter of P17 called that morning, meaning that the symptom of falling back on people was applied. P17 also mentioned having adopted children but P17 does not have contact with the adopted children. There was a discussion about this relationship, this was a treatment about adjusting realistic expectations regarding relationships.

**P19** DN02 asked P19 if P19 liked it in the new house. A discussion was followed up where P19 said that new neighbours are yet to arrive, but P19 does not yet know who they will be (Activity: Social interaction; Sub-activity: Housing conversation). DN02 shared the idea of going to the activities of the group. P19 said that P19 goes to that group, especially when there is a breakfast or a dinner. P19 then also said that P19 has good contact with the neighbour on the corner, this is part of the loneliness scale "talking about closely related people" but also on falling back on people.

By looking at the ontology, a broader understanding of the visit can be shown. DN02 recently made contact with P19 and discussed her adjustment to a new house. During the visit, DN02 suggested that P19 consider joining a group as a form of treatment, which is known as proving a meeting opportunity. P19 then spoke about her friendship with a neighbour on the corner. These symptoms are called "fall back people" and "feeling closely connected", and they were observed during the visit. These symptoms highlight the importance of social ties and interactions in a patient's overall health, which is a significant component of the ontology. Based on the audio data, it was noted that P19 may have a migrant background.

**P21** P21 reflected the 'feeling of emptiness' on the loneliness scale by expressing a wish to stop doing everything, mostly because of the stress of changing houses. DN02 and P21 had a conversation about the causes of these emotions (Activity: Mental health education; Sub-activity: Mental health conversation). When DN02 followed up to find out if P21 was lonely right now, P21 admitted to being lonely over the holidays even though P21 didn't feel lonely at the time. Currently, P21 does not converse with anyone in the flat. However, if P21 can move to a care home, P21 may be eligible for entitlement according to DN02 (Activity: Social interaction; Sub-activity: Housing



conversation).

By looking at the ontology, a broader understanding of the visit can be shown. P21 said that P21 no longer want to continue with everything, this is mainly due to moving house which shows the symptoms of emptiness and DN02 observed a loss of meaning. DN02 discussed with P21 why P21 was feeling this way. Later, DN02 asked if P21 was feeling lonely, but P21 said that P21 was now not feeling lonely but P21 felt lonely during the holidays. Currently, P21 does not converse with anyone in the flat. However, if P21 can move to a care home, P21 may be eligible for entitlement according to DN02.

**P22** The audio clip that combines DN02 with P22 effectively conveys the patient's sense of isolation. P22 can be heard sobbing at the beginning of the audio recording; this information was heard via the audio but not visible in the transcript. P22 reveals that P22 was angered by a comment P22 saw on the TV, the next step was that DN02 asked what the reason was for sobbing. DN02 provided practical support by comforting P22 that the statement on the TV was untrue and redirecting the conversation to ask about visitors to P22. After this conversation, the subject of loneliness was no longer a topic, and DN02 continued the visit by getting ready to perform basic care activities (Activity: Putting on gloves; Activity: Compression stockings; Sub-activity: Putting on a compression stocking).

By looking at the ontology, a broader understanding of the visit can be shown. P22 started crying because of a statement on the TV and the loss of P22's husband. DN02 asked if P22 was lonely, which P22 confirmed because DN02 had already observed the death of the partner. DN02 said that the statement on the TV was not right and asked about people who visit P22, this treatment was offering practical support to P22.

**P24** P24 is aware that they need to do a lot of work on their own. P24 had mentioned spending the day by themselves before doing something because P24 felt everything was good the way it was. DN03 stated that they are available for P24 if a district nurse is required. In doing so, the district nurse provided a service in the form of helpful advice. The researcher observed this visit and reported that P24 lived alone and that there were photos of possibly P24's husband.

By looking at the ontology, a broader understanding of the visit can be shown. P24 knows that P24 has to do things by themselves, and DN02 said that the district nurses are available to help P24. This is a treatment for offering practical support for P24.

**P25** DN03 inquired with P25 about any updates from the hospital, with P25 learning about a potential sagging of P25's vertebrae, though the certainty of this information remained unclear (Activity: Social interaction; Sub-activity: Hospital conversation). While assisting P25 during the undressing process, DN03 asked about potential visitors, and P25 shared that P25's sister-in-law had visited, engaging in pleasant conversations, this is part of the 'falling back on people' metric of the loneliness scale (Activity: Social interaction; Sub-activity: Family conversation). Despite these interactions, P25 expressed that P25 did not feel lonely. Subsequently, DN03 explored

P25's plans for Christmas, and P25 mentioned being invited by her niece, indicating connections with closely related people. This question is part of the loneliness scale, namely if the patient is talking about closely related people. Furthermore, P25 shared the unfortunate passing of a friend, and both P25 and DN03 discussed their mutual acquaintance with the deceased. The conversation then transitioned to a review of medicines.

By looking at the ontology, a broader understanding of the visit can be shown. P25 said that P25's sister-in-law went to P25 and that they had very nice conversations, this is a 'falling back on people' symptom. DN03 later asked if P25 had plans for Christmas for meeting people, DN03 suggested the treatment of providing a meeting opportunity, and P25 said that P25 had already been asked for Christmas by P25's niece, this is the symptom called falling back on people. A friend of P25 died, and the symptom death of partner/friend applies here, which DN03 also knows, they both talked about how they knew that person. After this conversation, the medicines were reviewed, and DN03 applied a treatment called offering occupations and distraction.

**P26** During the initial phase of the visit, DN03 inquired about P26's sleep quality (Activity: Social interaction; Sub-activity: Sleep conversation). P26 reported satisfactory sleep but expressed a sense of powerlessness in managing daily tasks, aligning with the 'experience of emptiness' metric on the loneliness scale. P26 disclosed a medical complication involving a collapsed vertebra, for which there was no immediate remedy, necessitating a two-week stay in a rehabilitation centre. In discussing P26's mood, DN03 highlighted that the rehabilitation would encompass not only medication but also physiotherapy and exercise routines. P26 shared a recent conversation with P26's sister, emphasizing that P26's sister was the only one who truly understood the situation, indicative of 'falling back on people' on the loneliness scale. Recognizing the need for professional support due to P26's loss of meaning and purpose, DN03 suggested that P26 should discuss the situation with the doctor (Activity: Doctor referral). The loneliness scale was not applied in this visit. The doctor, responsible for arranging P26's rehabilitation placement, was not previously aware of the collapsed vertebra.

