Antibiotic Use and Antibiotic Resistance Prevention in India: Exploring Nurses' Practices and Perspectives

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Abstract

Nurses are central to infection prevention management, and there is a growing recognition of their key position in preventing the development of antibiotic resistance in hospitals. However, there is a lack of studies examining nurses' involvement in managing antibiotic treatment and antibiotic resistance prevention in India.

This qualitative study was conducted to identify the determinants guiding and influencing hospital staff nurses' practice in their management of antibiotic treatment and antibiotic resistance prevention strategies in two hospitals in North India. Ethnographic methods were used to gain insight into the nurses' everyday practices in the hospitals. Participant observation allowed for an understanding of nurses' tasks and practices related to antibiotic treatment, such as preparing, disposing, and administering antibiotics, detecting signs and symptoms of infections, and complying with infection prevention and control measures. Semi-structured interviews with nurses explored their views and perspectives on the management of antibiotic treatment, their perceived need for competency development, and how relations with different professional groups and patients influence their practices.

Findings from this study revealed how nurses considered their importance in providing medicines to patients and their role in managing antibiotic treatment. Additionally, it was found that nurses' practices were influenced by socially constructed notions regarding antibiotic resistance, hygiene, and vital sign assessments. Despite the nurses' strong sense of responsibility and professional integrity, nursing workload and time limitations impacted their practices, potentially compromising patient safety. The study explored not only the individual practices and perspectives of nurses but also the social relations and resources within the hospitals. Power dynamics and limited prospects for professional development were found to hinder nurses' ability to stay updated on best practices and to engage in antibiotic resistance prevention efforts despite their readiness and willingness to gain new knowledge and competence.

By considering the local context, available resources, and cultural notions related to hygiene and antibiotics, interventions can be tailored to empower nurses as crucial stakeholders in antibiotic resistance prevention. Future interventions should focus on addressing power dynamics, improving working conditions, and providing professional development and training opportunities. A collaborative approach involving multidisciplinary teams can create an environment that supports nurses in their crucial role, contributing to the overall efforts in combating antibiotic resistance and improving patient outcomes.

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Abbreviations

ABR	Antibacterial Resistance
AMR	Antimicrobial Resistance
AMS	Antimicrobial Stewardship
BSc	Bachelor of Science
CHC	Community Health Center
GAP	Global Action Plan
GNM	General Nursing and Midwifery
HAIs	Healthcare-Associated Infections
HP	Himachal Pradesh
ICN	International Council of Nurses
ICU	Intensive Care Unit
IPC	Infection Prevention and Control
MCH	Medical College and Hospital
MRSA	Methicillin-Resistant *Staphylococcus Aureus*
NAP	National Action Plan
NICU	Neonatal Intensive Care Unit
PHC	Primary Healthcare Center
VAP	Ventilator Associated Pneumonia
WHO	World Health Organization

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Chapter 1: Introduction

Antimicrobial resistance (AMR) occurs when microbes evolve and develop mechanisms that mitigate their responses to antimicrobial medicines. A more specific term, antibiotic resistance (ABR), refers to bacterial resistance toward antibiotic medicines used to treat and prevent infections caused by bacteria. The phenomenon threatens global public health because effective prevention and treatment of common and complex infections are jeopardized (World Health Organization, 2015). In hospitals, a multidisciplinary approach combining antimicrobial stewardship (AMS) and infection prevention and control (IPC) is recommended to reduce the development and spread of ABR while achieving the best clinical outcome for patients (Majumder et al., 2020; World Health Organization, 2015). IPC aims to reduce the incidence and spread of infections through, e.g., sanitation and hygiene, and AMS programs consist of coherent sets of actions to promote optimized management and use of antimicrobials (Dyar et al., 2017; World Health Organization, 2019).

While nurses have been acknowledged as central to IPC management since the 1960s (Gardner et al., 1962; Gradmann, 2018), AMS has traditionally been the domain of physicians and pharmacists. Recently, researchers around the world have been responding to the call for multidisciplinary action to address ABR, promoting the role of nurses not only in IPC but as key positioned to coordinate AMS activities and contribute to ABR governance (Kirby et al., 2020). Nurses are already performing specific tasks that can impact ABR, such as the management of intravenous antibiotics (van Huizen et al., 2021) and ensuring proper culture techniques (Carter et al., 2018). Additionally, nurses' presence at the patient's bedside, responsibilities for patient education, clinical observations, and therapeutic monitoring (Majumder et al., 2020) can contribute to important patient advocacy and support judicious antibiotic prescriptions (Carter et al., 2018).

India is one of the countries with the highest occurrence of antibiotic consumption and antibiotic resistance (Gandra et al., 2018). Implementation of AMS programs and activities in both public and private hospitals is still nascent (Sahni et al., 2020), and research involving nurses in the prevention of ABR is limited. There is a need for context-specific research focusing on nurses' current and potential role in managing antibiotic treatment and preventing ABR in India. Through participant observation and interviews of nurses at two hospitals in Himachal Pradesh, India, the present research provides insight into the role of hospital staff nurses and the determinants influencing and guiding their practices related to the management of antibiotic treatment and prevention of antibiotic resistance.

Chapter 2: Literature Review

2.1 Antibiotic resistance: burden and policy

In 2019, 4.95 million deaths were estimated to be caused by antibiotic-resistant bacterial infections (Murray et al., 2022). If no action is initiated, it has been projected that the number of deaths by antibiotic resistance could rise to 10 million per year by 2050 (O´Neill, 2016). The burden of drug-resistant infections remains high in low-and middle-income countries (Gandra et al., 2018; Murray et al., 2022). While the exact figures for the population burden of ABR is unknown, India has one of the highest rates of antibiotic resistance among bacteria that cause infections in both community and healthcare settings. A retrospective multi-institutional study conducted in 10 Indian hospitals revealed a significant correlation between multi-drug resistant pathogens and mortality rates. Widespread resistance to commonly used broad-spectrum fluoroquinolone antibiotics and third-generation cephalosporins has been observed, with rates exceeding 70% in *Acinetobacter baumannii, Escherichia coli,* and *Klebsiella pneumoniae*, and over 50% in Pseudomonas aeruginosa (Gandra et al., 2018).

The economic growth and increasing incomes in India have facilitated a significant surge in antibiotic usage (Laxminarayan & Chaudhury, 2016), with a growth rate exceeding 100% between 2000 and 2015 (Klein et al., 2018). A point prevalence study conducted in 16 tertiary care facilities across India found that 57.4% of the patients received at least one antimicrobial drug (Singh et al., 2019). This is considerably higher than found in the global point prevalence study from 2015 where 34.4 received at least one antimicrobial (Versporten et al., 2018). A study conducted in an Indian tertiary care facility, found that the majority of antibiotics were administered through the parenteral route, with third-generation cephalosporins being the most commonly prescribed group. Only a small portion, 8%, of the prescribed antibiotics were chosen based on culture reports (Sheikh et al., 2022).

Policies to address ABR and AMR were initiated in India after the discovery of the New Delhi Metallo-beta-lactamase-1 (NDM-1) gene in 2008. Afterwards, the National Policy on Containment of AMR was launched in 2011, and the Chennai Declaration was presented in 2012 to create a roadmap to address the challenge (Gandra et al., 2017). The World Health Organization (WHO) and the World Health Assembly launched the Global action Plan on Antimicrobial Resistance (GAP-AMR) in 2015 as a comprehensive One Health approach to AMR and ABR (World Health Organization, 2015). The idea of One Health acknowledges the interconnectedness of humans, animals, plants, and the environment. It involves a collaborative approach to developing and implementing programs and policies, where

multiple sectors and domains work together to improve public health outcomes (World Health Organization, 2017). A call was made for all countries to create National Action Plans to address AMR (NAP-AMR), with an emphasis on designing and customizing these plans to address local challenges aligned with the specific contexts of their health systems (Rogers Van Katwyk et al., 2020). Yet, several NAP-AMR share the objectives of the GAP-AMR, but they often lack specific policies and dedicated international legal agreements to support these objectives (Munkholm & Rubin, 2020; Rogers Van Katwyk et al., 2020). India's National Action Plan on Antimicrobial Resistance 2017-2022 was designed based on the GAP-AMR (Ministry of Health and Family Welfare & India, 2017). Due to India's federal system, health falls under the jurisdiction of individual states rather than the national government. Therefore, the NAP-AMR was created as a guiding document to assist in the development of State Action Plans. During the five years, only three out of 28 Indian states established AMR State Action Plans: Kerala, Madhya Pradesh, and Delhi. Implementation of the action plans was impeded due to a lack of multisectoral coordination, inadequate implementation strategies, lack of financial allocations at the government level and across states, and the COVID-19 pandemic (Nair et al., 2021)

The Indian National Action Plan and the GAP-AMR has been criticized for depending heavily on training, education, and behavior change among prescribers and distributors of antibiotics without considering the latest research on behavior change interventions. Additionally, the Indian NAP-AMR did not encompass the pluralistic and multisectoral healthcare services in India (Nair et al., 2021). Simultaneously, a growing body of literature have emphasized the necessity for interventions addressing antibiotic resistance to be tailored to local contexts, diverse governance systems, available resources, and the functioning of health systems (Charani et al., 2021). While the GAP-AMR and NAP-AMR align with the One Health approach, which emphasizes integration and collaboration across different sectors and domains, the primary solutions and interventions to address antibacterial resistance tend to focus on promoting individual behavior change (Chandler, 2019). According to Will (2018), people's behavior when consuming drugs is influenced by various factors including socioeconomic status, geographical location, employment, financial, and work-related pressure. Correspondingly, the prescription behavior and use of antibiotics are not solely determined by biomedical factors but are also influenced by structural inequalities. Charani et al. (2021) emphasizes the significance of understanding the sociocultural factors, population dynamics, and geographical disparities that influence antibiotic usage and infection prevention and control strategies.

2.2 Antimicrobial stewardship

One of the suggested interventions in the GAP-AMR and the Indian NAP-AMR was implementation of multidisciplinary antimicrobial stewardship committees in all secondary and tertiary health care facilities (Ministry of Health and Family Welfare & India, 2017; World Health Organization, 2015). Despite nurses accounting for a great deal of the health care service, further descriptions of nurses' role in multidisciplinary antibiotic stewardship teams or interventions were not defined in neither the GAP nor the Indian NAP-AMR. Sahni et al. (2020) reviewed published literature on the implementation of AMS programs in Indian hospitals and found that the process was at a developing stage. The progress of implementing AMS programs have been further impeded by the Covid-19 pandemic (Sheikh et al., 2022). One of the identified shortcomings of the implementation process was lack of integration of different hospital staff members to develop an effective AMS program. The need for training and education of all staff members, including doctors, microbiologists, and nurses was highlighted to meet the goals of the NAP-AMR (Sahni et al., 2020).

During the implementation of an AMS program in a tertiary care level hospital in North India, nurses were engaged in reviewing and discussing antibiotic prescriptions with the treating physician. The authors identified the inadequate involvement of nursing staff as a challenge during the implementation process. However, they did not further describe these challenges. As possible solutions, they suggested training nurses in rational antibiotic prescription and infection control practices and assigning more tasks to nurses in antibiotic usage guidelines (Verma et al., 2019). While implementing an AMS-program in a tertiary hospital in Kerala, South India, Mathew et al. (2020) found that resistance from pharmacologists, nurses, and microbiology staff diminished once the doctors were convinced about the implementation strategy. Furthermore, an interview with a pharmacist demonstrated how the medical staff was reluctant to question their seniors and doctors, in fear of negatively affecting the professional relationship: "Doctors would be like… how a nurse could question me! They will not take it in a professional way" (Mathew et al., 2020).

A survey conducted by Nair et al. (2019a) in West Bengal found that 65% of nurses erroneously agreed that antibiotics could treat viral infections. While 76% of the doctors disagreed with this statement, most of them answered that they would prescribe antibiotics for a cold or a sore throat. Although nurses are not legally entitled to prescribe antibiotics, 98.9% claimed that knowledge of antibiotics was essential to them as health providers. A qualitative follow-up study revealed that nurses would distribute antibiotics to patients in the

absence of doctors. In some cases of doctor shortages, the nurses received permission from the government to prescribe antibiotics (Nair et al., 2019b). Knowledge and awareness among health professionals regarding antibiotics are in many settings high (Pearson et al., 2018), but studies indicate a dissonance between knowledge and self-reported practices (Nair et al., 2019a). Traditionally, AMS has been the domain of pharmacists and doctors, but there is growing recognition that successful implementation of AMS activities can benefit from a multidisciplinary approach, including nurses (Majumder et al., 2020; World Health Organization, 2019). Additionally, nurses are already involved in several tasks that can impact the patients' antibiotic treatment.

