UiT The Arctic University of Norway

Faculty of Health Sciences

Integrating Pharmacists in Emergency Departments:

Exploring Key Factors for Future Physician-Pharmacist Collaboration

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A dissertation for the degree of Philosophiae Doctor

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Scientific environment

The work of this dissertation has been conducted as part of the "Pharmacist in the Emergency Department" (PharmED) project group. The project group consists of members from the Hospital Pharmacy of North Norway (project manager), the University Hospital of North Norway, Nordland Hospital, and UiT the Arctic University of Norway. Additionally, throughout the PhD period I have been a part of the IPSUM (Identification and Prevention of SUboptimal use of Medications) research group at the Department of Pharmacy, at UiT the Arctic University of Norway.

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Abbreviations

ED – Emergency Department

PharmED – Pharmacist in the Emergency Department

WOMBAT – Work Observation Method By Activity Timing

UNN HF – University Hospital of North Norway Trust

NLSH HF – Nordland Hospital Trust

UiT – University of Tromsø

Terms and definitions

Adverse Drug Events

"*Harm caused by the use of a drug*." (1)

Adverse drug events include e.g., adverse drug reactions, overdoses, medication errors, allergic reactions (1, 2).

Adverse Drug Reactions

"*Harm directly caused by a drug at normal doses."* (1)

An adverse drug reaction is caused by the properties of a drug, and therefore is not preventable (3).

Clinical pharmacy

"C*linical pharmacy aims to optimize the utilization of medicines through practice and research in order to achieve person-centered and public health goals*" (4).

Interprofessional Collaboration

"*Interprofessional collaboration is a type of interprofessional work which involves different health and social care professions who regularly come together to solve problems or provide services*" (5).

Interprofessional Teamwork

"*Interprofessional teamwork is a type of work which involves different health and/or social professions who share a team identity and work closely together in an integrated and interdependent manner to solve problems and deliver services"* (5).

Medication Discrepancies

"*Inconsistencies between two or more medication lists*" (6).

Medication Errors

"Any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in control of the healthcare professional, patient, or consumer" (2, 7).

Medication Module

The hospital's electronic documentation of a patient's medication list and prescribing tool. There is an integration between the Prescription Intermediary and the medication module in the electronic health record, and electronic prescriptions may be imported during medication reconciliation.

Medication Reconciliation

"*The formal process in which healthcare professionals partner with patients to ensure accurate and complete medication information at transfer at interfaces of care*" (8).

Medication-Related Problems or Drug-Related Problems

"*An event or circumstance involving drug therapy that actually or potentially interferes with the desired health outcomes*" (2, 9).

Medication review

"A structured evaluation of patient's medicines with the aim of optimizing medicines use and improving health outcomes. This entails detecting drug-related problems and recommending interventions" (10).

Prescription Intermediary (in Norwegian: "Reseptformidleren")

Database containing all active electronic prescriptions. Prescriptions can be imported to the medication module. Only prescribers have access, paper prescriptions are not shown, and medication history is limited to 30 days.

Summary Care Record (in Norwegian: "Kjernejournalen")

Contains a selection of key health data and three years' overview of prescribed and dispensed medications. All healthcare professionals can access.

Transitions of care/care transitions

"The various points where a patient moves to, or returns from, a particular physical location or makes contact with a healthcare professional for the purpose of receiving healthcare" (11).

List of papers

Paper I (published):

Johnsgård T, Elenjord R, Lehnbom EC, Risør T, Zahl-Holmstad B, Vesela Holis R, et al. Emergency department physicians' experiences and perceptions with medication-related work tasks and the potential role of clinical pharmacists. International Journal of Qualitative Studies on Health and Well-being. 2023;18(1):2226941. (12)

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Paper III (manuscript submitted to PlosOne Feb 26th, 2024):

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Abstract

Background: There is a continuing focus on medication-related problems and their impact on patients and healthcare services. Patients are particularly vulnerable to medication-related problems, during transitions of care, such as from home to the emergency department (ED). Previous studies have shown discrepancies in over 80% of patients' medication lists upon hospital admission and that approximately 20% of hospital admissions are medication-related. This was the background for a research project called "Pharmacist in the Emergency Department" (PharmED). The intervention concerned introducing pharmacists to the interprofessional team in three EDs in North Norway to investigate how this would affect outcomes related to both patients and healthcare services. The success of the pharmacists' work is influenced by several factors, among which physician-pharmacist collaboration is crucial.

Aim: The aim of this dissertation is to investigate the key factors necessary for successful collaboration between physicians and pharmacists in EDs.

Methods: This dissertation is based on studies conducted in the three EDs. Two semi-structured interview studies explored physicians´ experiences and perceptions with medication-related work tasks and pharmacist collaboration, before and during the intervention. One study investigated how much time ED physicians actually spent on medication-related tasks before the intervention, applying a time-and-motion study design using the Work Observation Method By Activity Timing (WOMBAT) tool.

Results: The interviews before the intervention showed that of all medication-related tasks, physicians mainly focused on medication reconciliation, which they considered a time-consuming detective work. They also expressed a need for assistance from pharmacists. Results from the observation study, however, showed that physicians spend very little time on medication-related tasks in the ED (8.7%) and only allocated a mean of 2.2 minutes per hour to medication reconciliation. Both interview studies showed that physicians perceived that medication-related tasks could not always be prioritized in the fast-paced ED environment. After working with pharmacists, physicians expressed having experienced significant time savings and a feeling that ED pharmacists complemented the team. Despite many positive findings and a desire to continue the collaboration, both our interview studies identified some challenges for the interprofessional collaboration due to a lack of role description, role acceptance, and responsibilities.

Conclusion: Key factors for successful physician-pharmacist collaboration include clear role description, acceptance of roles, and delineated responsibilities. This may be enabled by strong leadership in addition to organizational, regulatory, and educational changes.

Norsk sammendrag

Bakgrunn: Det er et stort fokus på legemiddelrelaterte problemer og deres innvirkning på pasienter og helsetjenester. Pasienter er spesielt utsatt for legemiddelrelaterte problemer ved overganger mellom omsorgsnivåer, som fra hjemmet til akuttmottaket. Tidligere studier har vist uoverensstemmelser i over 80% av pasienters legemiddellister ved sykehusinnleggelse og at rundt 20% av sykehusinnleggelser er legemiddelrelaterte. Dette er bakgrunnen for forskningsprosjektet «Farmasøyt i akuttmottaket». Farmasøyter ble introdusert i det tverrprofesjonelle teamet ved tre akuttmottak i Helse Nord for å undersøke hvordan de kan påvirke utfall relatert til både pasienter og helsevesenet. Farmasøytenes arbeid påvirkes av flere faktorer, blant annet samarbeidet med legene.

Formål: Formålet med denne avhandlingen er å undersøke hvilke nøkkelfaktorer som er nødvendige for vellykket samarbeid mellom leger og farmasøyter i akuttmottak.

Metoder: Denne avhandlingen er basert på studier som er utført ved de tre involverte akuttmottakene. To semi-strukturerte intervjustudier utforsket legenes erfaringer og oppfatninger knyttet til legemiddelrelaterte oppgaver og samarbeid med farmasøyter, både før og under samarbeidet. En studie undersøkte hvor mye tid leger ved akuttmottakene faktisk brukte på legemiddelrelaterte oppgaver før introduksjon av farmasøyter, ved å utføre en tids- og bevegelsesstudie.

Resultater: Intervjuene før integrering av farmasøyter viste at av alle legemiddelrelaterte oppgaver, konsentrerte legene seg hovedsakelig om legemiddelsamstemming, som de anså som tidkrevende detektivarbeid. De ga også uttrykk for et behov for hjelp fra farmasøyter. Resultatene fra observasjonsstudiet viste imidlertid at leger bruker svært lite tid på legemiddelrelaterte oppgaver i akuttmottaket (8,7 %) og kun i gjennomsnitt 2,2 minutter per time til legemiddelsamstemming. Begge intervjustudiene viste at leger opplevede at legemiddelrelaterte oppgaver ikke alltid kunne prioriteres i det travle akuttmottaksmiljøet. Etter å ha jobbet med farmasøyter, uttrykte legene at de hadde opplevd betydelige tidsbesparelser og en følelse av at akuttmottaksfarmasøyter utfylte teamet. Til tross for mange positive funn og et ønske om å fortsette samarbeidet, identifiserte begge våre intervjustudier noen utfordringer med det tverprofesjonelle samarbeidet på grunn av mangel på rollebeskrivelse, rolleaksept og ansvarsområder.

Konklusjon: Vi har identifisert følgende nøkkelfaktorer for et vellykket samarbeid mellom leger og farmasøyter i akuttmottak: tydelig rollebeskrivelse, rolleaksept, og ansvarsområder. Dette kan muliggjøres ved tydelig ledelse, i tillegg til organisatoriske, regulatoriske, og utdanningsmessige endringer.

1 Introduction – leading up to the dissertation

Health and football, my two major interests in life. Now, you are probably wondering why I mention football in the introduction part of my PhD dissertation, but I promise that you will understand by the time you finish reading. My pharmacy journey started when my aunt gave me a job working extra hours as an untrained pharmacy technician in the community pharmacy she managed, after the placement program we had in the 9th grade of elementary school. This experience led to starting my pharmacy education in 2009 and finishing my Master of Pharmacy degree ten years ago. Subsequently, I started working as a pharmacist in a community pharmacy in Lofoten. There, I tried to use my knowledge to prevent medication errors reaching the patient, improve patients' understanding and knowledge of medications, and contribute with medication-related recommendations when needed. I was able to gain experience in different aspects of pharmacy while working there, including performing medication reviews in nursing homes and with general physicians and nurses for patients with home care services. After seeing and experiencing "both sides" of prescribing, I was left with a feeling of wanting to use my knowledge in a different way. I began to reflect upon how the knowledge pharmacists possess is undervalued within the healthcare services and I wanted to explore new ways of working.

After two years in the community pharmacy, the "taste" of clinical pharmacy made me want to seek new challenges working as a clinical/hospital pharmacist in Tromsø. This increased my interest in clinical pharmacy and in understanding how the healthcare services are connected. In addition to working as a clinical pharmacist at different hospital departments, I have over the years worked with developing an electronic medication chart, teaching of nurses, physicians, and paramedics, and with audits and revisions concerning medication management in hospitals. I have experienced medication-related problems and errors on different levels in healthcare, and it has made me aware of the many medication-related challenges we face. For example, a medication list compiled in the stressful environment of the emergency department often contains unconfirmed information that requires follow-up later. Somehow it becomes a "true" list when the patient is hospitalized despite uncorrected discrepancies. This could lead to a vicious circle and the introduction of new medication-related problems.

I have also witnessed how the continuous 'improvement of efficiency' pressure has increased the workload of healthcare professionals, especially nurses and physicians. I have friends and family working as physicians and nurses at different hospital departments, and over the years we have discussed challenges from multiple perspectives. There seems to be new work tasks and responsibilities around every corner, yet not enough resources. In addition, policymakers seem to be unaware of the knowledge and competencies pharmacists possess and how this can be utilized.

Altogether, this led me to starting this PhD-journey where I got the opportunity to explore medication-related challenges and integration of pharmacists in the emergency department (ED) seen from physicians' viewpoint. It has been challenging to be a pharmacist trying to view matters from physicians' perspectives. I recognize that the two professions are fundamentally different in many aspects, which in turn will shape how we produce knowledge. A fear of mine during these years has been being a pharmacist interpreting data from physicians. Will my discussions be something physicians recognize? At the same time, being a pharmacist trained in e.g., medication safety and quality assurance, I think it is valuable that I have investigated physicians' experiences with medication-related work. Adding my own experiences with physicians' experiences will explore perspectives concerning medication-related work from multiple sides.

2 Background

This dissertation is part of the "Pharmacist in the Emergency Department (PharmED)" project, where the overarching background for introducing pharmacists in the ED is the frequency of medication-related problems and the burden it places on both patients and the healthcare system (14). Consequently, this background section will start by providing an introduction of medication safety and medication-related problems both in general and in the ED (chapter 2.1). Next, to deepen understanding and context, an overview of the Norwegian healthcare system and its different levels of care is given (chapter 2.2). Furthermore, since the two "main characters" of this dissertation are pharmacists and physicians, these professions will be introduced (chapter 2.3 and 2.4), before presenting experiences from the interprofessional collaboration (chapter 2.5). Finally, an introduction of the PharmED project will be given, including where the three studies of this dissertation is positioned within the overarching PharmED project (chapter 2.6).

2.1 Medication safety

2.1.1 Terminology

Medication-related problems, often used interchangeably with drug-related problems, is an umbrella term which also includes adverse drug events, adverse drug reactions, and medication errors (2). A presentation of connections between the terms, whether they cause harm or not for the patent, and whether they are preventable or not can be viewed in **Figure 2.1**. The Norwegian classification of medication-related problems comprises six main categories and 12 subcategories and provides an understanding of what causes the problem (e.g., too high dose, inappropriate choice of medication or adverse drug reactions). The system includes both potential and actual medication-related problems due to the importance of identifying problems before they occur, and thereby preventing a possible negative outcome (15). However, there is a complex connection between the terms, and the classification system does not comprise all types of medication errors.

Both medication errors and adverse drug reactions can be included in the term adverse drug events, however, not all medication errors are adverse drug events. Medication errors are preventable and can occur in any of the medication use phases, e.g., from prescribing and ordering to dispensing and administration. Medication errors can be divided into two groups; those that are identified *before reaching* the patient (not leading to an adverse drug event) and those that *reach* the patient (leading to an adverse drug event). Consequently, medication errors occur more often than adverse drug events (1-3, 7, 16, 17).

A medication discrepancy is one type of medication error and is often defined as "*inconsistencies between two or more medication lists*" (6, 18). Examples of frequent types of

medication discrepancies are omission of medications, incorrect dose of medications, or commission (19-21). Medication discrepancies most often occur during transitions of care, meaning when patients move between different levels of care in the healthcare system (**Figure 2.3**) (22). Medication discrepancies impact almost every patient during care transitions according to the World Health Organization (11).

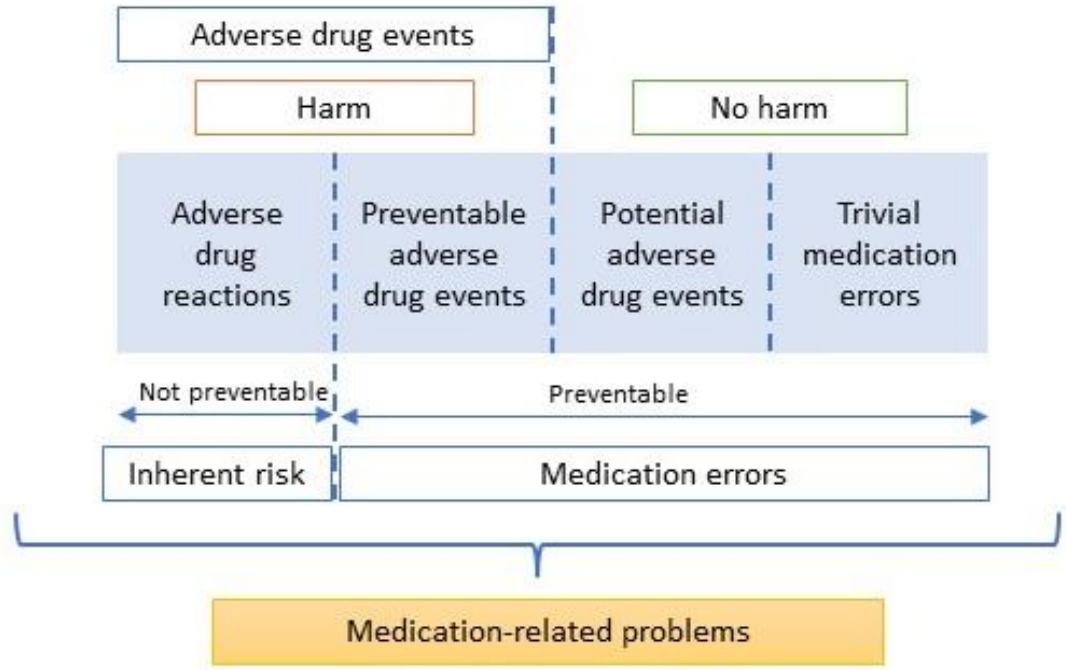


Figure 2.1 Relationships between different medication safety terminology. Reproduced and modified figure from the World Health Organization, where it was reproduced with permission from Otero (3, 8).

2.1.2 Medication-related problems

While medications are effective in preventing and treating symptoms and diseases, it is not without risk. Medication errors are a leading cause of injury and avoidable harm in healthcare systems across the world, with a global cost estimated at $42 billion USD annually (23, 24). The World Health Organization has highlighted polypharmacy, high-risk situations and transitions of care as key areas in the Patient Safety Challenge: Medication without harm (23, 24).

Medication-related problems are important causes for ED visits and hospitalizations, with up to 20% of ED visits estimated to be medication-related (25-31). Medication errors are identified in up to 60% of ED patients and occur most often in the prescribing and administration phase (32, 33). Medication discrepancies are detected in up to 80% of hospitalized patients in Norway and may lead to harm if unsolved (19, 20). The prevalence of medication-related readmissions also places a significant burden on the healthcare systems,

with rates of readmissions varying from 3% to 64% (34, 35). Hospital admissions due to adverse drug events seem to be increasing, in which a majority is estimated to be preventable (26). Medication groups most often involved comprise medications related to “the nervous system”, “the cardiovascular system”, and “the blood and blood-forming organs” (26, 36).

2.1.3 Medication reconciliation and medication review as action areas

Medication reconciliation is the process in which healthcare professionals ensure accurate and complete medication information at care transitions (11). It has for many years been proposed by the World Health Organization as an action area to reduce medication discrepancies during transitions of care (23). A meta-analysis showed that conducting medication reconciliation caused a 66% reduction the rate of medication discrepancies (37). However, discrepancies in medication histories continue to place a burden on healthcare systems (19, 20, 38). In Norway, physicians are often responsible for performing medication reconciliation as they have the overall medical responsibility, however, nurses and pharmacists can also be involved at some institutions (39).

A medication review is a structured evaluation of a patient’s medications with the aim of optimizing use and improving health outcomes (11). In addition to medication reconciliation, it is recommended by the World Health Organization to perform a medication review in order to achieve their goal of reducing severe, avoidable medication-related harm globally (11). A randomized controlled study from Sweden with pharmacists conducting medication reviews showed a 16% reduction in all visits to the hospital, and 47% reduction in visits to the ED (40). The World Health Organization also shed light utilizing different healthcare professionals’ skills mix, e.g., pharmacists, to ensure medication safety at transitions of care (11). The Norwegian Directory of Health recommends institutions to have procedures to describe allocation of responsibilities for performing medication reconciliation and medication review (39).

2.2 The Norwegian public healthcare system

After this introduction of medication safety and its challenges, we now turn to the Norwegian public healthcare system and its main actors and structure.

2.2.1 The different levels of healthcare

The public healthcare services in Norway are divided in primary and secondary care. Primary care is organized by the municipalities, and constitutes of e.g., nursing and social care/home care services, general practitioners, and municipal emergency clinics (41). All Norwegian citizens have the right to be assigned to a named general practitioner (in Norwegian: "fastlege") in their municipality to contact when needed. The general practitioner coordinates the patient's need for medical care and services and collaborates with other healthcare providers in both primary and secondary care. The general practitioner is contacted when patients need acute treatment during opening hours. All municipalities are obliged to have a 24/7 emergency care clinic that serves patients out-of-hours and also serves patients without a general practitioner (e.g., tourists or students) (41). Consequently, the EDs located in hospitals do not receive patients directly without any referral (see 2.2.2). The municipalities also manage home care services and nursing home facilities for patients that require extra help. Three out of four nursing home residents are on long-term stays, which is a service intended for the oldest and most care-dependent individuals (42). Social and home care services are services for everyone in need, regardless of their age and diagnosis. There is today a higher threshold than previously for obtaining a nursing home place, meaning that older individuals are more often referred to home care services. This increases the proportion of individuals that need a high level of assistance in home care services as well (42).

Secondary care includes hospitals that provide more specialized treatment (43). Public hospitals are owned by the Norwegian state, and are organized into four regional health authorities (**Figure 2.2**) (43, 44). The research of this dissertation has been conducted in the Northern Norway Regional Health Authority (further referred to using the Norwegian word "Helse Nord"). Norwegian public healthcare is primarily tax-funded, and have no or low co-payments (45, 46). Private healthcare supplements the public services (46).

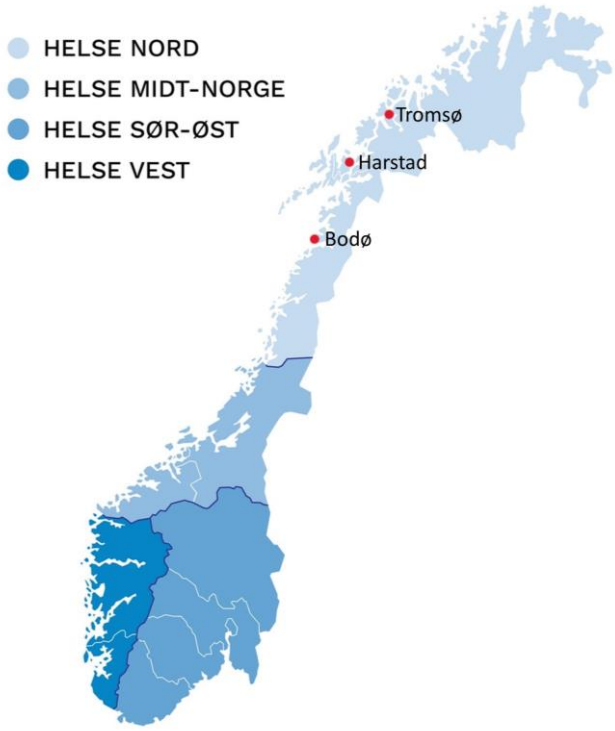


Figure 2.2 Modified map of the four regional health authorities in Norway (shown in various shades of blue) and the three locations within Helse Nord the research of this dissertation has been conducted. Original map from Helseforetaksreformen, by Hagen, Terje, 2023. https://snl.no/helseforetaksreformen. CC BY NC SA 3.0. (44)

2.2.2 Norwegian emergency departments

In Norway, general practitioners and municipal emergency clinics have a gatekeeper role over the hospital based EDs, which in turn have a gatekeeper role for further admission to the specialized hospital departments (47). Patients with acute conditions that require specialized care, arrive at Norwegian EDs through referral by their general practitioner, the municipal emergency clinic, or after elective appointments in the hospital's outpatient clinic. They may also be transported directly by emergency care services, e.g., an ambulance or an air ambulance helicopter (**Figure 2.3**). The EDs are staffed with secretaries, nursing assistants, nurses, junior and senior physicians, and sometimes emergency medicine specialists. Emergency medicine specialists are a relatively new (2017) specialty in Norway, therefore not yet working in all EDs (48). Other healthcare professionals, e.g., bioengineers, pharmacists, and radiographers, can also be a part of the interprofessional ED team, normally when summoned for specific patients.

Patients present to the EDs with a variety of symptoms, and the main tasks of the EDs are to assess the acuteness of the patient's symptoms, preliminary diagnosing, and treatment, and further determine adequate level of care, e.g., discharge, transfer, or hospitalization (49). In Norway, ED physicians are assigned the responsibility to perform medication reconciliation

and compile the medication list before admitting patients to a hospital department. There are few (approximately five to ten) Norwegian EDs offering clinical pharmacy services during weekdays, however, exact numbers are not available. Prior to this research project, none of the EDs located in Helse Nord had clinical pharmacists present in the EDs.

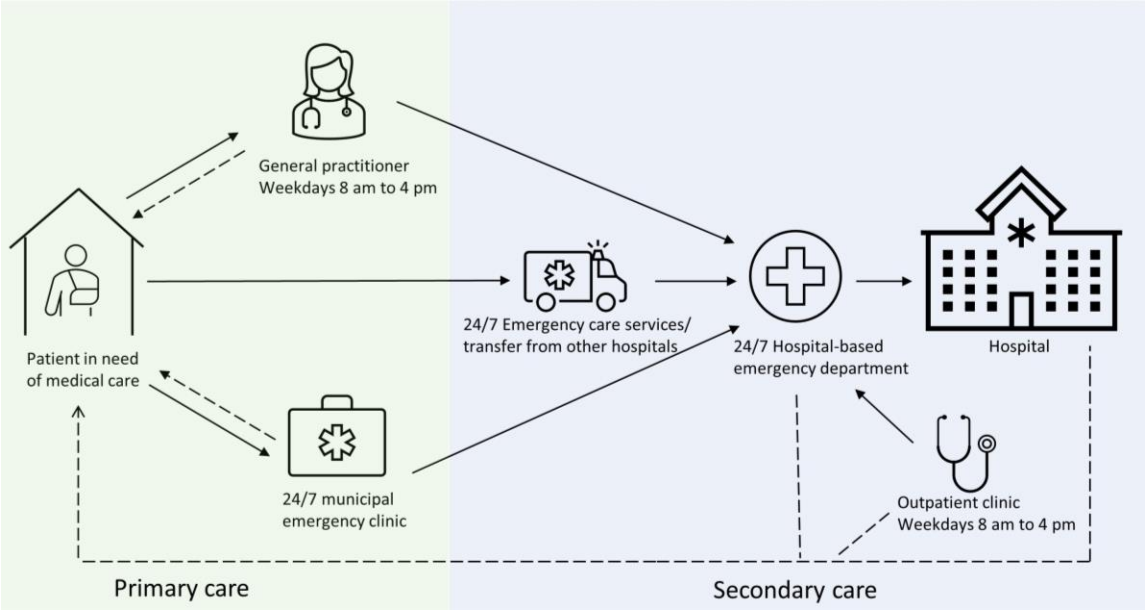


Figure 2.3 Pathways to the emergency department (independent of whether you live at home, in an institution, or in a care facility), and affiliations to primary or secondary care. Solid lines indicate ways to healthcare services, and dotted lines are ways back.

2.2.3 The pharmacist in the Norwegian healthcare system

The pharmacy profession in Norway is divided in two occupational titles: Bachelor of Pharmacy (in Norwegian titled "reseptarfarmasøyt") and Master of Pharmacy (in Norwegian titled "provisorfarmasøyt"). The length of the education differs, which is three years for the bachelor's degree and five years for the master's degree (50). Most of Norwegian pharmacists are employed in pharmacies. There are two main types of pharmacies in Norway: community pharmacies and hospital pharmacies, with 1011 and 34 pharmacies (per Jan. 2nd, 2024) respectively. Community pharmacies are affiliated with the primary care service and managed by private entities, and 90% of community pharmacies are members of a pharmacy chain. Hospital pharmacies are co-located with hospitals and are a part of the secondary care. Primary tasks for hospital pharmacies are to supply medications to the hospitals and dispense prescriptions to patients (51). In addition, most hospital pharmacies have a pharmaceutical production department and a clinical pharmacy service department. Norwegian pharmacists also work in e.g., the pharmaceutical industry, with research and teaching, and with clinical pharmacy services in municipalities (52).

2.3 Clinical pharmacy

2.3.1 Clinical pharmacy history and clinical pharmacist's tasks

Over the last 60 years, clinical pharmacists have been recognized as important members of interprofessional teams. The European Society of Clinical Pharmacy's core definition of clinical pharmacy is that "*clinical pharmacy aims to optimize the utilization of medicines through practice and research in order to achieve person-centered and public health goals*" (4). The further extension also comprises that "*pharmacists assume responsibility for achieving person-centered goals for individual patients as part of a multidisciplinary team*" (4).

Clinical pharmacy and pharmaceutical care development originated in the US in the early 1960s (53, 54). Since then, countries including the US, Canada, Australia, and UK have paved the way for the evolvement of pharmacists' roles in hospital and primary care settings (55-58). In contrast, the clinical pharmacist role did not start to expand until the late 1990s in Norway (59). There has been a great increase in full-time equivalents for clinical pharmacists in Norwegian hospitals over the last 15 years, yet there are still more hospital departments *without* a clinical pharmacist in the interprofessional team than *with*. There has also been increased focus on the role of clinical pharmacists in primary care in Norway over the last 10 years. In 2022, the Norwegian Directory of Health awarded the project "Pharmacists in home care services" with the improvement prize for their work with improving the quality of medication treatment for patients with home care services (60). However, clinical pharmacists are still only employed in around 10 municipalities in Norway (61).

Tasks for clinical pharmacists typically include medication reconciliation, medication review, medication therapy recommendations, assessing intravenous medication compatibility, and patient counseling (55). Integration of clinical pharmacists in interprofessional teams has been shown to reduce medication discrepancies and length of hospital stay, increase medication appropriateness and adherence, as well as identify and solve medication-related problems (62-65). Literature also show how pharmacist-led interventions can improve clinical outcomes including reducing $HbA1_C$ and blood pressure (66, 67), improve appropriate antibiotic prescribing (68, 69), achieve door-to-needle time under 45 minutes for thrombolytic treatment (70), and improve medication adherence and knowledge for patients with chronic diseases (71, 72). However, clinical pharmacists' impact on mortality, readmissions, quality of life, and costs have shown conflicting evidence (62-65, 73). It is challenging to interpret the findings given the heterogeneity of the interventions and healthcare settings included in these systematic reviews and meta-analyses.

2.3.2 The Emergency Department Pharmacist

The roles of clinical pharmacists working in EDs, hereafter referred to as ED pharmacists, are different across countries as the evolvement of the pharmacy profession has progressed with

various speeds. In the US, emergency medicine clinical pharmacists were first reported in the 1970s (74, 75), and today it is possible to become a Board-Certified Emergency Medicine Pharmacist (76). The ED pharmacist role in the US has expanded to include roles within resuscitation and medical emergency responses (77). Other roles for pharmacists include bedside activities, training and education, performance improvement, and scholarly activities, and **Table 2.1** provides examples of tasks as reported by Morgan et.al. (55).

In Norway, ED pharmacists' main task is to perform medication reconciliation. In addition, ED pharmacists review the medication list and contribute with counselling of patients and recommendations to healthcare professionals as appropriate. Compared to the US ED pharmacist's role (**Table 2.1**), the Norwegian pharmacist's role is quite limited. This can be explained by Norway not having a specific training program for ED pharmacists, as they have in the US (76).

A limitation for Norwegian clinical pharmacists is that they do not have prescribing rights, and therefore do not have access to the Prescription Intermediary (in Norwegian: "Reseptformidleren"), which contains the patients' active electronic prescriptions. Consequently, when pharmacists perform medication reconciliation, they are not able to independently complete the task. They must communicate their findings to the responsible physician, who according to procedures must update the required medication lists and electronic systems based on information they receive from clinical pharmacists.

2.3.3 Outcomes of emergency department pharmacist interventions

Clinical pharmacists working in interprofessional ED teams have been shown to improve the quality use of medications, with a reduction in medication errors and medication discrepancies, and improved appropriateness of antibiotic prescribing (69, 78-81). ED pharmacists also detect medication-related problems relevant to both the ED and hospital stay (82). However, there is conflicting evidence regarding ED pharmacist's effect on outcomes like rate of ED visits and readmissions, mortality, healthcare utilization and costs (79, 82-86). For example, the review by Mekonnen et al. found a substantial reduction in the rate of all-cause readmissions (86), while the review by Renaudin et al. did not show any significant reductions on the same outcome measure (85). Both studies showed no significant effect on all-cause mortality. More evidence is needed to support where clinical pharmacist resources most appropriately should be applied and which task to include to best affect outcomes. **Table 2.2** gives an overview of a purposely selection of systematic reviews, meta-analysis, and research articles reporting pharmacist interventions in EDs and transition of care settings. The table summarizes study design, intervention information, study setting, outcome measures, and results for the included studies.

Table 2.1 Examples of activities performed by emergency department pharmacists in the US as reported by Morgan et.al (55).

Activities	Examples
Bedside clinical activities	- Emergency department resuscitation team - Direct bedside care during high-risk medication use - Pharmacotherapy consultation (drug information, medication selection, medication dose based on patient specific factors, medication therapy monitoring) - Medication interaction analysis - Medication identification - Medication compatibility for admixing and administration - Error and adverse event reporting - Patient counseling and education - Toxicology recommendation - Targeted disease state counseling - Antimicrobial stewardship activities - Prospective medication order review and verification - Assistance with medication procurement/preparation - Medication administration - Vaccine administration - Emergency preparedness - Facilitation of medication histories - Oversight of pharmacy extenders (e.g., technicians, students)
Training and education	- Medication therapy updates and education on optimal medication therapy for emergency department team members - Conference and pharmacology rotations for emergency medicine physicians - Implementation and execution of post-graduate emergency medicine pharmacy residency programs - Participation in interdisciplinary simulation
Performance improvement	- Guideline/protocol/process development - Formulary management - Medication dispensing cabinet optimization - Optimization of medication procurement workflows - Medication safety initiatives - Participation in root cause analysis and failure mode and effects analysis - Assistance with adherence to regulatory and institutional medication use policies
Scholarly activities	- Interdisciplinary emergency medicine clinical research - Identification of patients for enrollment of investigational medication studies recruiting in the emergency department - Participation in interdisciplinary research committees that review emergency department related research protocols - Emergency medicine related research grant preparation - Emergency medicine medical resident research projects or quality improvement projects - Participation in articles, book chapters, case reports, or other collaborations with emergency medicine physicians

Table 2.2 Purposely selection of systematic reviews, meta-analysis and research articles showing results from studies of ED pharmacist interventions on clinical outcomes.