By looking at the ontology, a broader understanding of the visit can be shown. When DN03 inquired about P26's sleep during a visit, P26 said that P26 slept well but experienced a feeling of emptiness, which is a sign of loneliness. P26 reported needing a two-week rehabilitation stay due to a collapsed vertebra. DN03 provided practical assistance by talking about P26's treatment plan, which included exercises, physical therapy, and medicines. P26's perception was that only P26's sister knew P26 and this was an indication of P26's reliance on intimate bonds. DN03 recommended that P26 should talk to the doctor about P26's health, namely the collapsed vertebra, to get the right kind of medical attention.

#### 4.4.2 Reflecting on daily practice

For the BPMN Normative Model, the standardised/validated loneliness scale was not used but parts of the loneliness scale were mentioned in the discussion between the district nurse and the patient such as falling back on people, trusting people, experiencing emptiness, and talking about closely related people. Feelings of abandoning

were not found in the transcripts and observations.

The Ontology was used to identify the feelings into observations, and symptoms, assumptions, and add a treatment for those feelings. Some observations and symptoms were not identified in the transcripts. The observations of poverty, lack-of-self-confidence and a migrant background were not found in the transcripts and observations. Via the audio recording, it could be heard that P19 sounded like someone with a migrant background but could not be validated. The symptom "feeling abandoned" was not found in the transcripts and observational data. For the treatment, all treatments were applied by the district nurses. Overall, the ontology shows a lot in common with the real-world data of the case study.

#### 4.4.3 Loneliness outcomes

**Loneliness** When P15's skin was examined at a routine skin care appointment, P15 mentioned that P15 had recently attended a theatre performance and P15 was lucky that P15 went to the performance. In response, DN02 acknowledged P15's occasional feelings of loneliness and gave P15 credit for making the effort to participate in social activities like going to plays, highlighting the advantages of doing so. After that, DN02 changed the subject and asked P15 about the progress of the antidepressant medication, pointing out that P15 did not appear to be thinking very negatively, which was positive.

The visit of P15's involvement in self-care activities—all of which are crucial for maintaining friendships, producing cards, and having conversations with others was also discussed throughout the visit. It was also mentioned that P15's faith in other people had been negatively impacted by a recent unpleasant incident at the supermarket when they were categorized as an "old person". This story touches on the important topic of trusting others, making it especially pertinent in the context of the loneliness scale. The agreement with the BPMN Normative Model is visible in Figure 13 and the similarities with the ontology are visible in Figure 14.

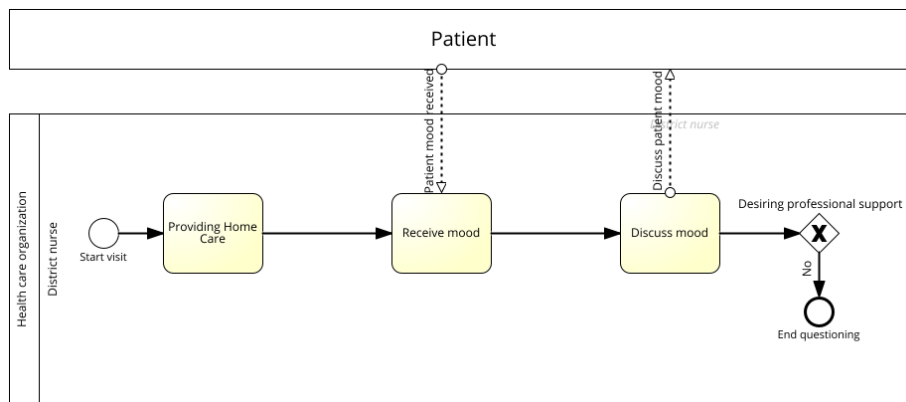


Figure 13: BPMN Normative Model adherence of P15.

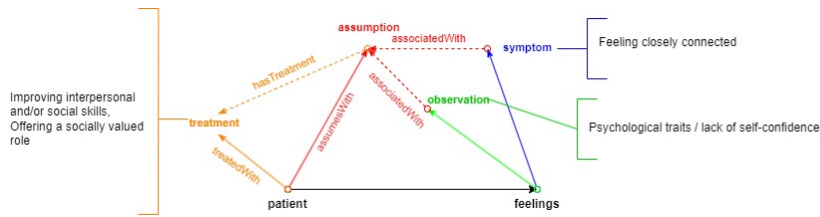


Figure 14: Ontology similarities of P15.

**Loneliness** Even if P21 does not feel lonely right now, the fact that P21 has in the past been lonely in the summer months raises intriguing concerns regarding the seasonality of loneliness. Examining the temporal dimensions of loneliness may shed light on the social or environmental elements that contribute to this feeling, opening the door to more focused interventions at particular seasons of the year. During this visit, there was no observation made by the researcher and therefore it is difficult to indicate that P21 lives alone. The district nurse saw that the P21 had a loss of meaning, which is part of the observation. The transcript did not involve any other person besides P01 and DN02 in the conversation. It is not certain whether P21 lives alone. Currently, P21 does not converse with anyone in the flat. However, if P21 can move to a care home, P21 may be eligible for entitlement according to DN02, which can be seen as a treatment. The agreement with the BPMN Normative Model is visible in Figure 15 and the similarities with the ontology are visible in Figure 16.

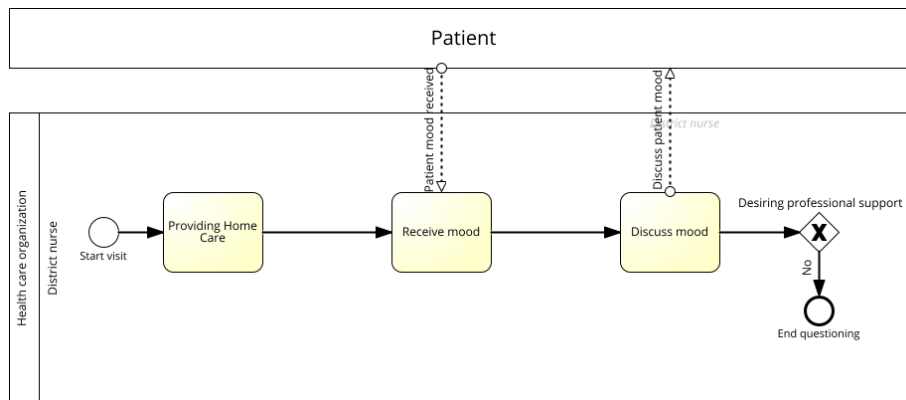


Figure 15: BPMN Normative Model adherence of P21.