Hospital staff nurses are responsible for the management of antibiotic treatment, including preparing, administering, and disposing antibiotics. It is essential for therapeutic effectiveness that antibiotics are administered in the correct dose at the right time. Antibiotic treatment may fail and increase ABR if the dose is too small or delayed (van Huizen et al., 2021). Preparing and disposing of intravenous antibiotics can potentially expose both nurses and the environment to small antibiotic doses, which can significantly impact ABR in and around hospitals. Nurses should therefore use gloves during preparation, and keep infusion sets intact during disposal. Pharmaceuticals should not be discarded into the sewer but should be stored in separate containers for incineration (Hocquet et al., 2016; van Huizen et al., 2021). This is important to avoid environmental contamination and reservoirs of ABR pathogens in the hospital which has been linked to healthcare-associated infections (Franco et al., 2020; Sukhum et al., 2022) and antibiotic resistant genes in hospital waste water systems (Zhang et al., 2020). Furthermore, hospital wastewater plants can create an environment that facilitates interactions and exchange of antibiotic resistant genes between different strains of bacteria (Fouz et al., 2020). Consequently, hospital wastewater has the potential to carry antibiotic resistant genes to communities. It can affect both human, animal, and environmental health outside of hospitals (Hocquet et al., 2016), rendering nurses important agents for waste diversion and disposal of antibiotic drugs and placing high demands on the waste infrastructure (Joseph et al., 2021).

Bringing the nurses' influence back into the hospital, their presence and bedside observations can contribute to important patient advocacy and proper antibiotic prescription and use (Carter et al., 2018). Broom et al., (2017) found that nurses had an essential role as "brokers" in the physicians' decisions to prescribe antibiotics. In various degrees, nurses guided, promoted, and influenced doctors' decisions when prescribing antibiotics. Additionally, nurses are often the patient's primary source of information. They educate

patients and caregivers about the appropriate use of medicines, the adverse effects of antibiotics, and antibiotic resistance (Majumder et al., 2020; Olans et al., 2015). Furthermore, nurses can contribute to optimize antibiotic treatment based on susceptibility testing by initiating and ensuring timely and proper techniques when collecting microbiological cultures. Breaks in sterile techniques while collecting microbiological cultures can adversely affect the proper selection of antibiotic treatment. This also applies when urine samples are collected from indwelling urinary catheters where bacteria are likely to be colonized (Carter et al., 2018). Moreover, specimen mislabeling with wrong patient identification, date or indication might jeopardize patient safety, and pre-analytic errors such as non-sufficient quantity of specimen are costly and can delay test results (Nguyen & Microys, 2022).

Additionally, a significant driver for unnecessary antibiotic use is microbiological testing of urine based on inappropriate indications for urinary tract infections, such as changes in smell or color. However, antibiotic treatment are not associated with improved clinical outcomes in patients with asymptomatic bacteriuria (Petty et al., 2019). Nurses can ensure that there is an appropriate indication prior to obtaining specimen samples to avoid antibiotic treatment of asymptomatic patients and exposing patients to unnecessary antibiotics (Monsees et al., 2019).

Although nurses are already involved in several tasks impacting antibiotic use and potential spread and development of antibiotic resistant bacteria, nurses are not always aware of their contribution. According to Mane et al. (2021), approximately one third of nurses in five Indian hospitals did not perceive poor infection control, lack of antibiotic restriction, and excessive antibiotic use as factors contributing to antibiotic resistance. Furthermore, the involvement of nurses in antibiotic stewardship programs have just recently been recognized. Lewis (2022) attributes gender discrimination in the healthcare sector and the enduring dominance of medicine over nursing to the restricted development of nursing practice (Lewis, 2022). Similarly, Garner et al. (2014) found discouraging challenges faced by student nurses in India, including safety, incongruence between theory and practice, and a hierarchical system. The participants recognized nursing as a profession with low rank in the society. Although nurses are obtaining undergraduate and postgraduate professional degrees, Sharma et al. (2020) argue that nurses' status in society and the hospital is declining. Monsees et al. (2019) suggest that the hierarchical nature of the medical sector might constrain the role of nurses in antimicrobial stewardship activities and argue that these obstacles are essential to overcome to strengthen communication between bedside nurses and prescribers.

2.3 Infection prevention and control

Infection prevention and control is considered to be a critical part of successful antimicrobial stewardship and can contribute to reduce the development and spread of drug resistant microbes (Majumder et al., 2020; World Health Organization, 2015). By preventing occurrence of infections in the hospital, IPC can contribute to preserve the effect of antibiotics and simultaneously reducing the need for antibiotics.

Healthcare-associated infections (HAI) are defined as infections acquired 48 hours after hospital admission and are a global patient safety concern. HAIs includes surgical site infections, catheter-associated urinary tract infections, ventilator-associated pneumonia, hospital-acquired pneumonia, central line-associated bloodstream infections, and *Clostridium difficile* infections (Monegro et al., 2023).

Hospitalization plays a significant role in managing acute illnesses. However, it furthermore enhances the risk of exposing patients to nosocomial and often antimicrobial-resistant pathogens. These pathogens can be acquired from hospital staff, other patients, or the hospital establishment. The risk for healthcare-associated infections is influenced by various factors, including the infection control measures implemented at the facility, the prevalence of different pathogens in the community, and the patient's immune system and overall health condition (Monegro et al., 2023). Healthcare-associated infections and multidrug resistant infections are strongly associated with increases in costs, prolonged length of hospital stays, and increased mortality (Gandra et al., 2018; Serra-Burriel et al., 2020). To reduce the prevalence of healthcare-associated infections, infection prevention and control strategies are widely implemented in hospitals across the world. Measures such as handwashing with soap and water or disinfection using alcohol-based rubs are vital in reducing transmission of pathogens. Furthermore, aseptic techniques and precautions during invasive procedures and disinfection of rooms and surfaces in the hospital is recommended to decrease the risk of HAIs (Monegro et al., 2023).

Improvement in hand hygiene practices has been highlighted as the most effective intervention to reduce HAIs, and the WHO's Five Moments for Hand Hygiene have been widely adopted in healthcare settings (Lydon et al., 2017). Despite comprehensive efforts and interventions to increase compliance with handwashing and sanitation, compliance rates often remain low to moderate (Kingston et al., 2016; Lambe et al., 2019). Studies conducted in India has showed an overall low compliance to hand hygiene in hospitals ranging between 23-41% (Biswal et al., 2013; Sahni et al., 2015; Tyagi et al., 2018). A systematic review

found that hand hygiene compliance among healthcare professionals improved during the COVID-19 pandemic (Wang et al., 2022). Moore et al. (2021) demonstrated similar findings but found a decrease in HH compliance in the end of the study period.

Nurses have been acknowledged as pivotal in managing infection prevention and control since the 1960s. As drug-resistant infections and new epidemiological insights unfolded, the role of the infection control nurse was established as a distinct profession with the responsibility to complement microbiologists by conducting infection surveillance and implementing hygiene measures to prevent the spread of infections (Gardner et al., 1962; Gradmann, 2017). Today, IPC is an integrated part of nurses' responsibilities and hand hygiene is considered a critical hygiene practice by medical and health professionals (Mouajou et al., 2022). Despite solid evidence of the benefits of hand hygiene and sanitation, several obstacles to adequate performance and compliance persists (Gould et al., 2018).

Barker et al. (2017) identified barriers to IPC at a tertiary care level hospital in Northern India and found a high rate of nursing staff turnover, heavy clinical workload and limited time to train new staff members as major challenges. Diwan et al. (2016) found that barriers to conduct hand hygiene was related to high workload, scarcity of resources, lack of scientific information, and a perception that priority is not given to hand hygiene, either on an individual or institutional level (Diwan et al., 2016). Inadequate space between beds and bed-sharing challenges the health care professionals ability to visualize the patients zones in which hand hygiene should be practices (Salmon et al., 2015). Boudjema et al. (2017) video recorded healthcare professionals hand hygiene practices and found that nurses often wore gloves in care situations, including when such use was not recommended. The most frequent breach of hand hygiene protocols was the overuse of gloves. Kurtz (2017) found that wearing gloves was a risk factor for low compliance with hand hygiene. Flores et al. (2020) found that the main motivation for hospital staff to wear gloves was for personal protection. Jackson and Griffiths (2014) found that the ways in which nurses view dirt does not always agree with rational responses to infectious material. They suggest that strategies to improve hand hygiene can benefit from taking socially constructed perceptions of dirt into account.

In the past few decades, there has been a significant rise in the use of gloves, single-use plastic tools, and packaging in healthcare facilities (Hodges, 2017). This trend has been further accelerated during the COVID-19 pandemic (Khosla et al., 2022). Disposable plastic equipment is often perceived as reliable and durable, and it has been promoted as a crucial element in enhancing hygiene and ensuring safety in healthcare settings. Consequently, it has become symbolic of hospital hygiene practices. However, the widespread adoption of single-

use devices has had unintended consequences. It has altered the ecological dynamics of everyday medical practices, leading to hospitals becoming heavily dependent on plastics and generating substantial amounts of medical waste (Hodges, 2017).

The embedded focus on infection control and prevention in nursing practices is crucial to limit the spread of antibiotic resistant bacteria, reducing healthcare-associated infections and the need to use antibiotics. Such activities include adherence to standard precautions for infection prevention to avoid transmission of pathogens in health care facilities, such as hand hygiene, use of gloves, gowns, and glasses in cases where exposure to blood or body secretion is possible. Intravascular catheters are associated with risks of both local and bloodstream infections. Using aseptic techniques when handling intravascular catheters and performing routine catheter site inspections is crucial to identify and prevent healthcare-associated infections (Heffner & Androes, 2021). By promoting the switch from intravenous to oral antibiotics, nurses can reduce the need for intravascular catheters and the risk of infections (Park et al., 2017). Nurses are often responsible for maintenance of indwelling and intermittent devices such as endotracheal tubes for mechanical ventilation, endotracheal suction catheters, peripheral and central venous catheters, and urinary catheters. While essential for patient care, these devices also pose a risk of infection as they can serve as entry points for microbes. Consequently, it is imperative for healthcare professionals to diligently follow proper procedures in managing these devices to prevent healthcare-associated infections.

The nurses' tasks and responsibilities within IPC may vary between countries and hospitals, and implementing interventions and guidelines tailored to the local and cultural context is vital, as the stakeholders involved may differ. Surendran et al. (2022) conducted a study in a South Indian hospital and discovered that caregivers played a considerable role in various aspects of patient care and IPC. The caregivers accompanied the patient during hospitalization, contributed to clinical decision-making, and supported the patient's personal and clinical care. Despite their significant contributions and influence on infection prevention and control, they did not receive formal education or training to support these responsibilities, and the organization and healthcare providers did not acknowledge the vital role played by caregivers (Surendran et al., 2022).

The nursing profession and the roles and responsibilities of nurses are continuously developing and changing according to the healthcare environment, new technologies, and the needs of the healthcare system (Brunt & Morris, 2022). Clinical tasks, duties, and responsibilities related to antibiotic use and infection prevention are a part of nurses' daily

practices. However, previous research has shown that nurses are not always aware of how their practices and behavior can impact the efficacy of antibiotics (Monsees et al., 2019; van Huizen et al., 2021). To maintain high standards of care, nurses should have the opportunity to engage actively in continuing professional development through acquiring knowledge, skills, and competency to ensure patient safety end evidence-based practice (Mlambo et al., 2021). Gulia et al. (2022) found that the majority of nurses in a NICU (neonatal intensive care unit) in an Indian hospital had never attended any teaching sessions on nosocomial infection prevention. Labrague et al. (2019) found that organizational barriers were identified as the most important obstacle to translate knowledge into evidence-based practice among nursing students. These barriers included lack of time and resources in the ward, and lack of authority to facilitate change in clinical care. The authors suggest that teaching approaches should be culturally tailored and highlight the need of collaboration between nurse managers and nursing faculties (Labrague et al., 2019).

2.4 Monitoring patient status and managing antibiotic treatment

Assessment of vital signs is fundamental to ensure patient safety and quality of care. Nurses spend more time with patients and families than most other health providers and are often the first to observe, identify, detect and report symptoms of infections (Monsees et al., 2019). Collected data on vital signs such as blood pressure, respiratory rate, pulse, and oxygen saturation can provide valuable insight into the patient's condition. It can give information on how the patient responds to treatment, early detection of infections, and if the patient's status is deteriorating (Elliott, 2021). Respiratory rates are sensitive to the patients' circumstances, and systems need to be in place to ensure its accuracy. It is crucial that respiratory rate is counted and not estimated, and it should preferably be counted for at least 60 seconds. Furthermore, the patient should be unaware that their respiratory rate is being measured as their awareness would likely cause changes in their breathing (Kallioinen et al., 2021). Although changes in respiratory rate are the most sensitive measure and an early indicator of clinical deterioration, several studies have found that nurses and health providers often underestimate or overlook measuring the patients' respiratory rate, and rely on other measurements such as oxygen saturation (Cooper et al., 2014; Elliott, 2021; Kallioinen et al., 2021; Mok et al., 2015).