Author, year	Article type	Interventions studied	Number of studies, study design, setting	Outcomes	Results/conclusions
Atey et al., 2022 (78)	Systematic review and meta-analysis	ED pharmacist interventions on quality use of medicines	n = 31 studies Controlled pre/post interventional studies = 10 Cohort studies = 9 RCT = 3 Controlled concurrent studies = 3 Pre/post interventional studies without controls Controlled sequential studies = 2 Multicenter cross-sectional study = 1 EDs in hospital settings	Changes in rates or proportions of the primary medication-related outcomes such as adverse drug events, medication errors, appropriateness of prescribed medications and time to drug initiation	Evidence demonstrated improved quality of medicines when pharmacists were involved in ED care. Pharmacist interventions were associated with a reduction in number of medication errors per patient (error rate decrease of 0.33, 95% CI: -0.42, -0.23), p<0.001) and a decrease in the proportion of patients having at least one error (RR = 0.27, 95% CI: 0.19-0.40, p<0.001). Interventions were also associated with improved medication history taking and 58% increased medication appropriateness (RR = 1.58, 95% CI: 1.21-2.06, p<0.001).
Santolaya-Perrín et al., 2019 (83)	Research article	RCT with an interprofessional collaboration program between hospital pharmacists, emergency specialists and general physicians. The pharmacist reviewed patient's (> 65 years) chronic medications.	RCT 4 EDs in Spanish hospitals	Number of all-cause emergency visits and hospital admissions per patient-year. The rate was established at 3-, 6- and 12-months following enrolment.	The overall analysis showed no statistical difference in the rate of emergency visits and hospital admissions between the control and intervention group throughout the study (rate ratio at three months: 0.808, 95% CI: 0.617-1.059, six months: 0.888, 95% CI: 0.696-1.134, and 12 months: 0.954, 95% CI: 0.772-1.179). However, a significant reduction was observed in two EDs (site 3: 0.452, 95% CI: 0.222-0.923 and site 4: 0.567, 95% CI: 0.328-0.983) that achieved a higher general physician acceptance rate (site 3: 52% and site 4: 53%) of treatment recommendations.
Nymoen et al., 2022 (82)	Research article	RCT with a systematic medication review, including medication reconciliation, conducted by clinical pharmacists	RCT 1 ED in Norwegian hospital	Primary outcome measure was proportion of patients with an unplanned contact with hospital within 12 months after inclusion stay discharge.	The designed pharmacist intervention did not significantly reduce the proportion of patients with an unplanned contact with hospital compared with standard care (p=0.546, OR = 0.92, 95%CI: 0.69-1.21). However, 23.1% of the medication-related problems identified by pharmacists were found to be clinically relevant to identify during the ED visit, and 50.9% of the medication-related problems were found to be clinically relevant to identify during the hospital stay. 44.8% of

					pharmacists' recommendations were implemented by physicians.
Lipovec et al., 2019 (79)	Umbrella review (systematic reviews and meta-analysis)	Pharmacist- supported interventions at transitions of care, e.g., medication reconciliation, medication review and patient counselling.	n = 14 (Designs included: quasi-experimental, RCT, non-RCT, before-and-after, post-intervention, cohort, pre-post intervention, prospective study, controlled studies, cost-effective analysis, clinical trials) Hospital = 10 Hospital/Community = 3 Long-term care settings = 1	Outcome in the majority of cases was related to the safety of medication use (adverse drug events, number of medication discrepancies). Nine reviews related to harder outcomes such as mortality and hospital readmissions.	Pharmacist supported interventions improve medication safety at transitions of care (decrease in medication discrepancies and adverse drug events) but show no significant effect on mortality. Effects on healthcare utilization and costs were inconclusive.
Ceshi et al., 2021 (84)	Research article	Medication reconciliation (in patients aged 85 years or older and/or with more than 10 medications at admission) performed in three steps at hospital admission involving pharmacy assistant, clinical pharmacist, and attending physician.	RCT 2 hospitals in Switzerland	The primary outcome was the proportion of patients with an unplanned all-cause hospital visit. Secondary outcomes were assessed during the first inpatient stay and consisted of the period prevalence of adverse drug events occurring during the hospital stay, length of hospital stay, number of in-hospital deaths, and number of resources used during the stay.	No significant difference was found for unplanned all-cause hospital visits to the ED (occurred among 39.3% in the intervention group and 39.5% in the control group, P = 0.93). No effect was found for secondary healthcare outcomes. Period prevalence of adverse drug events was 1.3% in the intervention group and 1.7% in the control group (P = 0.49). Median length of stay was 8 days in both groups (P = 0.23). In-hospital deaths were 2.2% in the intervention group and 2.8% in the control group (P = 0.55). Median number of laboratory tests was 9.5 in the intervention group and 9.0 in the control group (P = 0.31).
Cheema et al., 2018 (80)	Systematic review and meta-analysis of RCT	Evaluating the effect of pharmacist-based medication reconciliation (in adults ≥ 18 years).	n = 18 RCTs in hospital settings (all care transitions within the hospital)	Four outcomes were assessed: 1) Medication discrepancies, 2) potential adverse drug events, 3) preventable adverse drug events, and 4) healthcare utilization.	Pharmacist-led interventions were effective in reducing medication discrepancies (RR = 0.58, 95% CI: 0.49-0.67). There was a non-significant reduction in favor of the intervention group for potential (RR = 0.90, 95% CI: 0.78-1.03) and preventable (RR = 0.73, 95% CI: 0.22-2.44) adverse drug events and healthcare utilization (RR = 0.78, 95% CI: 0.61-1.00).
Kooda et al., 2022 (69)	Systematic review and meta-analysis	Impact of pharmacist presence or pharmacist-led antimicrobial stewardship interventions on appropriate antibiotic	n = 24 (n = 22 for primary outcome assessment) ED settings Pre/post cohort=8 Retrospective cohort=16	Primary outcome was to determine appropriate prescribing of antibiotics in the ED. Secondary outcomes was time to culture review, time to appropriate antibiotics and time to patient contact.	Primary outcome showed increased appropriateness of antibiotic prescribing for adult patients presenting to EDs with a variety of infectious diseases (OR = 3.47, 95% CI: 2.39-5.03). Pharmacist interventions appear to be beneficial. Pharmacist presence was associated with shorter time to appropriate antibiotic initiation (mean difference 18.86

		prescribing in the emergency department.			hours, 95% CI: 11.87-25.85). There were no differences in time to culture review and patient contact.
Renaudin et al., 2016 (85)	Systematic review and meta-analysis	Impact of in-hospital pharmacist led medication reviews (pediatric and adult patients).	n = 19 RCTs in hospital settings	Primary outcomes were all-cause readmissions and/or ED visits. Secondary outcomes were all-cause readmissions, all-cause ED visits, medication-related readmissions, mortality, length of hospital stay, adherence and quality of life.	No significant reduction in the rate of all-cause readmissions and/or ED visits due to pharmacist-led medication review (RR = 0.97, 95% CI: 0.90-1.05, P = 0.44). However, it was associated with a decrease in the number of ED visits (RR = 0.70, 95% CI: 0.59-0.85, P = 0.0002) and medication-related readmissions (RR = 0.25, 95% CI: 0.14-0.45, P<0.0001).
Mekonnen et al., 2016 (86)	Systematic review and meta-analysis	Effect of pharmacist-led medication reconciliation programs during transitions. Intervention targets were ranging from pre-admission to post-discharge.	n = 17 Hospital transitions. RCT = 8 Quasi-experimental studies with control group = 3 Before-and-after studies = 6	Outcomes were healthcare utilization, mortality, and adverse drug event related hospital revisit.	Substantial reduction in in the rate of all-cause readmissions (RR = 0.81, 95% CI: 0.70-0.95), all-cause ED visits (RR = 0.72, 95% CI: 0.57-0.92), and adverse drug event related hospital revisits (RR = 0.33, 95% CI: 0.20-0.53). There was no difference between groups for the pooled data on mortality (RR = 1.05, 95% CI: 0.95-1.16) and composite readmission and/or ED visits (RR = 0.95, 95% CI: 0.90-1.00).
Choi et al., 2019 (81)	Systematic review and meta-analysis	Effect of pharmacy-led medication reconciliation in the emergency department.	n = 11 RCT = 3 Non-RCT = 8 ED setting.	Primary outcome was medication discrepancy. Other outcomes were duration of medication reconciliation, types of medication discrepancies, clinical severity of medication discrepancies, or potential adverse drug events.	The intervention significantly reduced (68%) the proportion of patients with at least one medication discrepancy in the ED (RR = 0.32, 95% CI: 0.19-0.53), and reduced (88%) number of medication discrepancies (RR = 0.12, 95% CI: 0.06-0.26). Duration of medication reconciliation ranged from five minutes to three hours. The most common medication discrepancies included medication omission, followed by incorrect/omitted dose or frequency of medications. Four studies measured clinical severity by using different tools, which showed moderate or significant impact of identified discrepancies, or reduction in error scores per patient. One RCT showed a significant reduction in potential adverse drug events classified in three groups depending on severity (1 = unlikely to cause clinical deterioration, 3 = severe deterioration). Class 3: RR = 0.56, 95% CI: 0.41-0.77, class 2: RR = 0.51, 95% CI: 0.39-0.65, and class 1: RR = 0.71, 95% CI: 0.56-0.90.

2.4 Emergency department physicians

2.4.1 Work tasks in emergency departments

Physicians in EDs have a wide range of work tasks as they, together with the rest of the ED team, are required to provide immediate care for patients and handle a variety of acute health issues. In a systematic review of time-and-motion studies by Abdulwahid et al., authors suggested a task list of work activities for emergency physicians (87). The main tasks performed in the ED concerned 1) direct patient care tasks, e.g., history and physical examination, procedures at bedside, communication with patients, and reviewing patient records, and 2) indirect patient care tasks, e.g., documentation on charts, computer use for ordering tests or medications, and communication with staff. Additionally, "teaching and supervision", and "personal and other" (e.g., searching for files or social interactions) were two other tasks categories the authors suggested. Tasks performed away from the ED concerned mainly administrative, educational and research activities, e.g., meetings or professional development (87).

The suggested task list does not specify tasks like medication reconciliation, medication history, or medication review, however, it is presumably embedded within the other categories. Nonetheless, given the frequency of medication-related problems in EDs, it is crucial to also examine the time allocated to medication-related tasks. ED physicians have a lot of responsibilities, and time management is essential in the ED to prioritize and coordinate care for patients in the most efficient way. Effective time management is beneficial for patient care, increased productivity and reducing stress (88, 89).

2.4.2 Time distribution of medication-related tasks in emergency departments

Literature is scarce when it comes to questions about how much time ED physicians spend on medication-related tasks. Because of this, and the high degree of heterogeneity between studies, it is challenging to summarize the few studies reporting on physicians' time distribution. In addition, structure, organization, and workflow varies between EDs in different settings.

Heaton et al. (USA) aimed to evaluate and compare how ED physicians spent their time on a shift with and without a scribe present. Perry et al. (USA) aimed to characterize the tasks of ED radiologists and ED physicians and quantify proportion of time spent on these tasks to assess their roles in patient evaluation. Füchtbauer et al. (Denmark) aimed to investigate how ED physicians spent their time during day shifts. Common for these studies is that they report the time spent on medication-related tasks as part of other task categories, e.g., "patient history" or "initial interview/examination", with approximately 10 minutes per hour spent on these categories, of which part of the time is presumably medication-related (90-92).

Chisholm et al. (Australia) aimed to compare activities of physicians practicing in academic and community EDs. Hollingsworth et al. (USA) aimed to determine how ED physicians and nurses spent their time. Mache et al. (Germany) aimed to determine the amount of time ED physicians spent on different daily activities, and their workload in terms of work hours, patient load, interruptions, and multitasking. Calder-Sprackman et al. (Canada) aimed to assess the impact of transition to Epic© on ED physicians work activities in a tertiary care ED. These studies report on medication-related tasks as a part of overarching indirect and direct patient care tasks, making it challenging to extract specifically how much time is spent conducting medication-related tasks (93-96). However, Mache et al. also reports specifically on spending approximately five minutes per hour on admission history, of which some of the time is presumably spent on medication history (95), and Hollingsworth et al., report spending approximately 11 minutes per hour on compiling medication charts (94).

A few studies report on medication-related tasks specifically. Nymoen et al. (Norway) aimed to quantify how ED physicians distribute their time between various task categories, with a particular focus on medication-related tasks. Westbrook et al. (Australia) aimed to measure the association between ED physicians' rates of interruption and task completion times and rates. Wise et al. (Australia) aimed to define the concept of workforce flexibility by investigating the distribution of tasks and the social relationship between clinicians. Kee et al. (Australia) aimed to quantify proportion of time ED physicians spent on different predefined tasks. These studies report on medication-related tasks as independent categories, where time distribution ranged from around 0.3 minutes per hour to 11.9 minutes per hour in total. However, definitions of the medication-related categories vary, thus other medication-related tasks could be embedded within the other task categories the studies reported on (97-100).

Outcomes and methods used vary in these studies, consequently it is challenging to accurately describe the time ED physicians use on different medication-related tasks. Only one of the identified studies' overall aim were to focus on the time ED physicians spent on medication-related tasks specifically (97). Nymoen et al. conducted a study in a Norwegian ED setting and found that physicians spent 17.8% of the total time on medication-related tasks. They had three medication-related categories: 1) professional communication, 2) gather information, and 3) documentation, of which ED physicians spent 5.5, 6.5 and 6.1 out of 91.4 hours on respectively. On obtaining and documenting a patient's medication list (medication reconciliation) they found that ED physicians spent a mean of 7.8 minutes per hour. It is noteworthy that Nymoen et al. performed their study in a period with clinical pharmacists working 20 hours per week in the ED (97). We need more homogenous studies to investigate how ED physicians spend their time, inclusive of time spent on medication-related tasks specifically, to report and conclude on this more precisely. This will further help to evaluate and guide decision-making regarding physicians' time-management in EDs.

2.5 Interprofessional collaboration

Having introduced medication safety challenges, the Norwegian healthcare system, and work tasks for pharmacists and physicians in the previous sections, we will now examine experiences with interprofessional collaboration between the two health professions.

2.5.1 Why interprofessional collaboration and teamwork?

An important part of effective healthcare systems is teamwork. The Canadian Health Services Research Foundation states that it can "*improve the quality of patient care, enhance patient safety, and reduce workload issues that cause burnout among healthcare professionals*" (101). There are many key features of well-functioning interprofessional collaboration and teamwork. Clear roles and knowing which responsibilities and competencies that role bring to the team, including knowing the other team members' roles and which personal nuances they bring to the team are important (5). Other features include having clear goals and responsibilities, viewing accountability as a collective responsibility, good communication, shared team identity, interdependence between team members, active participation, recognizing benefits, and having a good climate of trust (5, 101, 102). It is important to be aware of knowledge, competencies, and attitudes needed for teamwork, interpersonal factors, and change management when integrating interprofessional teams in new practices. Additionally, having a strategy for team development that emphasizes building capacity within the organization and in the work environment is essential (101).

2.5.2 Interprofessional collaboration with pharmacists

How healthcare professionals in the interprofessional team experience and perceive collaboration with pharmacists has been investigated in several studies. Despite a high degree of heterogeneity when it comes to for instance setting and participants, many studies present common factors describing this interprofessional collaboration. An extraction and interpretation of the common barriers and enablers identified in the studies, including examples, are given below and an overview of the purposely selection of studies is shown in **Table 2.3**.

Resource allocation for pharmacist services is mentioned as a barrier in many studies, and may include funding, government support, and pharmacist availability, and concerns how resources, including financial support and other forms of backing from various entities are distributed and made available (58, 103-107). One example is from Chong and Yap et al. (Singapore), who investigated general physicians' perceptions of community pharmacists' current roles and attitudes towards interprofessional collaboration. They found that *"Respondents recognized the need for government backing and additional funding as perhaps the most important factor needed to facilitate adoption of any community-pharmacist led services for primary care patients."* (105). Another example is from Lindquist et al. (Sweden),

who explored the working relationships of physicians, nurses and ward-based pharmacists, and found that funding was noted as a barrier, with a nurse saying: "*If it's taken by the nurses' budget it's a direct no*" (103).

Another barrier is related to **operational challenges,** which is related to logistics, lack of space, routines, organization, practice structures and access to patient records. It captures the various practical and systematic difficulties that can affect functioning in a healthcare setting (56, 58, 103-110). Pottie et al. (Canada) investigated family physicians' perspectives on collaborative practice 12 months after integration of pharmacists, and found that "*A key challenge for physicians was adjusting their daily routines to include using a pharmacist*." (108). Lee et al. (Australia), who investigated non-pharmacist health professionals' views on hospital pharmacists' roles, also found that operational challenges was perceived to affect interprofessional collaboration and workflow efficiency (104). A physician example was that comprehensive pharmacist activities might be unnecessary in some units, and the researchers identified a need for tailored scope aligned with clinical units.

The **governance** barrier encapsules how the concepts of for example role clarity, responsibility, legal and professional boundaries could be a barrier in the interprofessional collaboration and it was found to be mentioned in most studies (56, 58, 103-105, 107, 109-111). Faruquee et al. (Canada) explored family physicians' perceptions and experiences of pharmacists' prescribing practice and found that *"Participants believed that they were ultimately responsible for care as well as the main prescriber for their patients. Other healthcare providers were perceived to help them to ensure optimum care."* (110). Another example is physicians having initial concerns about "*being told what to do*", which was found in the previously mentioned study by Lindquist et al. (103).

Social dynamics as a barrier encompasses the underlying social forces, such as cultural norms, attitudes, and interpersonal familiarity, which influence the behavior and interactions between participants and groups (58, 103, 110-112). One example of the social dynamics barrier in the study by Safitrih et al. (Indonesia), who explored physicians and nurses' perceptions and expectations of the pharmacist role in emergency units, was *"One participant revealed that there was a communication hierarchy which made the pharmacist's advice difficult to accept."* (111). Another example is from the previously mentioned study by Faruquee et al., where "*All participants were hesitant to trust pharmacists with whom they were unfamiliar*" (110).

The final barrier identified in the studies is the **awareness gap,** which indicates a shortfall in understanding or recognition of the roles, contributions, and qualifications of pharmacists within the healthcare setting (58, 103-105, 109). Makowsky et al. (Canada) explored nurses, pharmacists, and physicians' experiences of integrating pharmacists in a healthcare team, and

they stated that *"Team members reported increased awareness of the clinical role of the pharmacist"* and a physician in their study said *"I think that we all learned that we owe so much more respect than perhaps we previously had to pharmacists, the role they played and the knowledge they had."* (109).

The studies of healthcare professionals' experiences and perceptions with pharmacists did not only find barriers, but also a wide range of enablers and benefits, and the first is **collaborative synergy.** This term includes the positive and productive energy generated when healthcare professionals come together, support one another, and form strong relationships to achieve common goals, enabled by closeness and clear communication. Building relationships over time fosters the collaborative synergy (56, 58, 103, 106-110, 112). An example of this can be found in Chen et al.'s study (Taiwan), who evaluated the effects of integrated medication management on non-pharmacist healthcare professional's intentions to collaborate with pharmacists. They found that *"This integration also played a crucial role in strengthening the interpersonal relationships between pharmacists and non-pharmacist healthcare professionals, further fostering a culture of interprofessional collaboration."* (112). Another example from the previously mentioned study by Pottie et al. was "*How the pharmacist was able to affirm a physician's direction in patient care by helping to present a united front*" (108).

Another enabler is **innovative learning**, which captures the idea of adopting new viewpoints and knowledge to enhance practice, resulting in increased patient safety and quality in patient care (56, 103-109, 111, 112). For example, in the study by Lindquist et al., *"Most participants mentioned that pharmacists had something to add for physicians and nurses as well as patients. One physician noted: you continuously receive education through their comments on the rounds."* (103). Another example given in the study by Birt et al., is that general practitioners explained that it was helpful to have "*another pair of eyes*" to increase patient safety (56).

The **collaborative efficiency** enabler reflects healthcare professionals' experiences about the benefits of working with pharmacists, such as gaining more resources, being time efficient, and reducing workload and stress. Multiple studies stated that collaborating with pharmacists streamlines the processes and contributes to a more effective and less burdensome work environment (56, 104, 106-108, 110). Elliot et al. (USA), whose purpose was to examine non-pharmacist healthcare providers' perceptions of how pharmacists impact the work environment in ambulatory care settings, found it had a positive impact stating *"The clinical pharmacist being present in the clinic made a significant difference and improved the workflow within the clinic"* and that *"working with clinical pharmacists had a positive impact on their workload"* (106). Another example is from Pottie et al.'s study, who found that a benefit of integrating pharmacists in to family practice teams included freeing up resources (108).

Pharmacist competence was also seen as an enabler, and after working with pharmacists, healthcare professionals described them as proactive, adaptable, knowledgeable, and having clinical and communication skills. The term reflects a combination of personal attributes and professional abilities that pharmacists bring to their role in the team (56, 58, 103, 104, 107, 110). In the study by Lee et al., "*Hospital pharmacists were seen as pivotal in optimizing clinical decisions, leading to improved outcomes and enhanced patient experiences/satisfaction"* (104). Another example can be found in the systematic review by Sudeshika et al., who aimed to synthesize the literature related to pharmacists working in general practice in Australia. Stakeholders emphasized "*Pharmacists' characteristics including proactivity, good communication skills, clinical competency, credibility and adaptability*" as enablers for inclusion of pharmacists into general practices (58).

Another enabler is **role clarity,** which signifies the importance of having well-defined and understood professional boundaries and responsibilities, which is key to effective collaboration (58, 104, 108, 109). For example, Birt et al., stated that *"In summary, general practitioners and pharmacist with independent prescribing rights made clear what expertise an independent prescribing pharmacist could bring to the multidisciplinary team and saw a continuing place for pharmacists in care homes."* (56). An example of the opposite was found in the study by Makowsky et al., who reported that "*When roles were not well defined, teamwork was challenged*" (109).

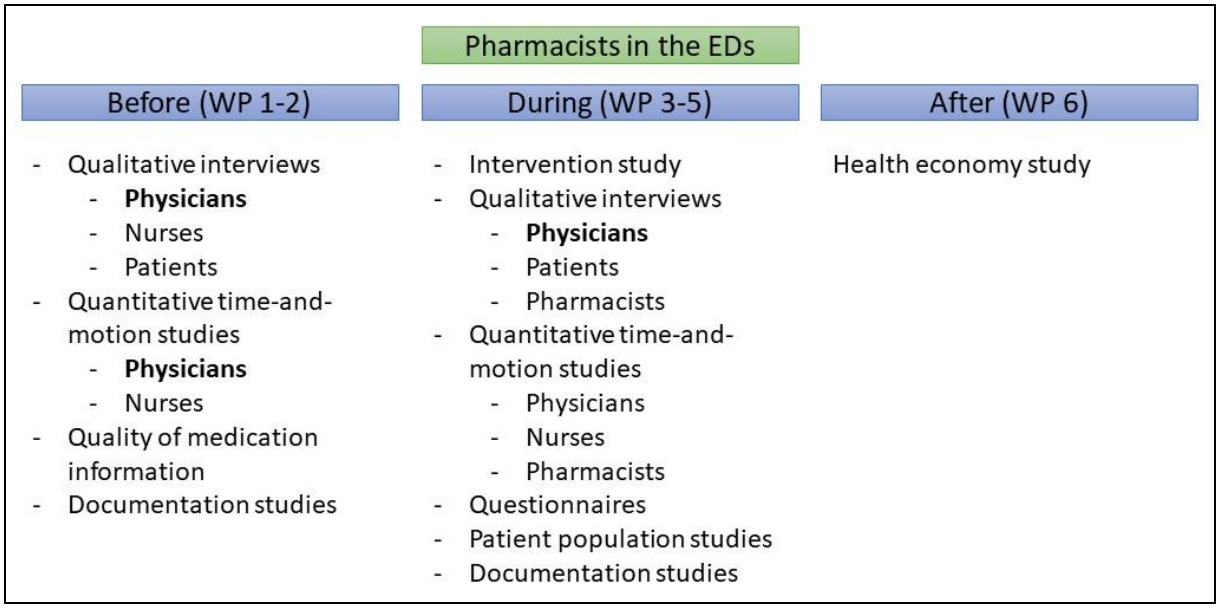
The final enabler identified in the selection of studies is **trust,** and multiple studies show how healthcare professionals trust pharmacists, and it becomes especially evident after working together for some time (56, 103, 107-110, 112). Snoswell et al. (Australia) investigated both pharmacists' and other healthcare professionals' perspectives of the impact of pharmacists working within interprofessional teams in outpatient clinics. They found that *"Interviewees believed that interprofessional collaboration fostered trust and allowed each discipline to focus on their own area of expertise"* (107). Another example is found in the previously mentioned study by Makowsky et al., who reported that "*Development of mutual respect and trust between practitioners was seen as another essential component contributing to success*" (109).

Table 2.3 Healthcare professionals' experiences and perceptions regarding the interprofessional collaboration with pharmacists. Grey areas show which studies included the specific barriers and enablers.

			Barriers					Enablers					
Author, year, type	**Setting, country**	**Participants**	**Resource allocation**	**Operational challenges**	**Governance**	**Social dynamics**	**Awareness gap**	**Collaborative synergy**	**Innovative learning**	**Collaborative efficiency**	**Pharmacist competence**	**Trust**	**Role clarity**
Sudeshika et al., 2021, systematic review (58)	General practice, Australia	General practitioners, pharmacists, patients, nurses, practice managers	■	■	■	■	■	■			■		■
Pottie et al., 2008, research article (108)	Family practice, Canada	Physicians		■				■	■	■		■	■
Chen et al., 2024, research article (112)	Hospital ward, Taiwan	Physicians, nurse practitioners, registered nurses				■		■	■			■	
Lindquist et al., 2019, research article (103)	Hospital ward, Sweden	Physicians, nurses, pharmacists	■	■	■	■	■	■	■		■	■	
Makowsky et al., 2009, research article (109)	Hospital ward, Canada	Physicians, nurses, and pharmacists		■	■		■	■	■			■	■
Birt et al., 2023, research article (56)	Care homes, United Kingdom	General practitioners, pharmacist with independent prescribing rights, care home staff		■	■			■	■	■	■	■	■
Lee et al., 2024, research article (104)	Hospital ward, Australia	Physicians, nurses, other allied health professionals	■	■	■		■		■	■	■		■
Faruquee et al., 2020, research article (110)	Primary care network, community clinic/ hospital, nursing home, mental hospital, Canada	Physicians		■	■	■		■		■	■	■	
Safitrih et al., 2019, research article (111)	Emergency unit, Indonesia	Physicians, nurses			■	■			■				
Chong and Yap et al., 2023, research article (105)	Primary care, Singapore	General practitioners	■	■	■		■		■				
Elliot et al., 2023, descriptive report (106)	Ambulatory care clinics, USA	Physicians, advanced practice providers	■					■	■	■			
Snoswell et al., 2022, research article (107)	Outpatient clinic, Australia	Pharmacists, physicians, nurses	■	■	■			■	■	■	■	■	

2.6 Pharmacist in the Emergency Department project

The PharmED project is a regional collaboration project between the Hospital Pharmacy of North Norway Trust, Nordland Hospital (NLSH), the University Hospital of North Norway (UNN) in Tromsø and Harstad, and the University of Tromsø, the Arctic University of Norway (UiT). The aim of the project is to introduce ED pharmacists in three EDs in Helse Nord and investigate its impact on various outcomes. The study hypothesis is that the pharmacist contribution will be beneficial for both patients, interprofessional teams and for the healthcare system (14). The project consists of several work packages and multiple studies (**Figure 2.4**).



EDs = emergency departments. WP = work packages.

Figure 2.4 Overview of the research studies conducted in the PharmED project. Bold indicate where the three studies in this dissertation is positioned within the overarching project.

Work packages 1 and 2 comprised pre-studies before the intervention study was carried out. Work package 3 concerned the stepped-wedge intervention study, where the primary endpoint is 'time in hospital during 30 days after admission to the ED' (14). ED pharmacists in the intervention study were trained clinical pharmacists with no experience from working in EDs (except one pharmacist with experience from another hospital). The intervention was pragmatic as it had to adjust to the specific needs of each ED. Pharmacists identified patients and work tasks independently or together with the ED team continuously. Consequently,

there were no predefined work tasks and pharmacists collaborated with the ED team to establish effective ways of working. The ED pharmacist intervention (work package 3) began May 3rd, 2021, in Tromsø, August 2nd, 2021, in Bodø, and November 1st, 2021, in Harstad, and lasted until January 31st, 2022. Work packages 4 and 5 comprised similar studies to those performed in work packages 1 and 2 but were performed while the intervention was carried out. Additionally, work package 6 comprises a health economic study. Currently, the project is awaiting data from the intervention study, which will form the basis for the main intervention study article and the health economic study. This dissertation is a part of the PharmED study and forms part of work packages 1, 2 and 4 as indicated in bold in **Figure 2.4**.

3 Knowledge gaps

3.1 Perceptions and expectations prior to pharmacist collaboration

There have been several studies exploring the interprofessional collaboration between pharmacists and other healthcare professionals. However, there is limited research exploring physicians' perceptions and expectations *prior* to the integration of a clinical pharmacy service, and, to our knowledge, such studies have not been conducted in an ED setting before the present study (**Paper I**). Physicians' experiences with medication-related work in EDs are valuable when identifying potential tasks to which pharmacists can contribute. Additionally, their perceptions concerning medication safety tasks and attitudes towards integrating a new interprofessional team member are important to investigate for effective integration of pharmacists. To succeed with implementation or changes within healthcare, it is important to know about context, that the intervention is coherent, i.e., it makes sense and is meaningful for participants, and that participants are committed to and collectively tries to make the intervention work (113). A team effort is needed for a success, consequently performing interviews, and listening to physicians' suggestions prior to integration of ED pharmacists is a step in the implementation strategy.

3.2 Physicians' time distribution on medication-related tasks

Literature is scarce concerning physicians' time distribution on medication-related tasks, and especially in the ED setting. Transitions of care is a high-risk situation for occurrence of medication-related problems, and medication-related problems pose a significant burden on both patients and healthcare services. Consequently, it is important to know how much time ED physicians spend on the various medication-related tasks. Additionally, it is important to collect baseline data to investigate which factors that may change when introducing a new intervention. Our study is the first to investigate ED physicians' time distribution on medication-related tasks in an ED setting without pharmacists employed in the ED team. To our knowledge, only one study has investigated ED physicians' work patterns and time distribution concerning medication-related tasks in the ED (97). Our study therefore adds to the limited preexisting knowledge of time spent on medication-related tasks specifically.

3.3 Experiences with pharmacist integration in emergency departments

The ED is characterized by its fast pace, having patients suffering acute conditions that requires immediate attention, which in turn causes a stressful environment for healthcare professionals to work under. Implementation of new strategies, systems, or changes can lead to more stress for employees, which in turn can cause errors. The ED environment is therefore particularly vulnerable to changes, and consequently it is important to explore how the integration of new healthcare professionals are received by the existing ED team. Experiences

with interprofessional collaboration between physicians and pharmacists are investigated in other settings, however, literature from the ED setting is sparse. This study therefore adds to this knowledge.

In Norway, ED pharmacists are uncommon, and it is valuable to investigate how integration of pharmacists impacts the perceptions and experiences of ED physicians. Additionally, this is the first qualitative interview study that explores the physician-pharmacist collaboration in a Norwegian ED setting. How interprofessional collaboration and integration of pharmacists is experienced and perceived by physicians is also important to understand for future utilization of pharmacists' competencies and resources in healthcare services.

4 Aims

The overarching aim of this dissertation is to identify key factors for successful physician-pharmacist collaboration in emergency departments.

The following were the specific objectives of the papers:

Paper I

To explore how physicians experienced and perceived medication-related work tasks in the ED before the ED pharmacist was introduced, and how they perceived and anticipated the future introduction of the ED pharmacist.

Paper II

To identify how much time ED physicians spend on medication-related tasks with no pharmacists present. We also investigated how much time ED physicians spent on medication reconciliation related tasks.

Paper III

To explore how ED physicians experienced working with pharmacists, and their perspectives on future permanent collaboration.

Aims

5 Methods

5.1 Study designs

The three papers included in this dissertation consist of two qualitative interview studies (**Papers I and III**) and one quantitative observational time-and-motion study (**Paper II), Table 5.1**.

In **Paper I**, we conducted semi-structured individual interviews with 27 physicians from three EDs before introducing the ED pharmacist. **Paper II** is a time-and-motion study where we used the Work Observation Method By Activity Timing (WOMBAT) tool to collect and time stamp observational data from 225 two-hour observation sessions of physicians from the three EDs prior to introducing the ED pharmacist. In **Paper III**, we conducted semi-structured interviews with 20 physicians from two ED sites after physicians had been working with ED pharmacists for a few months. The following sections will elaborate on the methodologies applied.

Table 5.1 Overview of the methodology applied in three papers included in this dissertation.

Paper	Data collection period	Study design and data collection	Study setting	Study population	Inclusion criteria	Data analysis
I	Aug. 2019 to Nov. 2019	Semi-structured interviews (n=27) Interview guide and audio recorder	Tromsø: ED1 Bodø: ED2 Harstad: ED3	Physicians	Working shifts in EDs ***without*** pharmacists in the ED team	Content analysis
II	Nov. 2020 to Oct. 2021	Observational time-and-motion study (n=225) iPad© Mini with WOMBAT software application	Tromsø: ED1 Bodø: ED2 Harstad: ED3	Physicians	Working shifts in EDs ***without*** pharmacists in the ED team	Descriptive statistics
III	Nov.2021 to Jan. 2022	Semi-structured interviews (n=20) Interview guide and audio recorder	Tromsø: ED1 Bodø: ED2	Physicians	Working shifts in EDs ***with*** pharmacists in the ED team	Thematic analysis

ED = emergency department

5.1.1 Semi-structured interviews

Qualitative research methodology is suitable for research that aims to explore experiences, perceptions, meanings, thoughts, attitudes and expectations regarding a phenomena (114). Rather than explaining a phenomenon, the goal is to understand it, and qualitative research methods help increase our understanding of why humans do as they do, how they interact, and which experiences they have (114). Since the aims of **Papers I and II** were to explore experiences and perceptions of our informants, the most suitable method was qualitative research methodology (115).

Qualitative research methodology includes different strategic methods of systematic interpretation of written data from e.g., interviews, observations, or other written sources of information (114). When using interviews as a method, knowledge is constructed socially in collaboration and interaction between interviewer and informant (116). The interviewer should facilitate an environment where the informant feels comfortable with sharing information and trusts the interviewer (114). Qualifications for the interviewer includes being knowledgeable, structured, concise, friendly, sensitive, open, guiding, critical, recalling, and interpretive (116).

Semi-structured interviews are neither an open conversation nor a closed questionnaire, however it is performed with the support of an interview guide consisting of open-ended questions regarding the specific topics in question (116). Interviewers must be open to shifts in the order of the interview guide questions and wording, to place follow-up questions to deepen and clarify understanding where appropriate (116). The support of an interview guide is an advantage since it reminds the interviewer of acquiring knowledge about the specific topics decided upon (114). Interview guides for **Papers I and III** is provided in Appendix A.

Another interview approach is applying focus group interviews. The advantage with focus groups compared to individual interviews is that we can use the dynamics between participants to gain a different insight in the topics of discussion, and focus groups may be particularly beneficial when studying collaboration between people (114).

One reason why we opted for individual interviews rather than focus groups concerned practical considerations, such as challenges assembling five to eight physicians at the same time and the impracticality of monopolizing the time of multiple ED physicians during their work hours. Another advantage of individual interviews is that it is easier to transcribe afterwards since it is a back-and-forth conversation between people taking turn to speak. Whereas by using the focus group method, the moderator has slightly less control and the interplay among participants may cause more chaotic transcriptions (116). When performing individual interviews, the informants get the time and a safe place to share their personal, subjective, experiences without any influence or interference from other perspectives (which may be a challenge when conducting focus group interviews). Also, in individual interviews

the interviewer has the opportunity to be open to uncover and explore relevant topics in other places than initially thought of (114).

5.1.2 Time-and-motion study using WOMBAT

Within time-and-motion studies, different approaches exist. The standard old-fashioned one is applying the stop-watch (94), where the observer manually times each task performed by the person that is observed. This method is susceptible to bias. For instance, the observer must document the task being performed while timing it, but the physician may move on to the next task before documentation is complete, potentially leading to inaccurate results. This limitation have led to the development of a more advance method known as WOMBAT (117).