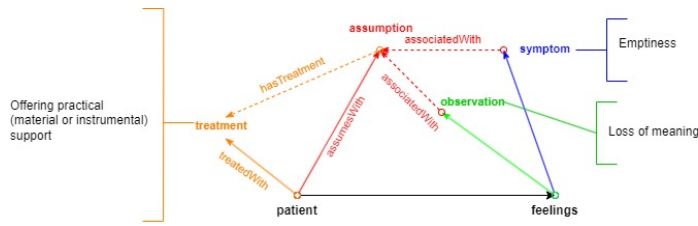


Figure 16: Ontology similarities of P21.

**Loneliness** There was one visit where loneliness was adopted. The loneliness that arises from this home care visit was found by P22’s visit. At the beginning of the recording, P22 can be heard sobbing. The emotional state was not included in the transcript. P22 discloses that P22 became distressed due to something P22 heard on television which made P22 feel empty. Understanding the psychological effects of this event, DN02 offers P22 both practical and emotional support. By inquiring about P22’s visitors and assuring that the statement on the TV was false, DN02 gently steers the conversation toward P22’s social interactions. This shift in focus indicates that DN02 is trying to lessen P22’s feelings of isolation by focusing on P22’s social support network and speaking about the granddaughter’s pregnancy which could be seen as offering a socially valued role. Following the meeting of P22’s immediate emotional needs, DN02 resumes routine care activities, indicating a return to the standard care protocol. This visit illustrates the multifaceted nature of loneliness in home care settings, where both physical and emotional support are provided. The transcript did not involve any other person besides P22 and DN02 in the conversation. It is not certain whether P22 lives alone. The agreement with the BPMN Normative Model is visible in Figure 17 and the similarities with the ontology are visible in Figure 18.

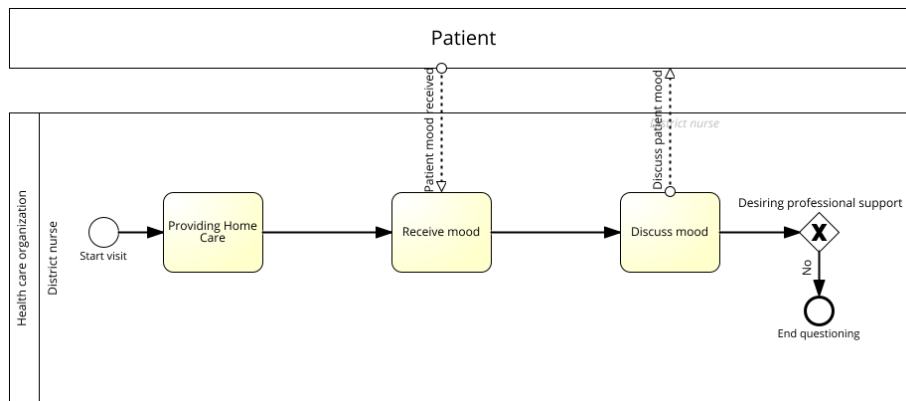


Figure 17: BPMN Normative Model adherence of P22.

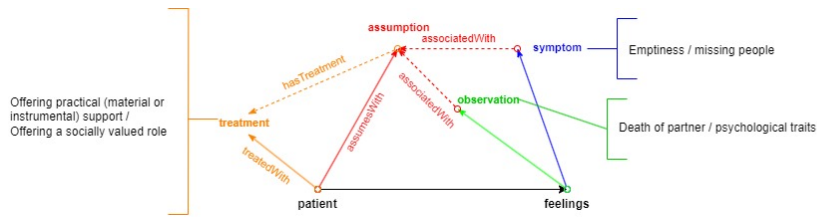


Figure 18: Ontology similarities of P22.

**Referral to other services** When DN03 saw how much P26 needed in terms of emotional and psychological support, DN03 saw a critical care gap. It became clear that P26 was experiencing a severe loss of meaning in life, which called for more than simply physical recovery. P26 recently shared a conversation with P26's sister, highlighting that P26 was the only one who knew how P26 was feeling. This is indicative of having 'fall back people' as a symptom. As a result, DN03 suggested that P26 should speak with the doctor to go over these difficulties in more detail. Remarkably, the doctor supervising P26's rehabilitation placement was oblivious to the whole scope of P26's disease, including the collapsed vertebra. This visit emphasizes the complexity of patient care as well as the varied responsibilities of district nurses. The transcript did not involve any other person besides P26 and DN03 in the conversation. It is not certain whether P26 lives alone based on this analysis. The agreement with the BPMN Normative Model is visible in Figure 19 and the similarities with the ontology are visible in Figure 20.

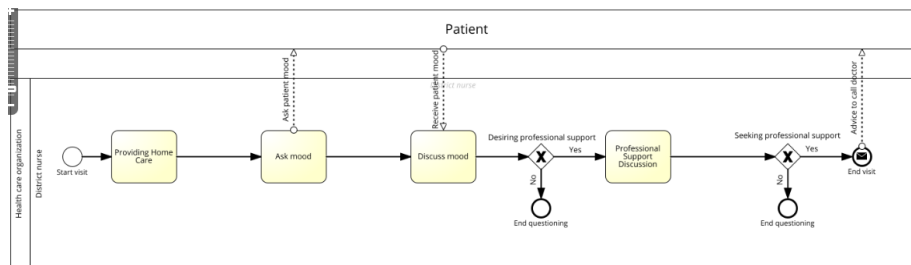


Figure 19: BPMN Normative Model adherence of P26.

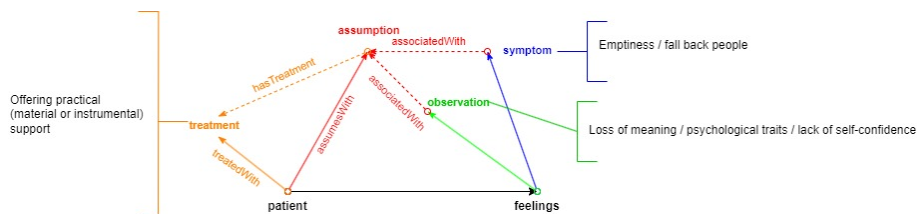


Figure 20: Ontology similarities of P26.