The assessment of vital signs and the patients clinical status is important to observe and detect potential side effects of antibiotic treatment, and to evaluate if the treatment has

the desired effect or not (Monsees et al., 2019). One of the practices to prevent adverse drug reactions in hospitals across India is to conduct a test dose or antibiotic skin testing where a small amount of the antibiotic is injected intradermally or subcutaneously to assess for hypersensitivity reactions. Antibiotic skin testing before antibiotic administration is a widespread routine practice in hospitals and health institutions across India but is rarely practiced in western countries. The efficacy and safety of skin testing depend on factors such as the concentration of the injection and the antibiotic being tested. This requires standard evidence-based protocols, which are rarely implemented in health institutions (Narayan & Rupert, 2019). Skin testing of antibiotics can generate false-positive test results. When relying solely on skin tests to determine drug allergies, the quality of care can be compromised because the alternative antibiotics may be less effective (Macy et al., 2017; Maguire et al., 2020). There is insufficient evidence that routine skin tests can reduce rates of anaphylactic reactions and it is therefore recommended to be restricted to patients with a history of reactions to the specific drug in question (Narayan & Rupert, 2019).

Nurses' presence and bedside observations can furthermore contribute to important patient advocacy and proper antibiotic prescription and use (Carter et al., 2018). The responsibility to manage antibiotic use safely and effectively is an integral part of nurses role. This is recognized by the International Council of Nurses (ICN) and the Indian Nursing Council's codes of ethics, stating that registered nurses across the globe are morally responsible, educationally prepared, and professionally accountable to safely fulfil their roles in promoting health and preventing disease (International Council of Nurses, 2021).

Medication use in hospitals is a complex process involving doctors, pharmacists, and nurses. Medication errors can be defined as preventable adverse effects of medical care and can significantly impact patients' health. Additionally, medication errors can lead to longer hospitalization and increased costs (Ahsani-Estahbanati et al., 2022). Nurses are responsible for preparing and administering intravenous medicines which can impact the therapeutic effect or lead to adverse drug reactions such as hypersensitivity reactions, infections, or drug resistance (van Huizen et al., 2021). Injections are preferred by doctors and patients in India due to the perception that injections provide quick relief compared to oral drugs. This contributes to overuse of injections and demands safe injection practices (Janjua et al., 2016). Therapeutic success and prevention of adverse effects rely on the proper administration of antibiotics and depend on the nursing team's skills, familiarity with the respective drug, and the relevant procedures and techniques (Hoefel & Lautert, 2006).

Zirpe et al., (2020) conducted a prospective observational study at a Tertiary Care Hospital in India and found a high level of transcription and prescription errors in patient medical charts. Furthermore, their study revealed that antibiotics was the drug class most prone to medication errors. Mendes et al (2018) found that the most frequent errors conducted when nurses prepared and administered intravenous drugs were neglecting to perform hand hygiene and aseptic techniques. Costa et al. (2022) found the medication error rate to be 36.6% at a University Hospital in Brazil. The most frequent errors were related to technique, wrong time or dose, and omission errors. The main factor associated with errors were interruptions and heavy workload. In addition to heavy workload, Gorgich et al (2016) found drug calculation errors as a risk factor for medication errors. Despite the high incidence of medication errors and the importance of nurses' responsibility for the administration of antibiotics, limited publications focusing on nurses' practices in the preparation and administration of antibiotics in India are found in the literature.

Chapter 3: Research question and objectives

What are the determinants influencing and guiding hospital nurses' practices related to antibiotic use and antibiotic resistance prevention in India?

The aim of the study is to identify determinants guiding and influencing hospital staff nurses' practices in their management of antibiotic treatment and antibiotic resistance prevention strategies in two hospitals in North India to gain a comprehensive understanding of the opportunities for their involvement in interventions to prevent the spread and development of antibiotic resistance bacteria.

Objectives

- Provide insight into the context and the role of the nurses to understand how their clinical practice influences antibiotic use and contributes to the prevention of antibiotic resistance.
- Explore nurses' perceptions of interprofessional relations and their involvement in antibiotic use and resistance prevention practices in the hospital.
- Identify the sources of information that nurses rely on and their perceived need for competency development.
- Investigate potential opportunities for nurses to be further engaged in antibiotic stewardship interventions in the future.

Chapter 4: Methodology

4.1 Hospital ethnography and positionality in the field

Originally derived from classic anthropology, the ethnographic approach involved anthropologists conducting extensive fieldwork in remote and unfamiliar cultures. However, during the mid-20th century, sociologists adopted this method and began applying it to more familiar settings, bringing the ethnographic approach closer to home (Green & Thorogood, 2018, p. 178). Ethnography as a research method can contribute to develop multidisciplinary solutions based on locally grounded knowledge to address persistent global health problems (MacDonald, 2017), such as AMR and other phenomena in healthcare settings. Hospital ethnography is a suitable approach to examining the social and cultural dynamics within healthcare settings. In their work, Van der Geest & Finkler (2004) challenge the notion of hospitals as mere replicas of a global biomedical system. Instead, they emphasize the importance of anthropological research in revealing the broader social and cultural context in which the hospital functions. Additionally, they highlight how disparities in medical perspectives and access to technical resources can lead to variations in diagnostic and therapeutic practices (van der Geest & Finkler, 2004).

In order to obtain insight into the nurses' practices and the factors that influence their work in infection prevention and antibiotic treatment management, this study utilized ethnographic methods in two hospitals. The research encompassed interviews and observations with staff nurses as research participants, along with the observation of their interactions with other hospital staff members and patients. By adopting an ethnographic view, the study aimed to gain a comprehensive understanding of their daily work and uncover the determinants that shape their practices.

The role of the ethnographic researcher can be divided into different categories. Conroy (2017) suggests six different roles within ethnographic observations in nursing research: the complete participant, the participant as an observer, the moderate role or peripheral member, the observer as a participant, the complete observer, and the non-participant. When entering the field, I anticipated to take on a moderate role in the hospital, where I would not be considered a member of the nursing staff but still engage in similar activities and maintain a balance between participation and observation. However, the language barriers I experienced made my role less of a participant and more of an observer: the observer as a participant. Because I am a registered nurse, I assisted the nurses in minor ways, such as helping them make the beds, fetching equipment, assisting in procedures, and

occasionally measuring vital signs. Furthermore, taking more of an observer role was useful to avoid interference with the nurse's behavior and practices, as my trained way of doing things might have contributed to changes in their performance. Being watched can change a person's behavior. For example, the nurses knew that infection prevention was part of my research, and I would occasionally see nurses look at me before searching for the nearest hand sanitizer. Although I attempted to collect as much data as possible, I tried to be unobtrusive by observing at a distance and refraining from becoming involved in irrelevant and sensitive activities. However, this proved challenging due to the layout of most wards, which were not equipped with divider walls or curtains to separate the beds.

My presence in the hospital did not go by unnoticed. I was undoubtedly considered an outsider and stood out because of my white complexion, blonde hair, and relatively tall stature. The hospital staff and patients were curious about my presence, but after a few weeks of fieldwork, the attention and interest in me seemed to decrease. Despite being seen as a foreigner in the hospital, I was also included as an insider by the nurses. Due to my background as a fellow staff nurse, they recognized the resemblance of our roles, similarities in our educational background, qualifications, and the tasks we perform at work. After getting to know me, most nurses seemed to appreciate the assistance I could provide, as I made a conscious effort not to be a burden while they conducted their work in the hospital ward. I wore my Norwegian nursing uniform to conform with the observed nurses and indicate my background in healthcare without taking on the clothes representing me as an employed staff nurse at the hospital.

I constantly found myself navigating between the roles of the insider and outsider throughout my research. As an insider, my background as a nurse provided valuable insights into understanding the responsibilities of staff nurses, their practices in managing antibiotic treatment, and their execution of sterile techniques and procedures. However, I approached my research with a reflexive mindset, aiming to navigate the cultural norms and structural influences that shape the nurses' practices without automatically imposing my own judgments based on what I have been taught as "right" or "wrong" through my education and work experiences in Norway. Additionally, my outsider perspective encouraged me to not only seek knowledge within the nursing community but also consider the diverse values and beliefs embedded in their social lives and the hospital's organizational structure.

Acknowledging the privileges associated with being a foreign researcher pursuing a master's degree, it was crucial to establish relationships based on trust and confidence to produce valid and reliable research findings. To build rapport, I actively listened and

demonstrated respect for the nurses' traditions, customs, and values related to their hospital work and personal lives. Engaging in dialogue beyond the scope of my research topic proved beneficial in enhancing my cultural sensitivity and understanding. I also sought feedback from participants and local researchers to clarify questions, identify potential misunderstandings and challenge my own perspectives and biases. These considerations encompassed various aspects, including caste, customs, promotion systems, and power dynamics within the hospital setting and contributed to ensure a more nuanced and balanced understanding of the research context while assuring that the research was culturally appropriate and respectful.

Maintaining a continuous reflexive approach was essential in recognizing and reflecting on how my positionality shaped my perceptions, interpretations, and interactions in the field (Green & Thorogood, 2018). For instance, during interviews and observations, I was mindful of the power dynamics between myself as a researcher, the local researcher and translator accompanying me, and the participant nurses. I made a conscious effort to understand how my presence and actions impacted these power dynamics, emphasizing my role as a fellow staff nurse to mitigate potential imbalances and foster equitable and respectful relationships with the nurses.

Furthermore, my nursing experience primarily comes from Norway. The population size marks the most crucial difference between Norway and India, resulting in significant disparities in healthcare resources and personnel. Norway boasts a ratio of 5 physicians and 18.4 nurses and midwives per 1000 people, while India has a mere 0.7 physicians and 1.7 nurses and midwives per 1000 people. Accordingly, the bed capacity in Norway equals 3.5 beds per 1000 people, while India has 0.5 hospital beds per 1000 people (The World Bank, 2023). Additionally, Norway allocates a larger percentage of its GDP to healthcare expenditures compared to India, and out-of-pocket expenses for healthcare are considerably higher in India (World Health Organization, 2021a, 2021b). Furthermore, antibiotic consumption in Norway is regulated and relatively low compared to India. The burden of infectious diseases in India is high, and antibiotics can be obtained without a prescription, leading to increased usage and contributing to the spread and development of antibiotic resistance (Browne et al., 2021; Charani et al., 2019). These variations in healthcare resources, funding, infrastructure, and disease burden highlight the need for tailored solutions to address the healthcare challenges in each country. As a researcher with a background from Norway, it was therefore important to take a reflexive approach in my work, considering the unique contexts and requirements of both India and Norway.

Conducting research across different cultures, languages, and countries introduces a significant level of complexity to the research process and its reporting (McKenna, 2022), particularly when it comes to communication. Within the hospital, a combination of Hindi, the local language, *Pahari*, and English was spoken. While medical and clinical terms were primarily in English, the nurses communicated with each other mainly in Hindi and with patients in Hindi or Pahari. The nurses reported that their nursing education was conducted in both Hindi and English, with English being the language used in textbooks. However, not all nurses were comfortable or fluent in English, and my ability to communicate in Hindi was limited to basic courtesy phrases, leading to occasional misunderstandings. One of these confusions was related to the hospital staff's perception of my role. Some nurses and ward sisters mistakenly believed I was a full-time employee and assigned me patient-related responsibilities. I politely declined these tasks and explained that my primary intent was to research, observe and learn from the nurses. However, using the term "learn" sometimes led to nurses providing spontaneous lectures on anatomy or different health issues. On one occasion, a nurse even found a chair for me and instructed me to memorize the different drugs in the acute care trolley. Furthermore, some matrons expected me to report instances of individual nurses' malpractice, which was not my intention at all. These experiences highlighted the linguistic barriers to communication and translation, prompting me to find alternative ways to convey the purpose of the study and clarify my role in the hospital.