When undertaking direct observational studies, WOMBAT is a tool to collect multi-dimensional views of the activities that are being observed while automatically timestamping the activities (118). WOMBAT was developed by Australian researchers to observe changes in healthcare professionals' work and communication patterns after introduction of new systems or interventions, however it can be used in any field and it is a reliable method to quantify aspects of work (117). The WOMBAT tool allows researchers to either use an existing template and compare results or create a new data collection template and make it suitable to answer their exact research question, both being advantages with the method.

Since the aim of **Paper II** was to quantify how much time physicians spent on medication-related tasks in the EDs without pharmacists, WOMBAT was an appropriate and easy method to use. Creating our own WOMBAT template (**Figure 5.1**) allowed us to collect details of medication-related activities which previous studies had not captured. The WOMBAT tool timestamps the chosen activity, and continuously record the time until a new activity is chosen. It is run on an application downloaded to a tablet, has a user-friendly interface, provides quick and easy transition between tasks, and can also record interruptions and multitasking. Consequently, the data collection method is easy and can be carried out using only one tool. Other studies have used two tools simultaneously, for instance one tool to collect data and a stopwatch to time-stamp the data, or other types of data collection forms like excel sheets (91, 94, 119). These methods appeared to be more cumbersome and old-fashioned than the chosen WOMBAT tool.

Another advantage with the WOMBAT approach is that observations are carried out in a 1:1 ratio between observer and participant, allowing for continuous collection of detailed observational data. In contrast, other research methods have employed a 1:3 observer-to-participant ratio, with data collection occurring every third minutes (92). Consequently, the WOMBAT approach provides a more direct and focused observational strategy that increases the richness and accuracy of the data.

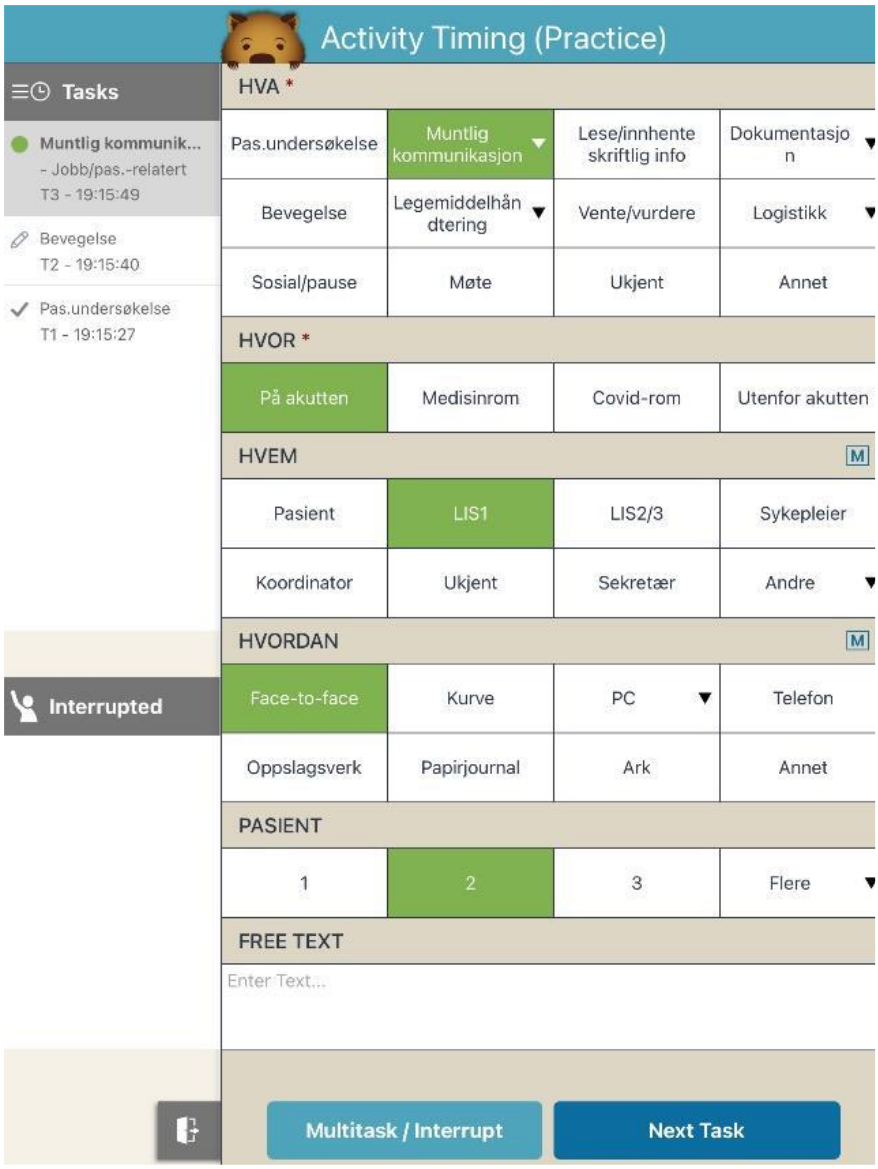


*Figure 5.1 Screenshot of the WOMBAT template used in **Paper II** (with Norwegian language).*

5.2 Study setting

5.2.1 Northern Norway Regional Health Authority (Helse Nord)

The research for this dissertation has been conducted within Helse Nord as depicted in **Figure 2.2**, which covers the regions of Nordland, Troms, Finnmark, and Svalbard. The regions comprises a population of approximately half a million inhabitants and covers 45% of the land area (120). There are four hospital trusts (in Norwegian "helseforetak", shortened "HF") in Helse Nord that provide patient care (121): The University Hospital of North Norway Trust (UNN HF), Nordland Hospital Trust (NLSH HF), Helgeland Hospital Trust and Finnmark Hospital Trust. The hospitals serve a population of 193 150, 138 922, 77 352 and 74 112, respectively (122). In total, these four hospital trusts have 11 hospitals with emergency care localizations, and the research of this dissertation has been conducted in the three EDs located in Tromsø, Bodø and Harstad. The EDs in Tromsø and Harstad are both managed by UNN, while the ED in Bodø is managed by NLSH. Helse Nord also comprise the Hospital Pharmacy of North Norway Trust (Sykehusapotek Nord HF). Sykehusapotek Nord provides all hospitals in the region with services like for instance, supply of medications, producing medications for individual patients, and clinical pharmacy services.

5.2.2 University Hospital of North Norway and Nordland Hospital

The three hospitals differ in size and function (**Table 5.2**). UNN Tromsø serves as the university- and regional hospital for North Norway, including Svalbard, and offers highly specialized functions and national treatment services. NLSH Bodø has a broad spectrum of emergency care services, including emergency surgery, and multiple medical specialties. UNN Harstad has an emergency care service in internal medicine, an anesthesiologist on-call 24/7, and elective surgery. It may have emergency surgery if for instance availability of ambulatory care and weather conditions requires it (123). Junior and senior physicians working roster-based shifts in the ED are affiliated with different hospital departments. Secretaries, nursing staff and emergency medicine specialists are permanently affiliated with the EDs. Pharmacists affiliated with the hospital pharmacies and normally working as clinical pharmacists at different hospital departments covered the shifts during the PharmED study.

Table 5.2 Hospital and emergency department (ED) details and demographics.

	UNN Tromsø (ED1)	NLSH Bodø (ED2)	UNN Harstad (ED3)
Population serving as local hospital (122)	130 976	84 997	36 549
Yearly ED admissions	16 000	13 000	6000
Included in papers	I-III	I-III	I & II
Full-time equivalents for clinical pharmacists in the hospitals[1]	5	5	2
Full-time equivalents ED pharmacists[3]	2 (8 am – 7 pm)	2 (8 am – 7 pm)	1 (11.30 am – 7 pm)
Medication chart system[3]	Home medications printed from EHR[2]; new orders handwritten	All orders are handwritten	Home medications printed from EHR[2]; new orders handwritten
Physicians on site in the ED[3]	Junior and senior internists and surgical physicians	Junior and senior internists and surgical physicians, one EM[4] specialist	Primarily junior internists and surgical physicians

[1]Per 31.12.2023, inclusive of positions funded by Helse Nord and self-funded by individual departments, [2]EHR = electronic health record, [3]During the PharmED study, [4] EM = emergency medicine

5.2.3 Emergency department workflow

Each patient's pathway through the ED is unique, however, an overall workflow of the EDs can be described as the following and as presented in **Figure 5.2**:

The referring physician sets a tentative diagnosis, and patients get assigned to either an internist or surgical physician depending on the diagnosis. After the initial nurse triage, patients are examined by an ED nurse taking the appropriate measurements, e.g., blood pressure or temperature. Further, patients are met by the assigned (often junior) physician who performs the initial clinical assessment, examines the patient, and takes a medical history, including a medication history. Physicians order tests, e.g., blood samples and x-rays, and eventually decide on a preliminary diagnosis and treatment plan, and whether hospitalization is necessary. Junior physicians consult with the more experienced senior physicians and emergency medicine specialists. For acute trauma or severely ill patients, senior physicians or emergency medicine specialists examine the patients upon arrival. All healthcare professionals document observations, results, treatment plans etc. according to their area of responsibility in patient records.

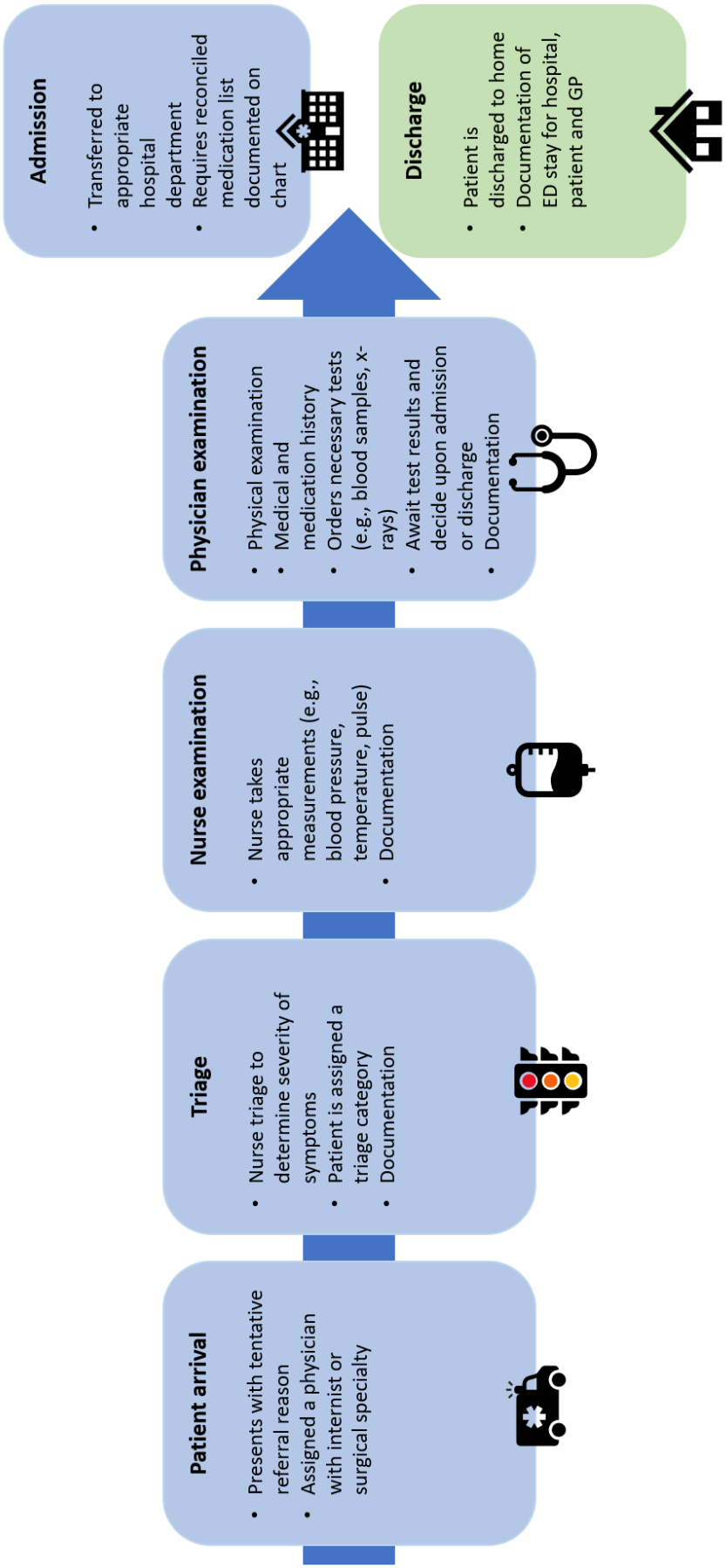


Figure 5.2 General workflow in the emergency departments.

5.3 Participants and recruitment

5.3.1 Norwegian physicians' specialty training

To understand the study context and which physicians that have been recruited to the studies in this dissertation, it is important to know how Norwegian physicians are trained and which experience the different ED physicians have.

Physicians who have completed six years of medical studies, received authorization to practice as a physician and want to become a specialist, go on to complete their specialization in a two- or three-part specialist program (**Figure 5.3**) (124). Part 1 is the same for all physicians and consists of 12 months of hospital service and six months of municipal health service (in Norwegian: "lege i spesialisering (LIS) del 1", shortened to LIS1). The hospital service is often split into two parts: six months of internist service and six months within a surgical specialty. During these 12 months physicians have regular shifts in the ED, and are often in charge of taking medical history, including medication reconciliation. All learning objectives from the hospital service must be fulfilled before the municipal health service, which has its own learning objectives.

Specialist training occurs continuously through daily practice, with guidance and supervision from more experienced physicians (124). Depending on specialty, physicians go through part 2 and/or part 3 to complete their specialization. For medical and surgical specialties that are closely related, they have a common part (part 2, "LIS2") before entering the final part of their specialization (part 3, "LIS3"). For some specialties, there are no part 2, instead they go directly from part 1 to part 3 (124). LIS2 and LIS3 physicians have a more experienced role in the ED, and often coordinate workflow, including overseeing and supervising LIS1 physicians. For this dissertation, physicians will be referred to by their overall specialty; internist or surgical physician, and by how far in their specialist education they are; junior – part 1 (LIS1), and senior – part 2 (LIS2) **or** part 3 (LIS3).

In 2017, emergency medicine (in Norwegian: "akutt- og mottaksmedisin") became its own specialty in Norway (48). After completing part 1, physicians must continue with internist training in part 2, which generally takes three years to complete. Part 3 is specific to emergency medicine training, and takes about 2 years to complete (48). During this period, physicians rotate between working in the ED and other specialties, including surgery, orthopedics, anesthesia, pediatrics and gynecology to name a few (48). An important aim of the parliament's decision to establish the emergency medicine specialty was to strengthen the first line quality of emergency care services (125). Throughout the PharmED study (May 2021-Jan 2022), only the ED in Bodø was staffed with an emergency medicine specialist during daytime from Monday to Friday. EM specialists are referred to as senior physicians in our studies to preserve anonymity.

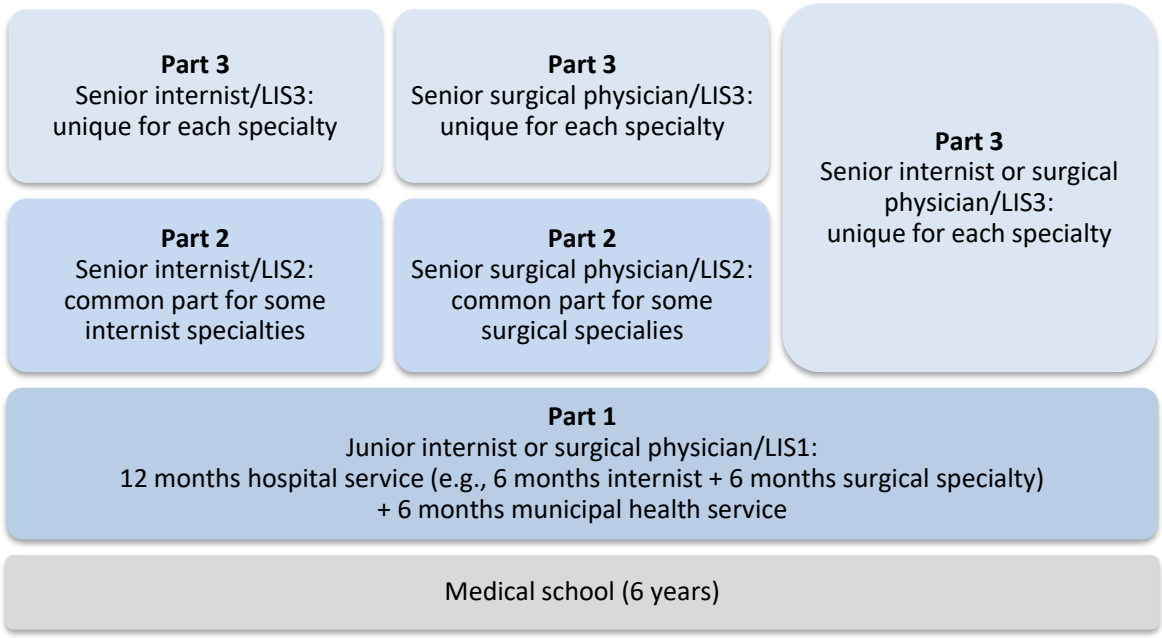


Figure 5.3 Translated and modified overview of Norwegian physicians' specialist training. Illustration from the Ministry of Health and Care Services' Circular I-2/2019 (126).

5.3.2 Recruitment

Recruiting participants to provide sufficient information power is related to the aim of the study, where a broad aim requires a larger sample than a narrow aim according to Malterud (127). A purposive sample is composed of informants with the prerequisite to shed light on our research question in the best way possible (114). Recruiting a purposive sample can be challenging, and an alternative strategy can be to recruit a convenience sample, which consist of informants that you can actually get a hold of (e.g., snowball) (114). For all studies in the three ED sites, information was consecutively given to staff through e-mails, meetings, and internal Facebook groups. All ED physicians currently working shifts in the EDs were eligible for inclusion.

For **Papers I and III**, we combined the two mentioned recruitment approaches. We knew physicians currently working shifts in the ED would give us a purposive sample, but we also had to use the convenience sampling strategy. In ED1 and ED2, we found that showing up in the EDs early in the morning and asking physicians to participate was the best approach for recruitment. For ED3 we had to schedule the interviews beforehand with available physicians. All informants had knowledge about our research topic, and we tried to maximize variation in sex, specialty, and experience in all three EDs. In **Paper I**, all approached physicians accepted the invitation to participate. In **Paper III**, two physicians declined to participate due to lack of time and workload.

For **Paper II** we also had a purposive sample of physicians currently working shifts in the ED, and they were recruited by observers showing up in the ED and asking physicians directly to participate. There were three observation sessions daily, and observers strived to observe different physicians each session. However, this was not always feasible due to physicians' timetable. Occasionally, if it was a shift change during the observation session, two different participants were observed in one session. All but three approached physicians agreed to be observed.

5.4 Data collection

In addition to the PhD-student (TJ), four Master of Pharmacy students (EF, MF, AJBT, NFS), one fifth year medical student (IN), and five members of the PharmED project group (BHG, ECL, RVH, BZH, EHO) have been involved in data collection. We aimed to have two researchers present for the semi-structured interviews, and for collection of time-and-motion data we used the same observer for all sessions in each ED. Data collection for **Papers I and II** was conducted prior to integration of clinical pharmacists in the EDs, while data collection for **Paper III** was conducted when our informants had been working with the pharmacists in the EDs for a while (**Figure 5.4**).

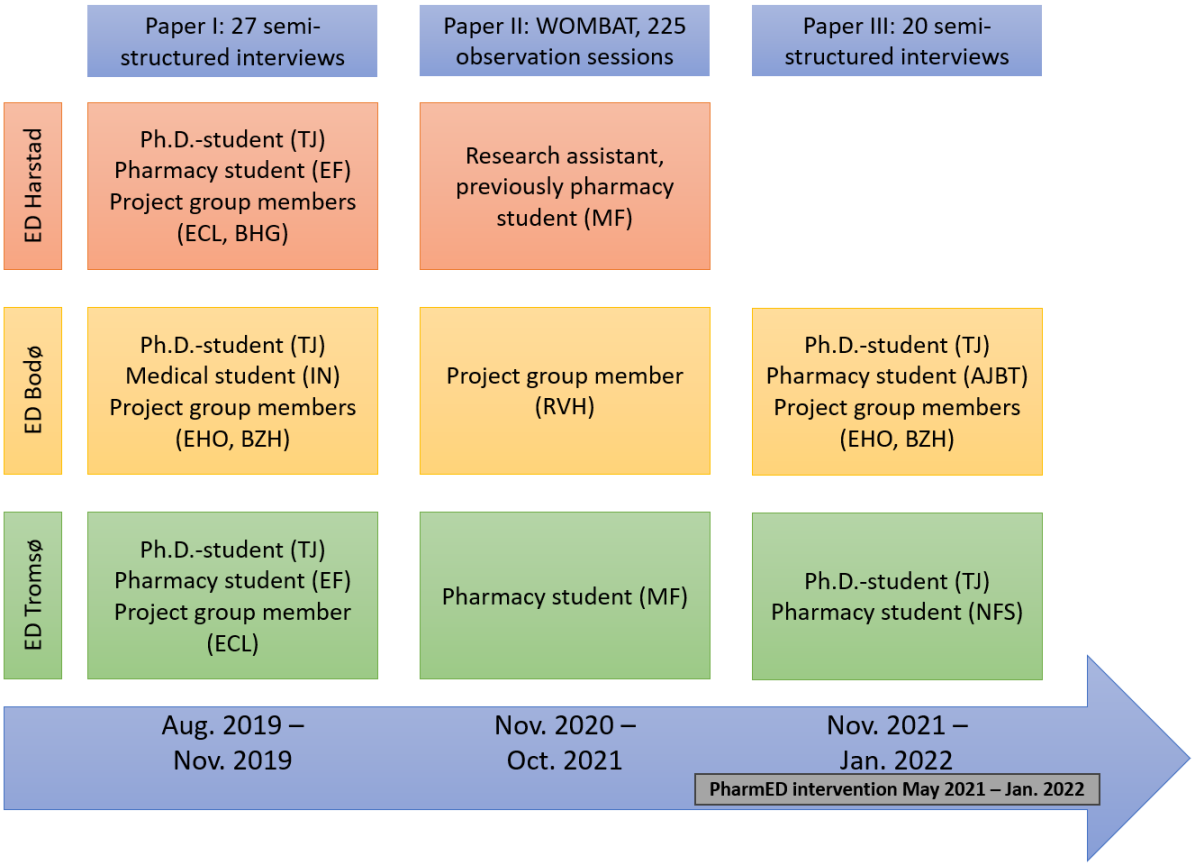


Figure 5.4 Overview of data collection periods and which researchers were involved in data collection for the different studies in the three emergency department (ED) sites.

5.5 Data analysis

5.5.1 Paper I: qualitative content analysis

The data analysis process for the qualitative interviews is presented to start at some point *after* data collection. However, it is important to acknowledge that the analysis in fact started much earlier in the research process. One example of this is that the interviewers discussed and shared initial thoughts with each other after each individual interview, a process occurring much earlier than the described stages of the presented data analysis. There is not one ideal data analysis method for a project, and therefore describing the steps in the data analysis process is an important part of transferability in qualitative research.

The interviews for **Paper I** was partly conducted together with two students (EF and IN) who used the data material for their master theses. They conducted individual analyses of data collected in Tromsø (EF) and Bodø (IN) using systematic text condensing as described by Malterud (128). The overall analysis merged interview data from all three ED sites and were re-analyzed by the PhD student. The master students' findings subsequently were used to ensure credibility of the overall findings.

For **Paper I** the analysis was inspired by *qualitative content analysis* as described by Graneheim and Lundman, and we applied five steps during the analysis (129). 1) To obtain a sense of the whole, transcripts were read several times, and preliminary categories were noted. 2) Meaning units were further sorted into initial codes, before 3) organization of data into subcategories and categories. 4) The research team continuously discussed categories and theme development. 5) A selection of interviews was re-coded using the agreed subcategories, categories, and themes. Graneheim and Lundman's qualitative content analysis allows for both *manifest* and *latent* content analysis. Manifest content refers to the visible aspects of the text and latent content concerns interpretation of the underlying meaning of the text (129). The interviews were conducted prior to integration of pharmacists, and a topic in the interview guide was to identify *which* medication-related work tasks ED physicians had at this point. We potentially wanted to use this information to target the intervention in the PharmED study, and consequently using a data analysis method which also allowed for manifest content analysis seemed appropriate and easier to handle being new to the field of qualitative research.

5.5.2 Paper II: WOMBAT analysis

Descriptive statistics were used to report on total observed time (hours: minutes: seconds), proportions of time (%) or medians (range). Time intervals are continuous variables, which have less standardized methods to calculate confidence intervals (130). The WOMBAT data was not normally distributed, and to reduce the reliance on parametric assumptions, we used a bootstrapping (i.e., resampling) approach to calculate 95% confidence intervals for

proportion of time per task. The method is specifically developed for WOMBAT data and works by sampling data many times and calculate proportions each time using the SAS Macro program (130, 131). Significant differences were defined as non-overlapping confidence intervals. We were not able to provide confidence intervals for aggregated task categories, as the SAS code did not allow this. Calculating confidence intervals manually are not recommended for WOMBAT data since time intervals are continuous variables, and it is not clearly defined what the sample size (n) is in the calculations (130).

In the calculations, proportions of time exceed 100 %, and the reason for this is that the proportion of time spent on single tasks was calculated as 'total time spent on task – including multitasking' divided by 'total time of observation'. For example, if a physician is communicating with a patient for one minute, and simultaneously starts washing her hands for 15 seconds while communicating, the total time of observation would be one minute, but the recorded time spent on the two tasks would be 1 minute and 15 seconds.

We also introduced the term 'active task time' when performing some of the calculations. 'Active task time' is 'total observation time' excluding the time spent being standby (meaning not having any specific work tasks, but ready when needed) and being in movement from one place to another. This was because in these two categories physicians do not perform any tasks, and we thought it would give a clearer picture of actual proportion spent on different tasks if we excluded these two categories from the calculations.

5.5.3 Paper III: thematic analysis

In **Paper III**, the analysis process also started subsequently after the first interview, although being described to occur at some point *after* data collection. The interviews for **Paper III** were also included as part of two master theses (NFS and AJBT), and the master students performed individual analyses for data from Tromsø and Bodø inspired by Malterud (115), Graneheim & Lundman (129), and Braun & Clark (132). In **Paper III**, data from both sites were merged and re-analyzed by the PhD student.

Prior to data analysis for **Paper III**, a few frameworks were read to see whether the analysis could be conducted deductively according to these. The Context and Implementation of Complex Interventions framework (133), Normalisation Process Theory (113), and Ten Principles of Good Interdisciplinary Team Work (102) were reviewed. A thematic analysis with inductive coding approach was decided upon for **Paper III**, yet the knowledge gained through reading the frameworks was incorporated and reflected upon during the analysis.

There are a lot of similarities between *reflexive thematic analysis* as described by Braun and Clark (134) and *content analysis* as described by Graneheim and Lundman (see above) (129), and therefore trying a new method while still immersing in similar ways of conducting qualitative research seemed interesting when embarking on the analysis for **Paper III**. Braun

and Clark present some inspiring examples about reflexive journalling, mapping, and developing codes and themes. Going from semantic to latent coding was a familiar way of doing data analysis, apart from the wording being different. Semantic coding in thematic analysis refers to the explicitly-expressed meaning (134), similar to the manifest content from content analysis. A lot of time was spent considering different angles to approach the analysis in **Paper III** (**Figure 5.5**), which ended with the overall fit where I felt the most comfortable with the uncertainty and discomfort that comes on the journey of thematic analysis (134). The following six steps were applied in **Paper III**: 1) Reading and re-reading data, noting initial thoughts and ideas for the analysis, discussions with co-author, 2) Inductive coding, accompanied by reflexive journaling, 3) Collating codes and searching for themes using NVivo and pen-and-paper methods, 4) Writing and reviewing themes with co-authors, 5) Defining and naming both themes and sub-themes, 6) Producing final results.

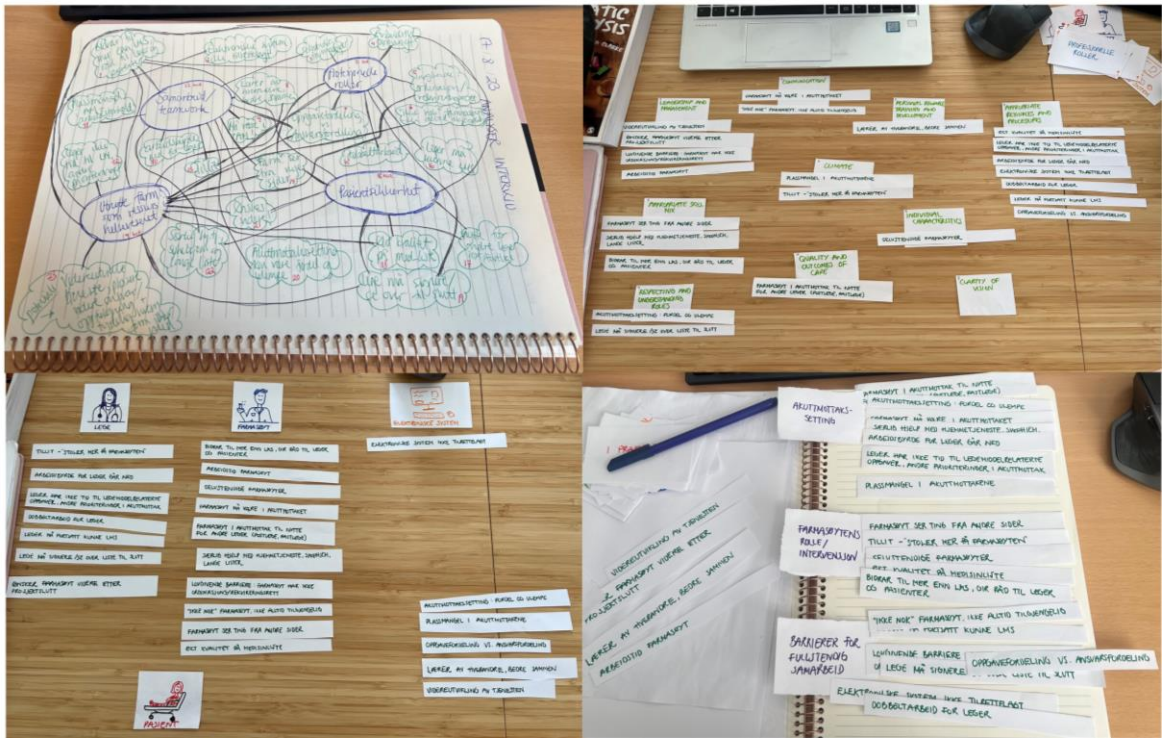


*Figure 5.5 Pictures illustrate testing different fits in the thematic analysis process in **Paper III**.*

5.6 Reflexivity

According to Braun and Clark, “reflexivity involves a disciplined practice of critically interrogating what we do, how and why we do it, and the impacts and influences of this on our research” (134). Reflexivity in qualitative research refers to the process of recognizing, interrogating, and understanding how your own subjective role as a researcher influences and shapes your research and the knowledge you create. Braun and Clark argue that “viewing subjectivity as something valuable, rather than problematic, is a key aspect of a qualitative sensibility”. The researchers’ personal identity, values and disciplinary perspectives therefore becomes an essential and active part of the analysis and knowledge creation (134).

I have been working as a pharmacist since 2014, the first two years of my career in a primary care pharmacy, and since 2016 I have been employed at a hospital pharmacy. In addition to working as a clinical pharmacist at different hospital departments, I have over the years worked with various tasks to ensure medication safety, with teaching of healthcare professionals, and with audits and revisions concerning medication management. All of this with the aim of contributing to reducing different medication-related problems from occurring at different stages, problems I know through practice and research pose a significant challenge in the healthcare system.

I recognize that by being a pharmacist, and especially having worked as a clinical pharmacist, I have viewpoints and preconceptions that influence the way I access and interpret data. During my time as a researcher, I have also had to be reflexive about how my background and presence may have influenced the participants in my studies. For instance, during the qualitative interviews, did physicians dare to speak their truth regarding the integration of ED pharmacists *to* a pharmacist? Or could they have been afraid to tell the truth, in fear of hurting me and my research project...?

I think words like accuracy, correctness, systematic, detailed, and thoroughness describe the pharmacist culture. We are trained from pharmacy practice that everything must be correct before dispensing a medication to a patient, we work according to procedures, and use electronic systems to eliminate and minimize errors. From a clinical perspective we are trained to get a complete overview of a patient’s medication use before reviewing medication lists and recommending therapy. Through working with medication safety, I have become aware of the multiple number of medication-related problems that can occur and the number of medication discrepancies we have for hospitalized patients both in “Helse Nord” and worldwide. These are problems I believe we as pharmacists can contribute to solve or prevent. Having received my professional socialization in this culture, I sometimes find it difficult to understand how physicians do not have the same values and priorities when it comes to medication safety. They probably think the same about me. However, when looking at a bigger picture, I can see physicians having to deviate from procedures and routines daily, perhaps to

maintain a workflow that is acceptable. I can also see their lack of time and resources, and therefore understand how their deviation from procedures becomes "necessary". This is also a big part of why I think that Norwegian EDs will benefit from having pharmacists employed, to relieve work pressure off physicians and contribute with knowledge in a setting where medications do not have the highest priority.

Understanding what the physicians' roles are, which challenges they have, and how I think pharmacists can be utilized as a resource by creating a new role in the ED is a big part of this dissertation. I have great belief in the fact that interaction and collaboration between healthcare professionals in EDs can lead to better outcomes, for both patients and staff. This in turn could leave me overly positive when interpreting data that considers the pharmacy profession.

I come from a background in natural sciences, where we are trained to need significant proof whether a medication works or not, e.g., the medication either reduces your blood pressure or not, and the gold standard is to have a randomized controlled trial study measuring the effect. From the start of this PhD-journey and my first qualitative paper, it has been challenging for me to adopt a "qualitative standpoint". Suddenly there was no "right answer" anymore. Or perhaps more accurately, the answers were bound in the practice of participants rather than bound by a written guideline. This has been an ongoing conflict within me as I have immersed myself more into the qualitative field. During the latter part of this journey, I have adopted more and realized that how we create knowledge is not independent of human experiences, and the answer to a question may depend on both who is asking and what the answer is needed for.

Reflexivity is a continuous process of reflection, and never final, and consequently my positioning and engagement of data is different now compared to when I started my PhD-journey five years ago. To exemplify this, I have interpreted the same data today as three years ago (**Table 5.3**). I believe this example shows two things in particular: 1) that my knowledge of conducting qualitative research has evolved over the past years and that I am maybe more capable of interpreting data on a different latent level than earlier, and 2) that my overall understanding of healthcare has changed as I have gained more knowledge over the years, and consequently I interpret the data differently. I think both data analysis examples give us knowledge we can use to understand and improve healthcare systems, but perhaps on separate levels and in different ways. Therefore, this example illustrates the importance of continuously reflecting on where you are positioned as a researcher, how you engage with the data, and what that means in knowledge creation. **Table 5.3** can also be used as an example to show how two individuals with different experiences might have interpreted the data at the same time point, also illustrating the importance of valuing researcher subjectivity as described earlier.