## 5 Discussion

With an emphasis on comprehending the variations in daily activities and adherence to quality standards in home care, this thesis sought to analyze audio recordings of district nurses' working days to investigate the activities of the district nurses. The research's conclusions provide insightful information about the intricate nature of district nursing, emphasizing the range of tasks involved as well as the difficulties in sustaining high standards of care.

**Loneliness** Other studies wrote about the use of the loneliness guideline by district nurses. The working group of V&VN, which were from different universities in the Netherlands, adhered strictly to the directives of the Healthcare Institute of the Netherlands' Advisory and Expert Group Committee on Quality Standards (AQUA). After going over bottlenecks, the working group came up with some baseline questions. The questions were first formulated by the researchers, who then carefully reviewed the scientific literature (van der Sande, de Leeuw, & Zilverentant, 2019). This research aims to contribute to the existing knowledge on the topic of loneliness. The findings suggest that loneliness is still considered a taboo subject, with only one patient openly admitting to feeling lonely. However, other patients shared experiences that had elements of loneliness but were reluctant to discuss them.

It's not always the case that living or being alone results in loneliness. Not all old persons who live alone experience loneliness, despite the possibility that it may. There is a difference between being alone and being lonely. Loneliness is the inevitable result of living alone (Van As, Imbimbo, Franceschi, Menesini, & Nocentini, 2022). Importantly, this current study should also address the fact that living alone does not always result in loneliness.

The paper of (van der Sande et al., 2019) wrote that there is not much literature about the interventions and suggests that the district nurse should interact with the patient if they appear lonely, even though there is little to no empirical evidence that psychological and/or social treatments help to reduce feelings of loneliness (van der Sande et al., 2019). This current study also underlines this train of thought because from the guideline it is necessary to ask how someone feels and how to anticipate if someone feels lonely.

**Sample size** This research has a relation with other research papers. The research of (Zolnoori et al., 2023) mentioned that they had a small sample size. A connection can be made, in this research, 27 audio recordings were made with sometimes the same patients. (Zolnoori et al., 2023) Mentioned also that their audio came only from one healthcare organization and that the generalizability is difficult. There is also a connection that can be made, in this research, only one healthcare organization from the Utrecht area was involved in the recording.

**Nurse washing hands** During the visits of this study, the hands of the district nurses were washed several times. This was at the beginning of the visit, but also after using body lotion and at the end of the visit. Boscart et al. (2008) wrote that it could be useful to use a wearable electronic hand wash device (Boscart et al., 2008).

**Complexity of District Nursing Tasks** The majority of health care interventions, for instance, are complex because they involve multiple elements that may interact to produce a variety of possible and unpredictable results (Veldhuizen et al., 2021). The analysis of this study uncovered a broad range of activities, including social engagement, medical care, and administrative work. This variety highlights the complex activities that district nurses must carry out in addition to providing health-care. The diversity of responsibilities challenges the conventional view of nursing as a profession primarily focused on providing direct medical care by demonstrating the flexibility and wide skill set needed in this discipline. Certain individuals may have extremely complicated wounds, which call for specialized knowledge that the organization does not have. The DNs' wound care might be better managed by clearly defining the various professional groups' areas of duty. There are specialists for these wound care groups, but they are only trained to do a specialisation in wound care.

**Culture** There was one patient who felt lonely (P22) in this research and did not have a migrant background, while there was one patient (P19) who sounded like someone with a migrant background, which could be heard via the audio recording. Other studies mentioned that patients from migrant backgrounds are generally thought to be less inclined than local patients to talk to their doctor or district nurse about psychosocial issues. Young and old migrants are hesitant to discuss psychological problems (Fokkema, Welschen, van Tilburg, & Thomese, 2016).

**Activities** A major doubt about the study's scalability and generalizability is raised by the fact that it only included 27 patients and 3 district nurses as its small sample. It is important to carefully consider the methodological approach to categorization as research involves more practitioners and, as a result, reveals a wider range of sub-activities. The challenge is knowing when to stop adding new sub-categories as more complex activities are found and when to start establishing a set of standard sub-categories that will work for a variety of activities.

**Expanding Sub-activities** An in-depth and targeted comprehension of the diverse range of activities district nurses perform is made possible by the addition of new sub-categories in response to fresh data. This method can offer a deep, situation-specific understanding that takes into account the particulars of every nurse-patient encounter. However, the main issue with adding new sub-categories constantly is the risk of overcomplication and fragmentation. The list may become unmanageable and less useful as it gets longer for training, analysis, and practice standardization.

**Standardized Sub-activities** Developing a standard set of sub-activities offers a more streamlined and manageable framework. This can facilitate easier analysis and comparison across different studies or settings. It also aids in creating standardized protocols and guidelines for district nursing. However, the risk with this approach is an oversimplification; it may not capture the full range of activities and nuances present in district nursing, potentially overlooking context-specific practices or unique patient needs.



**Inductive coding** For the majority of researchers, analyzing data in domains with little knowledge (e.g., a newly developed area of study or a fresh facet or dimension of interest in an already-existing field). There are no preconceived notions or theories regarding topics or codes needed for this kind of data analysis (Chandra, Shang, Chandra, & Shang, 2019).

The paper discusses the possibility of bias in inductive coding because of its interpretive character. Furthermore, depending just on audio recordings could leave out nonverbal clues and the context of the physical surroundings, both of which are important for comprehending interactions between patients and district nurses. Future research may include a thorough validation procedure for the categories that have been identified. To improve the robustness and dependability of the classification system, this means verifying these categories using a larger sample of transcripts or conducting expert reviews.

## 5.1 Limitations

This study is not without limitations. The focus on a single care organization may limit the generalizability of the findings. Future research could expand the scope to include multiple organizations and geographical locations. Additionally, longitudinal studies could provide deeper insights into how district nursing practices evolve. It's important to note that audio recordings may not capture all aspects of activities. For instance, while showering or getting dressed, not all steps may be verbalized. Another limitation is that the process maps were made as a DFG, which shows the activities after each other. By using other modelling approaches, the process could be viewed from different perspectives.