My interest in antibiotic use and ABR developed early in my nursing career. I wrote my bachelor's thesis on how nurses can prevent the spread and development of ABR in Norwegian nursing homes. Through work experience as a hospital staff nurse in Norway with specific responsibilities within infection prevention and control, I have noticed the essential contribution of nurses' clinical observations, professional assessment, and patient advocacy to provide accurate patient treatment. During my fieldwork in India, I sometimes found it hard not to compare what I saw with experiences from Norway, particularly regarding nurses' responsibilities, hierarchies, and task division. While the biomedical structure in India and Norway may seem similar, several components distinguish how hospitals are operated, such as the admission and referral system, health information system, infrastructure, and patient load. I made a conscious effort to leave behind any biased preconceptions and thoroughly explore the intricate ways in which the hospital functioned. My previous experiences with community health nursing in rural Tanzania and studies of religion and power in South India have been invaluable in broadening my perspective, familiarizing myself with variations in healthcare systems, and becoming accustomed to and navigating unfamiliar cultural settings.

4.2 Ethical considerations

The project was registered with the Norwegian Centre for Research Data (NSD) under reference number 683437. Additionally, it was registered under the DigiAMRLit project with NSD reference number 74461. In accordance with the national requirements in India, Ethical approval was obtained from the host institution, Dr. RP Govt. Medical College Tanda (Appendix A).

Ensuring complete anonymity during the recruitment of research participants posed challenges due to the attention drawn by my presence in the hospital. The nurses on duty were aware of who participated in the study. However, measures have been taken to prevent readers from identifying the research participants. Pseudonyms are used for all participants in the thesis, and limited demographic data is included while direct identifiers are removed from the text. Extra precautions were taken to protect the privacy of research participants from the community health center, including anonymizing the name of the facility, as it had a small group of nursing staff where almost everyone participated in the study.

All research participants were provided with written and verbal information about the study's purpose, how confidentiality and anonymity were ensured, and how they could withdraw from the study at any time. The information letter and consent form were issued in both Hindi (Appendix B) and English (Appendix C). It was emphasized that participation was voluntary and their choice. Some nurses expressed concerns about potential judgment or reporting of their care provision, but it was clarified that this was not the aim of the research, and their anonymity would be maintained. Approval from the ward sister, or matron was sought by the nurses before the they chose to sign the forms. Due to busy schedules, some nurses would read the forms during their lunch break. I would sit down with the nurse to explain the details of the consent form and, if needed, ask another nurse to translate to Hindi for those less comfortable in English. Written consent was obtained before or shortly after observations and consistently before interviews.

While in the hospital, interactions with patients and caregivers were inevitable. However, patient-sensitive information was not included in field notes or in the writing process of this thesis. Furthermore, nurses were encouraged not to disclose patient information during interviews.

The local researcher participating in the interviews signed a declaration of confidentiality and had access to audio recordings. Recorded interviews were stored on a password-protected, encrypted hard drive accessible only to the researchers. After returning

to Norway, the audio recordings were stored in TSD (services for sensitive data) and deleted at the end of the research period. Interview transcriptions were anonymized using file naming codes, with the key connecting the codes to participants' demographic information kept separately. Pseudonyms were assigned to all participants and used throughout the thesis.

The study was conducted with the support of HELSAM's master project scholarship, which provided 10,000 NOK to cover the expenses of flight tickets. The remaining costs, including visa fees and living expenses, were covered by private funds and Lånekassen. There were no conflicts of interest involved in the study.

4.3 Healthcare in India: introducing the field site

The healthcare system in India is characterized by a strong presence of both public and private sectors, offering a wide range of healthcare options. Alongside modern medicine, the private healthcare sector encompasses traditional systems of medicine such as Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homeopathy (AYUSH), which serve as complementary options to allopathic health providers (Selvaraj et al., 2022, p. 174).

India's Public Health System follows a 3-tier system consisting of primary, secondary, and tertiary levels of healthcare. Each level operates services of the level below it. Primary healthcare centers (PHCs) serve as the first point of contact for healthcare services. These centers are typically located in rural areas and provide basic medical care, preventive services, maternal and child healthcare, immunizations, and essential medications. The secondary level of healthcare is provided by district hospitals and community health centers (CHCs). District hospitals offer more specialized services, including emergency care, surgeries, and diagnostic facilities. CHCs are located in rural areas and provide comprehensive healthcare services, including outpatient care, basic surgeries, and laboratory services. Tertiary care facilities are advanced hospitals that offer specialized medical services, including complex surgeries, specialized treatments, and advanced diagnostic services (Dadhwal & Bhutani, 2017, p. 37; Selvaraj et al., 2022, p. 172-173).

According to the India Health System Review 2022 (Selvaraj et al., 2022, p. 74, 157) the provision of effective health services in India faces several challenges. These challenges include fragmented service delivery between public and private providers, disorganized patient pathways, and a tendency for patients to bypass primary facilities to seek care directly at secondary and tertiary facilities, contributing to overcrowded hospitals. In addition, challenges related to the quality of public services are elevated by shortages of healthcare

professionals, inadequate physical infrastructure, and insufficient supply of drugs and medical equipment.

The cost of care in the private sector is high, and public healthcare services are generally more affordable and accessible to the general population. Health insurance coverage in India has been expanding, with both government-sponsored schemes and private insurance providers offering coverage. Health insurance helps individuals access healthcare services and provides financial protection against medical expenses. Privately purchased or publicly funded insurance schemes provide partial or full coverage for hospitalization, but most private outpatient care is paid for out of pocket (Selvaraj et al., 2022).

This study was conducted in the Kangra district of Himachal Pradesh (HP), a hilly state in the northwestern India. HP is nestled in the Himalayas, offering a diverse landscape including low hills, high mountains, lakes, and rivers. With a population of 6,856,509, according to the 2011 census, the state consists of 12 districts and has a population density of 123 persons per square kilometer. The life expectancy in HP surpasses the national average by 3.4 years, and the poverty headcount is nearly one-third of the national average. Furthermore, the literacy rate is among the highest in the nation, with 90% for males and 76% for females. These factors have played a crucial role in the state's development, with its third-highest rank on the Human Development Index among Indian states. Health indicators in HP have also shown steady progress with high immunization rates and lower childhood mortality rates than the national average and the neighboring states (Das et al., 2015).

The Department of Health and Family Welfare in Himachal Pradesh is responsible for providing health services through a network of facilities. The majority of the population resides in rural areas, leading to a significant reliance on the public health system. This dependence has motivated the government to continuously strive for its improvement (Dadhwal & Bhutani, 2017). The utilization of the public health system is higher than that of the private sector compared to most Indian states. Only 23% of in-patient services were provided by private hospitals from 2017 to 2018 (Selvaraj et al., 2022, p. 174). While the overall availability of health services in the state meets the standard norms for hill states in India, there is an unequal distribution of these services across different regions, with district Kangra, where this research was carried out, being one of the districts having a lower level of health services compared to others. The availability of health professionals is less than 0.3 nurses and 0.12 doctors per 1,000 persons (Dadhwal & Bhutani, 2017). These figures are significantly lower than the recent data on the national average provided by the World Bank,

which indicates an average higher ratio of nurses (1.7 per 1,000 persons) and doctors (0.7 per 1,000 persons) (The World Bank, 2023).

This study encompassed a tertiary care level medical college and hospital and a secondary care level community health center. The medical college and hospital, formally known as Dr. Rajendra Prasad Government Medical College Kangra at Tanda (hereafter referred to as the Medical College and Hospital, MCH), serves as a teaching hospital for various healthcare professionals, including nurses, doctors, radiographers, paramedical assistants, and laboratory technicians. With a total of 802 beds, including an additional 64 beds specifically allocated for COVID-19 patients, the hospital plays a crucial role in catering to the healthcare needs of the population in district Kangra. In 2019, the hospital recorded 245,169 in-patient admissions, resulting in an average bed occupancy rate of 113%.

Medical teaching institutions in India are assigned a rural primary health center and an urban secondary care facility to provide medical students with an opportunity to gain an understanding of primary healthcare practices. In the context of this research, the Community Health Center (CHC) was associated with the Medical College and Hospital (MCH). The name of the CHC has been anonymized to safeguard the research participants' privacy, given the facility's small size. The CHC, situated in a rural setting, offered a wide range of healthcare services, encompassing outpatient care, medical examinations and treatments, wound care, and maternity care services. However, due to ongoing construction work, the CHC had restricted capacity during the fieldwork period. It comprised nine in-patient beds, with one bed specifically allocated for electrocardiogram tests (ECG), one emergency bed, and occasionally two beds placed in the hallway to accommodate high-demand situations. Notably, complex and surgical cases were referred to the MCH for further management.

During fieldwork, the MCH was in the early stages of planning a combined antimicrobial stewardship and infection prevention and control program, which underscores the timing and importance of delineating the role of nurses and their opportunities to contribute.

4.5 Population and sampling

Nurses from both the Community Health Center and the Medical College and Hospital were purposively selected based on their willingness and interest to participate. The criteria for participation were that the nurses had completed their General Nursing and Midwifery degree or a Bachelor of Science in Nursing. A total of 24 nurses participated in the study. Out of these, 17 nurses worked at the MCH, and seven worked at the CHC. Their age ranged from 24 to 46, with mean age 32. The years of work experience as a nurse went from 1.5 to 29, with a mean 8. I encountered only a few male nurses during fieldwork, and I was told that eight male nurses were working at the MCH. None of the male nurses worked in the general surgical and medical wards where I conducted my study.

The initial plan was to recruit six nurses for the study, three from the medical and three from the surgical wards. However, after entering the field, I realized the value of visiting different wards to include nurses from both the female and male wards in both the surgical and medical units. Despite efforts to limit the participants to get to know my informants well, it was often hard to plan as their next shift was scheduled on very short notice, often only one day ahead. However, the advantage of including several informants in the study was seeing a wide range of practices and opinions. In addition, the nurses' privacy was easier to ensure with more participants in the study.

4.6 Participants profile

Hospital (Ward)	Name	Age	Experience	Education	Interview
MCH (MMW1)	Ajeeta	36	14	GNM	X
MCH (MMW1)	Radha	41	18	GNM	
MCH (MMW1)	Champa	29	8	GNM	
MCH (FMW)	Meena	28	3	GNM	
MCH (FMW)	Heena	35	13	GNM	
MCH (FMW)	Sonia	26	1.5	BSc	X
MCH (MMW2)	Maya	35	12	GNM	X
MCH (MMW2)	Geeta	29	3	GNM	
MCH (MMW2)	Neera	31	10	BSc	
MCH (ICU)	Kamala	25	3	BSc	
MCH (ICU)	Jasmin	24	2	GNM	
MCH (ICU)	Deepika	45	25	GNM	
MCH (MSW)	Bela	42	29	GNM	
MCH (MSW)	Noor	28	5	BSc	X
MCH (MSW)	Anju	35	2	GNM	X
MCH (FSW)	Aarti	25	1.5	GNM	
MCH (FSW)	Kavita	26	3.5	BSc	X
CHC	Bhanu	32	3	BSc	
CHC	Geeta	28	6	BSc	
CHC	Karuna	46	17	GNM	
CHC	Amisha	30	6	BSc	
CHC	Krishna	32	5	BSc (PB)	X
CHC	Nirmala	32	5	GNM	X
CHC	Parvati	31	5	BSc (PB)	X

The abbreviations refer to the hospital wards: Male Medical Ward 1 (MMW1), Male Medical Ward 2 (MMW2), Female Medical Ward (FMW), Intensive Care Unit (ICU), Male Surgical Ward (MSW) and Female Surgical Ward (FSW). All the participants in this study were employed as nursing officers, formerly known as staff nurses, undertaking the same duties and responsibilities despite their educational backgrounds. General Nursing and Midwifery (GNM) is a diploma program in nursing that lasts for three and a half years. Bachelor of Science (BSc) in Nursing is an undergraduate degree program that spans four years. BSc (post-basic) is a 2-year undergraduate course to enhance the skills of nurses who already have a background in GNM. While GNM focuses on the practical aspects of nursing, BSc Nursing provides a broader understanding of nursing concepts, research methodologies, and evidence-based practice. It's important to note that both GNM and BSc Nursing programs are recognized by the Indian Nursing Council (Indian Nursing Council, 2023).

4.7 Data collection

Participant observation was used as the primary source of data collection. This allowed for an unmediated experience of the hospital ward, its actors, and routines focusing on antibiotic use and ABR. However, an apparent need for basic infection prevention and hygiene measures caught my attention during the first week of fieldwork. As infection prevention is considered pivotal to limit antibiotic use and the spread of antibiotic resistant bacteria, I soon decided to include infection prevention as a substantial part of the study. Thorough preparation was ensured before fieldwork. An observation guide (Appendix D) was developed based on nurses' practices and responsibilities related to antibiotic use and infection prevention derived from literature and my own experiences as a nurse. The observation guide was adjusted continuously and designed to enable broad observations in an open context, allowing exploration of emerging and unforeseen circumstances.