Table 5.3 Example of how researcher reflexivity could yield different results today (2024) compared to during data analysis in 2021.

Meaning unit	**Subcategory**		**Category**	
	Interpreted in 2021	Example from 2024	Interpreted in 2021	Example from 2024
Sometimes when you have little time, you get like drained and tired and think that I don't have time for this now	Challenging and time-consuming work	ED priorities	Medication reconciliation often feels like time-consuming detective work	Healthcare infrastructure
It takes an awful amount of time to clean up in medication lists, obtain sources and retrieve information				
We are interested in information about it, but it is a rocky road	Detective work	Organization		
The big frustration that I see in junior physicians, is that there are so many [medication] lists. We have ours, the general physician has his, patients have their own, home care nurses have theirs, and it is hard to know which one to trust when things do not add up. What does the patient take and what should he take?				

5.7 Ethical approvals

All studies in this dissertation have been approved by the Data Protection Officer at Sykehusapotek Nord, who serves as the ethical committee at this institution, holding the main responsibility for the project (Appendix B). We have also obtained approvals from the Data Protection Officers at the two involved hospitals, UNN and NLSH (Appendix B). The intervention study with ED pharmacists was approved by the Regional Committee for Medical Research Ethics North Norway (Appendix B).

The research has been conducted according to ethical guidelines stated by the Helsinki declaration (135).

All participants gave written informed consent for study participation (Appendix C) and were informed about the possibility to withdraw from the study at any time point. All participants received a unique code, and transcripts were anonymized before analysis. A separate file connecting participants and codes was stored on a secure server. Audio-recordings were also transferred to a secure server and deleted from the recorder after transcription. Data will be permanently deleted according to regulations after the project period.

6 Results

A summary of the main results from the three papers and how they contribute to answer the purpose of this dissertation are given in this chapter. The individual articles provide more detailed information about the results.

6.1 Results Paper I

Figure 6.1 (12) is already published in **Paper I** and summarizes the results from this study. We identified that medication reconciliation is physicians' main focus and concern when talking about medication-related tasks, and that few other tasks were systematically addressed in the ED to assure medication safety. Physicians expressed an ambiguity regarding the integration of a future ED pharmacist. On the one hand, they welcomed the pharmacist, and expressed a need for help with medication reconciliation. Physicians were unsure how to perform medication reconciliation and expressed it as time-consuming detective work. On the other hand, they were hesitant to the integration and had some concerns regarding e.g., physical barriers like enough space and computers, responsibilities, fear of interference and not being aware of pharmacist's competencies, and that the ED is not the place to prioritize medication safety. For further details on the results, refer to **Paper I** attached.

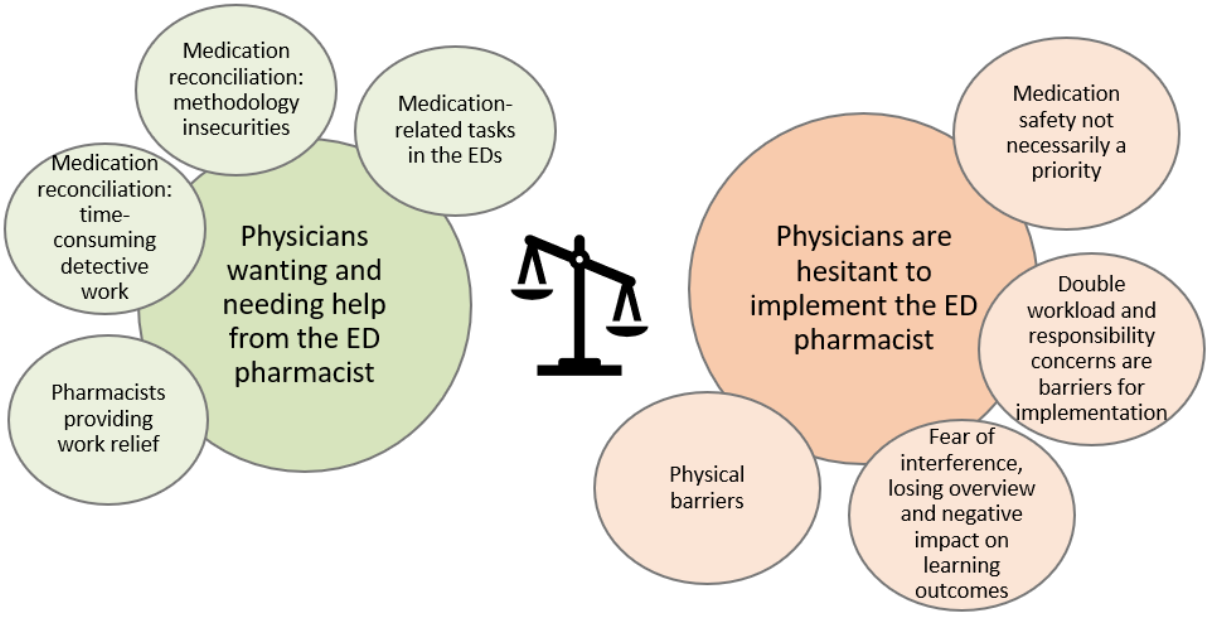


*Figure 6.1 Overview of the two themes and eight categories that emerged from the content analysis in **Paper I**. Figure from Paper I (12).*

6.2 Paper II

Physicians' work tasks were classified in three aggregated task categories: medication-related, non-medication-related clinical or administrative tasks, and other **Table 6.1**. In total, junior physicians spent 9.4% of their time on medication-related tasks, while senior physicians spent 7.4% of their time (**Figure 6.2**). Of the medication-related tasks, junior physicians spent most time on documentation (46.5%) and senior physicians spent most time on oral communication about medications with other healthcare professionals (63.1%, **Figure 6.3**). Medication reconciliation accounts for 6.1% of physicians' active task time, which is total time excluding time for movement and standby. This corresponds to a median 2.2 minutes per hour. Junior physicians spent significantly more time on medication reconciliation than senior physicians.

Results from **Paper II** showed a potential to increase focus on medication-related tasks in the ED, and that developing a role for pharmacists could contribute to this. When combining results from **Papers I and II**, questions arose about why the reported time distribution on medication reconciliation during qualitative interviews did not correlate with the quantitative data. For further details on the results, refer to **Paper II** attached.

Table 6.1 Overview of work tasks included in the three aggregated task categories (italic). Bold are the three medication reconciliation tasks.

CATEGORIES	SUBCATEGORIES
Medication-related	
Oral communication	**Retrieve medication-related information**
	Give medication-related information
	Communication about medications
Read/retrieve written information	
Documentation	
Medication management	Medication preparation without patient
	Preparation and administration of medications with patient
	Double checking
Logistics	
Non-medication-related clinical or administrative	
Patient examination/treatment	
Oral communication	Work-/patient-related
Read/retrieve written information	
Documentation	
Waiting/consideration	
Logistics	
Meeting	
Unknown	
Other	
Movement	
Standby	

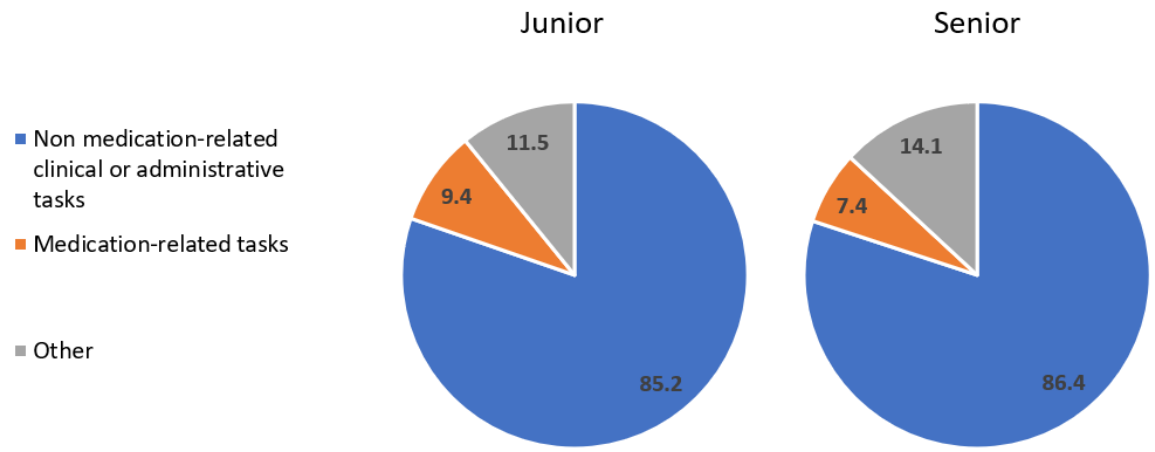


Figure 6.2 Overview of junior and senior physicians' time distribution for aggregated task categories.

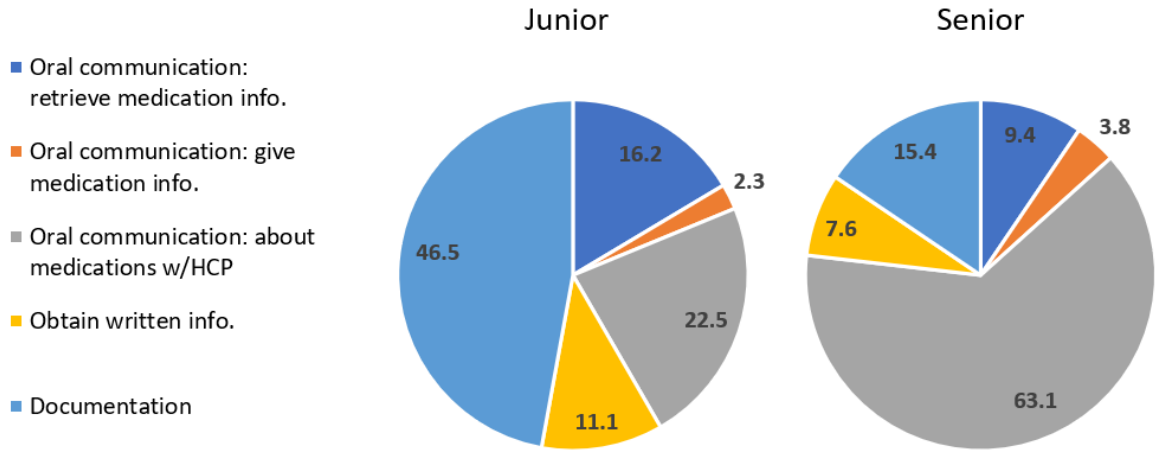


Figure 6.3 Overview of junior and senior physicians' time distribution for medication-related task categories.

6.3 Paper III

Identified themes and related subthemes for results from **Paper III** is shown in **Figure 6.4**, which has been submitted to the PlosOne journal. We identified a shift in physicians' perceptions towards the ED pharmacist. The hesitation was replaced with excitement, and physicians saw the potential of utilizing pharmacists to a greater extent after learning to know and trust them, and the knowledge they possess. All physicians wanted to continue the collaboration, even though similar challenges as before integration were evident. Challenges concerned for example physicians having time-constraints when managing medication-related tasks and that there is limited space and place for all healthcare professionals. Additionally, pharmacists not being able to access and amend electronic medication lists, for

instance in the Prescription Intermediary, led to non-efficient division of labor, lack of role clarity, and to uncertainties in responsibility areas. For further details on the results, refer to **Paper III** attached.

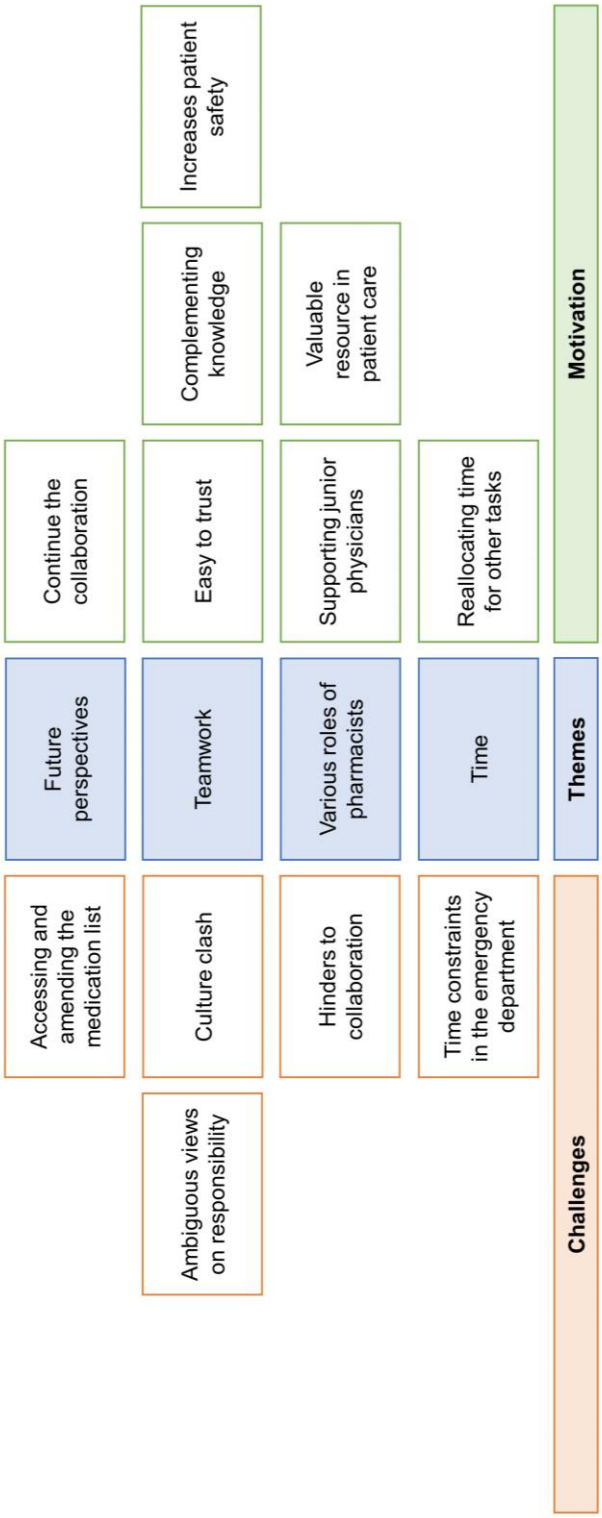


*Figure 6.4 Overview of themes and subthemes in **Paper III**. Figure from the unpublished Paper III.*

7 Discussion

7.1 Overall findings and connections with themes for discussion

In the three scientific papers on which this dissertation is based upon, the overall findings are as following:

In **Paper I (pre-intervention interviews)**, we found that ED physicians' main concern regarding medication-related work is *medication reconciliation*, for which they expressed a need for a pharmacist's assistance. Medication reconciliation was expressed as a very time-consuming task and receiving help from pharmacists was anticipated to allow physicians to allocate time to other important tasks in the fast-paced ED environment. We also identified challenges and hesitations towards integration of ED pharmacists, mainly concerning roles, responsibilities, lack of space, and scarce time to prioritize medication safety in the ED setting.

Findings in **Paper II (WOMBAT observations)** contradicted perceptions identified in **Paper I**, as we found that physicians actually spent very little time (8.7% of total) on medication-related tasks, for example medication reconciliation tasks (median of 2.2 minutes per hour). By combining results from **Papers I and II**, we suggest that physicians may perceive to spend more time on medication reconciliation than what they in reality do. We observed few medication-related tasks except medication reconciliation, e.g., communicating information *about* medications to patients. Consequently, we hypothesize that there could be a potential for including clinical pharmacists to increase focus on medication-related tasks and ensure medication safety tasks are maintained. Unfortunately, as **Paper II** concerned time distribution *prior* to integration of ED pharmacists, we were not able to identify whether physicians actually could allocate their time to other important tasks, as assumed by physicians in **Paper I**. However, a study investigating this will be published in the future.

Findings from **Paper III (interviews during intervention)**, after physicians had gained experience from working with ED pharmacists, showed that some of the physicians' previous hesitations towards pharmacists were not present anymore. Although some challenges remained, e.g., lack of space, responsibilities, role clarity, and cultural differences between physicians' and pharmacists' profession. Nevertheless, physicians expressed a strong desire to continue with and develop the physician-pharmacist collaboration and stated that having pharmacist resources saved physicians' time and complemented the ED team.

In the continuing discussion, findings from the three papers together will be used to give a perspective towards the future healthcare services and how our results point towards organizational, regulatory, and educational reform for successful integration of the ED pharmacist in the interprofessional team. See **Figure 7.1** for an overview of relationship between the study findings and the different thematic discussion carried out in the following sections.

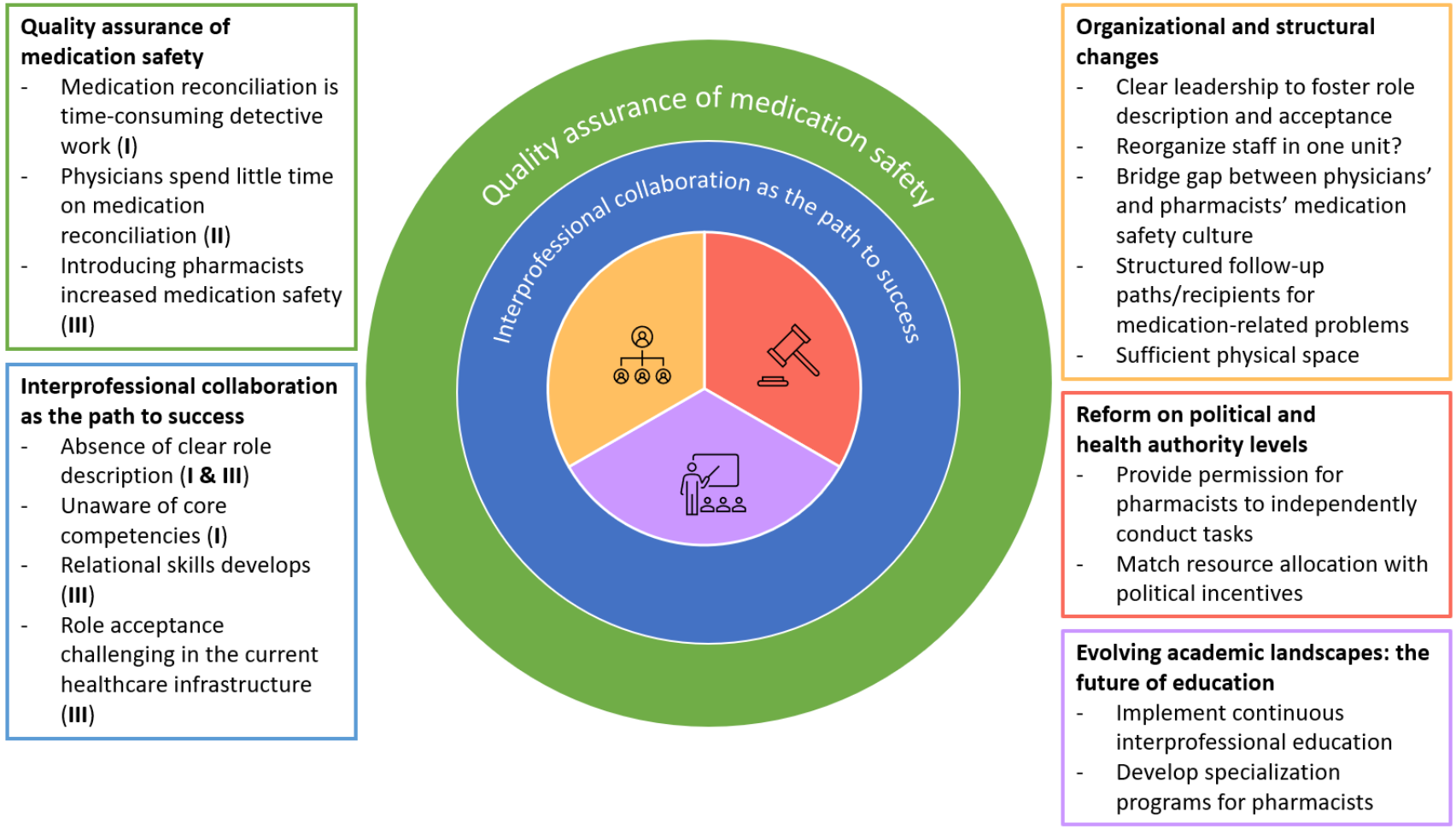


Figure 7.1 Illustration of how findings in the individual papers are related to the different discussions carried out in the present dissertation. Interprofessional collaboration (blue) is important for the overall goal of ensuring medication safety (green). However, to improve the interprofessional collaboration, reform and changes are needed on an organizational (orange), regulatory (red), and educational (purple) levels.

7.2 Quality assurance of medication safety

Both frequency and cost of medication-related problems pose a burden for healthcare systems and may lead to harm for patients (19, 20, 23-33). Many medication-related problems are preventable (26), as long as we use the appropriate measures to identify them, e.g., medication reconciliation, medication review, and double checking (11, 15). Preventing medication-related problems therefore has the potential to increase medication safety for patients and save costs for healthcare services. The World Health Organization even has highlighted transitions of care as a high-risk area for introducing medication-related problems (11), which means that the ED is especially susceptible to errors with two transitions in and out of the ED in a short time. Despite this knowledge, there are few EDs in Norway (and many other countries) equipped with healthcare professionals especially trained in quality assurance and medication safety tasks. The clinical pharmacist may serve as such a person. In Norway, the responsibility for quality assurance and medication safety tasks typically falls to junior physicians in EDs, who often receive minimal training for these tasks prior to commencing their roles and lack the allocated time to prioritize them, as indicated in **Papers I and III**.

We identified that physicians' main medication-related task concerns medication reconciliation (**Paper I**), which they describe to be time-consuming detective work, and many admit to not knowing the methodology for. Given that most medication reconciliations are performed by recently graduated junior physicians without receiving sufficient training in medication reconciliation (**Paper I**), it is not surprising that this task feels overwhelming in the stressful ED environment. Literature show how time perception can be influenced by a variety of factors, e.g., boredom, past experiences, and mental and physical tiredness (136, 137). The understandable stress involved in being thrown unprepared into the fast-paced ED environment may be one reason why they perceive to spend more time than they actually do on medication reconciliation (**Paper II**). This may cause physician burnout and a feeling of not conducting the task adequately, which is clearly not beneficial in today's healthcare service where we are already lacking healthcare professionals (138). In the past year, the issue of Norwegian physicians feeling overwhelmed and inadequate in their work and social life has also received considerable media attention (139). Other barriers for medication reconciliation are unreliable sources of medication history, patient knowledge, and lack of communication (140). These barriers, in addition to the feeling of being overwhelmed associated with medication reconciliation, may also be contributing reasons for the high frequency of medication discrepancies seen in medication lists in hospitals (19, 20).

Why then, does Norway not routinely employ pharmacists to assume responsibility for medication safety tasks, as is done in countries such as the UK and the US (55, 141). Pharmacists are experts in medications and trained in quality assurance (50). Systematic

reviews and meta-analyses show that medication reconciliation interventions at transitions of care reduces medication discrepancies, and that pharmacy-led interventions identify discrepancies of high clinical impact (37, 81). Studies also show how clinical pharmacists detect more medication discrepancies than physicians and other healthcare professionals (142), and also detect other, often more serious, medication-related problems in the ED setting (143-145). Even the physicians in our study (**Paper III**) perceived that including the ED pharmacists in the team increased medication safety. Reasons for this was because ED pharmacists could spend time focusing on medication reconciliation and that there were now two sets of eyes reviewing the patient's medication list. It makes sense to include more than one professional perspective in assessment and decision-making as populations with increasing multimorbidity and polypharmacy makes the tasks more complex. While the benefits are evident, the potential reasons why Norway has not yet adopted this practice widely will be touched upon in the following sections.

In our studies (**Papers I-III**), we did not identify physicians systematically conducting medication safety tasks like e.g., medication reconciliation and medication review, and changes in patient's medication were often done ad hoc. ED pharmacists have the competencies to introduce, work with, and facilitate tasks and quality systems ensuring medication safety. Examples from the US show that the ED pharmacists may take responsibility for many other tasks than merely medication reconciliation, as shown in **Table 2.1** (55). In the following, we discuss key factors to develop and improve the physician-pharmacist collaboration in EDs, aiming to increase both medication and patient safety.

7.3 The *Godfoten* theory: Collaboration as the path to success

Interprofessional collaboration and teamwork are recommended to tackle medication-related problems, improve quality, and increase patient safety (5, 101, 146, 147). For collaborative success, it is important to have clear roles and to know each other's core competencies (5). In **Papers I and III**, we identified multiple barriers related to a lack of clarity and understanding about the pharmacist's role in the ED. This section explores role understanding by drawing on parallels to the *Godfoten* theory (148), coined by Norwegian football coach Nils Arne Eggen, who led Rosenborg BK to international success in the 1990s. *Godfoten* refers to a player's dominant foot, but the theory extends beyond this to emphasize leveraging each team member's strengths to achieve the best collective outcome. Eggen viewed teamwork on the football field as a microcosm of society, suggesting that true collaboration is achieved when individuals shift from obligation to desire in pursuing a common goal (148).

In **Paper I**, we identified hesitations about the new ED pharmacist role, with physicians being reluctant to accept pharmacists' interference, uncertain of their competencies, and concerned about assuming responsibility for pharmacists' medication reconciliation.

Physicians also feared double work, losing control, and diminished learning opportunities when aided by pharmacists. Consequently, the absence of clear role description for ED pharmacists was a source of stress for the ED physicians and a barrier for collaboration. Literature suggests that well-defined roles enable interprofessional collaboration (58, 102). In line with this, according to Eggen and the *Godfoten* theory, prolonged collaboration often leads to the natural development of positive relational skills despite initial challenges (148). From **Paper I** to **Paper III**, we identified a shift from reluctance to pharmacist collaboration (**Paper I**) to appreciation for the pharmacists' role within the ED (**Paper III**). This collaborative synergy, which develops when healthcare professionals come together and form strong relationships, also supported by research literature (56, 58, 103, 106-110, 112), seemed to have evolved among the physicians and pharmacists in our EDs (**Paper III**). By working with pharmacists, physicians began to trust, recognize, and value the competencies and skills of pharmacists, seeing them as an important complement to the ED team. This aligns with the *Godfoten* theory, which emphasizes the importance of understanding, not only one's own role, but also the roles and core competencies of teammates to foster effective collaboration. According to Eggen, the relational skills are more valuable than each isolated individual skill, who also highlighted that awareness and evolvement of relational skills was where the football team Rosenborg was better than other top division teams filled with individualists (148) (also known as many Cristiano Ronaldo's). "Role description" is the term Eggen use to describe the process of knowing the roles and core competencies in a team (148). Pharmacists are slowly becoming more integrated in both primary and secondary healthcare teams in Norway. However, the role description process still has considerable shortcomings in which we have something to learn from other settings. In Australia, for example, the home medicines review program is well-established with key steps to ensure collaboration between general practitioners and pharmacists performing the service (149). Additionally, it is a government-funded model that supports provision for the medicines review (149). Another example is from the US, where role description for the ED pharmacist have been well-established for many years (55). Chapter 7.4 elaborates on potential organizational and structural changes to ensure role description in the future.

Core competencies and role descriptions are not the only requirements for efficient collaboration. Team members must also be *willing* to engage in the process, a concept described by Eggen as "role acceptance", which is identified as particularly challenging (148). Team members need to embrace their (new) roles, which should align with their core competencies, and actively develop them within the team's collaborative pattern. In **Paper III**, we identified how physicians recognized pharmacists' competencies and skills as beneficial in the ED team. Yet, full acceptance of new roles by both physicians and pharmacists is challenging considering that the current healthcare structure does not fully support the potential roles of pharmacists. Firstly, Norwegian clinical pharmacists do not work shifts,

which leads to their unavailability in the ED 24/7 and can result in potential unpredictability and changes in roles for other healthcare professionals. This also applies to clinical pharmacists working in hospital departments in general, as the sparse distribution of clinical pharmacists means that they often work only two to three days per week in various departments. Second, without prescribing rights, pharmacists cannot reconcile home medication lists with active electronic prescriptions, nor take responsibility for medication chart documentation. This is due to national regulations which considers this as a "prescription", and Norwegian pharmacists do not have prescribing rights. This limitation hinders pharmacists' integration, as it often leads to physicians resolving discrepancies identified by pharmacists. This duplication of effort results in inefficiencies and ultimately becomes a barrier to the acceptance of roles. Regulatory and educational reform may be needed to fully achieve role acceptance, which is discussed in chapters 7.5 and 7.6.

In **Papers I and III**, we identified uncertainties and ambiguity among the ED physicians concerning taking the responsibility for tasks performed by ED pharmacists, a new role in the healthcare setting. Some physicians viewed overseeing other healthcare professionals' work as part of their duties, while others believed each professional should be accountable for their own tasks. This issue was further complicated by pharmacists' inability to independently complete certain tasks. Clear role description and acceptance across the entire healthcare system would consequently clarify task responsibilities. Eggen's philosophy at Rosenborg "*you have the responsibility for your unit, but you assume responsibility for the whole*" (148), can be applied to the healthcare setting as well: when role description and acceptance is in place, individuals are accountable for their specific tasks, but the team collectively assumes responsibility for the whole. If pharmacists are restricted by legal regulations to perform and take responsibility of their work tasks, it is challenging to provide separate responsibility areas. In the PharmED study, pharmacists' assistance with medication reconciliation was still dependent on physicians, ultimately leading to inefficiency and most likely lowered the cost-effectiveness.

We identified in **Paper III** that physicians valued the integration of pharmacists in the ED team, and that the collaboration was a desire for the future. The above-mentioned challenges related to role description, role acceptance, and responsibilities require reform at the organizational, regulatory, and educational levels, which will be discussed in chapters 7.4-7.6. Other identified challenges from **Papers I and III**, such as culture clash and lack of physical space, will also be discussed.

7.4 Organizational and structural changes of healthcare systems

For pharmacists to fully assume their roles in the ED, and physicians to adapt to their new roles, the healthcare systems need to go through some fundamental organizational and structural changes.

First, according to Sturle D. Tvedt's chapter concerning healthy organizational change processes in "Work and Organizational Psychology" (by Per Ø. Saksvik), management is crucial when introducing new processes (150). Central to how employees tackle changes, is leaders being hands-on and available for their workers. As previously discussed, we identified in **Papers I and III** that there were uncertainties with the new roles of ED pharmacists, and the uncertainties may have been strengthened by the intervention being developed "on-the-go" and not defined prior to the integration of pharmacists. One way to address the lack of role description, is by having strong and clear leadership. In Norwegian EDs this may be difficult, as ED healthcare professionals are managed through different lines of leadership. Pharmacists are managed by the Hospital Pharmacy and physicians by their affiliated hospital departments. Nurses are the only profession employed and managed by the ED. Consequently, there are no single leader responsible for the overall process of role description, acceptance, and work sharing responsibilities in the EDs as fronted by the physicians in **Papers I and III**. It resembles a case of the "tragedy of the commons" as described by Hardin (151). This theory explains that domains open to many, but with no clear responsibility for maintenance and development, are always at risk of resource depletion and breakdown of functions, ultimately detrimental of the entire group. Applied to our context, the lack of a leader responsible for the whole ED team may have negative consequences for interprofessional collaboration in the ED.

The challenge with having different organizational affiliations between several daily work places was also identified when integrating clinical pharmacists to psychiatric emergency care in a Danish report from 2017 (152). Unlike the football team with a coach responsible for description, the ED team may lack clear leadership, which is vital for fostering interprofessional collaboration (102, 148, 150). Consequently, we may have to rethink ED organization to fully integrate the pharmacist and streamline medication safety work in the EDs. For instance, a UK study assessing the integration of advanced clinical practitioner pharmacists into ED settings concluded that for full integration, management should be situated within the ED (141). It would also be beneficial for the day-to-day support and for enabling interprofessional training. This arrangement ensures close collaboration while maintaining professional ties to the pharmacy department (141). When introducing pharmacists in ED teams for the future, a leader must clarify role description early in the transition process (150). Employees need to know about old and new roles, tasks, and responsibilities, as the new roles may lead to uncertainties concerning one's own work

situation. If there is divergence between role expectations and practice, role stress/strain may occur (153), which can affect both individuals and organizations negatively (154). This is what physicians in **Paper III** described. The current absence of a clear ED team management raises questions regarding the organization of the healthcare system as a whole. How should the different hospital trusts and departments be organized to collaborate towards mutual goals? Should staff be re-organized into a single ED unit rather than being dispersed across different units with separate leaders, similar to the UK setting? These are questions that needs to be raised on a national level.

A second element to consider is culture. Culture is often described as "the way we do things around here" and involves informal or unwritten rules for interpersonal interactions in organizations (150, 155, 156). The social norms guide employees' actions, and contributes to increase predictability among employees' behavior (150). In **Paper III**, we identified what we perceived as a culture clash between physicians and pharmacists in the ED. Physicians did not perceive medication safety to be of high priority in the ED, while pharmacists worked very thoroughly and detailed with medication-related tasks – which was why physicians trusted pharmacists with medication reconciliation. The cultural norms often reflect the organizations' underlying values and sets assumptions for the transition processes (150).

Currently, there may be a mismatch between pharmacists' and physicians' perceptions of the goal when working with medication-related tasks in the ED (**Paper III**). Research also shows that underlying social dynamics, such as cultural norms, attitudes, and interpersonal familiarity, may be barriers to interprofessional collaboration (58, 103, 110-112). Leaders can have an impact on the culture through communicating joint visions and goals for the organization and through socializing new employees so they understand the culture (157). On the one hand, the absence of a joint ED leadership may lead to a failure to socialize and integrate ED pharmacists into the preexisting culture. Or on the other hand, it may have failed to synthesize and agree upon a *new* clear and common vision for medication safety work in the ED, which may be bridging the gap between physicians' and pharmacists' attitudes concerning medication safety tasks in the ED…? In light of the cultural challenge, the presence of a dedicated leader with a clear vision for medication safety could be helpful in bridging the cultural divide between pharmacists and physicians in the ED. Such a leader would not only facilitate the integration of ED pharmacists into the existing culture but also foster the development of a new, shared culture that aligns with the goals of interprofessional collaboration and medication safety.

A third element identified in **Papers I and III**, which is hard for neither the ED physician or the ED pharmacist to encounter, is the lack of responsible recipients at the hospital wards to follow-up on medication-related challenges identified by the ED pharmacist. This may also require an organizational change, looking at the structure of how we work with medication

safety in the hospitals. In **Paper I**, physicians admitted postponing medication-related questions for the ward setting. However, they also recognized that they did not prioritize medication-related questions while on ward duty either. Similar challenges with communication of medication-related problems between secondary and primary care was also identified in a study by Johansen et al (158). Physicians in **Paper III** also highlighted that not all medication-related problems identified by pharmacists can be handled in the ED and they identified this as an improvement area. This is consistent with literature saying that pharmacists detect problems that are relevant for both the ED and the hospital stay (82). Consequently, healthcare organizations need to identify potential collaboration patterns across hospital departments and establish procedures to assign responsibility for follow-up on medication-related questions after transition of care from the ED. For example, could nurses consistently address responsibility for follow-up during pre-rounds with physicians? Alternatively, in hospital departments with a clinical pharmacy service, could pharmacists be tasked with this responsibility?