It should be noted that the audio recorder used during the study was carried only by the district nurse. However, there are multiple-channel audio recorders that can distinguish between multiple audio tracks for each participant in a conversation. These devices typically use numerous microphones that are utilized by various speakers, with each microphone sending its recorded voice to a separate channel (Zolnoori et al., 2022). The disadvantage of this is that the patient cannot wear the audio equipment when dressing and undressing and while showering.

## 5.2 Future research

This study is the start of an ongoing project of Care2Report. Another student of Utrecht University will analyse three process modelling approaches: Declare, BPMN-D, and Business Process Model Notation (BPMN) to find the model that best captures the procedures district nurses follow. The follow-up research will evaluate these models based on four main criteria. The ultimate objective of this research is to provide the groundwork for predictive process monitoring, which will enable healthcare settings to anticipate process flows and results.

With its insightful analysis and potential applications in the development of automated reporting systems customized to district nurse requirements, this study is especially relevant to Care2Report. In-depth report writing is Care2Report's speciality, and by incorporating a deeper understanding of the complex tasks and activities district nurses undertake during home visits, the study's findings could improve the functionality of their system. Reporting mechanisms within the Care2Report framework can be improved and customized as a result of the study's thorough examination of district nurses' daily routines, which were recorded and analyzed via audio recordings. By ensuring that the particular difficulties and subtleties of home care are precisely recorded and effectively conveyed through automated reporting tools, this cooperative integration may make reporting procedures more efficient.

Creating a flexible categorization framework with a core set of standard sub-categories and the ability to add context-specific sub-categories as needed is one possible strategy. This hybrid model would strike a compromise between the flexibility to adjust to a range of nursing activities and patient requirements and the requirement for a manageable and standardized system. Furthermore, by incorporating patients, district nurses, and healthcare administrators in the development process, these categories can be made to be both thorough and useful.

To make sure the categorization framework is reliable and effective, it would also be necessary to conduct empirical testing and validation of it using larger samples and in various settings. In summary, the choice to broaden or standardize sub-categories is not black-or-white and necessitates a thoughtful process that takes adaptability, comprehensiveness, and practicality into account. Using the NIC/NOC framework would be beneficial for uncovering the activities of the district nurses (Ramacciati, Giusti, et al., 2023).

## 6 Conclusion

Using audio recordings and process analysis, the study aimed to investigate the differences between the district nurses' everyday activities and the loneliness quality standard in home care. To address the main research question (MRQ), the study was divided into four sub-questions (SQs).

### **SQ1: How can we represent the key standards/protocols of the district nurses in a normative model?**

This sub-question outlined the main guidelines and procedures controlling district nursing practices by creating a BPMN Normative Model. There are different protocols and guidelines that district nurses should adhere to, such as the standard framework. The standard framework was published in 2014 and did not include the loneliness guideline. Based on the the loneliness guideline of V&VN, a BPMN Normative Model and Ontology were made which focused on two principles: identify loneliness, discuss loneliness and help (V&VN, 2021). The mood could be received from that patient or the district nurse could ask for the mood of the patient. After this, the mood can be discussed, and it can be discussed if there is a desire for professional support. If professional support is desired, this will be discussed and loneliness should be measured via the loneliness scale. After filling in the loneliness scale, professional support could be sought and an appointment could be made. The Ontology is an extra model to measure the patient's mood/feelings via observations, symptoms, and treatments. An assumption could be made by the district nurse for selecting the treatment.

### **SQ2: How can audio recordings be translated into process executions that can be checked against the normative model?**

The visits made by district nurses to their patients were recorded and then analyzed to create organized process executions. This conversion of real-world actions into data was necessary to compare them with the BPMN Normative Model. By examining the transcripts of the recordings, and the observational data, an event log could be made with categories, activities, and sub-activities. The process executions were created to provide an accurate and thorough description of the nurses' regular activities.

### **SQ3: How can the discovered process executions uncover how district nurses organize their patient visits?**

The discovery of process executions can help to make the complexities of district nursing practices more visible and understandable. These process executions, which were derived from detailed analysis and categorization of activities and sub-activities, effectively unveil the sequential flow and dynamics inherent in the daily routines of district nurses. Moreover, the visual representation of these process executions provides a valuable resource for training, quality improvement, and future research. This transparency facilitates targeted interventions, process optimization, and the refinement of normative models to better align with the realities of daily practice. It is necessary to understand that uncovering hidden activities can be challenging.

**SQ4: To what extent does the normative model reflect the daily practice of the district nurses?**

It becomes clear that the BPMN Normative Model reflects the actual process because the mood of the patient was asked or received and then a discussion started. When evaluating how closely it reflects the routine activities of district nurses. This model's integration of the loneliness scale, which includes elements like "emptiness" and "falling back on people," is crucial. These components are evident in many of the conversations that took place during the district nurse visits, which emphasizes their applicability in the context of nursing care. The loneliness scale itself, as a structured tool, was not explicitly used during the visits, even though some aspects of it were implicitly addressed through conversations and observations. District nurses often interact with patients in ways that address these aspects of loneliness, gaining knowledge through conversation and observation instead of using the loneliness scale as a formal assessment tool. The Ontology demonstrates a high degree of realism and applicability, as evidenced by its alignment with findings from the real-world case study. This ontology, encompassing a wide range of symptoms, observations, and treatments, mirrors the complexities and nuances of district nursing care observed in practice.

**MRQ: How can the use of audio recordings and analysis of district nurses' working days contribute to uncovering the differences between the daily tasks and quality standards in home care?**

The use of audio recordings to record district nurses' everyday activities helps to understand the subtleties of activities and quality standards in home care. Audio recordings catch the subtleties of conversations and activities as they happen in real-time, whereas traditional reporting techniques could miss some details. This method improves comprehension of the calibre of treatment by looking at things like following guidelines, communicating clearly, and providing individualized attention.

Moreover, these recordings allow for a detailed examination of differences in interventions that are impacted by nurses' experience and patients' requirements. It's crucial to remember that not all activities, like undressing, for example, could be seen in transcripts, or heard via the audio recording because those activities were not communicated during the visit. Notwithstanding this drawback, audio recordings and observations provide a thorough and distinctive viewpoint on the routine activities performed by district nurses. This improved comprehension is essential for comparing actual results to the guidelines, identifying areas that require development, and eventually raising the standard for home care services.

Although it provides some insights, the BPMN Normative Model showed which participant started about the mood and things that the patient is dealing with, followed up by a discussion. This is the most common path that took place during the visits. The BPMN Normative Model captures the nuances related to loneliness quality standards in home care while also acknowledging the diversity and complexity of everyday activities to uncover the differences between the daily tasks and quality standards in home care.