A notebook was used to jot down keywords during the observations and were typed out at the end of each day. The field notes included observation of the nurses' practices, conversations, direct quotes, information about the nurse-to-patient ratio and other circumstances in the ward. A fieldwork journal was kept to record summaries of conversations and reflections related to findings, experiences, ethical considerations, and possible biases. The data collection took place from September to December 2022. Over 8 weeks, 120 hours of observations and fieldwork in the MCH were conducted, and 25 hours at the CHC. Additional three weeks were spent on planning and carrying out interviews.

Before arriving in India, I had an online meeting with my co-supervisor, Dr. Sunil Raina, head of community medicine at Dr. RP Govt. Medical College Tanda. When I met him at the hospital two weeks later, he welcomed me and introduced me to the medical superintendent of the hospital and the principal of the medical college. He called on the matron who showed me around the hospital and introduced me to the nurses and other staff members. I briefly introduced my study and my purpose for being there. I was touched by the overwhelming hospitality and genuine friendliness with which the nurses greeted me. It was later that I discovered the profound meaning behind the common Hindi saying, "Atithi Devo Bhava," which translates to "a guest is akin to God." This saying truly reflected the warm and caring environment they had created in the busy hospital ward.

When time allowed for it during the observation sessions, I would ask the nurses questions to get a thorough understanding of what I observed and experienced in the ward, and they would share their own perspectives from nursing as a profession and their views on

IPC and antibiotic treatment. Some of the questions were selected from the interview guide (Appendix E) to "pilot" some of the questions and enrich the study's findings. These answers were not audio-recorded but written down in conjunction with the observations. Additionally, I would occasionally ask questions to clarify what I had observed. However, the conversations between the nurses and me were not always set to answer the research question. We often conversed about family, friends, Norwegian and Indian culture.

After completing observations at the MCH, interviews were organized to explore the nurses' views and perceptions regarding IPC, ABR, management of antibiotic treatment, and professional relations in the hospital. A local researcher accompanied me in the field the very first day and joined me during the interview sessions. She had a Master of Science in Microbiology and came from a city nearby. She had received training in anthropological methods and interview techniques through her job. We discussed the interview guide with one of her colleagues, a trained anthropologist in the field of AMR and medical anthropology. They both provided valuable feedback on the structure of the interview guide and the formulation of questions. The local researcher and I discussed interview strategies before the interviews and evaluated the outcome. Complimentary notes were written shortly afterward. The interview guide was further adjusted according to some of the findings from observations. I chose to include questions about the relationships between nurses and doctors, and nurses and patients because my observations reviled certain disagreements potentially affecting their professional relations. I also changed to ask about "antibiotic resistance" instead of "antimicrobial resistance" as the nurses were more familiar with this term.

While recruitment for observations in the hospital went straightforward, recruitment and planning of interviews turned out to be more challenging. I had scheduled the interviews to be held right before or after the nurses' duty hours in a private room in a separate building at the hospital. I planned to do six interviews at the MCH and Hospital and several nurses agreed to participate in interviews when I asked them during observations. However, several would turn down the invitation last minute or not show up at the agreed time and place. I soon realized this was because the important Hindu holiday, Diwali, was coming up the same week I had scheduled interviews. I had the local researcher join me for the interviews and felt the pressure of wasting both time and money waiting on interview participants who did not show up. On the third day, when the nurses had cancelled the scheduled interviews, I went to the hospital wards to see if some other nurses would participate after their duty hours. I was surprised to walk into one of the medical wards with only a few patients admitted. The nurses barely had work to do and two of them agreed to participate in interviews. They asked their

superiors to take time off for the interview, and the ward sister granted their request. However, the nurses insisted on doing the interview together. One would not go if the other were not allowed to come too. I discussed the opportunity with the local researcher. We concluded that a small group discussion could generate interesting information and agreed with the nurses' proposition.

The nurses were good friends despite a difference in age and seniority. One had two years of experience and was 35 years old, while the other had five years of experience and was 28 years old. I initially thought that the nurses might feel safer and speak more freely when they could support and accompany each other. It might create good discussions and add depth to the interviews by letting them fulfill each other's answers. This idea was partially confirmed, but the youngest nurse seemed to hold back her opinions. The older nurse would often interrupt the younger nurse and dismiss her view by saying, "no, all is good. There is no problem". Although the conversation generated interesting results, I declined the next proposition from nurses wanting to do the interviews together with their colleagues.

In addition to the group interview, four semi-structured individual interviews were conducted with nurses from the MCH, and three nurses were interviewed from the CHC. All interviews were conducted in collaboration with the local researcher to allow the nurses to express themselves in their preferred language. I would ask the questions in English, and the local researcher would translate if required. I could sometimes understand their replies in Hindi. Otherwise, the local researcher would interpret during the interview. Two of the interviews were held mainly in English, and the rest of them were in Hindi. The local researcher translated and transcribed the interviews in Hindi while I transcribed the interviews in English.

The second round of interviews was conducted at the CHC. Finding a private room was difficult because the hospital was under reconstruction. We used the nurses' break room but had to accept occasional disturbances and interruptions. The interviews lasted considerably shorter than the interviews at the MCH. When reflecting on the reasons behind this, the first thing that comes to mind is that I had just started to feel that I was coming down with the flu. I kept my distance from the nurses and wore a mask throughout the interviews. I was experiencing fatigue but insisted on completing all three interviews because I predicted it would be my last chance before returning to Norway. My anticipation proved to be correct. I woke up with a full-blown strep throat and fever the next day and was not well until the day I had to return home. However, fatigue from the flu, and anxiety of not being able to complete the interviews, combined with occasional interruptions during the interviews, might have

impacted the length of the interviews. The interviews at the MCH lasted between 35 to 52 minutes and between 23 to 37 minutes at the CHC. The mean time was 38 minutes per interview. Although the second round of interviews contained fewer detailed elaborations, my impression was that the responses were honest and straightforward without significantly compromising the quality of the data collected.

4.8 Analysis

During fieldwork, a pre-analysis was conducted to assess the need for modifications in the observation and interview guide. The interview transcripts and field notes were thereafter analyzed using NVivo software. The complete analysis took place after returning from the field and followed an inductive approach to thematic content analysis, as outlined by Braun and Clarke (2006) This method involved systematically organizing and interpreting textual data to uncover relevant patterns, concepts, and insights (Braun & Clarke, 2006).

To begin, I thoroughly read and re-read the data to gain a comprehensive understanding of its content. Next, I identified and labelled significant units of data, known as codes, to capture various aspects of the data. A total of 58 codes emerged, such as "cleanliness," "caregivers," "bed-sharing," and "religious beliefs." After coding the whole data set, I went through the codes, grouping and regrouping them into themes. For example, the theme "professional integrity" consists of data coded as "accountability", "religious beliefs," "evaluation of own performance," and "moral principles." I then searched for recurring patterns and themes relevant to addressing the research question and ensured that they accurately represented the data.

By employing thematic content analysis guided by the topical content of the qualitative data, I was able to identify, organize, and describe the themes in rich detail. These emerging themes and categories were compared with relevant literature to gain a deeper understanding of the emerging patterns and to find conceptual tools that could be used to construct the theoretical framework presented in the subsequent chapter.

The identified themes are presented in the findings section, where I provide explanations and examples to illustrate their meaning. This process allowed for a comprehensive analysis of the data, enabling the exploration of meaningful insights and connections.

Chapter 5: Theoretical perspectives

Anthropological perspectives on antibiotics explore how society and the healthcare system are structured around access to effective antibiotics and their utilization. This perspective highlights the global, national, and local importance of antibiotics in our societal infrastructure (Chandler, 2019). Antibiotics play a crucial role in enabling fast recovery from diseases and surgeries, resulting in shorter hospital stays and quicker return to work. This reliance on antibiotics is common among both employers and employees. Moreover, antibiotics are not limited to human use; they are also utilized in plants and animals, for example, to promote cost-effective farming. Considering antibiotics as part of the infrastructure helps us understand how antibiotic use and consumption are deeply rooted in society. It also prompts us to assess necessary changes and sustainable solutions to emerging resistance patterns worldwide (Chandler et al., 2016; Chandler, 2019).

The groundbreaking discovery of antibiotic drugs nearly a century ago revolutionized modern medicine. Although ABR is a naturally occurring phenomenon, the rapid development of resistance mechanisms toward antibiotic drugs that were once effective is making the treatment of bacterial infections increasingly difficult. Today, resistance to all known antibiotics has been observed, and reduced economic incentives and strict regulatory demands impede the development of new antibiotic drugs. The primary cause of ABR is widely attributed to the excessive use of antibiotics in human, animal, and environmental sectors (World Health Organization, 2015). In several countries, including India, antibiotics can be purchased over the counter without a prescription, allowing for easy access, abundance, and affordability. Limited regulation contributes to the problem of overuse and inappropriate use (Amábile-Cuevas, 2010; Gould & Bal, 2013; Ventola, 2015). Furthermore, low-and middle-income countries experience a higher burden of infectious diseases and healthcare-associated infections because limited access to water, sewage, and sanitation facilities positions the population at a higher risk of preventable infections. Consequently, the need and demand for antibiotics increase, and healthcare providers and individuals are compelled to prescribe or use antibiotics to compensate for the unsanitary conditions where they work and live (Amábile-Cuevas, 2010; Denyer Willis & Chandler, 2019). In hospitals, antibiotic prophylaxis and treatment can be escalated by a lack of hospital beds, overcrowding, and inadequate sterilization of patient rooms and medical equipment (Denyer Willis & Chandler, 2019). Thus, the use of antibiotics becomes a necessity embedded in the

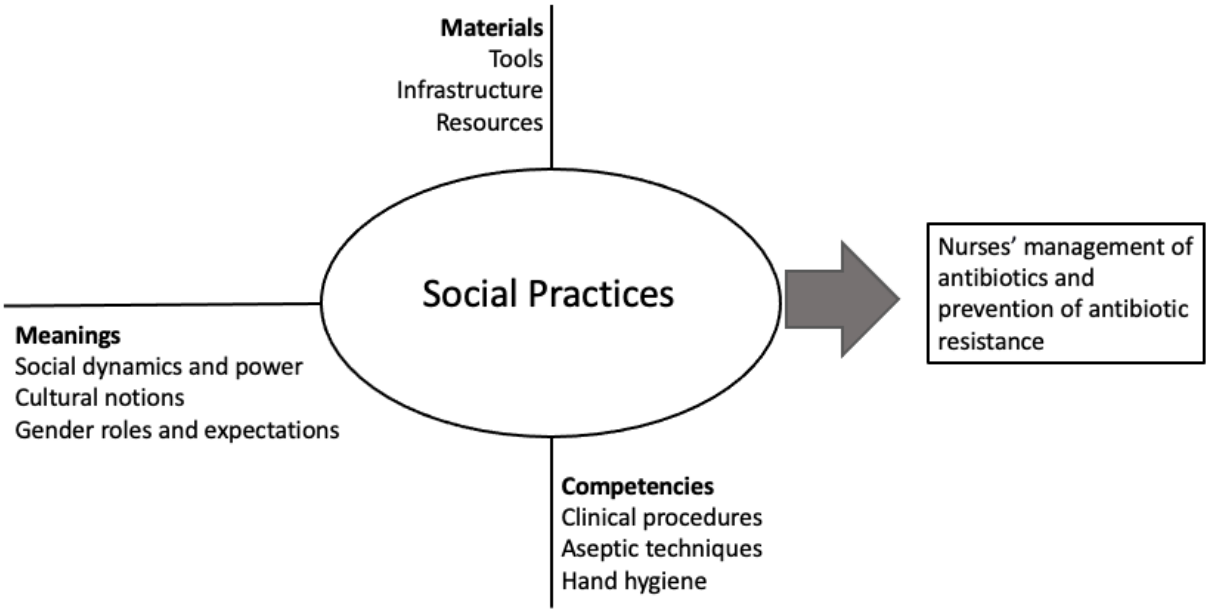
hospital's infrastructure (Chandler, 2019). Denyer Willis and Chandler (2019) describe this kind of antibiotic use as a quick fix for care and a quick fix for a lack of hygiene.

Throughout history, infection prevention and control have been portrayed as a barrier separating nature from a hygienic, disease-free human population. Practices such as hand hygiene and sanitation created a world where pathogenic microorganisms could be kept at a distance (Chandler, 2019; Gradmann, 2018). The introduction of antibiotics further reinforced this divide by enabling the treatment and prevention of bacterial infections, emphasizing the growing separation between humans and nature. However, the emergence of antibiotic resistance has started to erase these boundaries, calling for a more holistic approach (Chandler, 2019; Wolf, 2015). Solutions to address overuse and inappropriate use of antibiotics, such as antibiotic stewardship and infection prevention and control, often rely on individual responsibilities and behavior change. This approach indicates that behavior is a consistent, conscious choice without addressing the contextual frames and institutional practices (Denyer Willis & Chandler, 2019). Traditionally, healthcare providers' behaviors have been studied independently of the social contexts and thus devoided practices of locally relevant social meanings (Maller, 2015). Accordingly, researchers have recently emphasized the need for social science perspectives and context-specific research to design and implement effective AMS and IPC programs (Charani et al., 2021; Denyer Willis & Chandler, 2019; Lu et al., 2020).