To take this even further, there are also collaborative challenges between primary and secondary healthcare services. The Norwegian Health Commission's official report from 2023 "Time to act" suggest establishing a committee to investigate and justify if a holistic organization of healthcare services at one level may contribute to better use and utilization of healthcare services (159). It may therefore be that our findings about the physician-pharmacist collaboration should also be explored in this larger context, but obviously this goes beyond the scope of the present dissertation. Our results, however, clearly indicate a need for a similar evaluation and investigation of the healthcare structure within secondary care hospitals. One possible solution may be to establish pharmacotherapy clinics, to where patients with medication-related problems may be referred during or after hospitalization. To our knowledge, such clinics are established in other countries (160, 161). This may be one way of making sure medication-related issues are taken care of before the patient is discharged. Another way may be similar to the Australian home medicines review, where general practitioners refers patients to their preferred pharmacy or pharmacist for a medication review, and subsequently the pharmacist document and communicate their findings to the general practitioner who further formulate a plan together with the patient (149). A third way may be to introduce the "family pharmacist" concept, a solution implemented in Belgium in 2017 (162). The family pharmacist, based in a community pharmacy, signs a contract with the patient. The main task is to keep the patient's medication plan up to date and make it available to other healthcare professionals. As the designated point of contact for matters concerning a patient's medications, the family pharmacist plays a pivotal role in strengthening the relationship with the general practitioner (162).

A fourth element relevant for organizational change is related to design of physical space of EDs. Roxberg et al. argues that our understanding and utilization of the concepts of place and space are important for health and care (163). For example, physical design of residential care homes may affect the health and well-being of people living there, as their frail health may isolate them in their rooms and prevent people from using the common areas (163). Place and space can be conceptualized in two ways; as a passive "somewhere", or as an active participative element in health and care creation (163). In **Papers I and III**, we identified a lack of space in the EDs as a barrier to collaboration between healthcare professionals. From the perspective of space as a passive "somewhere", the EDs lacked sufficient physical space and resources, such as computers for all healthcare professionals, leading to the use of temporary workspaces by medical students, junior physicians, and pharmacists. Viewing space as active in health and care creation, lack of space not only disrupts the ED's workflow but also hinders formal and informal communication between physicians and pharmacists, which is crucial for interprofessional collaboration. Adequate space is vital for fostering communication, building relationships and trust, and enable learning, education, and consultation (164-167).

7.5 A need for reform on political and health authority levels

The need for a healthcare organization reform has recently been acknowledged by the Norwegian Health Commission (159). This is mainly based on the growing population of the elderly and the simultaneously increasing shortage of healthcare professionals. The use of temporary workers contributes to a major cost for Norwegian healthcare services (168-170). A recent campaign called "Physicians must live" (in Norwegian: "Leger må leve") received massive support and engagement in (social) media, which communicates that physicians experiencing their work in healthcare as an excessive burden in their own private lives (139). The healthcare service is facing a critical shortage of healthcare professionals, a crisis that is affecting services both nationally and globally. To ensure a sustainable healthcare service, there is an urgent need to educate and recruit new healthcare professionals, retain existing staff, and alleviate the workload pressure on healthcare professionals (159, 171). This is important in relation to working conditions, but also in the perspective of patient safety, as research show that healthcare professionals who are stressed and on the limit of the capacity are more likely to make mistakes (172, 173).

A proposed strategy suggested by the Norwegian Health Commission to tackle the shortage of resources is task shifting/sharing, which involves moving tasks from one health profession to another, for example to pharmacists (159). The commission proposes that healthcare services must work targeted and systematic to identify and utilize various health professions' core competencies and capacity to solve different work tasks (159). Clinical pharmacists are well-trained in tasks like medication reconciliation, medication review, and patient counselling. They are also medication experts, which is the foundation for their high

competence performing these tasks (50). In **Paper III**, these were also some of the tasks identified by physicians that ED pharmacists had contributed with, in addition to complementing the ED team with their competencies. Physicians experienced that task shifting and sharing saved both time and effort by alleviating physicians' workload, in addition to increasing the overall medication safety. However, physicians also identified that the physician-pharmacist collaboration in the ED were not as efficient as it could potentially be (**Paper III**).

One obstacle for efficiently utilizing Norwegian pharmacists' competencies, is the lack of prescribing rights. Because of this, pharmacists do not have access to the prescription intermediary, and are not able to individually amend the medication list after identifying medication discrepancies or errors. This must be done by the physician. For example, if the pharmacist identifies that a patient has two prescriptions for the same medication, but only one of them contains the current dose regimen, the pharmacist needs to involve a physician to remove the prescription not in use. This workflow was identified in **Paper III** as inefficient and leading to double work according to the physicians. When available, physicians had to update medication lists according to information received from pharmacists in e.g., journal notes, post-its, or face-to-face communication. Currently in Norway, being responsible for documentation and updating a patient's home medication list requires prescribing rights, which Norwegian pharmacists do not have. For utilization of clinical pharmacist resources through task shifting, health authorities must acknowledge their position in facilitating the process, not merely placing responsibility on healthcare institutions. The Norwegian Health Commission's report states, with some exceptions, that there are no definitive answers to which healthcare professional should perform which task (159). However, to enable task shifting of medication reconciliation from physicians to pharmacists, we must look at the current regulatory challenges that hinders the pharmacy profession from independently completing this task.

There are different solutions to address this challenge. One way is to look at the health system and structure, and provide regulations, procedures, and access for pharmacists to independently be responsible for medication reconciliation. For example, Danish pharmacists do not have prescribing rights, yet, they have worked with medication reconciliation and reviews in many EDs for the past decade (174, 175). In Denmark, for instance, they make a clear separation between an "ordination" and a "prescription". National regulations enable physicians to delegate certain tasks to other healthcare professionals. For example, physicians can delegate the *ordination* of medications to pharmacists, which does not require prescribing rights (175-177). Another way to address this challenge, is by introducing prescribing rights for pharmacists, as done in the UK. In 2006, the UK implemented regulatory changes that empowered pharmacists to independently prescribe medications, provided they do so within

the scope of their clinical expertise (178). Their pharmacy education system is also underpinning this approach, as pharmacists need to be both taught and trained in medication prescribing. In Canada, pharmacist prescribing rights differ between provinces and are characterized by the ability to initiate, continue/renew, or adapt prescriptions (57, 110). A hybrid approach used in the US allows pharmacists to prescribe medications under collaborative practice agreements with primary care providers (physicians) within healthcare institutions (179). For instance, if a patient is diagnosed with diabetes, the physician refers the patient to the pharmacist who then manages the treatment and follow-up care for the patient's diabetes. The agreement specifies procedures for types of decisions the pharmacist is allowed to make and how to communicate patient care issues back to the physician. Such collaborative practice agreements on behalf of the physician exist for various conditions, e.g., diabetes, hypertension, heart failure, and chronic obstructive pulmonary disease, depending on the clinic (179).

In 2015, a Norwegian white paper named "Medicinal Products: Correct use – better health" emphasized that pharmacists should have a role in patient treatment due to their specialized knowledge of medications, and that clinical pharmacy services are an important measure to ensure medication safety and increase patient safety (180). This is now almost a decade ago, and clinical pharmacy positions are still not widespread across Norwegian hospital departments, nor EDs. In **Paper III**, we identified that pharmacist availability was a barrier for physician-pharmacist collaboration in the ED. Literature also support that resource allocation, both financial and availability of staff, are barriers for interprofessional collaboration in both primary and secondary care (58, 103-107). There is conflicting evidence regarding the cost-effectiveness of clinical pharmacist interventions, along with a call for more robust studies (62). However, research has shown that clinical pharmacy services decrease cost and/or are cost-effective due to e.g., reduction in length of stay and medication-related problems, including medication errors (62, 181-183). While there are political incentives to ensure medication safety by using pharmacists, there may be a lack of financial support from health authorities to allocate enough resources to educate and employ clinical pharmacists across hospital departments and EDs.

7.6 Evolving academic landscapes: the future of education

Organizational and regulative changes also need to be followed up by educational changes. The growing elderly population is driving a higher demand for healthcare services, both now and for the future (159). Having multiple health-related issues and polypharmacy is common among the elderly, and they are at a greater risk of suffering medication-related problems because of e.g., physiological changes, adverse drug events, or interactions between medications (184). The medical advancement and increasing demands for patient safety requires further specialization for healthcare professionals (159).

Pharmacists should be educated and made ready for the future tasks. The Norwegian educational system has not followed the same changes as for instance the one in UK, where all pharmacists educated from 2026 will be independent prescribers after graduation (185). Neither do Norway have an ED pharmacist education as they do in the US (76). However, throughout the last decade, clinical pharmacy practice has been implemented in some Norwegian pharmacy educations (186).

In **Paper I**, we identified that physicians were unaware of pharmacists' competencies. This is not surprising seen in the light of the relative novel role of clinical pharmacists in Norway, in addition to the sparce distribution of clinical pharmacists across Norwegian healthcare services. Also, pharmacy students have not traditionally had clinical placement outside primary care pharmacies. Physicians are therefore unaccustomed to collaborating with pharmacists and consequently unaware of how pharmacist knowledge and competencies can be utilized. Additionally, other healthcare students may be unaware of the pharmacist competencies, as the Norwegian healthcare education often conduct "silo education", with limited interprofessional contact (187).

The World Health Organization emphasizes interprofessional education as a precursor to collaborative practice, which enhances healthcare systems and patient care quality (171). Recent Norwegian national guidelines also emphasize that healthcare students must be trained in interprofessional collaboration throughout their education, which consequently becomes an integral part of their final competencies after graduation (188). During the pharmacy education at UiT the Arctic University of Norway in the beginning of the 2010s, there were no interprofessional educational activities included in the pharmacy curriculum. This has changed. Today, a mandatory 10 ECT course is carried out for all first year students at the Faculty of Health Sciences, where all health and social care students participate (189). The course aims for students to acquire fundamental knowledge regarding collaboration, ethics, and communication within healthcare services. However, the students have yet to acquire considerable knowledge to practice within their own health profession. Consequently, the course does not facilitate learning interprofessional collaboration in practice. Efforts have though been made throughout many years to improve and evolve interprofessional education at the Faculty of Health Science at UiT. For instance, efforts have been made to introduce interprofessional learning activities at different levels of the students' education program, e.g., in clinical practice. For pharmacy students, the currently established interprofessional activity is with medical students. where 1st year pharmacy students on the Master program meet and perform medication review together with 4th year medical students. This is new from 2023 and have not yet been described in literature. In order for interprofessional teaching and learning to develop, educational institutions and workplaces must acknowledge their role in fostering interprofessional collaboration, both during teaching and training.

Perhaps some of the challenges identified in **Paper I** could be overcome if pharmacy and medical students worked more closely together throughout their educational programs?

The Interprofessional Education Collaborative's core competencies for interprofessional education include four competency areas: 1) Values and Ethics; 2) Roles and Responsibilities; 3) Communication; and 4) Teams and Teamwork (190). At UiT, efforts to achieve these objectives has been made through the "Tromsø model" for interprofessional collaboration, who's main elements concern spiral learning, practice-oriented, and pragmatic solutions (189). To our knowledge, this work is currently ongoing but has not yet been fully integrated and the implementation of interprofessional education requires institutional anchoring and leadership (191).

Another way to focus on interprofessional education is through the Linköping interprofessional education model that has received international attention and praise (192). The model has yielded experiences for nearly 40 years and contains three modules for interprofessional learning occurring at three separate time points during the health professions education (192), similar to the "Tromsø model". The first module aims to develop a base of common values and holistic views, in addition to introducing problem-based learning and group work. The second module aims to test and combine own emerging professional identity with others. In the final module students get to test their team skills in realistic settings (192). A study on interprofessional simulation training showed high satisfaction, with students desiring more focus on interprofessional teams in their own curriculum (193). Such education aids medical students in transitioning to a junior physician by fostering an understanding of healthcare roles and collaboration (194, 195).

In **Papers I and III**, we found that ED physicians want and need help from pharmacists, and that pharmacists possess knowledge and skills that complements the ED team. Norwegian politicians were recently in the UK to study how pharmacies may relief work off physicians by providing consultations and treatment for minor conditions (196), and educational institutions should prepare students for similar task shifting in the future. In **Paper III**, we also identified that physicians experienced that the pharmacists identified medication-related problems that was deemed irrelevant by ED physicians. In Norway, it is possible to study clinical pharmacy as a master program at the University of Oslo. However, the future need for healthcare services may need further specialization for pharmacists as well. In the US, for instance, pharmacists can pursue specialized education to become board-certified in emergency medicine pharmacy (76). Tasks for ED pharmacists in the US concerns e.g., resuscitation, medication preparation/administration, and toxicology recommendations (55). In the US the value of having specialized trained and knowledgeable pharmacists is more strongly recognized than in Norway, and for example, it is also possible to become a certified geriatric,

pediatric, infectious disease, critical care, or psychiatric pharmacist (197). Physicians in an Australian study also emphasized the need for specialized training for pharmacists (104).

8 Methodological considerations

8.1 Evaluating quality in research

Critically evaluating the various stages of the research process and outcomes through methodological considerations are considered quality assurance activities (198, 199). Methodological considerations in quantitative research often implies the use of standardized procedures, such as the use of blinding, randomization, and control groups (200). Assuring quality in qualitative research has been a topic of discussion for decades, and a standardized approach using procedures and guidance is less frequently used in qualitative research (198, 199). In a review by Reynolds et al. concerning quality assurance in qualitative research, they interpreted two dominant narratives from the literature which concerned 1) quality as assessment of outputs and 2) assuring quality of process (198). In the output-oriented approach, the perspective is external and done post-hoc and concerns e.g., validity, rigor, confirmability, credibility, and trustworthiness. Checklists are often recommended in this approach. Many journals require the use of reporting guidelines when submitting manuscripts with different qualitative and quantitative study designs, for example the consolidated criteria for reporting qualitative research (COREQ) checklist (201, 202). In the process-oriented approach, the perspective is internal, researcher-led, and ongoing, and concerns e.g., reflexivity, transparency, comprehensiveness, responsibility, ethical practice, and systematic approach. Active methodological awareness is recommended over checklists (198).

Stenfors et al. summarized five criteria for evaluating the trustworthiness of qualitative research: credibility, dependability, confirmability, transferability, and reflexivity (203). Using universal criteria for evaluating qualitative quality is an ongoing debate and considered contradictory by some. However, Sarah J. Tracy (2010), a teacher of qualitative methods, argues that using concepts to consider quality can help us provide a common language to help us communicate the value of our work – especially to power holders who may see qualitative research as "*just a good story*" (199). Tracy's approach is more comprehensive than the previously mentioned approach by Stenfors and will be used further in this part with methodological considerations. Tracy conceptualized eight "big-tent" criteria driven by a pedagogical motivation: to help students practice excellent qualitative work. Throughout the work with this dissertation, it has been helpful to evaluate quality through this universal way. The eight "big-tent" criteria for excellent qualitative research includes both an output- and process-oriented approach and are further elaborated on in the following sections. The same criteria have been used for methodological considerations for the quantitative data.

8.2 Worthy topic

Tracy proposes 'worthy topic' as the first criteria for quality, and states that the topic of the research "*is relevant, timely, significant, interesting or evocative*" (199). Researching interprofessional collaboration between physicians and pharmacists are important for other countries across the whole world who, like Norway, are not accustomed to integrating clinical pharmacists in interprofessional teams in hospital wards and EDs on a routine basis. Additionally, the background and knowledge gap sections of this dissertation show how the three papers check the above-mentioned criteria for a worthy topic. The topics of the papers were also relevant for the PharmED project. Physicians' perspectives prior to and during integration of pharmacists in EDs are not, to our knowledge, investigated in a Norwegian setting previously. Nor are physicians' distribution of time on medication-related tasks prior to integration of ED pharmacists. Physicians' time distribution concerning medication-related tasks in general is a scarcely investigated field which **Paper II** adds to the knowledge of. Timing of the studies in **Papers I and III** gave the opportunity to study differences in physicians' perceptions prior to and during the integration of ED pharmacists. The current and future demands on healthcare professionals calls for action, and task shifting is one of the proposed strategies (159). The World Health Organization suggests medication reconciliation and medication review as action areas to decrease medication-related problems, especially during transitions of care, and that pharmacists' competencies should be utilized in interprofessional teams (11). Studying how integration of pharmacists may affect ED physicians is therefore relevant also in this context. Our findings may be of interest to other countries in a similar situation as Norway.

8.3 Rich rigor

Qualitative data with 'rich rigor' refers to a rich complexity of abundance and is generated by a "*requisite variety of theoretical constructs, data sources, context, and samples*" (199). Requisite variety suggests that "*a researcher with a head full of theories, and a case full of abundant data, is best prepared to see nuance and complexity*" (199). Rich rigor calls for sufficient data and time in the field, including appropriate data collection and analysis process. However, rich rigor is not synonymous with quality, but it increases the likelihood of quality (199). Interviewing multiple physicians with different experiences from three EDs in **Paper I** generated a diversity in the data sources and context, and consequently increased the richness of the data. Combining a qualitative and quantitative approach provided knowledge and complexity to the studies in this dissertation which also increased the richness and quality.

One limitation of our overall approach is that ED physicians in the third hospital UNN Harstad were not interviewed for **Paper III**. In retrospect, adding interviews from Harstad could have increased the richness of the data and therefore influenced the analysis.

In **Paper II**, we ensured rich rigor by choosing the WOMBAT approach for data collection. WOMBAT provided detailed and continuous data measurements including multitasking, compared to other methods noting observations every third minutes, or stop-watch methods with all its challenges concerning time stamping, observation bias, and the inability to record multitasking (92, 94).

8.4 Sincerity

According to Tracy, 'sincerity' in research refers to "*being honest and transparent with researcher's biases, goals and foibles as well as how these played a role in the methods, joys and mistakes of the research*" (199). Sincerity as a criterion for quality is therefore characterized by self-reflexivity about subjective values of the researcher and transparency about methods used and challenges faced. These aspects are accounted for throughout the present dissertation by describing the role of the researcher as a pharmacist trying to analyze and view physicians' perspectives. This has been quite challenging throughout the process. Knowing that preconceptions as a pharmacist have been brought into both interviews and analyses has caused a fear of misinterpreting the data. Additionally, as pharmacists were interviewing physicians about their perceptions towards pharmacists, we acknowledge that physicians may have been prevented from speaking the full truth and expressing their true opinions. Consequently, this may lead to uncertainties (less sincerity) in the data material. We have strived for sincerity in all three papers by being transparent about the methods used, acknowledging contributors, funding, and the researcher's roles in each study.

8.5 Credibility

'Credibility' refers to the study's trustworthiness, meaning research where readers can act on and make decisions according to results they deem as trustworthy enough (199). In quantitative research, terms used to earn credibility are for example reliability, i.e., are results replicable, and validity, i.e., are measurements accurate and measuring what they intend to measure (199, 204). These concepts are considered inadequate for evaluating credibility in qualitative research, however, they may still be applied for **Paper II**. The WOMBAT tool is a reliable and validated method to collect and time-stamp observational data (117). We also conducted reliability testing prior to and during data collection periods to ensure highest possible inter-observer agreement (205, 206). Tracy argues that qualitative credibility is achieved through practices including thick description, triangulation or crystallization, multivocality, and member reflections (199).

'Thick description' concerns in-depth illustrations, and suggest that researchers show, rather than tell, meaning and complexity in their data through details so that readers can come to their own conclusions (199). Thick description is one of the important criteria for credibility, and "*requires that the researcher account for the complex specificity and circumstances of*

their data" (199, 207). The use of citations from interviews has been given considerable space in both **Papers I and III**, and to an extent where it was challenging to identify journals that did not have very limited space for disseminating results. We also spent time to observe and develop detailed categories for the WOMBAT data in **Paper II**. Where other studies may have merged different types of "oral communication about medications" to one category, we separated what we through observations identified as different types of oral communication into four subcategories to provide further details on the matter. For example, to *retrieve information* about medication use (as a part of medication reconciliation) can be separated from *giving information* about medications.

According to Tracy, 'triangulation' often assumes that different methods or researchers identify the same findings in the same setting and assumes a single reality (199). Tracy argues that different methods or researchers often do, and should, give different results. However, the use of multiple methods or researchers are considered valuable by some researchers (199). Triangulation may also be described as combining various methods to offer perspectives of the phenomenon of interest, and methods leading to the same result provides more trust in the findings (114, 208). According to Malterud, the different perspectives do not answer the same question, but makes it possible to ask further questions about the same phenomenon (114). **In Paper II**, we found that physicians spend *very little time* on medication-related tasks, while they in **Paper I** described to use *a lot of time* on this. It is notable that the aim of **Paper I** was not to have physicians estimate the exact time spent on medication-related work. However, the findings are contradictory and rises questions we should seek to understand.

'Crystallization' aligns with triangulation, and contributes to the credibility of the research (199). It encourages researchers to use different methods and researchers, yet not to provide a single reality, but rather to provide a more complex understanding (199). In our interviews, several students were involved conducting individual analyses using different methods before all interviews were merged and re-analyzed. Analysis performed by students on data material in **Papers I and III** yielded similar results, which is considered a strength in the study. The students have both medical and pharmacy backgrounds and had less knowledge about the study context. It was therefore somewhat reassuring for an unexperienced qualitative researcher that we identified similar challenges and enablers, although we presented it in different ways. Crystallization is considered a strength in this study. When using both qualitative and quantitative methods we were provided with a deeper knowledge and understanding of e.g., medication reconciliation conducted in the ED. Results from the two methods made us reflect upon why we identified such differences in time distribution expressed in interviews and measured by the WOMBAT tool.

Tracy explains 'multivocality' as closely related to crystallization, and that "*multivocal research includes multiple and varied voices in the qualitative report and analysis*" (199). In addition to the above-mentioned contributions to quality, our research team consisted of researchers with backgrounds from pharmacy and medicine, with a variation in experiences and expertise in the use of different research methods. This has provided the opportunity to gain multiple perspectives through the research process and in the production of the final results. We also gained multivocality in our data, by interviewing and observing physicians from different backgrounds, men, women, junior, senior, internists, and surgeons.

Concepts like member checks, member validation, and host verification are often used to demonstrate whether the researcher's findings align with the understanding of the participants being studied (199). Tracy argues that these terms propose a true reality, and instead advocate the use of 'member reflections' as an umbrella term covering these labels (199). Member reflections can be viewed as an opportunity for "*collaboration and reflexive elaboration*" rather than to confirm findings (199). In our studies, member reflections were not carried out. One reason for this was that we were already grateful for the time physicians gave us in their already stressful and jam-packed days, and we were perhaps afraid to "ask for more". Additionally, we had to consider COVID-19 restrictions continuously. Seen retrospectively, we should have planned for a structured member reflection. This could have been done by making the informants read through their interviews, or by discussing the overall results with informants and those we observed. This would have increased the quality of the studies. However, planning for member reflections could also be a challenge since physicians change placement during their training program and consequently could be hard to reach.

8.6 Resonance

'Resonance' refers to the "*research's ability to meaningfully reverberate and affect an audience*". Tracy describes two methods of practice to achieve 'resonance': aesthetic merit and generalizability/transferability (199). Aesthetic merit means "*that text is presented in a beautiful, evocative, and artistic way*" and generalizability/transferability refers to "*the study's potential to be valuable across a variety of contexts or situations*" (199).

It is challenging to evaluate the aesthetic merit of the text as it involves individual preferences. However, we tried our best in all papers to present results using figures, tables, and providing names for our informants to make the text more "alive". Additionally, being consistent with the colors of challenges/barriers and enablers/motivations in figures and tables throughout this dissertation have also been a method to achieve aesthetic merit.

In **Paper II**, we identified surprisingly similar results for time spent on different tasks for physicians across the three EDs. Therefore, we can assume that the results may be

generalizable to other Norwegian ED settings considering they are often organized quite similarly. However, the workflow and organization may differ across EDs, and should therefore be considered when generalizing results. Transferability in qualitative research is created "*when readers feel as though the story of the research overlaps with their own situation and they intuitively transfer the research to their own action*" (199). It is challenging to consider if other researchers resonate with the findings of our studies. **Papers I and III** tell a story that concerns the physician-pharmacist collaboration in the ED setting, yet it is not unreasonable to believe that the presented challenges may concern clinical pharmacists collaborating with physicians in other settings, e.g., in hospital wards or primary care settings. Some of the identified challenges may also be transferable to integration of other healthcare professionals than pharmacists into interprofessional teams. The increasing demand on healthcare services and lack of healthcare professionals have caused a need to utilize various healthcare professionals' competencies, including pharmacists. Rather than trying to be transferable to other settings by reporting results, this dissertation focuses on telling a story of which challenges that can occur when integrating pharmacists as new members of interprofessional teams in Norway, and what we can do to enable and accommodate for the identified challenges. However, the empirical studies were conducted in three different ED settings yet yielded the same reported challenges.

8.7 Significant contributions

Research should according to Tracy provide 'significant contributions' either theoretically, practically, morally, methodologically, or heuristically (199). The findings in the studies of this dissertation may not have any theoretical or methodological contributions per se, rather some practical and heuristic implications. Practically significant implications concern whether the knowledge is useful and shed light on a contemporary problem (199), which the dissertation clearly does, shedding light on future collaboration between physicians and pharmacists in EDs. The results show that physicians want to establish a permanent collaboration with ED pharmacists in the future and suggest ways to improve the collaboration. Further this dissertation discusses in chapters 7.4, 7.5, and 7.6 how different policymakers could take responsibility for their area to enable the future physician-pharmacist collaboration.

Heuristic significant contributions concern whether the research motivates to further research and exploration in the future. Many questions can be raised after viewing the contributions of this research; what will happen if pharmacists are provided with individual responsibilities in the ED? How can interprofessional education be promoted? Do (junior) physicians need more training in medication-related tasks? What is the ideal time spent on medication reconciliation in relation to the use of resources? How can collaboration between the ED and wards be improved? The research has arguably had significant contributions in this concern.

8.8 Ethical considerations

'Ethical considerations' include procedural, situational, relational, and existing ethics (199). Procedural ethics refer to which procedures and approvals that are needed to conduct research (199) and are elaborated in chapter 5.8 and in the individual papers.

Situational ethics concern moments that may arise in the field (199). One example where situational ethics was considered was during collection of WOMBAT-data in **Paper II**. We were shadowing physicians, but patients were always informed of the purpose, and we included an "unknown" category in the WOMBAT tool that were used if the situation required the observer to wait outside due to sensitivity. We did not know what the physicians were doing, therefore the category was named "unknown". However, it could also have been called "confidential" which may have described the category better.

Relational ethics involves self-consciousness and the importance of mutual respect (199). During observations and interviews it was important for the researchers to establish why we were there, and create an environment where physicians felt comfortable with sharing. We strived to act or react in a respectful way throughout the data collection. Relational ethics was particularly important during the observations in the WOMBAT-study, where a risk of introducing Hawthorne biases exist. The Hawthorne effect concerns whether the participants being studied change their behavior during observations (209). Consequently, it was important for observers to be self-aware and strive to make physicians comfortable with being observed. Prior to observation sessions we explained that we were not there to evaluate in any way *how* they conduct their work, but merely observe *what* they do so that we could see if introducing ED pharmacists changed their time distribution later. However, we cannot exclude the possibility of the Hawthorne effect impacting our data material.

Existing ethics considers how researchers present their research to avoid misinterpretations or injustice (199). The research team have continuously discussed reporting of findings and took steps to ensure for example that translation of quotes is correct. Another step was identifying correct names for categories in the WOMBAT tool. For example, one category was initially named "break/social", however after discussions in the research team we were afraid it could be misinterpreted by readers. Consequently, we changed it to "standby", which was deemed a more appropriate term. At the same time, our studies may raise some questions concerning attitudes and time spent on medication-related tasks by physicians in the ED. It has been important to not "throw physicians under the bus" when reporting results, yet we acknowledge that some may interpret our results in a different way.

8.9 Meaningful coherence

A meaningful coherent study achieves its purpose and uses methods that aligns with the stated aims and objectives. Additionally, it "*attentively interconnect literature reviewed with foci, methods, and findings*" (199).

This dissertation aims to identify key factors for successful physician-pharmacist collaboration in the ED. The qualitative studies shed light on physicians' perceptions of these factors and their attitudes towards the new interprofessional collaboration. It provides in-depth knowledge on how perceptions changed after learning to know the pharmacists, and that some of the identified challenges prior to integration was still evident during. Combining different methods provided the opportunity for a broader understanding of medication-related problems in an ED context. Findings have also connected with and added to existing literature. The studies are therefore believed to be coherent and have complemented each other in generating data. However, coherence may have been strengthened by spending more time on the theoretical approach prior to data collection, and perhaps included or combined physicians' perspectives with pharmacists' perspectives. It would have been interesting to conduct focus group interviews with physicians and pharmacists to further explore their combined experiences of the identified key factors. Nonetheless, we hope that the generated knowledge of this dissertation is useful and contributes to potential evolvement and improvement of the healthcare system.

9 Future research and perspectives

This dissertation serves as foundation and generator for many new research questions and future research studies.

Based on **Papers I-III**, we have identified a need for ED pharmacists to take on a greater responsibility concerning medication safety tasks, ultimately to improve medication therapy and reduce the frequency of various medication-related problems. If pharmacists are granted with the opportunity to independently conduct various medication safety tasks, such as medication reconciliation, future research should investigate whether this improves various patient outcomes.

In **Paper III**, we identified a need to place responsibility for follow-up concerning medication-related problems identified in the EDs. Future studies should investigate how this should be done, who should be involved, and where this should be done. One possible solution can be by implementing “medication-related follow-up” as a standard part of the workflow during pre-rounds with physicians on hospital wards. Another possible solution may be to design an intervention where patients are referred to an outpatient pharmacotherapy clinic.

In **Papers I and III**, we identified challenges in physician-pharmacist collaboration, including a lack of clear role descriptions, acceptance, defined responsibilities, and cultural differences. Clear leadership is proposed as a potential enabler for clarifying roles and fostering a collaborative culture. Currently, healthcare professionals in EDs are managed by different departments. Future research should explore how the leadership role influence interprofessional collaboration in the current healthcare system.

The research presented in this dissertation is primarily based on physicians' perspectives. However, it is crucial to acknowledge the significance of other stakeholders in the healthcare continuum. For instance, the patient, for whom the healthcare system ultimately exists, warrants attention. The patient perspective is currently being investigated by another PhD student in the PharmED project. The project is also investigating how the integration of pharmacists affected ED physicians’ time distribution using the same WOMBAT template as in **Paper II**. Additionally, time distribution for pharmacists and nurses are being investigated.

10 Conclusions

This dissertation has identified that medication safety may not always be a priority for ED physicians, indicating a potential need for pharmacists to take on greater responsibility in this area. The studies reveal that physicians recognize and appreciate the value and core competencies the pharmacists add to the ED team, particularly in enhancing medication safety. Our findings underscore the importance of clear role descriptions and mutual role acceptance to strengthen the physician-pharmacist collaboration, which will further enable clear responsibility areas. Clear leadership is proposed as a potential enabler for clarifying roles and fostering a culture of collaboration. Within the Norwegian healthcare system, the study uncovers structural and regulatory challenges in leveraging clinical pharmacists to their full potential. Despite their expertise in medication reconciliation, clinical pharmacists are constrained by the current system, which does not grant them the opportunity to perform and complete this task independently. These limitations highlight the need for regulatory and political changes that transcend the daily collaboration between physicians and pharmacists in the ED.

The key factors influencing physician-pharmacist collaboration in EDs, as identified by our findings, are crucial for advancing our understanding of medication safety and the integration of clinical pharmacists in EDs, and perhaps also in other healthcare settings. We pinpoint that **clear role description**, **acceptance of roles**, and **delineated responsibilities** are essential, which may be enabled by **strong leadership**. To shift medication-related tasks from physicians to pharmacists, we further emphasize the need for **organizational** and **regulatory** changes. In addition, improving interprofessional collaboration and continuing education through the **educational system** will be necessary. These factors may not only optimize the physician-pharmacist collaboration, but also meet the evolving demands of delivering safe and effective healthcare services.

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Paper I

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EMPIRICAL STUDIES

Emergency department physicians' experiences and perceptions with medication-related work tasks and the potential role of clinical pharmacists

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ABSTRACT

Purpose: Medication-related problems are frequent among emergency department patients. Clinical pharmacists play an important role in identifying, solving, and preventing these problems, but are not present in emergency departments worldwide. We aimed to explore how Norwegian physicians experience medication-related work tasks in emergency departments without pharmacists present, and how they perceive future introduction of a clinical pharmacist in the interprofessional team.

Methods: We interviewed 27 physicians in three emergency departments in Norway. Interviews were audio-recorded, transcribed, and analysed using qualitative content analysis.

Results: Our informants' experience with medication-related work tasks mainly concerned medication reconciliation, and few other tasks were systematically performed to ensure medication safety. The informants were welcoming of clinical pharmacists and expressed a need and wish for assistance with compiling patient's medication lists. Simultaneously they expressed concerns regarding e.g., responsibility sharing, priorities in the emergency department and logistics. These concerns need to be addressed before implementing the clinical pharmacist in the interprofessional team in the emergency department.

Conclusions: Physicians in Norwegian emergency departments welcome assistance from clinical pharmacists, but the identified professional, structural, and legislative barriers for this collaboration need to be addressed before implementation.

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Introduction

Medication-related problems (MRPs) among emergency department (ED) patients occur frequently and is detrimental for patient care (Budnitz et al., 2011; T. K. Patel & Patel, 2018; P. Patel & Zed, 2002). ED pharmacists contribute significantly to reduce and prevent MRPs (Mekonnen et al., 2016; Mogensen et al., 2012; S. R. Morgan et al., 2018; Roman et al., 2018) and they are highly valued for promoting medication safety and improving patient care (Coralic et al., 2014). Activities performed by ED pharmacists involve e.g., medication reconciliation (MedRec), medication review (MedRev), pharmacotherapy consultation, drug interaction analysis, and patient counselling, as well as other activities like training and educating ED team members (S. R. Morgan et al., 2018).

ED pharmacy services have been established for more than 20 years in the US and UK, which have inspired the development of ED pharmacist practice worldwide (Roman et al., 2018). However, in many countries the ED pharmacist is not a fully integrated part of the health care service. This is the case in Norway, where only a handful EDs have employed pharmacists. During the last decade, MedRec has become an important task in Norwegian hospitals, with both local and national regulations, written procedures, and recommendations (The Norwegian Directorate of Health, 2018; Vorland, 2018), which has increased ED physicians' workload considerably. At the same time, studies show that 62–84% of medication lists in Norwegian hospitals contain medication discrepancies (Aag et al., 2014; Damlien et al., 2017). This increases the risk of MRPs and challenges patient safety (Makary & Daniel, 2016).