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## A Appendix - Permission

Figure 21 shows how the information folder was shared with the district nurse to ask for permission to join the research. The following list explains every step of the figure:

- (A) Before asking for permission from the district nurse, the project should be defined;
- (B) Inclusion and exclusion criteria should be made;
- (C) The district nurse information folder was sent to the district nurse and the district nurse could read the information folder;
- (D) The district nurse got one week to read and then to decide whether to participate;
- (E) The district nurse approves to participate;
- (F) The district nurse declined to participate;
- (G) The district nurse communicates his/her decision to the researcher;
- (H) The researcher writes down the answer of the district nurse

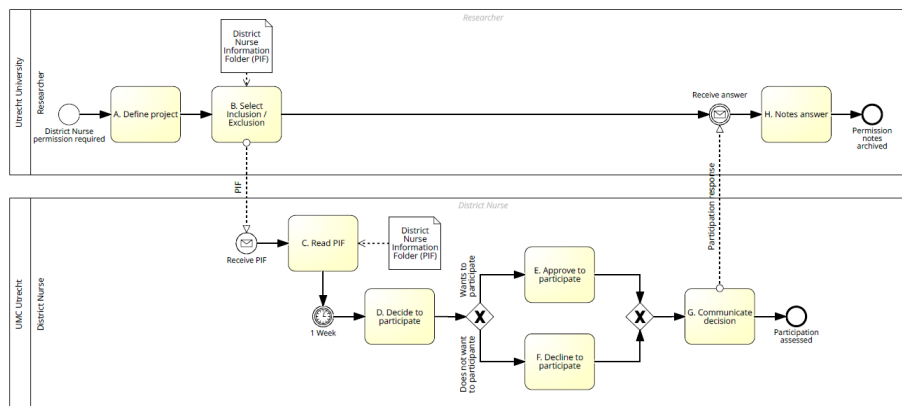


Figure 21: Information Folder for the district nurse.

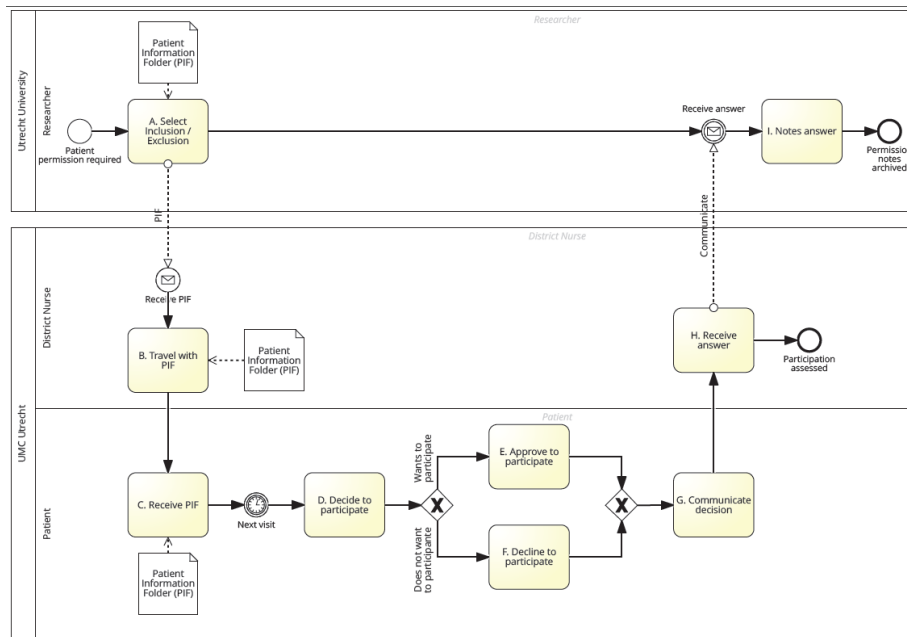


Figure 22: Patient Information Folder (PIF) for the Patient.

Figure 22, shows how permission of the patient is asked by the district nurse. The following steps show the flow of the Patient Information Folder (PIF) with the question for permission.

- (A) The researcher writes down the inclusion/exclusion criteria and sends the patient information folder to the district nurse;
- (B) The district nurse travels with the information folder;
- (C) The district nurse gives the information folder to the patient;
- (D) The patient can think about participating and at the next visit decide to participate;
- (E) The patient can approve to participate;
- (F) The patient can decline to participate;
- (G) The answer will be communicated to the district nurse;
- (H) The district nurse will communicate it to the researcher;
- (I) The researcher writes down the answer of the district nurse

The next step is to start with the recordings. In Figure 23, the flow of recording is made visible. On workday 1, the process starts with (step A) the arrival of the researcher. The researcher accompanies the district nurse to the patient's home at the predetermined time and place. The next step is that the researcher explains the audio recorder (step B). This ensures that the district nurse knows how the equipment works so that the district nurse can carry it out independently on other

working days. During the working day, the researcher observes the district nurses' processes (step C), and in parallel the audio starts (step D) and after the visit the audio recording stops (step E). Next to the stop recording step, the audio is stored on the audio recorder (step F). The audio recording(s) from the audio recorder will be stored by the researcher in a secure environment at the hospital (step G). After this, the researcher will convert the audio to a transcript via the Care2Report website and the audio recording(s) will be deleted at the hospital. The final transcript will be pseudonymized.

On workday 2 until 4, each district nurse will work individually without the researcher. The district nurse will first switch on the audio recorder and microphones (step H) and make sure everything is functional. Then the recording will be started (step D) and after completion of the home visit it will be stopped (step E). Next to the stop recording step, the audio is stored on the audio recorder (step F). Next, the researcher retrieves the microphones and audio recorder (step I), and the researcher will store the audio recording(s) from the audio recorder in a secure environment at the hospital (step G). After this, the researcher will convert the audio to a transcript via the Care2Report website and the audio recording(s) will be deleted at the hospital. The final transcript will be pseudonymized.