Maller (2015) suggests that contemporary social practice theories can reframe how practices are understood to inform more effective interventions that move beyond attitudes, behavior, and choices. Practices are interpreted as being constituted by three key elements: meanings, materials, and competences. Meanings refer to the cultural conventions, expectations, and socially shared meanings that shape how and why certain actions are performed within a practice. These meanings provide a framework for understanding the significance and purpose of specific practices. Materials encompass the objects, tools, and infrastructures that are used within a practice. These material elements are essential for carrying out the actions and tasks associated with the practice. They provide the necessary resources and physical components that enable the practice to be performed. Competences refer to the knowledge and embodied skills that individuals possess within a practice. These competences can be both tacit (unconscious or intuitive) and explicit (formally learned or articulated). Competences include the practical know-how, expertise, and abilities that individuals develop through their engagement in a particular practice.

As described by Spurling et al. (2013) in Maller (2015), observable actions or practices are just the surface of a much larger situation. The true elements that contribute to these practices are hidden beneath the surface and can only be revealed through deeper observations and analysis. By considering the interplay of meanings, materials, and competences, social practice theory provides a comprehensive framework for understanding how practices are formed, maintained, and transformed within social contexts. This perspective recognizes the complex and interconnected nature of practices and emphasizes the importance of examining the cultural, material, and skill-based dimensions that shape human behavior and social interactions (Maller, 2015, p. 57-59).

In this study, the practices of nurses are a central unit of analysis. By analyzing and defining these practices through a social practice theory lens, we can gain insight into how their practices are influenced by their working environment, including professional relations and available material resources. Taking into account the surrounding environment and cultural context provides a comprehensive understanding of the determinants that influence hospital staff nurses' practices and their opportunities to engage in future antibiotic stewardship and infection prevention interventions.



The figure presented illustrates themes derived from the analysis of the thesis, organized within the framework of social practice theory.

Chapter 6: Findings I - Observations

This section will provide a summary of observations related to the nurses' practices. The observations are focused on procedures and tasks describing the nurses' management of antibiotic treatment and infection prevention and control measures. Quotes and details of the surroundings are added to give a rich description of the situations encountered. The practices described were regularly seen and represents the nurses' day-to-day work.

6.1 The hospital ward: a brief introduction

On my very first day in the medical wards, nurse Ajeeta introduced me to several diligent nurses and doctors. They were busy but paused to welcome me and to hear a brief description of my project. Before inviting me to join her to administer medicines, Ajeeta told me, "I know we should use aseptic techniques when giving antibiotics. There are just too many patients." Ajeeta and the other nurses worked rapidly to get through to all the patients in the crowded ward. There was limited space between the beds, and it was common to see patients with varying medical conditions or infectious diseases sharing a single bed. One or more family members always accompanied the patients.

The process of medication use in the hospital is complex. It starts with the physicians' prescription, followed by the nurses' transcription onto the patients paper medical chart. Most drugs were collected from the ward's medicine storage room, but if the prescribed antibiotic was out of stock or not covered by the patients' health insurance scheme, the patient or his/her caregiver would have to purchase the drug at one of the nearby pharmacies, adding to the out-of-pocket expenditures on their medical bill. The nurses would prepare and administer the intravenous drugs. If a patient were about to receive his or her first dose of the antibiotic drug, a small amount of the antibiotic dose would be injected subcutaneously or intradermally to check for adverse reactions. The nurses called this a "test dose". If no signs of reactions occurred within 5 to 15 minutes, the full dose would be administered as an injection or infusion.

My first day in male medical ward was warm, and only one out of five air conditioners were working. The ceiling fans were turned on, but the heat grew stronger as the sun rose high. While the nurses were doing paperwork behind the nurse's reception desk, two young men with handheld pesticide sprayers were walking between the beds. They attempted to eliminate cockroaches; however, it did not seem like the pesticide had the desired effect.

This made me think of the billions of microorganisms surrounding the ward, symbionts and pathogens. They are not visible to the naked eye, but no microscope was needed to see the cockroach's resistance to the pesticide as they kept persisting in the hospital ward.

While some of the days in the hospital were busy from the beginning of the shift to the end, other days quieted down after administering medicines. On these days, nurses and junior doctors would chat, joke, and laugh behind the nursing reception. They always made me feel welcome and invited me to join them for lunch and tea. Furthermore, taking a great interest in my life in Norway, my job as a nurse, and how I found India, Indian food, and Indian culture.

The nursing hierarchy consists of staff nurses who report to the ward sister, of which there are one or two in each ward. The staff nurses report to the matrons of whom there are approximately 16 across the hospital. The matrons report to the nursing superintendents, who oversees the nurses in the entire hospital. Staff nurses work three shifts: morning from 8am to 2pm (6-10 nurses), evening from 2pm to 7pm (6-10 nurses) and night from 7pm to 8am (2 nurses). At the end of each shift, outgoing nurse's handover information to incoming nurses, creating a brief overlap of between 5 to 15 minutes. In addition to patient care, nurses have responsibilities to maintain medical records, treatment charts, and stock registers. Other operational roles that provide services in the wards are the doctors (intern, junior and senior), the "ward boys" responsible for disinfection of surfaces and transportation of patients, the housekeeping/cleaning staff, and catering services.

6.2 Infection prevention and control

Infection prevention and control in hospitals are crucial to limit the spread of infections, including infections with antibiotic resistant bacteria. The following section will provide a detailed description of the observed infection prevention and control measures nurses were engaged in, ranging from hand hygiene practices to aseptic techniques, screening for tuberculosis, collecting microbiological samples, and waste management.

Hand hygiene and gloves

In the MCH, there was one sink in every ward used for handwashing by the hospital staff. It was located behind the nursing reception desk. The hot water geyser was rarely turned on, and liquid or solid soap was always available. Bottles with hand sanitizers were stored behind the nursing reception but tended to disappear when placed in the hospital ward. In the CHC, the sink was located in the nurses changing room across the hall from the patient units. I found it handy to carry a small bottle in my pocket, but rarely observed the nurses bringing hand sanitizer into the ward.

In one of the wards, I noticed a poster created by one of the nurses to promote WHO's "my five moments for hand hygiene." It was displayed on the wall in the nurses' station. During my observations, I observed inconsistency in adherence to the WHO's guidelines. However, I did identify two consistent moments of hand hygiene among the nurses. The first occurred after attending to patients and administering medications in the ward, while the second took place before having lunch. On both occasions, the nurses diligently washed their hands with soap and water.

Most nurses wore rings, bracelets, bangles, nose rings, and *kautuka* (traditional sacred thread). A newly wedded nurse showed me pictures from her wedding day. She wore 15 cm wide red and gold bangles on both her arms and explained that it was mandatory and rooted in tradition to wear the wedding bangles at least 12 months after the wedding. “I know it is not allowed in the hospital, but it is tradition. It’s because of infections. So, in the operating rooms, they do not use it”. Before eating lunch some of the nurses would take of their bangles when washing their hands and thereafter wash their bangles as well.

Observations revealed that nurses and other health providers performed hand hygiene inconsistently and irregularly, as described in the following observation of a nurse from the female surgical ward: “Neither before nor after changing gloves was hand hygiene practiced. Hand hygiene was not conducted between tending to six patients nor before administering

medicines in a central venous catheter. While inserting a peripheral venous catheter, the nurse spilled blood on her hands and changed her gloves after completing the procedure."

While most nurses would change their gloves after visible contamination of bodily fluids, the two following observations illustrate that this was not always the case:

"Heena attended to 15 patients. She gave injections to nine of these patients and inserted four peripheral venous catheters. Her gloves were contaminated by blood after inserting the second peripheral venous catheter. She wiped her gloves with a cotton swab and continued working. She dropped tablets on the floor and picked them up before dispensing them. She did not change her gloves during the session, lasting from 9 am to 11 am."

"Sonia removed the indwelling urinary catheter from the deceased patient and continued dispensing and administrating medicines wearing the same pair of gloves." Visibly contaminated or not, the nurses' gloves were in continuous contact with patients, surfaces, sterile and unsterile devices, waste, and medical documents, resulting in several opportunities for the nurses' gloves or hands to become colonized with potential pathogens.

My observations revealed that nurses would wear gloves in most care situations, including when such use was not recommended or necessary, such as when making the beds, doing paperwork, and bringing clean equipment from the storage room. Furthermore, the nurses almost exclusively wore sterile gloves regardless of the procedure they conducted. Maya explained to me, "We use sterile gloves when inserting cannulas, mixing medicines, giving injections, or inserting urinary catheters. Otherwise, we use clean gloves. We use sterile when there is any chance of infecting the patient". The sterile gloves frequently came into contact with unsterile surfaces or objects prior to reaching the patient's bedside. As a result, they served no different purpose than clean gloves since they were no longer sterile. The choice of sterile gloves over clean gloves was observed among all staff members, including cleaning staff, ward boys, and doctors.

After the nurses finished attending to the patients and discarded their gloves, they would fetch patient records, medical documents, and medicine trays from the patient's bedside, bringing the microbes from the ward behind the nurses' station. Sister Bhanu worked at the CHC and was the only nurse to mention the patients paper records as a possible source of infections, "These patient files are a source of infections. They go back and forth from the patient bed to the duty room all day".

Screening for tuberculosis

Screening for tuberculosis symptoms was well implemented in the wards. Upon admission, the nurses asked all patients if they had experienced any of the classic tuberculosis symptoms, including a persistent cough lasting more than two weeks, weight loss, loss of appetite, blood in sputum, night sweats, or evening fever. Some wards conducted daily screenings, while others only performed them upon admission.

In the event of a positive screening, the doctor would order a sputum sample. A nurse would then provide the patient with a plastic container to collect the sputum. The responsibility of delivering and collecting the sample from the lab fell upon the ward boys or caregivers. According to the nurses, if the test results returned positive, the patient would be transferred to a dedicated tuberculosis ward.

Isolation

The ward had limited opportunities for isolating patients with infectious diseases. However, tuberculosis-positive patients who were not receiving treatment were transferred to separate wards. According to some of the doctors I spoke to, Methicillin-Resistant *Staphylococcus Aureus* (MRSA)-positive patients were accommodated with the rest of the patients, without elevated infection prevention measures. I encountered only one patient with a positive MRSA sample in their record. The doctors had exhausted various antibiotics in an attempt to treat the serious infection, and eventually found success with vancomycin. The patient had been admitted for several weeks, and the nurses displayed great care and affection towards her, often holding her hand or stroking her hair, sometimes even without gloves. No heightened infection control precautions were observed to prevent the spread of MRSA to other patients in the ward. Both nurses and doctors would wear the same gloves without practicing hand hygiene after attending to the patient.

I noticed that the patient was assigned to cabin 5, which made me wonder if this was a deliberate infection prevention or isolation strategy. Cabin 5 was consistently the last to be attended during the doctor's rounds and the nurses' medication rounds, potentially reducing the risk of MRSA transmission to other patients. Additionally, this cabin had fewer admissions, fewer patients, and even a few empty beds. When I asked the nurses if the patient was placed in cabin 5 to facilitate infection control, they exchanged glances before explaining that she was assigned there because it was close to the bathroom, quieter, and provided a better environment for rest and recovery.

Despite the lack of infection control and isolation measures in most areas of the ward, there was a separate room at the opposite end of some wards designated for clinical examinations. Occasionally, patients would be admitted to this room for protective isolation. During my time at the hospital, I encountered two patients in protective isolation. One was pregnant, and the other had a chest tube, putting them at high risk of infections. This measure aimed to protect vulnerable patients from direct contact or droplet transmission from other patients and caregivers. However, the patients were not shielded from cross-contamination by healthcare professionals, as the doctors and nurses did not change their gloves before entering the room, nor did they sanitize their hands before attending to the patients.

Aseptic techniques and reuse of one-time equipment

Aseptic techniques play a crucial role in preventing healthcare-associated infections during sterile procedures. However, I frequently observed breaks in aseptic procedures that compromised patient safety by increasing the risk of infections. These breaks included instances where sterile equipment was touched with contaminated gloves, such as the tip of a peripheral venous catheter prior to insertion directly into the vein. Additionally, sterile equipment would still be used even if it had accidentally fallen on the floor. Furthermore, the sterile equipment often came into contact with the surrounding environment, such as the medicine tray, patient paper records, or the patients' clothes or bedsheets.