ED pharmacists work closely together with physicians. Literature shows that physicians in primary care settings are generally positive and highly value the contributions of clinical pharmacists in providing comprehensive patient-centred care (Costa et al.,

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2015; Moreno et al., 2017). A study investigating the collaborative working relationships between pharmacists, physicians, and nurses in an inpatient medical setting found that role clarity and relationships built on mutual respect and trust were essential for successful integration and collaboration with pharmacists (Makowsky et al., 2009). To our knowledge, literature regarding ED physicians' expectations and perceptions concerning future collaboration with ED pharmacists is scarce. A Swedish study from 2017 investigated perceptions of nurses and physicians before implementing a ward-based clinical pharmacy service (Sjölander et al., 2017). They identified limited experience with and knowledge about what pharmacists can contribute with among these professions, yet positive expectations.

The added value of working in interprofessional teams in healthcare have been established for years (Leape et al., 1999), yet teamwork can be challenging (Zajac et al., 2021). The variability among team members related to e.g., personalities, training, and expert areas, causes differences in understanding and approaching of problems (Hall, 2005). Zajac *et al*. identified numerous internal and external factors influencing team effectiveness, pointing out that "a team of experts does not automatically create an expert team" (Zajac et al., 2021). This is important to keep in mind when planning interventions where new team members, e.g., pharmacists, are introduced.

In the Norwegian "Pharmacist in the Emergency Department" (PharmED) study, the impact of introducing the ED pharmacist as part of the interprofessional team in three EDs in North Norway is being investigated (Vesela et al., 2021). This is a complex intervention, where the overall service provided most likely will change. During the intervention period, ED pharmacists were present as a part of the ED team from 8 am to 7 pm Monday to Friday, performing medication-related tasks according to the need of the patients and the EDs. The primary outcome of the study was "time in hospital during 30 days after admission to the ED", for which data has not yet been analysed. The project, however, also comprise several sub-studies investigating effects of the ED pharmacists on various outcomes. In this sub-study, we aimed to explore how physicians experienced and perceived medication-related work tasks in the ED *before* the ED pharmacist was introduced, and how they perceived and anticipated the future introduction of the ED pharmacist.

Methods

Study design and setting

We conducted semi-structured individual interviews with ED physicians from the three hospitals in Norway where the ED pharmacist was to be introduced in relation to the PharmED study. Annual admission rates in the EDs were in the range of 6 000–16 000 patients, reflecting that the size of the hospitals differs. Physicians in the EDs are employed at different hospital wards, with roster-based shifts in the EDs. Hospital A (urban) is in the university hospital for the Northern part of Norway with more specialized functions than the other two hospitals. Hospital B (urban) is in the smallest hospital, with mainly junior physicians present in the ED, and senior physicians on call in the hospital. Hospital C (urban) is the only hospital with emergency medicine specialists present in the ED to supervise and help junior and senior physicians on call in the ED.

Interview guide, piloting, and training of interviewers

The research team developed an interview guide informed by the following research questions; 1) Which specific medication-related work tasks are performed by ED physicians? 2) What are ED physicians' experiences and perceptions with these medication-related work tasks? 3) What are the ED physicians' perceptions regarding implementing the ED pharmacist? The interview guide (Supplementary file 1) was piloted in one interview and was subsequently modified to make it shorter and more concise while maintaining room for discussion and follow-up questions. Additional questions were also asked during the interviews to get a more elaborate answer and to clarify the interviewers' understanding. There were three main interviewers, one in each hospital (EF a fifth-year pharmacy student, IN a fifth-year medical student, and TJ a clinical pharmacist and PhD student), see Table I. EF and TJ completed a course in qualitative method at UiT—the Arctic University of Norway and trained on interview skills with healthcare personnel from the ED before conducting interviews with physicians. All three interviewers were trained and supervised by experienced qualitative researchers (ECL, BHG, EHO) during the data collection period.

Data collection

Interviews were conducted from August to November 2019 and took place in meeting rooms at the local hospitals. We aimed duration of 30–45 minutes. Informants in the two largest EDs (hospital A and C) were recruited by a purposive sampling strategy. The interviewers recruited informants in the morning based on the informants' presence in the ED. We tried to maximize variation in gender, experience, roles, and department specialities classified as medical (med) or surgical (sur) among the informants. In the smallest ED (hospital B), interviews were scheduled

Table I. Overview of interviewers and characteristics of informants.

Alias	Sex[1]	Hospital	Age	Specialty	Seniority	Experience (years)	Main interviewer/ Assistant[2]	Duration of interviews
Walther	M	A	32	Med	Senior	5	EF/TJ	37 min
Ken	M	A	30	Med	Senior	3	EF/TJ	51 min
Adam	M	A	31	Med	Senior	4	EF/TJ	54 min
Christian	M	A	25	Sur	Junior	1	EF/TJ	46 min
Emily	F	A	26	Med	Junior	1	EF/TJ	35 min
Marcus	M	A	28	Sur	Junior	1	EF	41 min
Toby	M	A	36	Med	Senior	3	EF/ECL	62 min
Josephine	F	A	30	Med	Junior	1	EF/TJ	42 min
Nick	M	A	33	Med	Senior	5	EF/TJ	46 min
Irene	F	A	31	Sur	Senior	3	EF/TJ	64 min
Martha	F	B	38	Med	Senior	1	TJ/EF	22 min
Mona	F	B	27	Sur	Junior	1	TJ/EF	39 min
Andrea	F	B	32	Med	Senior	3	TJ/ECL	28 min
Charlotte	F	B	31	Med	Senior	3	TJ/ECL	35 min
Tina	F	B	32	Med	Senior	5	TJ/ECL	44 min
Henry	M	B	30	Med	Junior	1	TJ/BHG	51 min
Vivianne	F	B	27	Med	Senior	3	TJ/BHG	44 min
Christina	F	C	-	-	Junior	>1 year	EHO/IN	32 min
Elias	M	C	-	-	Junior	>1 year	IN	22 min
Martin	M	C	-	-	Junior	>1 year	IN	25 min
Beatrice	F	C	-	-	Junior	>1 year	IN	46 min
Matt	M	C	-	-	Junior	>1 year	IN	44 min
Joey	M	C	-	-	Senior	>1 year	IN	45 min
Celine	F	C	-	-	Senior	>1 year	IN	26 min
Marie	F	C	-	-	Junior	>1 year	IN	22 min
Jacob	M	C	-	-	Senior	>1 year	IN	28 min
Ivan	M	C	-	-	Junior	>1 year	IN	25 min

Note: [1]*M* = male, F = female.
[2]EF: fifth-year pharmacy student, TJ: pharmacist, IN: fifth-year medical student, ECL: pharmacist, BHG: pharmacist, EHO: physician.

beforehand in collaboration with the head of the medical department as the interviewers had to travel to get there. All physicians that were approached accepted participation. We recruited physicians until a sufficient information power was gained in our data (Malterud et al., 2016). No repeated interviews were conducted.

Data analysis

All interviews were audio recorded and transcribed non-verbatim for analysis by the main interviewers at each hospital. Transcripts were not returned to informants for comments or correction. Audio files were listened to several times to ensure that the transcripts were correct. Each interviewer performed an individual analysis of their empirical data, while the main author (TJ) made the final and overall analysis of all interviews. TJ was supported by experienced qualitative researchers with backgrounds in pharmacy (BHG, ECL) and medicine (TR). Transcripts were read thoroughly several times throughout the analysis, which was inspired by "qualitative content analysis" as described by Graneheim and Lundman (Graneheim & Lundman, 2004). We applied the following five steps during our analysis: 1) Transcripts were read and preliminary categories were noted by the main author who further discussed this with two co-authors, 2) Meaning units were sorted into initial codes using NVivo 12 software 3) Meaning units and codes were transferred to MindManager 2020 software, and meaning units were labelled with more describing codes before further organizing them into subcategories and categories with manifest content. See Supplementary file 2 for an example of coding and categorizing. 4) Categories and subcategories were continuously discussed by the team who agreed upon two main themes with latent content in the final analysis. 5) To verify the analysis, a selection of interviews from each ED was finally read through and coded using the agreed subcategories, categories, and themes. In addition, the individual analyses of the two other interviewers were also reviewed. The entire process was iterative, going back and forth in these steps during the analysis.

Authors' preunderstanding

The main researcher (TJ) is a pharmacist, who through both education and experience of working as a clinical pharmacist has gained knowledge about medication use and the potential of MRPs. She believes that pharmacists' in-depth knowledge about medications and their use should be utilized to a greater extent to increase medication safety and prevent MRPs. The remaining authors have a mixed background from both medicine (TR, EHO) and pharmacy (BHG, BZH, RVH, RE). All are involved in the PharmED study.

Ethics

The informants were ensured anonymity and complete confidentiality. Transcripts were anonymized,

and informants were given a unique code and pseudonyms. Informed consents were obtained from all participants. Quotes used in this article were translated to English by the main author (TJ) and verified by a co-author (ECL). The study was approved by the Data Protection Officer at Hospital Pharmacy of North Norway Trust (nr. 02330).

Results

Informants and interviews

We included 27 informants, ten each from the two largest hospitals (A&C), and seven from the smallest (B). The length of the interviews ranged from 22 to 64 minutes. The characteristics of informants are provided in Table I. Unfortunately, age, department speciality and experience were not collected for the physicians from hospital C.

Themes and categories

During analyses, we identified eight categories which we put together into two themes illustrating the ambiguity identified among the informants; on the one hand they really wanted and needed help, on the other hand they were concerned and hesitant about the pharmacist implementation (Figure 1). As MedRec was a repetitive subject in all interviews despite repetitive attempts to make the informants talk about other medication-related tasks, the categories concern different aspects of MedRec. We did not identify any pattern of differences in view between junior and senior physicians.

Medication-related work tasks in the emergency departments

When asked about which medication-related work tasks the informants were performing in the ED, *all* informants explained that their main medication-related work task was to find out which medications a patient uses and to write a medication chart based on this information. They used the term "medication reconciliation" for this task, and most of them expressed something similar to Nick:

> I spend a lot of time on medications. […] How I start varies, but I often go into the prescription intermediary (PI; nationwide electronic prescription database) and reconcile the medications there. And then it is not certain that it matches what the patient is using, because they could have paper prescriptions also [not included in the PI], so you have to go and talk to the patient and reconcile the list. […] Patients from nursing home are definitely the biggest challenge […] There is nothing in the PI, and they may come in without a medication list, or a medication list that is outdated. Then you have to search many different systems to create a medication list that is complete and correct, and talk to the patient again, but often you're left with a feeling that they don't know either what medications they are using. ***Nick***

When making the informants elaborate on other medication-related tasks performed, it was quite difficult for the physicians to move away from medication reconciliation, but some of them also mentioned "*stopping medications*", "*starting medications*", "*checking for drug interactions*", "*paying attention to risk medications*". These tasks were done "ad hoc" depending on patients' characteristics, physicians' experiences, and time. Other tasks like monitoring for adverse effects, verifying dosages and appropriateness of drugs, or additional medication safety tasks were not mentioned specifically.

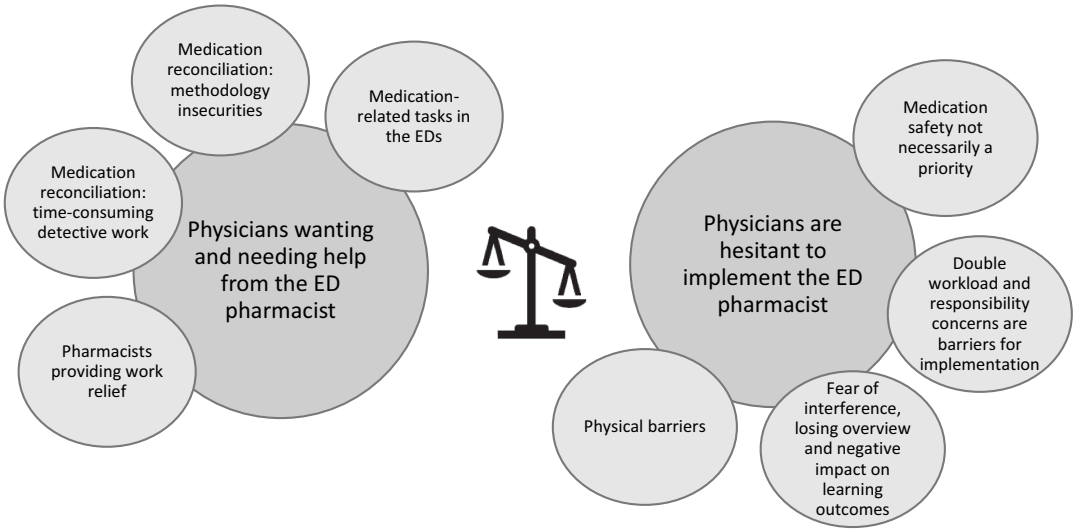

Figure 1. Two themes illustrating how eight categories from the analysis identifies an ambiguity in how the physicians perceive the future ED pharmacist.

Medication reconciliation: methodology insecurities

Several different answers were given when we asked what MedRec is and what it means. In the interviews, MedRec was said by some to be about "cleaning up" and getting concordance in the electronic systems, others said it was to find out which medications patients uses, and a few said they did not really know what it was.

> MedRec … I feel that I can tick 'yes' to MedRec when I have talked to the patient and looked at the PI that it is somewhat correct. Even if it is not correct, you have in a way reconciled [the medication list]. Then you tick 'yes' for MedRec and write that it needs to be checked further on the ward if there is some uncertainty about a dose. As long as it is not a complete mess, then I write that I've done MedRec. Because it is a part of what you are doing when you check the PI and talk to the patient. ***Christina***

For many informants MedRec was about what they need to do for them to "be allowed" to tick the box for MedRec (as hospital procedures have them do), and not about the patient. Some said it was about having a medication list that is somewhat correct. Beatrice said that she disagreed with those that taught them MedRec from the beginning, and explained:

> They say MedRec is when you just go over the medications that they [patients] use and try your best to reconcile what they use regularly and/or as needed. For instance, my colleague says that as long as you have done some sort of assessment [of the medication list], it's considered MedRec. But to me, MedRec is only performed if the medication list is absolutely correct. You are supposed to get everything right. ***Beatrice***

A challenge expressed by several informants was what they should do if the medication list from the general physician (GP) do not add up with what the patients say. *"One thing is what the lists say, another thing is what the patient says, and a third is what the patient actually does"*, and Jacob explained the dilemma further like this:

> It's a bit problematic when I learn from the patients what they take, because they tell me and they have control over that, but then I see that it doesn't match the list from the GP that was recently updated. Does that mean that we should start metoprolol, or whatever, even when the patient says they have never used it? Should we trust the medication list or trust the patient? That's often a problem, I'd say. ***Jacob***

Nobody described MedRec as a standardized systematic *method* for retrieving accurate and complete information about a patient's current medication use.

Medication reconciliation: time-consuming detective work

Informants described and shared frustrations related to the MedRec task, and it was often said to be time-consuming detective work. *"It's veeeery time-consuming"*, *"It can take a shitload amount of time"*, and *"We use a lot of time, and it [MedRec] involves a lot of detective work"* are examples of quotes given (from Mona, Irene, and Vivianne) during the interviews. They expressed that the reason for it being time-consuming is the need for multiple sources of information, and the remaining risk of not being certain about the correctness of the medication list. Charlotte illustrated this by saying:

> There is no reliable [medication] list anywhere, there are hundreds of [different] lists. ***Charlotte***

Many informants shared this view and reported that it could be difficult to find out what information that can be trusted. Jacob said that *"the big frustration I see among junior physicians, is that there are so many [medication] lists. We have ours; the GP has theirs; patients have their own; home care nurses have theirs, and it is hard to know which one to trust when things don't add up. What does the patient take and what should they take?"*. In addition to what Jacob said, informants also mentioned the PI, the Summary Care Record (SCR), post-it notes, phone-calls, next-of-kin, medication lists from nursing homes and pharmacies as potential sources in their detective work.

Informants said that they had different preferences regarding which source to use.

> It [PI] is much easier to use than the SCR. But I'm actually not good at using the SCR, I should use it much more. ***Henry***

Other informants expressed that they learned that the gold standard is to use the SCR, and a few admitted to still using mostly the PI. On the contrary, Christina said she thought about the SCR as not being up to date or trustworthy, so she did not use it. Many informants mentioned nursing home patients as being particularly challenging. Henry also said that *"it is a struggle to find out what's correct"*, and that the medication part is *"often a pain in the ass"*.

Positive to work relief provided by pharmacists

Most informants were positive when asked about what their thoughts on adding a pharmacist to the ED interprofessional team was. Mona said she thought it sounded reasonable to add a group of experts on that area early on. It was quite clear among most informants what they need help with, illustrated by the following quote from Vivianne:

> What I think we need help with the most is perhaps to get an accurate medication list early on. ***Vivianne***

It was expressed by many informants that this could be a time-saving resource if pharmacists were the ones to do MedRec. Several liked the idea of getting an accurate list served on a silver platter for them to look over. Other tasks informants said they would like help with is *"cleaning up in the electronic health record and PI"* and "*writing the chart*", in addition they saw the potential to learn from pharmacists and vice versa.

Medication safety not necessarily a priority

Many informants expressed that getting an accurate medication list can not be a top priority in the ED. Patients are there in the need of urgent care, and physicians' focus is to diagnose and treat the patient for the current issue. Several informants said their attitude was to get the list as correct as possible, and expressed something like Vivianne:

> In an emergency setting, to be honest, I don't know if it can be prioritized. To make sure [the medication list] is 100 % correct. ***Vivianne***

It was a general perception among multiple informants that it is ok to postpone completion of the medication list to when the patient has been admitted to the hospital ward, because it is not the same pressure of time there compared to the ED. Multiple informants explained that they felt pressured to clear the ED for patients as soon as possible, both by nurses and because it is measured how much time patients spend in the ED.

The informants also explained that if they do not complete MedRec in the ED, they write in the admission note that MedRec must be done more thoroughly on the hospital ward. At the same time, they also acknowledged that few physicians on the wards prioritize MedRec.

In addition to feeling that MedRec can't be prioritized in the ED, the informants had the same feeling regarding whether the ED is the best place to have pharmacists. Because of the circumstances physicians work under, like time pressure and heavy workload, it could become a challenge if the ED pharmacist did not quite understand this, and it could also negatively impact patient length of stay in the ED if pharmacists uncovered medication discrepancies in the ED that needed to be clarified before the patient was sent to the ward. One informant said:

> If it was one [pharmacist] who was very eager and very thorough, and thought now is the time to make this [the medication list] absolutely perfect, and then spent an extremely large amount of time on it … I don't think that the pharmacist should be in the ED, but rather on the ward where there is more room to do those deep dives into those things. ***Emily***

When asked if they would want a pharmacist in the ED or on the wards, some informants said that they could see the logic behind the project and placing pharmacists in the ED, but they still believed the ward could be a better place. Christina expressed the following:

> If there was a pharmacist who could sort out what [medications] they were coming in with, then maybe. But I think it might be better to do this on the ward. Because there will be medication changes on the ward. Maybe it's not wise to sort it out when they arrive but rather when they leave … ? I don't know. ***Christina***

Double workload and responsibility concerns are barriers for implementation

Many informants asked during the interviews if pharmacists have access to the PI, and the answer to that is no. They then voiced that without access to the PI the work distribution would not be as straight forward as they initially thought it would be, and this could lead to double workload. This was because physicians would have to check information they received from pharmacists. Several informants raised questions about responsibility and who should do what. Pharmacists do not have the authorization to sign charts and write medication orders or prescriptions, this meant that having pharmacists performing MedRec implied physicians having to sign off on someone else's work. The following quotes illustrates issues with this work distribution:

> I think it's fair that I sign for medications that I have ordered myself and ensured are correct, but not when I just receive a chart that they [the pharmacists] have checked and printed and I'm just supposed to put my name on it? I do not like that much. Then I'd like to ensure that it's correct. […] If I were to sign a chart someone had printed and said was correct because they had performed MedRec, then I would have a need for control, to double check. Then I'd prefer them to sign it themselves. ***Andrea***

> On my part, if I received a message that 'MedRec is performed, here is the chart'. Then I'd be suspicious, because I'd feel the need to double check that it had been done [correctly], because it is still me who orders the medications. It is still me who signs the chart. ***Jacob***

Multiple informants raised questions about this during the interviews, and said it was important that role clarification have to be in place before implementing the ED pharmacists. Many informants also expressed medications being physicians' responsibility, and it is not something they would want the pharmacists to just take over.

Fear of interference, losing overview and negative impact on learning outcomes

Some of the informants also voiced a fear that having a pharmacist present could have an impact on their learning outcomes, since some work tasks would be outsourced. They said that they are in the ED to learn, so maybe a different role for pharmacists would be

better in that case. Mona and Charlotte said the following:

> "[MedRec] is very time-consuming. But with that said, it involves a lot of learning for us. So, I understand in a way when someone thinks it's dumb that pharmacists would take over this task in the future." ***Mona***

> The junior physicians' job could be the same, but you [pharmacists] could help me [senior physician] look over [the medication chart]. I think that I over the years have learned a lot by having the role junior physicians have, and that you become more aware of what kind of medications can be "scary" and that you need to keep an extra eye on. ***Charlotte***

They also expressed concerns about losing the overview of the patient if the pharmacist takes over the medication part. Fear that pharmacists would interfere with other medication-related questions were also expressed by multiple informants. Contributing to treatment decisions or giving suggestions to dose adjustments were not roles they thought pharmacists should take on. Tina expressed:

> There is something about keeping to your role, and not take part in diagnostics and all that. [. . .] That's not your job. It might sound a bit harsh, but it's the way it's supposed to be. It's the role of the physician that decides [diagnosis and treatment]. And it has to do with not assuming responsibility for something you shouldn't even be a part in. ***Tina***

Josephine said she didn't really know what the pharmacists learns during their education:

> I don't know much about what pharmacists study, but this [the patient] is a human, and there's the body and that whole package. So, I would think that the physician is probably better suited [to know why the patient uses their medications] than nurses or pharmacists. But I don't know what pharmacists … What they really do other than being knowledgeable about medications. ***Josephine***

When explained what a pharmacist knows and does, she said that maybe they should use pharmacists more often. A few physicians explained that they knew pharmacists had in-depth knowledge about the use of medications and admitted that they could probably know more about medications than themselves.

Physical barriers

The informants also expressed that there were no room or place for the pharmacists in the EDs, as they already had low capacity in their workspace. Multiple informants said there had to be done some reconstruction if there were going to be enough space for pharmacists in the EDs. Two informants said:

> No, there's no space for the pharmacist to sit here [in the ED] and work. There are three computers and many physicians, so we're already fighting over the computers. ***Charlotte***

> I think we need to get a better workspace where there is room for those who work there and for additional staff, because that's a big challenge right now. So, I think that is an important premise, so you [pharmacists] don't feel like you come and occupy a workstation and are in the way. ***Adam***

Discussion

This study provides insight in ED physicians' experiences with medication-related work tasks, and MedRec was the only medication-related task systematically done for all patients. This indicates that there are room for future clinical pharmacists to systematically contribute with other medication-related tasks in the ED as well, like e.g., MedRev, patient counselling and education of healthcare personnel (Hampton et al., 2022; S. R. Morgan et al., 2018). Our study also provides knowledge about how ED physicians perceive the implementation of a future ED pharmacist. Despite welcoming the ED pharmacist and expressing a positive attitude towards a new collaborating profession, hesitation and concerns were also identified among the informants.

One reason for this contradiction may be founded in the MedRec work task itself, and physicians' perceptions about it. Our informants fronted many challenges when performing MedRec, for instance lack of time, unreliable information sources and uncertainty about the MedRec methodology, which corresponds with findings in other studies (Al-Hashar et al., 2017; Boockvar et al., 2011; Kleppe et al., 2017). Having dedicated healthcare personnel, like ED pharmacists trained to perform MedRec, could help relieve some of the physicians' workload (Aag et al., 2014). So, on one hand, informants in our study would value MedRec help from pharmacists.

On the other hand, our informants did not fully see the benefit of MedRec, and perhaps fails to fully understand the pharmacists' contribution in the ED. This could be because the ED is a high-pace environment where decisions must be made quickly, and our informants stated that MedRec can be postponed to the next day. This aligns with findings by Boockvar et al, who also identified that when time is limited, physicians prioritized other responsibilities over MedRec (Boockvar et al., 2011). Our informants reported that often when they postponed completion of MedRec it was not necessarily done later at the ward either. Similar findings have been reported by Kleppe, where informants found it difficult to gain a complete overview of medications in the ED and thought MedRec was handled on the ward, but were unsure whether this was actually done (Kleppe et al., 2017). Physicians and pharmacists in Boockvar's study

also questioned physicians' quality of MedRec (Boockvar et al., 2011). Clinical pharmacists are well-trained in medication optimization activities like MedRec and MedRev, and a reconciled medication list is fundamental for an optimal MedRev. Having pharmacists perform these tasks in the ED can identify and prevent MRPs (Rothschild et al., 2010).

Our informants were hesitant to the ED pharmacist contribution, which may be founded in not being fully aware of the clinical pharmacists' knowledge and competences. This was also found in studies by Sjölander *et al*. and Zielinska-Tomczak *et al*., where participants were unfamiliar with pharmacists and their clinical skills (Sjölander et al., 2017; Zielińska-Tomczak et al., 2021). This contrasts with physicians in the US, having long experience from working with ED pharmacists. A statement issued by the American College of Emergency Physicians (Physicians, 2021), advocates that ED pharmacists serve a critical role ensuring efficient, safe, and effective medication use. However, without this knowledge, it is clearly challenging for physicians to collaborate with and trust pharmacists concerning e.g., treatment decisions or drug choices. In a study of the integration process of clinical pharmacists carried out by Makowsky *et al*., nurses and physicians reported an increased awareness of the clinical role of pharmacists, and said that they learned something more about the knowledge pharmacists have (Makowsky et al., 2009). In order to educate and inform physicians and other healthcare personnel about pharmacists knowledge (and vice versa), interprofessional teamwork should be highly focused on during the undergraduate studies (Green & Johnson, 2015). Having knowledge about each other's competencies helps build trust, which further could facilitate teamwork, which in the end benefits the patient (Galloway, 2009; Hwang et al., 2017; Makowsky et al., 2009; Radević et al., 2021).

Pharmacists in Norway do not have prescribing rights (The Ministry of Health and Care Services, 1993), and consequently cannot amend medication lists in the hospital system after performing MedRec. Therefore, the ED physicians will have to do the final work and updates on the medication lists themselves and the potential reduction of ED physicians' work burden will not be fully achieved by the assistance of the ED pharmacist. Additionally, the physician will be holding the final responsibility for any amendments suggested by the ED pharmacist. It is therefore comprehensible that physicians have ambiguous perceptions about the pharmacist contribution. In other countries like UK, Australia, Canada, and Denmark, pharmacists have the legal rights to prescribe or make necessary changes in the medication list if they e.g., uncover medication discrepancies during MedRec (Hoti et al., 2011; Law et al., 2012; Sosabowski & Gard, 2008; Vand et al., 2012).

Our informants feared a potential loss of learning outcome for physicians if pharmacists were to take over tasks from them, like performing MedRec. This is understandable, especially if the ED is not being equipped with pharmacists 24/7. A solution for this may be to employ pharmacist services 24/7, as in other countries (Szczesiul et al., 2009). This debate needs to be fronted within the pharmacy profession in Norway, not being accustomed to work shifts. In order for pharmacists to be fully integrated in positions like the ED, clinical pharmacists must also accept shift work and taking patient responsibility, in accordance with the pharmaceutical care philosophy first fronted by Hepler and Strand (Hepler & Strand, 1990).

The identified ambiguous perception regarding implementation of ED pharmacists indicates a need for a team development program (i.e., simulation training or targeted workshops) to successfully integrate a new team member in the ED interprofessional team during the PharmED study and similar interventions. In a recent study by Morgan *et al*., the impact of an interdisciplinary team development program was evaluated among participants with no previous experience of working together (S. E. Morgan et al., 2021). The program comprised an eight-session workshop and showed meaningful improvements in readiness to collaborate and behavioural trust among participants (S. E. Morgan et al., 2021). Future studies should investigate and evaluate the interprofessional collaboration in the ED, using e.g., the "team effectiveness framework" as described by Zajac (Zajac et al., 2021) or "ten principles of good interdisciplinary team work" as described by Nancarrow (Nancarrow et al., 2013). ED physicians' experiences of working with ED pharmacists and their perception of appropriate use of resources should also be explored.

Strengths and limitations

The main strength of this study is the large number of informants with a varied background included in the study. Because of this, we believe that our results may be representative to physicians in other Norwegian EDs, despite involving physicians from only three EDs. It may also be representative to other countries, where the ED pharmacist is not fully integrated. Another strength of this study is that multiple researchers have performed the analyses, which verifies our results. The main limitation to this study is that most interviewers and project participants were also a part of the PharmED project, obviously positive to implementing the ED pharmacist. This may influence the analysis and interpretation of data. However, one interviewer (hospital C) was not a part of the project, and the analysis from those interviews aligned with the overall findings. Results from all

three individual analyses aligned with each other, which strengthen our final analysis.

Conclusion

In this study investigating Norwegian ED physicians' experiences and perceptions with medication-related tasks and the future introduction of pharmacists in the ED, we found that medication reconciliation was their main focus and concern. They emphasized this task as time-consuming detective work. They warmly welcomed the clinical pharmacist as part of their interprofessional team and expressed a need for assistance. However, they did not seem to know about pharmacist competencies, and were also concerned about professional, structural, and legislative barriers for this collaboration. These barriers must be addressed before future implementation of the ED pharmacist.

Geolocation information

Geolocation for the three hospitals where the interviews were performed:
Tromsø: Latitude: 69° 38′ 56.04"N, Longitude: 18° 57′ 18.29" E
Harstad: Latitude: 68° 47′ 53.99"N, Longitude: 16° 32′ 29.94" E
Bodø: Latitude: 67° 16′ 48.00"N, Longitude: 14° 24′ 18.04" E

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Disclosure statement

No potential conflict of interest was reported by the authors.

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Data availability statement

The informants in this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research supporting data is not available.

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Supplementary file 1: Semi-structured interview guide

Describe how you work in the ED regarding medication-related tasks (introducing question)

Further questions and keywords for follow-up questions were prompted if necessary:

- Obtaining information
- Discussions with colleagues
- Considerations when ordering new medications for patients
- Thoughts around current treatment/adverse drug effects/drug interactions
- Prescription errors
- Documentation

What are the pros and cons about the current situation to ensure correct medication use/treatment for patients?

- What makes you feel safe in the way you work?
- What could be better?
- How can medicine safety be improved?

Based on your experiences, what do you think an ED clinical pharmacist should focus upon?

- Thoughts and experiences with clinical pharmacists/what knowledge they possess?
- What would physicians like help with?
- Who should do which tasks? Practical organization

When the clinical pharmacist becomes a part of the ED interprofessional team, how do you think this collaboration should be?

- What is needed to collaborate well in the ED?
- Thoughts on bringing in a new profession?
- Any worries regarding the ED pharmacist?
- Measures to be taken before implementation?

Supplementary file 2: data analysis example

Meaning unit	Code	Subcategory	Category
It [MedRec] takes an awful amount of time.. It is really… It can take 45 minutes just to make up the chart.	MedRec takes a long time to perform, chart-making as well	Challenging and time-consuming work	MedRec often feels like time-consuming detective work
We use a lot of time	A lot of time is spent		
If it is paracetamol and calcium it is something else, but the multimorbid medical patients use a lot of medications, so it takes a lot of time	A couple of drugs per patient is ok, but multimorbidity increases time spent on MedRec for a patient		
Sometimes when you have little time, you get like drained and tired and think that I don't have time for this now	Time is limited, and MedRec takes time that you don't have, which is frustrating		
It is problematic that it [MedRec] sometimes takes a lot of time	Problematic that MedRec takes time		
It takes an awful amount of time to clean up in medication lists, obtain sources and retrieve information	The MedRec process takes time		
There is no reliable list anywhere, there are hundreds of lists	Many available sources for information make it hard to know what is correct	Detective work	
So, it is like detective work	MedRec involves detective work		
We are interested in information about it, but it is a rocky road	Medication information is interesting, but the path is difficult		
We use a lot of time, and it [MedRec] involves a lot of detective work	MedRec takes time because it is like detective work		
The big frustration that I see in junior physicians, is that there are so many [medication] lists. We have ours, the general physician has his, patients have their own, home care nurses have theirs, and it is hard to know which one to trust when things do not add up. What does the patient take and what should he take?	Many sources of information make it hard to know what to trust and find out what is correct		

Paper II

BMC Emergency Medicine

RESEARCH

Open Access

How much time do emergency department physicians spend on medication-related tasks? A time- and-motion study

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Abstract

Background Medication-related problems are an important cause of emergency department (ED) visits, and medication errors are reported in up to 60% of ED patients. Procedures such as medication reconciliation and medication review can identify and prevent medication-related problems and medication errors. However, this work is often time-consuming. In EDs without pharmacists, medication reconciliation is the physician's responsibility, in addition to the primary assignments of examining and diagnosing the patient. The aim of this study was to identify how much time ED physicians spend on medication-related tasks when no pharmacists are present in the EDs.

Methods An observational time-and-motion study of physicians in three EDs in Northern Norway was conducted using Work Observation Method by Activity Timing (WOMBAT) to collect and time-stamp data. Observations were conducted in predefined two-hour observation sessions with a 1:1 relationship between observer and participant, during Monday to Friday between 8 am and 8 pm, from November 2020 to October 2021.

Results In total, 386 h of observations were collected during 225 observation sessions. A total of 8.7% of the physicians' work time was spent on medication-related tasks, of which most time was spent on oral communication about medications with other physicians (3.0%) and medication-related documentation (3.2%). Physicians spent 2.2 min per hour on medication reconciliation tasks, which includes retrieving medication-related information directly from the patient, reading/retrieving written medication-related information, and medication-related documentation. Physicians spent 85.6% of the observed time on non-medication-related clinical or administrative tasks, and the remaining time was spent standby or moving between tasks.

Conclusion In three Norwegian EDs, physicians spent 8.7% of their work time on medication-related tasks, and 85.6% on other clinical or administrative tasks. Physicians spent 2.2 min per hour on tasks related to medication reconciliation. We worry that patient safety related tasks in the EDs receive little attention. Allocating dedicated resources like pharmacists to contribute with medication-related tasks could benefit both physicians and patients.

Keywords Emergency department, Physicians, Medication reconciliation, Workflow, Time, Medication errors, Observations

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Introduction

Emergency departments (EDs) are high-paced work environments where different healthcare professionals (HCPs) work together to provide care for patients with various medical issues. Physicians play a key role in the EDs, often multitasking under time pressure. In addition to having the main responsibility for patient assessment and diagnosing, physicians initiate appropriate therapy and make decisions regarding admission or discharge. A central part of this process includes obtaining and documenting the patient's medical history and medication list [1, 2]. Correct information is essential for making appropriate decisions regarding treatment during admission, and to prevent medication discrepancies during transitions of care. Medication reconciliation (MedRec) is a process ensuring correct information about patients' medication use, and while HCPs recognize the value of MedRec, a lack of agreement regarding HCPs' roles and responsibilities in the process has been identified [3]. In some countries, pharmacists have been introduced as a part of the ED interprofessional team, having the responsibility for some of the medication-related work tasks that in other countries are the responsibility of physicians, e.g., MedRec [4, 5].