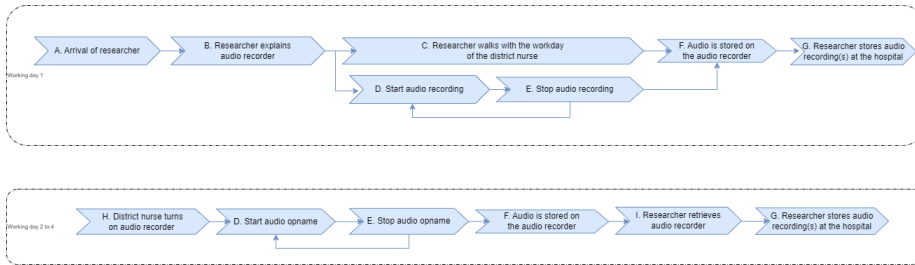


Figure 23: Process steps of the recording.

## B Appendix - Visit list

Table 3: Visits district nurse and patient

DN	Patient	Day	Start Time	End Time
DN01	P01	12/09/2023	08:48	09:22
DN01	P02	12/09/2023	09:35	09:43
DN01	P03	12/09/2023	09:55	10:07
DN01	P04	12/09/2023	10:34	10:55
DN02	P05	13/10/2023	08:41	09:33
DN02	P06	13/10/2023	09:35	10:09
DN02	P07	13/10/2023	10:15	10:58
DN02	P08	13/10/2023	11:27	12:15
DN01	P09	24/10/2023	08:23	08:52
DN01	P10	24/10/2023	09:03	09:35
DN01	P11	24/10/2023	09:44	09:54
DN01	P12	24/10/2023	10:05	10:24
DN01	P13	24/10/2023	10:40	10:55
DN02	P14	24/10/2023	21:46	22:01
DN02	P15	04/11/2023	08:49	09:06
DN02	P16	04/11/2023	10:11	10:38
DN02	P17	04/11/2023	10:47	11:23
DN02	P18	04/11/2023	11:35	12:06
DN02	P19	04/11/2023	12:17	12:30
DN02	P20	05/11/2023	08:33	09:16
DN02	P21	05/11/2023	09:19	09:33
DN02	P22	05/11/2023	09:44	10:06
DN02	P23	05/11/2023	10:39	11:21
DN03	P24	04/12/2023	08:28	09:10
DN03	P25	05/12/2023	08:33	09:38
DN03	P26	07/12/2023	08:05	09:04
DN03	P27	08/12/2023	08:30	09:04

## C Appendix - Observation data

Day	Time	Category	Activity	Sub-Activity	Medium	Participants	Initiated	Duration	District	Patient	Field notes
12.09.2023	08:48:00	General Nursing Care	Showering		In house	Independent	DN01	0:25:00	DN01	P01	P01 is living alone
12.09.2023	09:13:00	General Nursing Care	Plaster care	Placing plaster	In house	Independent	DN01	0:01:00	DN01	P01	
12.09.2023	09:14:00	Social Interaction	Social interaction	Pedicure conversation	In house	Independent	DN01	0:01:00	DN01	P01	
12.09.2023	09:14:00	General Nursing Care	Putting on compression stockings		In house	Independent	DN01	0:01:00	DN01	P01	
12.09.2023	09:15:00	Social Interaction	Social interaction	Bike conversation	In house	Independent	DN01	0:01:00	DN01	P01	P01 granddaughter called to tell great-grandchild born
12.09.2023	09:20:00	General Nursing Care	Dressing patient	Putting on trousers	In house	Independent	DN01	0:02:45	DN01	P01	
12.09.2023	09:20:00	Social Interaction insights	Social interaction	Family conversation	In house	Independent	P01	0:02:45	DN01	P01	P01 talking about grandchild
12.09.2023	09:21:30	General Nursing Care	Nurse washing hands		In house	Independent	DN01	00:00:20	DN01	P01	
12.09.2023	09:21:51	Social Interaction insights	Social interaction	Family conversation	In house	Independent	DN01	00:01:07	DN01	P01	

Figure 24: Observational data of patient 1.

Day	Time	Category	Activity	Sub-Activity	Medium	Participants	Initiated	Duration	District	Patient	Field notes
12.09.2023	09:35:00	Social Interaction insights	Social interaction	Weather conversation	In house	Independent	P02	0:01:00	DN01	P02	P02 is living alone
12.09.2023	09:36:00	Medication reviews	Review medicines	Intake with water	In house	Independent	P02	0:01:00	DN01	P02	
12.09.2023	09:37:00	Phlebotomy	Checking blood thinner	Take photo	In house	Independent	DN01	0:01:00	DN01	P02	DN01 checks smartphone
12.09.2023	09:38:00	Medication reviews	Review medicines	Medicines out of packaging	In house	Independent	P02	0:02:00	DN01	P02	
12.09.2023	09:38:09	Medical reviews	Review medicines	Putting medicines on saucer	In house	Independent	DN01	00:00:41	DN01	P02	
12.09.2023	09:40:00	General Nursing Care	Dressing patient	Putting on tights	In house	Independent	P02	0:01:00	DN01	P02	
12.09.2023	09:40:27	Social Interaction	Social interaction	Sleep conversation	In house	Independent	DN01	0:01:00	DN01	P02	Hairdresser rings the bell

Figure 25: Observational data of patient 2.

Day	Time	Category	Activity	Sub-Activity	Medium	Participants	Initiated	Duration	District	Patient	Field notes
12.09.2023	09:55:10	General Nursing Care	Nurse washing hands		In house	Independent	DN01	00:00:30	DN01	P03	P03 is living alone
12.09.2023	09:55:55	General Nursing Care	Putting on gloves		In house	Independent	DN01	00:00:39	DN01	P03	
12.09.2023	09:57:03	General Nursing Care	Showering		In house	Independent	DN01	00:05:14	DN01	P03	
12.09.2023	10:02:22	General Nursing Care	Dressing patient		In house	Independent	DN01	00:03:03	DN01	P03	
12.09.2023	10:06:20	General Nursing Care	Nurse washing hands		In house	Independent	DN01	00:00:25	DN01	P03	DN01 washed her hands
12.09.2023	10:06:41	Social Interaction insights	Social interaction	Weather conversation	In house	Independent	DN01	00:00:25	DN01	P03	

Figure 26: Observational data of patient 3.