In the high-dependency and intensive care units, most patients relied on mechanical ventilation support. Nurses routinely performed intermittent endotracheal suctioning to remove respiratory tract secretions and minimize the risk of ventilator-associated pneumonia (Speck et al., 2016). Although the nurses would change to sterile gloves shortly before the procedure, these gloves often came into contact with the patient and their surroundings prior to suctioning, compromising the aseptic standards of the procedure.

While preparing medications and conducting sterile procedures, nurses demonstrated efforts to minimize unnecessary use of single-use plastics to reduce waste and costs. They explained how the reuse of equipment had been instructed from their superiors. The reuse of equipment could in certain situations compromise patient safety. For instance, disposable endotracheal catheters were stored in plastic containers with saline solution between uses, but no disinfection methods were employed before reuse. The practices for catheter reuse varied among nurses, with different routines and intervals for disposal, ranging from every three hours to once per shift or after the catheter had been reused two or three times.

Microbiological cultures and antibiotic susceptibility testing

Microbiological cultures and antibiotic susceptibility testing were central topics to explore during fieldwork, as nurses often are involved in the initiation and sampling process. However, I found that the responsibility of collecting blood samples primarily fell on the junior and intern doctors, but that they sometimes sought guidance from the nurses. Sonia expressed her concerns about their lack of practical knowledge and skills, by referring to their knowledge as "book-ish", noting that they frequently caused infections and struggled with proper collection techniques. She emphasized how some patients requested the nurses to take their blood samples instead, as they lacked confidence in the doctors' abilities.

I did not have the opportunity to observe the collection of wound swabs during my time in the hospital. However, it became apparent that the nurses did not consider themselves responsible for sampling urine, sputum, or feces cultures, as this task was delegated to patient caregivers. This raised concerns, especially regarding the sampling of urine cultures, which require a sterile process for accurate results. By asking nurses and observing interactions with patients and caregivers, I found that nurses provided limited information to patients and caregivers regarding the collection of urine cultures. The nurses handed them a cup and instructed them to collect the sample in the bathroom or from the catheter bag without further guidance regarding obtaining an uncontaminated midstream sample. As a result, caregivers often collected urine directly from the catheter bag for culture purposes, leading to potential contamination.

During a conversation with two microbiologists from the hospital, I was informed that a significant number of the urine samples received in the lab were either contaminated due to incorrect sampling techniques or sterile as a result of ongoing antibiotic treatment. They emphasized the importance of obtaining cultures before antibiotic use to improve the chances of identifying the offending microorganism and explained that the lab had the capacity to test more than the 20-30 samples they received daily from both in-patient and out-patient departments. Further observations in the hospital ward and discussions with junior and senior doctors confirmed that obtaining cultures prior to antibiotic treatment were not routine or prioritized practices in the hospital ward. Instead, most antibiotic treatments were initiated solely based on clinical anamnesis, without microbiological confirmation. This indicated that the hospital had the resources to expand antibiotic susceptibility testing and highlights the opportunities to improve protocols and training to ensure accurate microbiological sampling techniques, diagnosis, and appropriate antibiotic use.

Waste management

Some of the nurses at the MCH recently underwent training on biomedical waste management. Four color-coded bins were placed in each ward to ensure proper waste diversion. The bins were labeled as follows: green for general waste (such as packaging of sterile equipment and food), red for plastic waste (including gloves, urine bags, syringes, IV sets, catheters, and bottles), yellow for infectious waste (such as dressing material, face masks, cotton waste, and expired medicines), and blue for sharp objects (including needles, ampules, vials, and glass syringes).

Sonia described the consequences of inconsistencies and errors in waste management. She emphasized the need to educate all cleaning staff, interns, and other healthcare professionals who come into contact with patients. Sonia described the consequences of the inconsistencies and errors in waste management, "We need to teach them all, because they are also dealing with patients. [...] They collect samples and do procedures. But they do not know how to discard the waste. So, if we give them proper knowledge then there will be proper segregation of waste which will lead to less infections. They even do not know that there are rules, that if we do not do proper segregation, then there is some lakhs penalty and there can be filed a case against them."

Observations from the ward revealed that antibiotic leftovers would be poured in the sink or directly on the floor between the patients' beds. Empty or half full medicine vials was disposed in the blue bin designated for sharp objects.

During each shift, nurses were tasked with estimating and documenting the quantity and weight of various types of waste, such as urine bags, face masks, needles, and syringes. While this practice was contributed to monitoring waste generation and implementing waste management strategies, it was also a time-consuming task.

To ensure the prevention of medical equipment reuse, nurses had been instructed to perform interventions such as sterilization and the breaking of needles. They had also been advised to cut holes in personal protective equipment, such as gloves and masks, to render them unusable.

6.3 Preparing and administering antibiotic injections

The following findings highlight observations regarding the roles and responsibilities of nurses in preparing and administering antibiotics to their patients. It also explores the tools, routines, and contextual factors that influence their practices.

The nurses agreed that giving the patients medicines was one of their most essential duties in the ward. According to my observations, administering medicines was also the task that frequently brought the nurses from behind the nursing reception desk and into the ward. They would engage in conversations with their patients and record data related to food and water intake (input-chart), as well as urine and faeces output (output-chart), and occasionally measure vital signs. These activities appeared to be the primary opportunities for nurses to interact with their patients throughout the day.

Following is a summary of the procedures Anju performed related to administering medicines on a typical morning shift. “There were 25 patients admitted and five nurses on duty. All injections were prepared behind the nurses' station. Anju and another nurse began administering intravenous medications, while a different nurse administered tablets from a separate tray. They moved swiftly between the patients and the medication trays. Anju administered intravenous drugs to 11 patients, with all but one receiving antibiotics. On one occasion, the sterile end of the infusion set touched the floor but was still used and connected to the patient's IV port. Anju inserted four cannulas and administered multiple doses of Ceftriaxone, each lasting under 10 seconds, including when it was administered to a 10-year-old patient.”

Common intravenous medications used in the medical and surgical wards were Ceftriaxone, Cefotaxime, Piptaz (piperacillin and tazobactam), Doxycycline, Pantoprazole, and Ondansetron. Ceftriaxone and Cefotaxime are third generation cephalosporines. These drugs were administered as intravenous push injections lasting under 10 seconds. I regularly collected package leaflets to supplement online sources on how the respective drugs with different brand names were to be administered. According to the package leaflets, Ceftriaxone and Cefotaxime should be administered as injections over 3-5 minutes due to the risk of potential life-threatening arrhythmia caused by rapid injections of Cefotaxime through central venous catheters (Spencer et al., 2018). From time-to-time, nurses would tell me about the importance of slow injections. However, they rarely demonstrated this in practice, and it was common to observe rapid injections of Ceftriaxone (under 5 seconds).

Watching as they navigated the crowded ward was overwhelming. The expeditious process of administering medicines and the nurse's perception of time pressure seemed to compromise hygiene and induce errors in injection practices. In the process of preparing medicines, nurses applied strategies to increase efficiency. Following is a presentation of the two most common ways to prepare and administer medicines and the advantaged and disadvantages of the two approaches. The first approach starts with small explosions of antibiotics, while the second ends with administering undiluted constitutions of antibiotics.

Approach 1: Production line and explosions of antibiotics

The most observed way of administrating injections started with one to three nurses preparing and diluting medicines behind the nursing reception. They would prepare 15-20 injections of Ceftriaxone, a few injections of Cefotaxime, and 15-20 injections of pantoprazole and ondansetron. They started by filling 10ml syringes with saline solution. Thereafter, they used the sharp end of an infusion set to puncture the rubber membrane of the medical vial, leaving a scar in the membrane as the end of the infusion set was significantly thicker than the commonly used needle. After the membrane was punctured, the nurse would insert 10 ml saline solution directly from a plastic syringe and into the vial. This process increased the pressure in the vial. Instead of extracting the content to stabilize the pressure, the nurse would extract the syringe immediately. As a result, concentrated antibiotic powder would explosively burst out from the thick hole in the rubber membrane, landing on the nurses' hands, clothes, and the surrounding area. Nurses referred to this technique as "the more effective way" compared to the traditional procedure, where a thin needle punctures the membrane and the pressure in the vial is stabilized by extracting the same amount of fluid or air as was inserted. In addition to the increased risk of antibiotic exposure, one of the flaws observed with "the more effective way" was that the sharp end of the infusion set was used to puncture all the medical vials and was stored on an unsterile surface between uses. Consequently, it could potentially introduce microbes from the ward into the sterile contents of the medicine vial, which would later be injected into the patient's veins.

The different prefilled syringes were temporarily stored in separate boxes to distinguish the medicines from each other. One of the nurses pointed out that "it is not the right way to do it, it should be done by the patient's bedside to ensure right medication to the patient, but this is much faster." Accordingly, the risk of giving the wrong injection might increase when the syringes are not adequately labeled with its content. The organized

preparation of prefilled syringes behind the nurse's reception reminded me of a production line. It was systematic, efficient, and perhaps faster than reconstituting the drug one by on at the patient's bedside

When administering the injections, two to three nurses would start in Cabin 1 and work their way up to the last cabin, patient by patient. In the meantime, the other staff nurses would attend patients assigned by the ward sister. The nurses would instruct the patients to make their beds according to the hospital's standard before checking the patients' vital measurements, output, and input charts. After checking on their patients, the nurses would continue with paperwork or assist with the injections.

Approach 2: Patient continuity and injections of undiluted antibiotics

The second way of organizing the preparation and administration of medicines was more frequently used when fewer patients were admitted. The ward sister would assign the nurses one cabin each. Nurses would ensure that the caregivers made the beds, collected information about output and input charts, measured vital signs, and prepared and administered medicines. The nurses would check the patient records including the medical chart before they went to the storage room and collected the necessary equipment and medicines. They would reconstitute the antibiotic iv doses at the patient's bedside before administering the drugs. This approach ensured a higher level of continuity in patient care. However, one of the crucial flaws commonly observed was that intravenous medicines constituted from powder would often need more time to dilute fully. The pure and undiluted antibiotic powder was injected directly into the patient's veins.

I joined Kavita in the ward one morning. Only 23 patients were admitted, and seven nurses were on duty. She was responsible for Cabin 3 with five patients. She checked their medical chart and went to the storage room to fetch the medicines. She prepared an injection of ceftriaxone by the patient's bedside. The reconstitution did not get sufficient time to dilute thoroughly and was injected undiluted. I wanted to ask her why she did not wait until the reconstitution was ready, but she beat me to it and explained, "We should do the procedure like in the books, in a professional way where everything is placed on a tray and is sterile, but we like to do it *fatafat"* She explained that "fatafat" means "fast, fast" in Hindi. I asked why she had to do it *fatafat* when fewer patients were admitted. She explained, "No, that is true, but you see, it has really become a habit for us!"

The Five Rights

The “Five Rights” of medication administration is a set of principles to help nurses reduce the risk of medication errors by ensuring the right drug, right dose, right route, and right patient at the right time. Several nurses mentioned the Five Rights as a tool during fieldwork, but several obstacles and determinants challenged their ability to comply with the Five Rights.

The Right Patient: Patients often shared beds and sometimes changed beds without notifying the nurses. Patient records, admission numbers, and names could become mixed up, underlining the importance of confirming that the medicines were given to the right patient. Patient names, diagnosis, admission numbers, bed numbers and treatments would be manually duplicated by the nurses in several registers on each shift. Errors in the duplication of patient information sometimes led to confusion about where to find the right patient.

The Right Drug: Doctor’s notes were not always easy to read, and the similarity between drug names, such as cefotaxime, ceftriaxone, and cefuroxime, could be interpreted wrong. One of the nurses expressed: “there are some doctors who have very bad handwriting, and we need to ask others about what he has written”. This was observed by several occasions, where nurses asked me or their colleges to interpret the doctors handwriting to confirm that they administered the right drug.

The Right Dose: Medication dosage calculation is a crucial part of nurses’ job and have to be conducted carefully to ensure the proper dose to the patient. I frequently observed that the full antibiotic dose would not be administrated. Some of these errors were made due to inadequate calculation of medication dosages, such as the following examples.