Medication-related problems are an important cause of ED visits [6–8]. Medication errors are reported in up to 60% of ED patients [9, 10], and can lead to hospitalizations and even deaths [11]. Early identification of medication errors and medication-related problems through tasks like MedRec and medication review can prevent hospitalization, reduce length of stay and improve therapy [12, 13]. However, this work demands time and attention, and studies have shown that these tasks have low priority among ED physicians [14, 15]. In Norway, MedRec is the physicians' responsibility and in a recent publication, Norwegian ED physicians describe MedRec as time-consuming detective work where they often have to make decisions based on contradictory information from several different sources [16].

Previous studies have investigated how physicians in EDs spend their time [17–19]. However, as the applied task categories vary between studies, it is hard to compare their results. To our knowledge, only one study has specifically focused on the proportion of time spent on medication-related tasks [4]. This Norwegian study from 2022 found that physicians spent about 18% of their time on medication-related tasks in an ED where the clinical pharmacist was present [4]. The most time-consuming medication-related task was to gather information about medication use (part of MedRec), of which physicians spent 7% of the observed time.

The aim of the present study was to identify how much time ED physicians spend on medication-related tasks with no pharmacists present. We also investigated how much time ED physicians spend on the MedRec process.

Methods

Study design and setting

This was an observational time-and-motion study of physicians in three EDs in Northern Norway, applying the validated Work Observation Method by Activity Timing (WOMBAT) methodology which allows for collection of time-stamped observational data [20, 21]. The study was designed and reported according to the "Suggested Time And Motion Procedures (STAMP)" guidelines [22] and STROBE statement [23]. Observations were performed between November 13, 2020, to October 15, 2021.

We observed physicians in EDs located in three urban specialist healthcare hospitals. The annual admission rates were approximately 6000 (ED1), 13.000 (ED2) and 16.000 (ED3) patients. ED1 has mainly junior physicians (1–2 years of experience) present in the ED, and senior physicians (≥ 3 years of experience) on call in the hospital. ED2 and ED3 have both junior and senior physicians present in the ED. ED2 was the only hospital with emergency medicine specialists present in the ED to supervise and help junior and senior physicians (weekdays 8 a.m. to 4 p.m.). ED3 is a part of a university hospital and provides specialized services for patients from the northern part of Norway, including the areas covered by the hospitals housing ED1 and ED2.

In Norway, patients arriving at the EDs are usually referrals from primary care (e.g., general practitioner or municipal emergency clinic) or transfers from other hospitals. Severely ill patients or patients with acute trauma can also arrive directly by ambulance. Most often, patients are first seen by an ED nurse who uses the Rapid Emergency Triage and Treatment System (RETTS) to determine the urgency of the situation [24, 25]. Depending on severity, a junior or senior physician examines the patient. Physicians from different departments provide care for their respective patients. Most often, junior physicians take a medical history including a medication history, perform MedRec and compile a medication list. In Norway, medication lists are not automatically shared between different care settings, and there are many sources to consult for information when performing MedRec. In addition to talking to patients, next-of-kin, and nursing homes etc., physicians can access and read from other sources (Table 1). After taking a medical history, the physicians further decide on a treatment plan and determine whether admission is necessary.

Sample size and recruitment

We aimed to achieve equal observation time of physicians within the following categories: 1) junior internist,

Table 1 (Norwegian) Sources for reading and retrieving information about medication use during medication reconciliation

Sources	Contains
Summary Care Record	A selection of key health data and complete overview of prescribed and dispensed medications with 3 years medication history. Access: all healthcare professionals
Prescription Intermediary	Database with all valid electronic prescriptions. Strength: prescription information can be imported to the medication module in the electronic health record. Limitations: only 30 days medication history and paper prescriptions are not shown. Access: only prescribers
Medication module in the electronic health record	The hospitals electronic documentation of a patient's medications. If not reconciled and updated with prescriptions from the Prescription Intermediary upon admission, old prescriptions from previous hospitalizations can become part of the medication list. A table with the medication list can be automatically inserted in patient records. This list forms the basis for medication information throughout the hospital stay
Medication chart	Paper list with the patient's current medications, used for documentation of prescribed and administered medications during hospitalization. The medication chart at ED1 and ED3 was a printed version from the medication module in the electronic health record. For ED2 the medication chart was handwritten

2) junior surgical physician, 3) senior internist, 4) senior surgical physician and 5) emergency medicine specialist in ED2 (see Fig. 1). We planned for 30 h observation time per physician category in each ED, in total 120–150 h per ED. The number of observation hours were based on previous studies using WOMBAT and determined as sufficient for the purpose of the study [26–28].

Physicians were informed about the study through e-mails, Facebook groups and department meetings. We recruited physicians daily during the observation period, by showing up in the ED asking them directly to participate. All ED physicians at work during the observation period were eligible for inclusion. The internists and surgeons are affiliated with different hospital wards, with roster-based shifts in the ED, leading to frequent changes of on-duty physicians in the ED. We strived to observe different physicians each time. All but three approached physicians agreed to be observed.

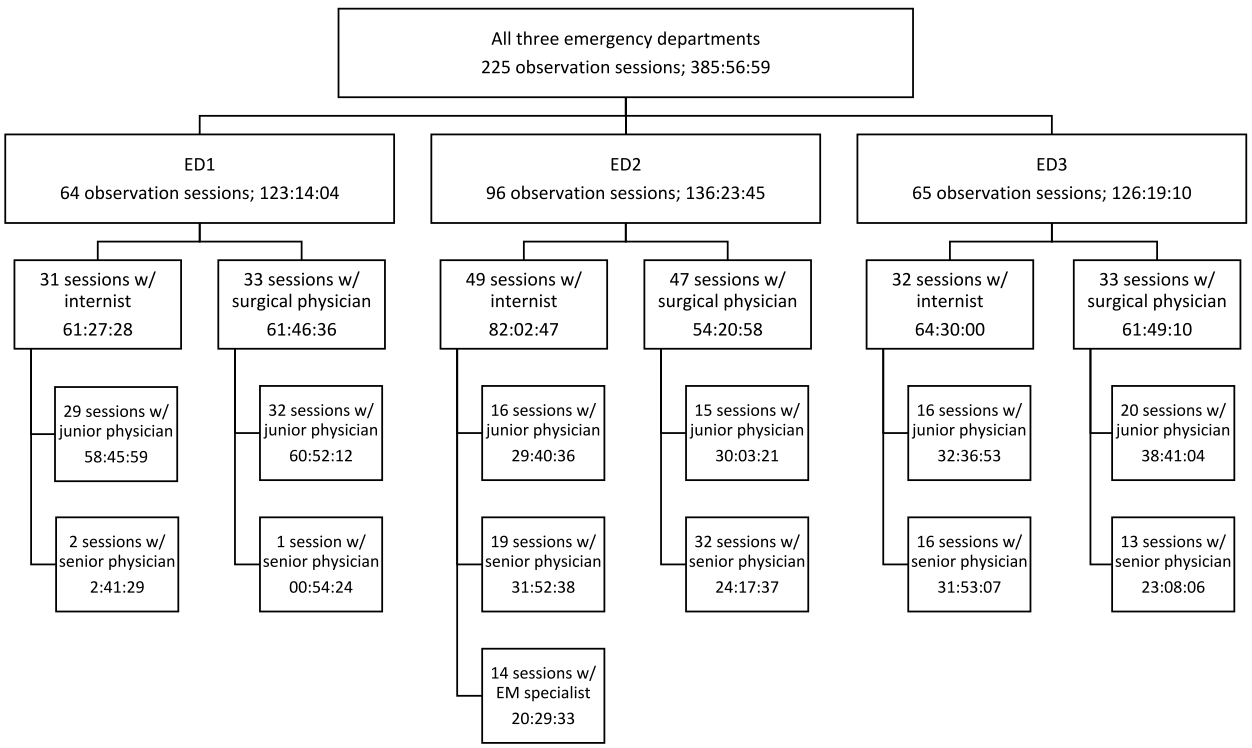

Fig. 1 Distribution of observation sessions and total observation time per physician category and emergency department (ED)

EM = emergency medicine

Task categories and piloting

We developed the task categories for the WOMBAT software based on open observations in the EDs (TJ, RVH). Inspiration for categories and definitions was also gathered from a similar Norwegian study [4], and an Australian study [29]. Five observation dimensions with categories and subcategories were developed describing 1) *What* task was done (Table 2), 2) *Where* the task took place, 3) *Who,* if anyone, the task was done with, 4) *How* the task was done, and 5) a consecutive unique number of the *patient* treated, communicated with or about during the observation session.

The WOMBAT dimensions and categories were piloted in all three EDs by several members of the research team (TJ, RVH, MF, ECL), and adjusted accordingly. Observers (MF, RVH) received training and supervision by an experienced researcher (ECL). A total of 50 h of training and piloting were conducted by the two observers prior to data collection. See Supplementary 1 for the final version comprising five dimensions, 32 categories and 25 subcategories, and Supplementary 2 for definitions and examples of the "what" categories and subcategories. All tasks were defined as either medication-related, non-medication-related clinical or administrative, or other. The "read/retrieve written information" category was defined as medication-related if this was apparent from the how-dimension (i.e., if the Summary Care Record, Prescription Intermediary, Chart, or medication module in electronic health record were used). We defined the MedRec process to include the following medication-related tasks in the *What*-dimension; 1) oral communication – retrieve medication-related information, 2) read/retrieve written information, and 3) documentation – medication related.

Table 2 The categories and subcategories under the dimension "WHAT"

Categories	Subcategories
Patient examination/treatment	-
Oral communication	Retrieve medication-related information
	Give medication-related information
	Communication about medications
	Work-/patient-related
Read/retrieve written information	-
Documentation	Medication-related
	Non-medication-related
Movement	-
Medication management	Medication preparation without patient
	Preparation and administration of medications with patient
	Double checking
Waiting/consideration	-
Logistics	Medication-related
	Other
Standby	-
Meeting	-
Unknown	-
Other	-

Data collection and validation

Two observers (MF, Master of Pharmacy student, and RVH, clinical pharmacist/post-doctoral research fellow) collected data in pre-defined two-hour sessions with maximum three sessions per day to minimize observer fatigue. MF collected data in ED1 and ED3, and RVH collected data in ED2. The observation sessions were pre-scheduled to ensure equal distribution of observation time throughout all weekdays, and covered the working hours of ED pharmacists in a planned future intervention study [30]: Monday to Friday between 8 am and 8 pm. Observations were conducted in a 1:1 relationship between observer and participant.

Reliability testing was conducted prior to and during the data collection period to ensure highest possible level of inter-observer agreement. We arranged seven 20 min-sessions where two observers simultaneously observed and registered tasks conducted by the same participant. If the agreement was too low, a new session was conducted until reaching excellent agreement between observers [31, 32].

Data management and analysis

Data was collected using an iPad® Mini with WOMBAT software version 3.0 installed, which provides quick and easy transition between task categories. Data management and analysis were performed applying Microsoft Excel© (version 2014), IBM SPSS Software© (version 29.0) and SAS Software© (version 9.4).

Data is presented descriptively with total observation time (hours:minutes:seconds), proportions (%) or medians (range). Proportion of time spent on single tasks was calculated as ´total time spent on the task´ (including multitasking), divided by ´total time of observation´. When including multitasking in the proportion calculations, the proportions add up to more than 100%. 'Active task time' is total observation time excluding time for being standby or in movement. The 95% confidence intervals (CIs) for proportions of time per task (what categories) were calculated by a bootstrap approach using a SAS Macro program developed for WOMBAT data [33].

Statistically significant differences were defined as non-overlapping 95% CIs.

Ethics

All participants supplied a signed written consent. Patients were informed that an observer of the physician was present. The study was approved by the Data Protection Officer at Hospital Pharmacy of North Norway Trust (no. 02330).

Results

A total of 225 observation sessions (Fig. 1) resulted in 386 h of observations (total observation time). Including multitasking, this corresponds to 412 h of data (total time). Median session time was 2.0 h (2 h: 0 min: 18 s).

Physicians spent 85.6% of observed time on non-medication-related clinical or administrative tasks, of which work-/patient-related oral communication (33.3%, 95% CI: 32.2–34.3), reading/retrieving written information (14.4%, 95% CI: 13.5–15.2) and documentation (15.9%, 95% CI: 14.9–17.0) were the most time-consuming tasks. 11.7% (95% CI: 10.6–12.6) was spent on patient examination or treatment (direct patient care). Physicians spent 8.7% of observed time on medication-related tasks, and the most time-consuming tasks were documentation (3.2%, 95% CI: 2.8–3.6) and oral communication about medications (3.0%, 95% CI: 2.8–3.3). The remaining time (12.4%) was spent standby or moving between tasks. Junior physicians spent significantly more time on the three MedRec tasks than senior physicians (Table 3). See Supplementary 3 for results per ED.

Medication-related tasks

Of the observed time spent on medication-related tasks (Table 4), 34.6% was spent on communication about medications with other HCPs, 16.8% on documenting medications on charts, 14.2% on orally retrieving information about patients' medication use, 12.0% on documenting medications in the medication module in the electronic health record, and 10.0% on retrieving written information about patients' medication use.

Table 3 Total observed time and proportion of time for physicians across all task categories

Categories of the "What" dimension	Junior physicians (250:40:05[a])			Senior physicians (135:16:54[a])			Total (385:56:59[a])		
	Time (h:min:s)	%	(95% CI)	Time (h:min:s)	%	(95% CI)	Time (h:min:s)	%	(95% CI)
Non-medication-related clinical or administrative tasks	213:33:56	85.2	-	116:54:29	86.4	-	330:28:25	85.6	-
Patient examination/treatment	30:02:40	12.0	(10.6–13.3)	14:58:58	11.1	(9.4–12.4)	45:01:38	11.7	(10.6–12.6)
Oral communication	73:08:55	29.2	**(28.1–30.4)**	55:22:50	40.9	**(38.9–42.9)**	128:31:45	33.3	(32.2–34.3)
Read/retrieve written information	32:13:50	12.9	**(11.9–13.9)**	23:12:18	17.2	**(15.6–18.9)**	55:26:08	14.4	(13.5–15.2)
Documentation	49:00:26	19.6	**(18.3–21.1)**	12:11:16	9.0	**(7.8–10.2)**	61:11:42	15.9	(14.9–17.0)
Waiting/consideration	8:48:04	3.5	(3.1–4.1)	4:41:35	3.5	(2.8–4.4)	13:29:39	3.5	(3.1–4.0)
Logistics	3:58:21	1.6	(1.4–1.8)	1:37:13	1.2	(1.0–1.4)	5:35:34	1.4	(1.3–1.6)
Meeting	6:46:15	2.7	(1.6–3.6)	2:19:18	1.7	(0.2–4.1)	9:05:33	2.4	(1.4–3.2)
Unknown	9:16:28	3.7	(2.2–5.0)	2:29:25	1.8	(0.9–3.2)	11:45:53	3.0	(2.0–3.9)
Other	0:18:57	0.1	(0.0–0.3)	0:01:36	0.02	(0.0–0.04)	0:20:33	0.1	(0.0–0.2)
Medication-related tasks	23:29:44	9.4	-	9:59:14	7.4	-	33:28:58	8.7	-
Oral communication:	9:39:05	3.9	-	7:37:18	5.6	-	17:16:23	4.5	-
Retrieve medication information[b]	3:48:34	1.5	**(1.3–1.8)**	0:56:34	0.7	**(0.5–0.8)**	4:45:08	1.2	(1.1–1.4)
Give medication information	0:32:38	0.2	(0.2–0.3)	0:22:50	0.3	(0.2–0.4)	0:55:28	0.2	(0.2–0.3)
About medications	5:17:53	2.1	**(1.9–2.4)**	6:17:54	4.7	**(4.0–5.2)**	11:35:47	3.0	(2.8–3.3)
Read/retrieve written information[b]	2:35:56	1.0	**(0.9–1.3)**	0:45:27	0.6	**(0.3–0.8)**	3:21:23	0.9	(0.7–1.0)
Documentation[b]	10:55:00	4.4	**(3.7–4-8)**	1:32:33	1.1	**(0.8–1.5)**	12:27:33	3.2	(2.8–3.6)
Logistics	0:00:00	0.0	-	0:00:00	0.0	-	0:00:00	0.0	-
Medication management	0:19:43	0.1	(0.0–0.3)	0:03:56	0.05	(0.01–0.1)	0:23:39	0.1	(0.0–0.2)
Other	28:53:01	11.5	-	19:08:18	14.1	-	48:01:19	12.4	-
Movement	8:37:49	3.4	**(3.2–4.0)**	6:20:43	4.7	**(4.2–5.1)**	14:58:32	3.9	(3.7–4.3)
Standby	20:15:12	8.1	(6.6–9.5)	12:47:35	9.5	(7.5–11.4)	33:02:47	8.6	(7.4–9.7)

Bold numbers show non-overlapping 95% CIs between junior and senior physicians' time distribution

[a] Proportions were calculated using total observation time (hours:minutes:seconds) as denominator. The proportions add up to more than 100% due to multitasking

[b] The three medication reconciliation tasks

Table 4 Total observed time and proportion of time across medication-related tasks, including "with whom" or "how" the task is performed

What	With whom/how	Junior physicians (23:29:44[a])		Senior physicians (9:59:14[a])		Total (33:28:58[a])	
		Time (h:min:s)	%	Time (h:min:s)	%	Time (h:min:s)	%
Oral communication		**9:39:05**	**41.1**	**7:37:18**	**76.3**	**17:16:23**	**51.6**
Retrieve medication information[b]		**3:48:34**	**16.2**	**0:56:34**	**9.4**	**4:45:08**	**14.2**
	Patient	3:36:27	37.4	0:54:02	9.0	4:30:29	13.5
	Next-of-kin	0:26:44	1.9	0:00:48	0.1	0:27:32	1.4
	Source outside hospital[c]	0:07:04	0.5	0:00:00	0.0	0:07:04	0.4
Give medication information		**0:32:38**	**2.3**	**0:22:50**	**3.8**	**0:55:28**	**2.8**
	Patients	0:25:42	1.8	0:18:52	3.1	0:44:34	2.2
	Next-of-kin	0:06:59	0.5	0:04:24	0.7	0:11:23	0.6
About medications		**5:17:53**	**22.5**	**6:17:54**	**63.1**	**11:35:47**	**34.6**
	Nurse	1:09:24	4.9	0:49:00	8.2	1:58:24	5.9
	Junior physician	0:53:11	3.8	2:05:13	20.9	2:58:24	8.9
	Senior physician	2:24:32	10.3	1:25:51	14.3	3:50:23	11.5
	Medical student	1:17:37	5.5	0:14:25	2.4	1:32:02	4.6
	Specialist physician	0:05:59	0.4	0:23:39	3.9	0:29:38	1.5
	Patient	0:06:38	0.5	0:21:53	3.7	0:28:31	1.4
	Pharmacists	0:00:00	0.0	0:00:00	0.0	0:00:00	0.0
	Next-of-kin	0:00:00	0.0	0:04:40	0.8	0:04:40	0.2
	Nurse coordinator	0:01:38	0.1	0:04:49	0.8	0:06:27	0.3
	Source inside hospital	0:03:25	0.2	0:44:44	7.5	0:48:09	2.4
	Source outside hospital[c]	0:02:35	0.2	0:21:28	3.6	0:24:03	1.2
	Other	0:00:00	0.0	0:06:58	1.2	0:06:58	0.3
Read/retrieve written information[b]		**2:35:56**	**11.1**	**0:45:27**	**7.6**	**3:21:23**	**10.0**
	Summary Care Record	1:30:59	6.5	0:29:20	4.9	2:00:19	6.0
	Prescription intermediary	0:39:43	2.8	0:11:41	1.9	0:51:24	2.6
	Medication module in electronic health record	1:16:46	5.4	0:19:06	3.2	1:35:52	4.8
	Medication chart	0:09:07	0.6	0:03:26	0.6	0:12:33	0.6
Documentation[b]		**10:55:00**	**46.5**	**1:32:33**	**15.4**	**12:27:33**	**37.2**
	Medication chart	4:59:43	21.3	0:37:07	6.2	5:36:50	16.8
	Medication module in electronic health record	3:48:34	16.2	0:11:47	2.0	4:00:21	12.0
	Other	2:06:43	9.0	0:43:39	7.3	2:50:22	8.5

[a] Proportions are calculated using the observed medication-related time (hours:minutes:seconds) as denominator

[b] The three medication reconciliation tasks

[c] Sources outside hospital, e.g., pharmacies, nursing homes and home care nurses

Bold font show the "what" categories and subcategories

The patient was the most frequently used source of orally retrieved information about his/her medication use (13.5%). Only junior physicians contacted other information sources like nursing homes, home care nurses or pharmacies. When physicians communicated about medications, they most often communicated with other physicians (junior and senior), including medical students. When physicians were reading or retrieving written information about patients' medication use, they spent most time retrieving information from the Summary Care Record and from the medication module in the electronic health record.

MedRec tasks were observed in 177 of the 225 observation sessions and for 298 unique patients. Physicians spent

Table 5 Time and proportion of time spent on medication reconciliation (MedRec) tasks

Table	Junior internists Time (h:min:s)	Junior surgical physicians Time (h:min:s)	All physicians Time (h:min:s)
Active task time[a]	109:20:40	112:26:24	337:55:40
Observed time[b]	10:57:58	06:21:32	20:34:04
% time[a]	10.0	5.7	6.1
Median time/session	00:10:41	00:05:05	00:04:18
Min. time/session	00:02:17	00:00:17	00:00:11
Max. time/session	00:32:05	00:23:17	00:32:43
No. sessions w/MedRec	56	57	177
No. patients in sessions w/MedRec	110	98	298

[a] Active task time is total observation time excluding time for movement and standby and is used as denominator when calculating proportions in each group

[b] Observed active task time spent on MedRec tasks: 1; oral communication – retrieve medication-related information, 2; read/retrieve written information; from Summary Care Record, Prescription Intermediary, medication module in electronic heath record and chart, and 3; medication-related documentation

6.1% of their active task time on these tasks, corresponding to median 2.2 min per hour (minimum 5.5 s and maximum 16.4 min). Junior internists spent 10.0% of their active task time on MedRec (median 5.3 min per hour), while junior surgical physicians spent 5.7% of their active task time on MedRec (median 2.5 min per hour). See Table 5.

Discussion

This is, to our knowledge, the first study that specifically focus on the time physicians spend on medication-related tasks in EDs without pharmacists present. We observed that 8.7% of physicians' time was spent on medication-related tasks, while the majority (85.6%) of time was spent on non-medication-related clinical or administrative tasks. This study describes the baseline of work time distribution for ED physicians before the implementation of clinical pharmacists in the interprofessional team [30]. Future studies can thereby investigate how pharmacists impact physicians' use of time in the same EDs.

Medication-related problems are important causes of ED visits [6–8] and medication errors occur frequently in ED patients [9, 10]. Adding the consequences related to readmissions, morbidity and mortality [6, 34, 35], it is surprising that physicians in our study spent less than 10% of their time on medication-related tasks. A previous Norwegian study from 2022 found that physicians in EDs spent 17.8% of their time conducting medication-related tasks [4]. The EDs in our study and the previous Norwegian study are similar with regards to observation times, admission rates and physicians working shifts in the EDs, but one important difference was the part-time presence of the ED pharmacist in the study by Nymoen et al. On the one hand, one could assume that the time physicians spend on medication-related tasks would be *lower* with the presence of pharmacists taking responsibility for time-consuming activities like for instance MedRec. On the other hand, the presence of ED pharmacists acts as a reminder to physicians to be more aware of and prioritize medication-related tasks and thus spend *more* time on them. This spill-over effect can be explained by the theory of "three degrees of influence", saying that our (e.g., pharmacists') words and actions influence others (e.g., physicians), and most influence is seen for those with whom we are directly connected [36]. Professional communication between physicians and pharmacists in Nymoen's study accounted for only 0.04% of the medication-related tasks performed by physicians, so the interaction itself cannot explain why physicians in Nymoen's study spent twice as much time on medication-related tasks compared with our study. Nonetheless, spending more time on medication-related tasks could be seen as a means to increase patient safety. Future studies should investigate optimal use of time and effort for patient safety tasks, and which tasks each HCP should contribute with.

With regards to MedRec, we were surprised by finding that only 2.2 min per hour was dedicated to this task, given the importance of identifying the correct use of medications at admission [37]. In comparison, this is 5.5 min less than the study by Nymoen *et.al* who reported 7.8 min per hour on MedRec tasks [4]. The observed time for MedRec is interestingly much shorter than what physicians convey in a previous study [16]. In a qualitative interview study of 27 physicians from the same three EDs, physicians perceived MedRec as 'a very time-consuming task' demanding high effort [16]. In addition, they perceived the MedRec process as overwhelming and burdened with uncertainty. This, as well as the general state of time pressure in the ED, was a reason why physicians

in the same study expressed that they wanted work relief by ED pharmacists [16]. The gap between actual time and perceived time in these two studies indicates that physicians associate a high cognitive burden with the MedRec process, which should be taken into consideration when allocating resources to different work tasks in the ED. Our results also show a tendency for surgical physicians to spend less time on MedRec than internists. Potential reasons for this may include surgical patients having fewer medications or that internists focus more on medications compared to surgical physicians. It could also be that internists and surgical physicians are trained differently and have different workflows. Future studies are needed to shed light on this.

With extensive knowledge about medications and medication use, ED pharmacists play an important role in the ED team in other countries [38–40]. In a Spanish study from 2017, 57.2% of the medication errors detected and intervened on by pharmacists were considered severe, and the authors suggested that emergency care would benefit from services provided by pharmacists [39]. Norwegian studies show that up to 80% of hospital medication lists contain medication discrepancies [37, 41], it is therefore necessary to increase focus on MedRec at transitions and ensure correct medication lists in hospitals. By allocating ED pharmacist resources to perform MedRec, physicians' work burden is relieved, and may allow for increased cognitive capacity to concentrate on other essential work tasks in the ED [15]. In addition, pharmacists can contribute to early identification of medication-related problems and medication errors through tasks like medication review and patient counselling [13, 42]. We argue that placing pharmacists in the ED team represents a great potential to improve patient safety tasks in the ED, as physicians' work burden is relieved, and patients' medicines are reviewed by both physicians and pharmacists.

Strengths and limitations

The main strength of this study is the observation methodology with predefined task categories, observation schedules and time-stamped WOMBAT-data, reducing observation bias and observation fatigue and ensuring accuracy of calculated time [26]. Other strengths include that data were collected from three EDs over the course of a year, we observed different physicians, and we ensured inclusion of physicians with different experience and medical specialties. Time spent on medication-related tasks is quite similar in the three EDs, indicating that the results are probably representative to other ED settings in Norway as well. The high number of observed hours from the three EDs are comparable to other studies of work patterns [4, 43] and observations are spread from Monday to Friday between 8 am and 8 pm which provides a realistic, generalizable, representation of ED physicians' work time distribution during the day. Altogether, these measures ensure a data material representative of the work time distribution for ED physicians in North Norway, across hospitals, physician specialty and variation over time in admission rate and staffing.

The main limitation of this study is that we have not followed single patients and are not able to calculate how much time is spent on different tasks per patient. Other limitations include that our results are not representative for nights and weekends, as observations were not performed at these times. Rather, our results represent physicians' work time distribution during the busiest workhours of the three EDs. Another limitation to our study is that senior surgical physicians in ED2 were not always present in the ED during the entire observation session, leading to a few sessions being cut shorter than two hours. We had a similar challenge in ED1, where senior physicians rarely were present in the ED. Consequently, we were forced to change observation strategy by increasing the number of observation sessions of junior physicians instead. Also, using two different observers could introduce inter-observer bias, however we took steps to ensure a high inter-rater agreement between observers through tests of agreement both before and during the data collection period.

Conclusion

This study shows that physicians working in EDs without pharmacists employed, spend 8.7% of their work time on medication-related tasks. The two most time-consuming medication-related tasks concern oral communication about medications with other HCPs and medication-related documentation. Medication reconciliation accounts for 2.2 min per hour. Results from this study indicate that medication safety tasks in the ED receive little attention. Allocating dedicated resources like pharmacists to contribute with medication-related tasks in the ED could be beneficial for both physicians and patients. In addition to conducting studies investigating patient outcomes, future research should investigate whether physicians' perception of time and actual time spent on medication-related tasks changes when introducing the ED pharmacist.

Abbreviations

ED	Emergency Department
HCP	Healthcare professional
MedRec	Medication Reconciliation
WOMBAT	Work Observation Method by Activity Timing
STAMP	Suggested Time And Motion Procedures
RETTS	Rapid Emergency Triage and Treatment System

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

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Authors' contributions
TJ, RVH, KS, ECL, RE and BHG were involved in study design. TJ, RVH, ECL and MF developed and piloted the categories for the WOMBAT app. MF and RVH collected data. Data analysis was performed by TJ, supported by RVH and MW. TJ drafted the first manuscript, while all authors contributed further with writing and editing. The final manuscript was read and approved by all authors. This study is a part of a larger project that investigates implementing the clinical pharmacist in the ED interprofessional team, in which TJ, RVH, BZH, KS, ECL, EHO, TR, BHG and RE have been a part of conceptualizing the research.

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Availability of data and materials
The dataset used and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The research has been conducted according to ethical guidelines stated by the Helsinki declaration. The experimental protocol for the study was approved by the Data Protection Officer at Hospital Pharmacy of North Norway Trust, who serves as the Ethical Committee for the project (no. 02330). All participants gave written informed consent for study participation.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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Publisher's Note

Supplementary 1

The final version of the WOMBAT outline consisted of five dimensions as illustrated in Figure 1 (in beige). Data was collected using iPad® Mini's with WOMBAT software version 3.0 installed (see Picture 1 for screenshot). The WOMBAT software allows for collection of timestamped observational data, recording the exact time from when you start/press the current "what" task until a new task is started or interrupted. It provides with quick and easy transition between task categories. *Indicates mandatory dimensions. Current running task is automatically marked in green, and on the left panel the previously time-stamped tasks and current running task are shown.

Tasks (T)	WHAT*			
●Oral com.. T3 19:15:49	Patient examination/treatment	Oral communication ↓	Read/retrieve written information	Documentation ↓
Movement T2 19:15:40	Movement	Medication management ↓	Waiting/consideration	Logistics ↓
V Patient examin.. T1 19:15:27	Standby	Meeting	Unknown	Other
	WHERE*			
	ED	Medication room	Covid19 area	Outside ED
	WHO			
	Patient	Junior physician	Senior physician	Nurse
	Nurse coordinator	Unknown	Secretary	Others ↓ -
Interrupted	HOW			
	Face-to-face	Chart	PC ↓	Telephone
	Encyclopedia	Paper journal	Paper	Other
	PATIENT			
	1	2	3	More ↓
	FREETEXT			
	Multitask/interrupt	Next task		

Figure 1: Illustration of the WOMBAT software with five dimensions and associated categories.

1. **WHAT**

Describes which task that is done by the observed physician. This dimension was mandatory. Definitions and examples of categories and subcategories in this dimension is provided in Supplementary 2. Down arrow indicates that there are subcategories chosen from a drop-down menu, consisting of the following:

Oral communication ↓

- Retrieve medication-related information
- Give medication-related information
- Communication about medications
- Work-/patient-related

Documentation ↓

- Medication-related
- Non-medication-related

Medication management ↓

- Medication preparation without patient
- Preparation and administration of medications with patient
- Double checking

Logistics ↓

- Other
- Medication-related

2. WHERE

Describes where the observed physician was when conducting the recorded task. This dimension was mandatory, with only one option possible to register.

3. WHO

Describes with whom (if anyone) the observed physician performed the task with. This dimension was not mandatory, as many work tasks is conducted without interaction with others. Multiple options possible are to register, e.g., oral communication with a nurse and a senior physician. Down arrow indicates that there are other choices available from a drop-down menu:

Others ↓

- Specialist physician
- Healthcare personnel
- Medical student
- Pharmacist
- Next-of-kin
- Outside hospital

4. HOW

Describes practically how the observed physician conducted the task. This dimension was not mandatory, as some tasks don't require explaining how they are performed, e.g., movement. Multiple options were possible to register, e.g., reading and retrieving information from the prescription intermediary and the Summary Care Record at the same time. Down arrow indicates that there are other choices available from a drop-down menu:

PC ↓

- Electronic Health Record
- Medication module in Electronic Health Record
- Prescription intermediary
- Summary Care Record
- Interaction information screen
- Electronic chart
- Other on PC
- Voice recorder

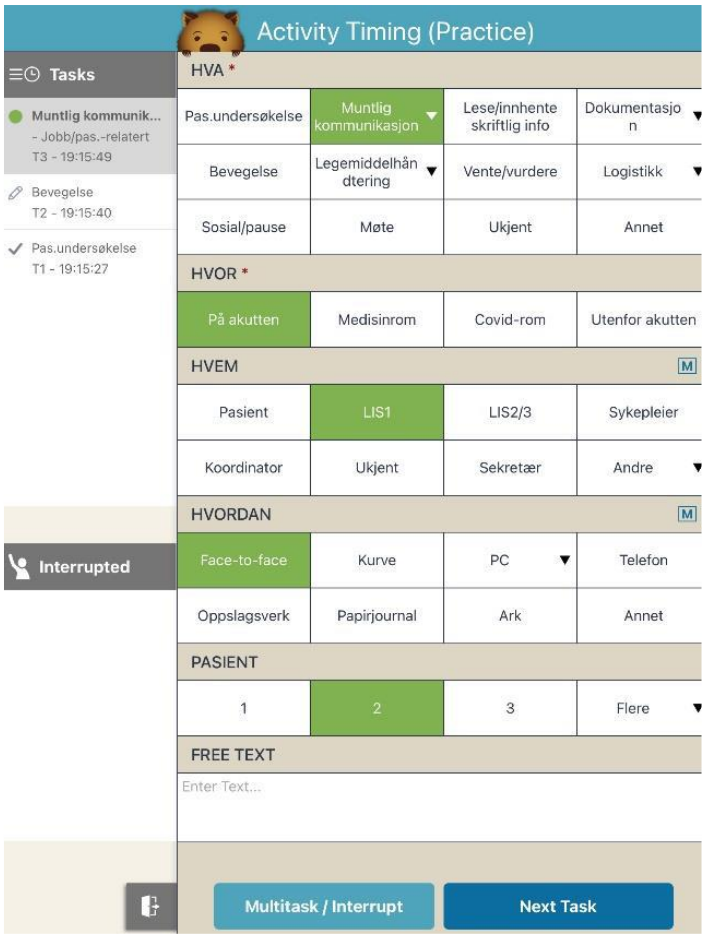
5. PATIENT

Every patient that was treated, communicated with or about during the day of the observation was registered with a unique number. The drop-down menu consisted of numbers up to 30, including "x" which was used if the patient was unknown to the observer. This dimension was not mandatory as not all conducted tasks involves patients, e.g., being standby. Only one option was possible to register.