Day	Time	Category	Activity	Sub-Activity	Medium	Participants	Initiated	Duration	District	Patient	Field notes
12.09.2023	10:34:25	General Nursing Care	Putting on gloves		In house	Independent	DN01	00:00:35	DN01	P04	P04 was not living alone
12.09.2023	10:35:35	General Nursing Care	Showering		In house	Independent	DN01	00:11:02	DN01	P04	
12.09.2023	10:53:06	General Nursing Care	Compressing stockings	Putting on compressing stockings	In house	Independent	DN01	00:00:51	DN01	P04	
12.09.2023	10:54:16	Social Interaction	Social interaction	Birthday conversation	In house	Independent	P04	00:00:56	DN01	P04	
12.09.2023	10:55:14	Social Interaction	Social interaction	Ask for a drink	In house	Independent	P04	00:00:10	DN01	P04	
12.09.2023	10:55:27	Insights	Social interaction	Guest arrival	In house	Independent	Guest	00:00:21	DN01	P04	A guest rings at the door

Figure 27: Observational data of patient 4.

Day	Time	Category	Activity	Sub-Activity	Medium	Participants	Initiated	Duration	District	Patient	Field notes
13.10.2023	08:41:10	Toilet care	Toilet care	Support in bathroom	In house	Independent	DN02	00:30:52	DN02	P05	P05 was not living alone
13.10.2023	08:49:45	Toilet care	Toilet care	Urine conversation	In house	Independent	DN02	00:04:41	DN02	P05	P05's wife called the doctor
13.10.2023	08:49:18	Phlebomoty	Blood sugar testing		In house	Independent	DN02	00:02:29	DN02	P05	
13.10.2023	09:06:25	General Nursing Care	Compression stockings	Putting on compression stockings	In house	Independent	DN02	00:05:56	DN02	P05	
13.10.2023	09:12:22	Review medicines			In house	Independent	DN02	00:04:54	DN02	P05	
13.10.2023	09:21:10	Insights	Social interaction	Family conversation	In house	Independent	DN02	00:11:32	DN02	P05	P05 was recently dreaming a lot about his life and family

Figure 28: Observational data of patient 5.

Day	Time	Category	Activity	Sub-Activity	Medium	Participants	Initiated	Duration	District	Patient	Field notes
13.10.2023	09:35:22	Insights	Social interaction	Mental health conversation	In house	Independent	DN02	00:02:00	DN02	P06	P06 is living alone
13.10.2023	09:38:27	General Nursing Care	Nurse washing hands		In house	Independent	DN02	00:00:23	DN02	P06	
13.10.2023	09:40:23	General Nursing Care	Showering		In house	Independent	DN02	00:08:57	DN02	P06	No notes could be made during the showering
13.10.2023	10:01:09	General Nursing Care	Nurse washing hands		In house	Independent	DN02	00:00:21	DN02	P06	DN02 washed her hands
13.10.2023	10:03:30	Medication reviews	Review medicines		In house	Independent	DN02	00:07:16	DN02	P06	P06 uses antidepressants
13.10.2023	10:03:55	Administrative duties	Writing report of visit		In house	Independent	DN02	00:06:51	DN02	P06	

Figure 29: Observational data of patient 6.

Day	Time	Category	Activity	Sub-Activity	Medium	Participants	Initiated	Duration	District	Patient	Field notes
13.10.2023	10:15:38	General Nursing Care	Nurse washing hands		In house	Independent	DN02	00:00:12	DN02	P07	DN02 washed her hands
13.10.2023	10:17:48	General Nursing Care	Showering		In house	Independent	DN02	00:23:10	DN02	P07	DN02 washed her hands after showering P07 spoke about his holidays
13.10.2023	10:40:58	General Nursing Care	Compression stockings	Putting on compression stockings	In house	Independent	DN02	00:01:31	DN02	P07	
13.10.2023	10:44:10	General Nursing Care	Dressing patient	Putting on socks and slippers	In house	Independent	DN02	00:01:00	DN02	P07	
13.10.2023	10:47:39	General Nursing Care	Eye dripping		In house	Independent	DN02	00:00:33	DN02	P07	
13.10.2023	10:48:03	General Nursing Care	Shaving face		In house	Independent	DN02	00:05:23	DN02	P07	Beard shaving
13.10.2023	10:53:46	General Nursing Care	Nurse washing hands		In house	Independent	DN02	00:00:29	DN02	P07	After hands washing, P07 spoke about actrose

Figure 30: Observational data of patient 7.

Day	Time	Category	Activity	Sub-Activity	Medium	Participants	Initiated	Duration	District	Patient	Field notes
13.10.2023	11:27:00	Social interaction	Social interaction	Care planning conversation	In house	Independent	P08	00:05:58	DN02	P08	P08 her husband is in the hospital
13.10.2023	11:32:58	General Nursing Care	Nurse washing hands		In house	Independent	DN02	00:00:22	DN02	P08	DN02 washed her hands.
13.10.2023	11:38:26	Skincare	Blemish spots	Checking blemish spots	In house	Independent	DN02	00:00:11	DN02	P08	
13.10.2023	11:41:47	Wound care	Apply gauze		In house	Independent	DN02	00:05:19	DN02	P08	
13.10.2023	11:44:04	General Nursing Care	Social interaction	Revalidation conversation	In house	Independent	P08	00:03:01			Revalidation of DN08 because she came out of the hospital
13.10.2023	12:05:15	Skincare	Bandage care	Leg bandaging	In house	Independent	P08	00:04:48	DN02	P08	
13.10.2023	11:47:06	Wound care	Rinsing the wound		In house	Independent	DN02	00:01:06	DN02	P08	
13.10.2023	12:11:17	Social interaction insights	Social interaction	Pyjama conversation	In house	Independent	P08	00:00:26	DN02	P08	
13.10.2023	12:11:44	Social interaction insights	Social interaction	Care planning conversation	In house	Independent	P08	00:03:48	DN02	P08	P08 wanted to know the planning of the work rounds of the district nurses

Figure 31: Observational data of patient 8.

Day	Time	Category	Activity	Sub-Activity	Medium	Participants	Initiated	Duration	District	Patient	Field notes
04.12.2023	08:44:00	General Nursing Care	Washing	In house	In house	Independent	DN03	00:12:14	DN03	P24	P23 heard the shower was on; P23 was living alone; The researcher was downstairs when the district nurse and patient were upstairs.
04.12.2023	09:06:57	Medical reviews	Review medicines	In house	In house	Independent	DN03	00:03:06	DN03	P24	There were pictures on the cabinet of husband of P23, unknown if husband was deceased or not. The blind is closed by the district nurse.

Figure 32: Observational data of patient 24.