More ↓

- 4
- 5
- … up to 30
- X (unknown patient)
-

Picture 1: Screenshot of the actual WOMBAT software used in the study (with Norwegian language).


Activity Timing (Practice)
Tasks
Muntlig kommunik...
- Jobb/pas.-relatert
T3 - 19:15:49
Bevegelse
T2 - 19:15:40
Pas.undersøkelse
T1 - 19:15:27
Interrupted
HVA *
Pas.undersøkelse
Muntlig kommunikasjon
Lese/innhente skriftlig info
Dokumentasjon
Bevegelse
Legemiddelhåndtering
Vente/vurdere
Logistikk
Sosial/pause
Møte
Ukjent
Annet
HVOR *
På akutten
Medisinrom
Covid-rom
Utenfor akutten
HVEM
M
Pasient
LIS1
LIS2/3
Sykepleier
Koordinator
Ukjent
Sekretær
Andre
HVORDAN
M
Face-to-face
Kurve
PC
Telefon
Oppslagsverk
Papirjournal
Ark
Annet
PASIENT
1
2
3
Flere
FREE TEXT
Enter Text...
Multitask / Interrupt
Next Task

Supplementary file 2

"What" dimension's categories, subcategories, definitions, and examples.

WHAT CATEGORY	WHAT SUBCATEGORY	DEFINITION	EXAMPLE
Patient examination/treatment	-	Examination or treatment of the patient (directly)	Measures blood pressure
Oral communication	• Retrieve medication-related information	Retrieving information about a patient's medication use	Talks to e.g., the patient or home care nurse about a patient's home medications
	• Give medication-related information	Give information that is medication-related	Tells a patient about side effects of morphine
	• Communication about medications	Communication about medications between healthcare personnel	Two physicians discuss a patient's medication list
	• Work-/patient-related	Communication with or about the patient with healthcare personnel. Work-related communication between colleagues. Not medication-related communication.	Nurse informs physician about triage results
Read/retrieve written information	-	Reading in Electronic Health Record or encyclopedia	Read previous discharge notes in Electronic Health Record or checking blood test results
Documentation	• Medication-related	Documenting a patient's medications	Writing medical chart, prescribing medications
	• Non-medication-related	Documenting patient history or blood tests	Writes about a patient's previous medical history in Electronic Health Record
Movement	-	Movement from one place to another, within the ED or between departments	Moving from the break room to the patient room
Medication management	• Medication preparation without patient	Preparing medications for the patient	A nurse prepares antibiotic infusion in the medicine room
	• Preparation and administration of	Administration of the prepared medication to the patient	A nurse gives a patient the infusion with antibiotic

	medications with patient		
	• Double checking	Checking (by you or by a colleague) that a medication prepared for administration is done after protocol/prescription	A nurse double checks another nurse to see if he/she prepared the correct medication
Waiting/consideration	-	Physician/nurse is not directly active in the work task, could be e.g., thinking, considering or waiting for test results	A nurse waits for results of the urine sample
Logistics	• Other	Preparing for the next patient, organizing the day with patients and healthcare personnel.	A nurse cleans a patient room
	• Medication-related	Order medications from hospital pharmacy or other tasks related to medications stated in hospital protocols	Checking the expiration date of the medications available in the medicine room
Standby	-	Time spent not doing any specific work tasks.	Lunch/toilet break. Inactive/available time (e.g., no patients in the ED).
Meeting	-	Staff meeting, morning meeting, internal teaching/education	Morning meeting where they summarize the previous 24 hours
Unknown	-	Not observable work tasks	Due to prevention of infectious diseases the observers can't join the nurse/physician
Other	-	Work tasks inapplicable with the other categories.	A nurse washing hands, completely independent on some of the other work tasks

Supplementary file 3

Table S1 Proportion of physicians' work time across all task categories.

CATEGORIES OF THE "WHAT" DIMENSION	ED1 123:14:04* %	ED2 136:23:45* %	ED3 126:19:10* %	**Total** **385:56:59** **%**
NON-MEDICATION-RELATED CLINICAL OR ADMINISTRATIVE TASKS	**84.6**	**88.8**	**82.9**	**85.6**
Patient examination/treatment	10.7	18.4	5.3	**11.7**
Oral communication	33.7	34.9	31.2	**33.3**
Read/retrieve written information	9.7	15.5	17.6	**14.4**
Documentation	17.4	13.2	17.3	**15.9**
Waiting/consideration	3.3	3.7	3.6	**3.5**
Logistics	1.9	1.0	1.6	**1.4**
Meeting	4.0	0.7	2.5	**2.4**
Unknown	3.9	1.6	3.7	**3.0**
Other	0.1	0.0	0.2	**0.1**
MEDICATION-RELATED TASKS	**8.4**	**9.6**	**8.0**	**8.7**
Oral communication:	3.7	5.4	4.2	**4.5**
Retrieve medication information	1.4	1.4	0.9	**1.2**
Give medication information	0.2	0.3	0.2	**0.2**
About medications	2.2	3.7	3.0	**3.0**
Read/retrieve written information	0.8	0.8	0.9	**0.9**
Documentation	3.6	3.3	2.8	**3.2**
Logistics	0.0	0.0	0.0	**0.0**
Medication management	0.2	0.0	0.0	**0.1**
OTHER	**10.5**	**12.0**	**14.8**	**12.4**
Movement	3.5	4.5	3.6	**3.9**
Standby	7.0	7.6	11.2	**8.6**

*Proportions were calculated using total observation time (hours:minutes:seconds) as denominator. The proportions add up to more than 100% due to multitasking.
ED = emergency department

Table S2 Proportion of time (%) across medication-related tasks, including "with whom" or "how" the task is performed.

WHAT	WITH WHOM/HOW	ED1 (10:22:23*) %	ED2 (13:04:16*) %	ED3 (10:02:19*) %	**Total (33:28:58*) %**
ORAL COMMUNICATION		**44.2**	**56.7**	**52.6**	**51.6**
Retrieve medication information**		**16.4**	**14.7**	**11.3**	**14.2**
	Patient	15.6	13.4	11.3	**13.5**
	Next-of-kin	2.7	1.0	0.5	**1.4**
	Source outside hospital***	0.0	0.0	1.2	**0.4**
Give medication information		**2.0**	**3.2**	**2.8**	**2.7**
	Patients	1.9	2.0	2.8	**2.2**
	Next-of-kin	0.8	0.4	0.6	**0.6**
About medications		**25.9**	**38.8**	**38.2**	**34.6**
	Nurse	6.5	3.9	7.9	**5.9**
	Junior physician	5.6	13.3	6.4	**8.9**
	Senior physician	8.6	9.9	16.5	**11.5**
	Medical student	8.0	2.9	3.3	**4.6**
	Specialist physician	0.1	3.7	0.0	**1.5**
	Patient	0.5	0.6	3.5	**1.4**
	Pharmacists	0.0	0.0	0.0	**0.0**
	Next-of-kin	0.0	0.4	0.3	**0.2**
	Nurse coordinator	0.2	0.3	0.4	**0.3**
	Source inside hospital	0.3	4.9	1.0	**2.3**
	Source outside hospital	0.3	1.1	2.2	**1.2**
	Other	0.0	0.0	1.5	**0.5**
READ/RETRIEVE WRITTEN INFORMATION**		**9.9**	**8.8**	**11.7**	**10.0**
	Summary Care Record	5.5	7.1	5.1	**6.0**
	Prescription intermediary	0.8	3.9	2.6	**2.6**
	Medication module in Electronic Health Record	4.1	4.9	6.4	**5.1**
	Chart	0.9	0.2	1.0	**0.6**
DOCUMENTATION**		**42.9**	**34.2**	**35.3**	**37.2**
	Chart	19.4	17.5	13.1	**16.8**
	Medication module in Electronic Health Record	13.4	11.4	11.3	**12.0**
	Other	10.1	5.3	10.9	**8.5**

*Proportions are calculated using the observed medication-related time in each emergency department (ED) as denominator. **The three medication reconciliation tasks. ***Sources outside hospital, e.g., pharmacies, nursing homes, home care nurses

Table S3 Time (hours:minutes:seconds) and proportion of time (%) spent on medication reconciliation (MedRec) tasks.

	ED1			ED2			ED3			**Total**		
	All physicians	Jr. internists	Jr. surgical physicians	All physicians	Jr. internists	Jr. surgical physicians	All physicians	Jr. internists	Jr. surgical physicians	All physicians	Jr. internists	Jr. surgical physicians
Active task time*	110:18:17	53:10:28	54:04:00	119:59:58	27:17:43	26:29:47	107:37:25	28:52:29	31:52:37	337:55:40	109:20:40	112:26:24
Observed time**	07:10:51	04:54:37	02:07:11	07:32:12	03:33:22	02:18:35	05:51:01	02:29:59	01:55:46	20:34:04	10:57:58	06:21:32
% time*	6.5	9.2	3.9	6.3	13.0	8.7	5.4	8.7	6.1	6.1	10.0	5.7
Median time/session	00:04:43	00:09:58	00:02:46	00:03:14	00:12:28	00:05:56	00:04:57	00:09:36	00:06:34	00:04:18	00:10:41	00:05:05
Min. time/session	00:00:10	00:00:24	00:00:14	00:00:09	00:02:09	00:00:14	00:00:13	00:04:17	00:00:22	00:00:11	00:02:17	00:00:17
Max. time/session	00:45:00	00:45:00	00:21:09	00:30:21	00:28:27	00:30:21	00:22:47	00:22:47	00:18:22	00:32:43	00:32:05	00:23:17
No. sessions w/MedRec	56	26	27	63	16	14	58	14	16	177	56	57
No. patients in sessions w/MedRec	100	50	47	99	31	24	99	29	27	298	110	98

*Active task time is total observation time excluding time for movement and standby and is used as denominator when calculating proportions in each group.

**Observed active task time spent on MedRec tasks: 1; oral communication – retrieve medication-related information, 2; read/retrieve written information; from Summary Care Record, Prescription Intermediary, medication module in electronic heath record and chart, and 3; medication-related documentation.

ED = emergency department

Paper III

Appendix A

Semi-structured interview guide Paper I

Describe how you work in the ED regarding medication-related tasks (introducing question)

Further questions and keywords for follow-up questions were prompted if necessary:

- Obtaining information
- Discussions with colleagues
- Considerations when ordering new medications for patients
- Thoughts around current treatment/adverse drug effects/drug interactions
- Prescription errors
- Documentation

What are the pros and cons about the current situation to ensure correct medication use/treatment for patients?

- What makes you feel safe in the way you work?
- What could be better?
- How can medicine safety be improved?

Based on your experiences, what do you think an ED clinical pharmacist should focus upon?

- Thoughts and experiences with clinical pharmacists/what knowledge they possess?
- What would physicians like help with?
- Who should do which tasks? Practical organization

When the clinical pharmacist becomes a part of the ED interprofessional team, how do you think this collaboration should be?

- What is needed to collaborate well in the ED?
- Thoughts on bringing in a new profession?
- Any worries regarding the ED pharmacist?
- Measures to be taken before implementation?

Interview guide Paper III

Opening question:

The ED pharmacists started working in the ED May 3rd/August 2nd, and you have worked together for X (fill in) months now. How has the time with ED pharmacists been for you?

Further questions:

1. Do you have previous experience of working with pharmacists at hospital wards? And if yes, how do you experience the collaboration in the ED vs. the ward?
2. How have working with ED pharmacists affected your day?
3. How do you proceed when you want to communicate with the pharmacists? Are they available when you need them?
4. Which work tasks do ED pharmacists have?
5. ED pharmacists do not work 24/7. How have the pharmacists influenced your way of working?
6. How does the pharmacists' way of working *work* in an ED setting?
7. What do you feel that you need help with (regarding medications) in the ED?
8. Have you learned something by working with ED pharmacists?
9. The project end is closing in, what are your thoughts on this?

Appendix B

NORDLANDSSYKEHUSET
NORDLÁNDA SKIPPIJVIESSO

Til:

Birgitte Zahl-Holmstad
Sykehusapotek Nord

Renate Elenjord
Forskningsleder
Sykehusapotek Nord

Harald Stordahl
Klinikkleder
Prehospital klinikk

Saksnr i Elements .:	Saksbeh.:	Dato:
2019/5441	Julie Rydland Antonsen	12.07.19

Vedrørende personvernkonsekvensvurdering for kvalitetsprosjekt

Prosjektnummer: 28-19

Prosjekttittel: Farmasøyt akuttmottak, intervju/observa.

Prosjektperiode: 01.08.19-01.08.28

1. Vurdering fra personvernombudet

Rettslig grunnlag
Det legges til grunn at det i prosjektet skal behandles både alminnelige personopplysninger og særlige kategorier av personopplysninger (helseopplysninger). Basert på prosjektets formål defineres prosjektet som et kvalitetsprosjekt, og behandling av personopplysninger i prosjektet har hjemmel i følgende behandlingsgrunnlag:

- Personvernforordningen artikkel 6 første ledd bokstav a) og artikkel 9 annet ledd bokstav a).
- Helsepersonelloven § 26

Personvernprinsipper
Personvernombudets vurdering er at den planlagte behandlingen av personopplysninger vil overholde prinsippene i personvernforordningen.

Håndtering av personopplysningene

Personopplysningene i prosjektet skal håndteres på sikker måte. Det anbefales at det opprettes område for sikker lagring på Nordlandssykehusets server, og at alle personopplysninger i prosjektet lagres på dette filområdet. Seksjon for forskning kan bistå på dette punkt. Ta kontakt på forskning@nordlandssykehuset.no.

Personvernombudets anbefaling
Personvernombudet gir sin anbefaling til gjennomføring av prosjektet, forutsatt at følgende punkter følges:

- Alle endringer i prosjektet må meldes til personvernombudet.
- Det skal ikke samles inn og behandles flere personopplysninger enn det som er nødvendig for å oppfylle formålet med kvalitetsprosjektet.
- Alle personopplysninger skal slettes eller anonymiseres ved prosjektets avslutning.
- Det skal gis tilbakemelding til personvernombudet når personopplysningene er slettet.

Personvernombudets vurdering er at behandlingen av personopplysningene i prosjektet vil være i samsvar med personvernlovgivningen, forutsatt at behandlingen gjennomføres i tråd med opplysningene i meldeskjemaet. Det presiseres at det er prosjektleders ansvar å påse at prosjektet følger gjeldende lovkrav.

Det minnes om at ved eventuell viderebehandling av personopplysningene til nye formål kreves nytt behandlingsgrunnlag (lovhjemmel eller samtykke). Det minnes også om at det skal brukes en egen brukerrolle i DIPS for tilgang til pasientjournal som ledd i arbeid med kvalitetsprosjekt. Se PR37665 for mer informasjon.

Med vennlig hilsen

Julie Rydland Antonsen
Personvernombud

2. Avgjørelse fra ledelsen

Prosjektet godkjennes under forutsetning at anbefaling fra personvernombud følges.

Med vennlig hilsen

Alisa Larsen
Informasjonssikkerhetsansvarlig

SYKEHUSAPOTEK NORD
DAVVI BUOHCCEVIESSOAPOTEHKA

28.11.2019

Vedrørende personvernkonsekvensvurdering for kvalitetsprosjekt

Prosjekttittel: Farmasøyt akuttmottak, intervju/observa.

Prosjektperiode: 01.08.19-01.08.28

1. Vurdering fra personvernombudet

Rettslig grunnlag
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- Personvernforordningen artikkel 6 første ledd bokstav a) og artikkel 9 annet ledd bokstav a).
- Helsepersonelloven § 26

Personvernprinsipper
Personvernombudets vurdering er at den planlagte behandlingen av personopplysninger vil overholde prinsippene i personvernforordningen.

Håndtering av personopplysningene
Personopplysningene i prosjektet skal håndteres på sikker måte. Det anbefales at det opprettes område for sikker lagring, og at alle personopplysninger i prosjektet lagres på dette filområdet.

Personvernombudets anbefaling
Personvernombudet gir sin anbefaling til gjennomføring av prosjektet, forutsatt at følgende punkter følges:

- Alle endringer i prosjektet må meldes til personvernombudet.
- Det skal ikke samles inn og behandles flere personopplysninger enn det som er nødvendig for å oppfylle formålet med kvalitetsprosjektet.
- Alle personopplysninger skal slettes eller anonymiseres ved prosjektets avslutning.
- Det skal gis tilbakemelding til personvernombudet når personopplysningene er slettet.

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Personvernombudets vurdering er at behandlingen av personopplysningene i prosjektet vil være i samsvar med personvernlovgivningen, forutsatt at behandlingen gjennomføres i tråd med opplysningene i meldeskjemaet. Det presiseres at det er prosjektleders ansvar å påse at prosjektet følger gjeldende lovkrav.

Det minnes om at ved eventuell viderebehandling av personopplysningene til nye formål kreves nytt behandlingsgrunnlag (lovhjemmel eller samtykke). Det minnes også om at det skal brukes en egen brukerrolle i DIPS for tilgang til pasientjournal som ledd i arbeid med kvalitetsprosjekt. Se PR37665 for mer informasjon.

Med vennlig hilsen

Stian Eilertsen

Personvernombud

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UNIVERSITETSSYKEHUSET NORD-NORGE
DAVVI-NORGGA UNIVERSITEHTABUOHCCEVIESSU

Lars Røslie
Akuttmedisinsk klinikk

Deres ref.:	Vår ref.:	Saksbehandler/dir.tlf.:	Dato:
	2020/206	Kristin Andersen/77626506	6.1.2020

ANBEFALING – BEHANDLING AV PERSONOPPLYSNINGER

Det vises til Meldeskjema for forsknings- og kvalitetsprosjekt og annen aktivitet som medfører behandling av personopplysninger, mottatt 1.7.2019 med avklaringer i e-poster, møte 21.11.2019 og ettersendte godkjenninger mottatt 18.12.2019

Meldingen gjelder prosjektet:

> ***Nr. 02330***
> ***Navn på prosjektet:***
> *Identifikasjon av arbeidsprosesser, tidsbruk ogerfaringer med optimalisering av lege middelbruk til pasienter i akuttmottak*

Prosjektet er et multisenter ***forskningsprosjekt*** ledet av sykehusapoteket Nord HF og hvor Universitetssykehuset Nord-Norge HF deltar.

> ***Formål:*** *«Prosjektet er en del av et større prosjekt "Farmasøyt i akuttmottak", se vedlagt protokoll. Formålet med dette delprosjektet er å identifisere, kartlegge og måle arbeidsprosesser som har med kvalitetssikring av legemiddelbruk å gjøre i tre akuttmottak i Helse Nord (UNN Harstad/Tromsø, NLSH Bodø), samt undersøke hvilke erfaringer personale og pasienter har med dette. Dette skal gjøres før og under/etter innføring av intervensjonen, ved bruk av intervju, observasjoner og spørreskjema.»*

REK har vurdert prosjektet, og finner at behandlingen av personopplysningene ***ikke faller inn under medisinsk- og helsefaglig forskning etter Helseforskningsloven.*** Behandlingen vil være hjemlet etter Personvernforordningen artikkel 6.1.a), artikkel 9.2. a) og j) og artikkel 89.1, jf. Personopplysningsloven § 10.

PVOs anbefaling forutsetter at prosjektet gjennomføres i tråd med de opplysningene som er gitt, samt i henhold til Personopplysningsloven og Helseregisterloven med forskrifter.

PVO har på bakgrunn av tilsendte meldeskjema med vedlegg registrert prosjektet og opprettet et eget område (mappe) på **\\hn.helsenord.no\UNN-Avdelinger\Forskning** (O:\) med navn **02330** hvor all data i forbindelse med prosjektet skal lagres.
I tillegg er det opprettet et område på **\\hn.helsenord.no\UNN-Avdelinger\Forskning\Key** med navn **02330N** hvor nøkkelfil skal oppbevares. Tilgang til dette området er begrenset til kun å omfatte prosjektleder og den/de som prosjektleder oppgir. PVO vil ha tilgang til området. *Skjema for ikke-ansatte prosjektmedarbeidere forutsettes signert av aktuell avdeling.*

Data som skal hentes ut fra UNNs forskningsserver O:\ må være avidentifisert.

PVO gjør oppmerksom på at dersom registeret (data lagret på O:) skal brukes til annet formål enn det som er nevnt i meldingen, må dette meldes særskilt.

PVO skal ha melding når prosjektet er avsluttet og når registeret er slettet. PVO skal ha melding hvert 3. år inntil prosjektet er slutt.

Med hjemmel i Personvernforordningens artikkel 39, anbefaler PVO at behandlingen kan iverksettes.

Med vennlig hilsen

UNIVERSITETSSYKEHUSET NORD-NORGE HF

for Personvernombudet

Kristin Andersen

Kopi: Klinikksjef Jon H. Mathisen

Om personvernombud
Personvernombudet er utpekt av Universitetssykehuset Nord-Norge HF (UNN) og meldt til Datatilsynet. Personvernombudet har som oppgave å bidra til at UNN følger gjeldende regelverk for behandling av personopplysninger. Oppgaven innebærer blant annet å kontrollere overholdelsen av regelverket, informere og gi råd til virksomheten og de ansatte, og gi råd i vurdering av personverskonsekvenser. Personvernombudet er uavhengig og kan ikke instrueres av UNN i gjennomføring av sine oppgaver.

Om uttalelsen
Personvernombudets uttalelse er ikke selvstendig juridisk bindende og du kan selv velge hvordan du ønsker å forholde deg til denne. Du er imidlertid selv ansvarlig for at du følger gjeldende personvernregler innenfor ditt ansvarsområde. Velger du å avvike fra personvernombudets uttalelse bør du begrunne dette skriftlig i ditt arbeid.

Klageadgang
Personvernombudets uttalelse er har ingen selvstendig juridisk virkning og det finnes ingen adgang til å klage på uttalelsen. Dersom uttalelsen konkluderte på annen måte enn du ønsket kan personvernombudet bistå.

Taushetsplikt
Personvernombudet har taushetsplikt ovenfor opplysninger om personlige forhold, enkeltpersoners varsling om mulige brudd på personvernlovgivningen, forretningshemmeligheter eller sikkerhetstiltak som det får kjennskap til i utførelsen av sitt arbeid. Dersom slike opplysninger er nødvendig for å gjennomføre lovpålagte oppgaver kan den registrerte bli bedd om samtykke til å gi nødvendige opplysninger videre.

For mer informasjon om personvernombud se Datatilsynets sider om personvernombud
For mer informasjon om pasientens rettigheter se Dine rettigheter på Datatilsynets sider
For mer informasjon om virksomheten (UNN) sine plikter se Virksomhetenes plikter

REK
REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSKNINGSETIKK

Region: REK nord
Saksbehandler:
Telefon:
Vår dato: 06.11.2018
Vår referanse: 2018/1949/REK nord
Deres dato: 25.09.2018
Deres referanse:

Vår referanse må oppgis ved alle henvendelser

Renate Elenjord
Sykehusapotek Nord HF

2018/1949 Farmasøyt i akuttmottak

Vi viser til søknad om forhåndsgodkjenning av ovennevnte forskningsprosjekt. Søknaden ble behandlet av Regional komité for medisinsk og helsefaglig forskningsetikk (REK nord) i møtet 25.10.2018. Vurderingen er gjort med hjemmel i helseforskningsloven § 10.

Forskningsansvarlig institusjon: Sykehusapotek Nord HF
Prosjektleder: Renate Elenjord

Prosjektleders prosjektomtale:
I dette forskningsprosjektet skal det utvikles, testes ut og evalueres en ny arbeidsstruktur i akuttmottaket hvor den kliniske farmasøyten inngår som en del av det tverrfaglige teamet. Vår hypotese er at ved å innføre intervensjonen reduserer legemiddelrelaterte problemer (inkludert uhensiktsmessig legemiddelbruk, interaksjoner og bivirkninger), liggetid i akuttmottak, lengde på sykehusopphold og reinnleggelsesrate, samt at tid til re-innleggelse og andel samstemte legemiddellister øker. For å teste vår hypotese har vi utformet et forskningsprosjekt med 6 arbeidspakker. De strekker seg fra å identifisere nå-situasjon og hvilke arbeidsoppgaver som utføres, hvordan de utføres, hvor lang tid de tar og hvilke oppfatninger helsepersonell og pasienter har per i dag (AP1-2), til å gjennomføre en «forbedringintervensjon» (AP3), samt evaluere den både kvantitativt (AP4), kvalitativt (AP5) og økonomisk. Vi anvender både kvalitative og kvantitativ forskningsmetodikk.

Vurdering av framleggingsplikten
Formålet med prosjektet beskrives som å se på effekten av «farmasøyt i akuttmottaket» ved å innføre en ny arbeidsstruktur i akuttmottak hvor farmasøyten inngår som en del av det tverrfaglige teamet og utfører oppgaver som har med kvalitetssikring av legemiddelbruk å gjøre. Bakgrunnen for å få farmasøyter inn i akuttmottaket, er for å forbedre kvaliteten på pasientbehandlingen. Det er allerede bestemt at ordningen skal gjennomføres.

Grensen mellom forskning og kvalitetssikring kan være noe uklar. I internasjonale retningslinjer fra CDBI i Europarådet, som REK anvender som retningsgivende, et det lagt til grunn at det kan være nyttig og relevant med tre kontrollspørsmål:

1) Er prosjektets formål å forsøke å forbedre kvaliteten på pasientbehandlingen på lokalt plan, for eksempel ved en sykehusavdeling?

2) Går prosjektet ut på å prøve praksis mot etablerte standarder?

3) Innebærer prosjektet at noe gjøres med pasientene som ellers ikke ville blitt gjort som ledd i klinisk praksis og kvalitetssikring?

I retningslinjene heter det at dersom svaret på de to første spørsmålene er ja og svaret på det siste spørsmålet er nei, så er prosjektet med all sannsynlighet kvalitetssikring.

Etter en samlet vurdering er REK kommet til at prosjektet er et kvalitetssikringsprosjekt. Kvalitetssikringsprosjekt skal forankres i egen institusjon og skal ikke vurderes av REK.

Vedtak
Etter søknaden fremstår prosjektet ikke som et medisinsk og helsefaglig forskningsprosjekt som faller innenfor helseforskningsloven. Prosjektet er ikke framleggingspliktig, jf. helseforskningsloven § 2.

Klageadgang
Du kan klage på komiteens vedtak, jf. helseforskningsloven § 10 og forvaltningsloven § 28 flg. Klagen sendes til REK nord. Klagefristen er tre uker fra du mottar dette brevet. Dersom vedtaket opprettholdes av REK nord, sendes klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag for endelig vurdering.

Med vennlig hilsen

May Britt Rossvoll
sekretariatsleder

Kopi til: renate.elenjord@sykehusapotek-nord.no; rek-svar@unn.no

Appendix C

FORESPØRSEL OM DELTAKELSE I FORSKNINGSPROSJEKTET

FOKUS PÅ RIKTIG LEGEMIDDELBRUK I AKUTTMOTTAK – ERFARINGER OG HOLDNINGER

Dette er et spørsmål til deg om å delta i et forskningsprosjekt gjennom å intervjues. Vi ønsker legers perspektiv på jobben som gjøres i akuttmottak for å sikre at pasienter får riktig legemiddelbehandling og bruker legemidlene riktig. Prosjektet utføres som en del av ett større prosjekt i Helse Nord kalt «Farmasøyt i akuttmottak» hvor det forskes på implementering av klinisk farmasøyt som en del av det tverrfaglige teamet i akuttmottak.

HVA INNEBÆRER PROSJEKTET?

Vi vil intervjue deg for å undersøke dine erfaringer og meninger rundt jobben som gjøres i akuttmottak for å sikre at pasienter får riktig legemiddelbehandling og bruker legemidlene riktig. Med dette mener vi alle prosesser fra man identifiserer hvilke legemidler pasienten bruker, vurderer riktighet av legemiddelbehandling, forskriver legemiddelbehandling med alle vurderinger og tiltak som ligger bak dette, til at man sikrer at pasienten får nødvendig informasjon om legemidlene. Vi ønsker å vite: Hva som fungerer? Hva fungerer ikke så bra? Hvordan kan vi eventuelt forbedre systemet? Vi ønsker også å høre dine tanker og ideer om hvordan en farmasøyt i akuttmottak bør arbeide.

HVORFOR FOKUS PÅ RIKTIG LEGEMIDDELBRUK?

Flere av innleggelsene på akuttmottak har bakgrunn i feil eller manglende legemiddelbruk. Studier viser at det ofte forskrives feil eller uhensiktsmessig legemiddelbehandling, at legemiddellistene ikke representerer det pasienten faktisk bruker og at mindre enn halvparten av legemidler ikke brukes slik de er ment å brukes. Legemiddelfeil oppstår i 5-14 % av alle legemiddeldispenseringer, og mellom 1-10% av disse er assosiert med pasientskade. Forskning viser at over 50 % av legemiddelfeil kan forebygges.

HVA SKJER MED OPPLYSNINGENE OM DEG?

Data som lagres om deg i dette prosjektet, vil være lydopptaket fra intervjuet. Lydopptaket transkriberes (skrives ned ordrett) hvor navn eller annen identifiserbar informasjon anonymiseres. Opptaket slettes når det er transkribert og ferdig analysert. En kode knytter deg til dette opptaket gjennom en navneliste. Det er kun prosjektgruppen som har tilgang til denne listen.

Du har rett til innsyn i hvilke opplysninger som er registrert om deg og rett til å få korrigert eventuelle feil i de opplysningene som er registrert. Du har også rett til å få innsyn i sikkerhetstiltakene ved behandling av opplysningene.

FRIVILLIG DELTAKELSE OG MULIGHET FOR Å TREKKE SITT SAMTYKKE

Det er frivillig å delta i prosjektet. Dersom du ønsker å delta, undertegner du samtykkeerklæringen på siste side. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke. Dersom du senere ønsker å trekke deg eller har spørsmål til prosjektet, kan du kontakte stipendiat Tine Johnsgård.

KONTAKTOPPLYSNINGER

Dersom du har spørsmål, ta kontakt med stipendiat Tine Johnsgård, tine.johnsgard@sykehusapotek-nord.no

JEG SAMTYKKER TIL Å DELTA I PROSJEKTET «**FOKUS PÅ RIKTIG LEGEMIDDELBRUK I AKUTTMOTTAK – ERFARINGER OG HOLDNINGER BLANT PERSONALE OG PASIENTER**» OG TIL AT MINE PERSONOPPLYSNINGER BRUKES SLIK DET ER BESKREVET

Sted og dato

Deltakers signatur

Deltakers navn med trykte bokstaver

Vil du delta i forskningsprosjektet

«Kartlegging av tidsbruk på legemiddelrelaterte oppgaver i akuttmottak?»

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å undersøke hvor mye tid leger og sykepleiere i akutten bruker på legemiddelrelaterte oppgaver, uten og med farmasøyt til stede. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål
Prosjektet er en del av et stort forskningsprosjekt, «Farmasøyt i akuttmottak», som går over 4 år i Tromsø, Harstad og Bodø. I denne delstudien skal vi observere leger og sykepleiere i akuttmottaket for å se hvilke arbeidsoppgaver de gjør i løpet av sin arbeidsdag og hvor mye tid dem bruker på de ulike arbeidsoppgavene. Vårt fokus vil være legemiddelrelaterte oppgaver.

Hvem er ansvarlig for forskningsprosjektet?
Helse Nord er ansvarlig for dette delprosjektet.

Hvorfor får du spørsmål om å delta?
Du er sykepleier eller lege som arbeider på akuttmottaket på Universitetssykehuset i Nord-Norge (UNN). Akuttmottaket på UNN er et av observasjonsstedene i denne studien.

Hva innebærer det for deg å delta?
Hvis du velger å delta i prosjektet, innebærer det at en masterstudent vil følge deg og observere dine arbeidsoppgaver. Disse vil bli registrert på en iPad med programmet Work Observation Method By Activity Timing (WOMBAT), som gjør det mulig å beregne tidsbruk. Et observasjonsintervall blir på to timer, og planen er å observere i totalt 100 timer. Disse timene vil fordeles på ulike leger og sykepleiere, på dag- og ettermiddagsvakter. Observasjonen skal ikke være et hinder for deres arbeid.

Det er frivillig å delta
Det er frivillig å delta i forskningsprosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger
Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.
Navnet og kontaktopplysningene dine vil erstattes med en kode som lagres på egen navneliste adskilt fra øvrige data. Det er kun observatør og forskere som har tilgang til disse opplysningene.
I publikasjonen av resultatene fra forskningsprosjektet, vil det ikke være mulig å identifisere hvem som har blitt observert.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?
Opplysningene anonymiseres underveis i arbeidet med masteroppgaven. Ved prosjektslutt vil alle personopplysninger makuleres.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg, og å få utlevert en kopi av opplysningene,
- å få rettet personopplysninger om deg,
- å få slettet personopplysninger om deg, og
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

Da det er Helse Nord som står bak dette forskningsprosjektet er det PVO- Personvernombudet som har vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?
Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:

- Renate Elenjord, Sykehusapotek Nord HF /Institutt for farmasi ved UiT, e-post: renate.elenjord@sykehusapotek-nord.no

Hvis du har spørsmål knyttet PVO sin vurdering av prosjektet, kan du ta kontakt med: PVO-Personvernombudet, Datatilsynet på telefon: 22 39 69 00.

Med vennlig hilsen

Elin Lehnbom	Marie Fagerli
(Veileder)	(Masterstudent)

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet «Farmasøyt i akuttmottaket» og har fått anledning til å stille spørsmål. Jeg samtykker til:

- ☐ å delta i å bli observert

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet

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(Signert av prosjektdeltaker, dato)

Vennligst fyll ut denne tabellen:

Kjønn	**Medisinsk/ kirurgisk**	**LIS1/ LIS2/3/ sykepleier/ fagsykepleier**

FORESPØRSEL OM DELTAKELSE I FORSKNINGSPROSJEKTET

FARMASØYT I AKUTTMOTTAK – ERFARINGER OG HOLDNINGER

Dette er et spørsmål til deg om å delta i et forskningsprosjekt gjennom å intervjues. Vi ønsker legers perspektiv og erfaringer knyttet til samarbeid med farmasøyt i akuttmottaket. Studien utføres som en del av ett større prosjekt i Helse Nord kalt «Farmasøyt i akuttmottak» hvor det forskes på implementering av klinisk farmasøyt som en del av det tverrfaglige teamet i akuttmottak. Formålet med prosjektet er å sikre riktig legemiddelbruk allerede ved innkomst i sykehus.

HVA INNEBÆRER STUDIEN?

Vi vil intervjue deg for å undersøke dine erfaringer og meninger rundt det å arbeide med farmasøyt i akuttmottaket, da spesielt med tanke på samarbeid, kommunikasjon og arbeidsoppgaver. I tillegg vil vi høre dine tanker om en eventuell videreføring av prosjektet og dine ideer til forbedringspotensialer. Vi ønsker å vite: Hva fungerer? Hva fungerer ikke så bra? Hvordan kan vi eventuelt forbedre samarbeidet? Vi ønsker også å høre dine tanker og ideer om hvordan en farmasøyt i akuttmottaket bør arbeide.

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KONTAKTOPPLYSNINGER

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