The dose contained in many commonly used medicine vials is typically designed for adult patients and may not be suitable for children. In cases where these medications are prescribed to children, doctors usually adjust the dose based on the patient's weight or age. For instance, during my observations, I witnessed a four-year-old pediatric patient being prescribed 650 mg of Amoxiclav intravenously. Each medical vial contained 1000 mg of amoxicillin and 200 mg of clavulanic acid. However, the prescription did not specify whether the 650 mg referred to amoxicillin or clavulanic acid. Upon inquiry, the nurse informed me that it referred to amoxicillin, and she proceeded to dilute the content with 10 ml of saline solution. She extracted and administered 3 ml of the solution, resulting in an administered dose of 300 mg. This dosage was less than half of what the patient was prescribed. Although no immediate harm was caused to the patient, errors in dosage calculation can potentially have fatal consequences.

Sonia commented on the practice of dose calculation during the interview, “Also for children the dose is different. [...] There are so many staff members who do not know dose preparation. [...] They should have classes related to dose preparation, classes of antibiotics and also how to administer the antibiotics to the patient in which kind of solution. Some nurses don’t know that we don’t give injections through D5 [Dextrose 5]. We only give in normal saline, but sometimes they just don’t read. They fill the injection and give to the patient. And because of that there is reaction. So, we should have the knowledge. If we are coming daily to do our duty, then we should be aware about what injections we are giving because the patient should not suffer due to us.”

Errors in administering the correct antibiotic dose to patients were not solely attributed to dosage calculation. Other practices were observed to routinely contribute to patients receiving incorrect doses. One common error occurred when nurses extracted antibiotics from the medical vial, leaving behind some of the content. Since the vial's contents are often diluted with 10 ml of saline solution, leaving just one ml behind equates to a 10% loss of the antibiotic dose. Another frequently observed mistake was the failure to fully dissolve and detach the powder content from the walls of the medical vial. This occurred because the powder often requires a few minutes to dissolve completely. Consequently, patients may not receive the full intended dose. Furthermore, it was observed that if an air bubble was present in the syringe, some nurses routinely left 1-2 ml of antibiotic medicine along with the air bubble. This practice was intended to avoid injecting air into the patient's bloodstream but could have been resolved by extracting the air bubble and thereby administering the full antibiotic dose.

The Right Route: In rare cases, the prescribed drug was not in stock. This was seen a few times with intravenous doxycycline, rendering the patient’s caregivers to leave the hospital to purchase doxycycline from outside the hospital. Most of the time, the treatment would be delayed, and sometimes the nurses would dispense a tablet of doxycycline instead of the intravenous infusion.

The Right Time: As prescribed above, delays in treatment could happen when the patients’ caregivers had to purchase medicines outside the hospital. Furthermore, it could take over two hours to administer medicines to all the patients in the ward. Nurses reported that during the night shift, when only two nurses were on duty, it could sometimes take up to five hours. This makes timely antibiotic treatment a challenge. My observations confirmed that the patient who should receive antibiotics twice a day, 9 am and 9 pm, would receive the morning dose between 9am-11am, and the night dose between 7pm-9pm. The interval

between the morning and evening dose was 10 hours, while the gap between the evening and morning dose was 14 hours.

In one of the wards, the evening staff would relieve the night nurses from the burden of giving medicines to all the patients and therefore gave the medicines before their shift ended at 7pm, resulting in more uneven intervals between the antibiotic doses. Night nurse Maya explained, “The evening staff was helping us, so they gave all the medicines. It’s because we are only two nurses on night shift”.

Furthermore, the standard practice for administering oral medicines, such as tablets and capsules, in the MCH was to dispense tablets to the patients and caregivers at 9 am for the entire day. This gave the patient and their caregivers responsibility for remembering to take the drugs on time. This routine was not observed at the CHC where the nurses would dispense tablets at fixed times throughout the day.

The test dose

According to the nurses, one of their foremost responsibilities related to antibiotic treatment was injecting a small dose intradermally or subcutaneously before the first intravenous injection. The purpose of the test dose is to prevent adverse drug reactions such as allergic or anaphylactic reactions. The nurses would look for skin reactions or symptoms such as nausea or vomiting. If no symptoms occurred within 5-15 minutes, the full dose would be administered. I witnessed this practice only on a few occasions, although the nurses told me it happened every time before starting antibiotic treatment on a new patient. With a lot going on simultaneously in the hospital ward, I cannot out-rule the persistent practice of test doses. When asking the nurses about the test dose routines, they reported inconsistent practices related to the drugs concentration, amount, injection site, and the time between giving the test dose and assessing the result.

Sonia describes the purpose, importance, and procedure for the test dose: “Before giving any antibiotic, we should give a test dose. Suppose we are giving a test dose to some patient, and we did not note the reaction. So later, when we give the patient the same injection, then he will show hypersensitivity. So, the knowledge of antibiotics is must. [...] It (test dose) is given to all patients intradermally at an angle of 15 degrees. And we just circle it with a blue pen, write down the injection name and also mention the time we have given test dose to the patient. And after 15 minutes, we just administer the injection from iv route, direct IV. Or given as prescribed by doctor”.

6.4 Clinical observation and patient monitoring

This section presents the findings regarding the responsibilities of nurses in conducting vital sign assessments and clinical observations of their patients. It also explores the practice of fabricating vital signs and how nurses sometimes relied more on machines than their own clinical judgment.

Measuring vital signs was one of the nurses' main responsibilities, sometimes shared with the post-graduate doctors and caregivers. In some wards, nurses would register the patient's temperature and pulse while post-graduate doctors would measure the patient's blood pressure. In some other wards, nurses would measure both pulse and blood pressure. Sometimes, both nurses and doctors would do the exact same measurements in the morning, but the nurses would be responsible for following up on routinely vital sign assessments throughout the day and night. Nurses and doctors registered the patient's respiratory rate in the patient records, but despite respiratory rate being one of the most sensitive measures and important indicators for clinical deterioration, I never observed anyone counting the patient's breathing frequency. The patients and caregivers would purchase or bring private thermometers and would report the body temperature to the nurses. Lack of capacity among the nurses and doctors prevented them from following up on hourly vital sign measures, especially during the night, and led them to only check on the patients that reported a fever.

Estimation of vital signs

I conducted several observations of nurses routinely estimating or fabricating vital signs. This practice was observed more frequently in the medical wards and the ICU than in the surgical wards. In some of the wards, it was common practice to enter fabricated vital signs to comply with the prescribed hourly or daily assessments.

The following examples describes observed practices related to patient monitoring and fabrication of vital signs in the medical wards. Firstly, while following one of the nurses in the ward, I observed that she consistently wrote down her patients' pulse, temperature, and respiratory rate without measuring any of the vital signs. On another occasion, I observed a nurse asking her patients or caregiver if the patient had a fever. If the answer was "yes," the nurse palpated the patient's pulse. She did not have a watch but concluded with an estimated rate. If the patient did not report having a fever, she would write down an estimated rate without palpating the pulse. She wrote down the body temperature reported by the patient or caregiver and wrote down a respiratory rate between 20-22 on all patient monitoring charts.

Furthermore, fabrication or falsifying of vital sign measurements were also observed in the ICU. One afternoon, I observed a caregiver measuring the patient's axillary temperature on instructions from the nurse. The patient was suffering from SEPSIS. The caregiver measured twice before showing the display to the nurse: 93 °F (33.8℃). It surprised me that the nurse noted 98 °F in the chart, when hypothermia is associated with adverse outcomes in patients with sepsis (Wiewel et al., 2016). I asked why she registered 98°F instead of 93°F, and she answered, "because this is the normal temperature!"

I was sitting behind the nurses' station next to Mira in the ICU while she registered vital signs in the patient charts. She would look at the monitors above the patient's beds displaying the respiratory rate and pulse. She wrote down "BP [blood pressure] 100/60". I asked her how she knew this measurement, and she replied, "well, I looked at what the doctor has already written". She showed me the patient record, and we both discovered that the doctor's note on vital signs was two days old and the blood pressure was 180/90. Mira looked surprised and edited the blood pressure measurement in the chart to 140/80. I asked again, "but how do you know this measurement?" Mira replied "Its an idea, what's the word? Estimate!". I asked her about the purpose of writing an estimate when the patient's vital signs could have changed since last measured. Mira explained, "If the patient crashes, then we measure. If the patient seems fine, then we just estimate."

When time constraints limited the nurses from attending the patients to measure their vital signs, some of the nurses would sit behind the nurse's reception, registering the patient's estimated pulse and temperature in their records. I asked them to explain the purpose of registering the patients' vital signs without measuring. The nurses replied, "we only measure when the patient complains about a fever."

I never fully understood the purpose of entering fabricated vital signs in the patient charts and records. However, it was apparent that the nurses attempted to detect exacerbations and changes in the patient conditions, despite the inconsistency in vital sign assessment. I often observed nurses notifying the ward sister or their seniors to contacting the junior doctors and report exacerbations in the patient's condition. For example, during Maya's night shift, one of her patients developed a fever. She started by administering paracetamol to lower the fever. It did not have the desired effect, and she instructed the caregivers to place cool damp washcloths on the patient's forehead and neck. The fever persisted and she contacted the doctor to assess the patient.

Trusting machines

The ICU was equipped with monitors automatically registering the patients' respiratory rate and pulse. However, by two occasions I noticed that the patient's actual respiratory rate did not agree with the number displayed on the monitor.

I was standing by the bed with a nurse. She looked at the monitor and commented that the patient's respiratory rate was good. The monitor displayed 18 breaths per minute. Looking at the patient, I could quickly tell that was not true, as the sound of her breaths and chest was moving fast. I notified the nurse and counted the patents breathing. The respiratory rate was 44 breaths per minute. The nurse asked me, "do you think we should measure saturation?" I agreed it was a good idea. The patient's oxygen saturation level was satisfying. Despite the patients severely high respiratory rate, the nurse did not register the measurement in the patient chart and moved on to the next patient. I would usually not interfere in the nurse's assessment, but I worried about the patients changing condition. I suggested that the nurse might want to notify the doctor about the rapid respiratory rate. She conferred with her colleagues and decided to wait.

On another day, I assisted the nurses in registering the vital sign measurements of some of the patients. The monitor displayed 34 breathes per minute in an older patient. The nurse told me, "Write 34". I looked from the monitor to the patient and saw that his chest was moving slowly and calmly. I told the nurse and suggested counting the respiratory rate. Together, we counted 22 breaths per minute. The nurse seemed surprised but did no action to inspect the patient's monitor. These examples illustrated how trust in machines occasionally surpassed the nurses clinical gaze, as they tended to forget or avoid assessing the clinical signs of changes in patient condition and relied on the screens above the bed.

Chapter 7: Findings II - Nurses perspectives

This chapter provides an overview of the nurses' views, perceptions, and perspectives on practices and responsibilities related to healthcare-associated infections, prevention of antibiotic resistance, and antibiotic treatment and usage. It builds upon the previous chapter presenting observations conducted in the ward, which focused on infection prevention and control, preparation, and administration of medicines, and clinical observations. By delving into the nurses' perspectives, this chapter provides insight into their experiences and understanding of these critical aspects of healthcare.

7.1 Healthcare-associated infections and IPC

Most of the nurses I spoke to during fieldwork and interviews acknowledged the prevalence of healthcare-associated infections in the hospital. During my first conversation with Sonia, she explained, "if they (patients) don't come in with a fever, they will get one during admission." The nurses described overcrowding in the wards and bed-sharing as the root cause for infections in the hospital. Sonia ranked the reasons behind the prevalence of HAIs, "Yes, bedsharing is the first problem, second is the lack of knowledge among the attendants [caregivers], third one is that doctors spread infections." Sonia was the only one to mention doctors as possible sources of spreading infections. A much more common view among the nurses was that healthcare-associated infections was a problem confined to and between the patients, as one nurse stated, "the patients are always infecting each other!". Maya further explained: "Yes, bedsharing is first problem. [...], As you have already witnessed, sometimes we have one bed with two patients. This is the main reason why patients are acquiring infections". Another nurse (MMW1) told me "The patients only infect each other and the attendants". The nurses referred to the patients' caregivers as attendants. It was interesting to note that nurses would firstly attribute the risk and occurrence of HAIs to patients infecting each other, while the notion of health professionals transmitting infections to patients emerged only later, during the interviews.

To manage infection prevention in the overcrowded ward, nurses developed specific methods to limit the spread of infections, such as instructing the patients to face opposite in the bed and to avoid sharing food, water bottles and personal equipment. However, the patients and their families often became friends during the hospital stay, which complicated the intended infection prevention measures. Furthermore, the nurses would ask relatives and patients not to bring children into the ward to protect the children from infections. The nurses

would also instruct relatives to leave the ward while nurses and doctors conducted bedside procedures. Maya explained some of these infection prevention measures: “If they [patients] are facing opposite [in one bed], after some time they become friends. They are talking, sharing things, and sitting next to each other. This is how they get infected. We explain «don’t do this» but you can’t correct the mentality of the patients that are here, cause they are like, «we are family, we are getting together, we are on the same bed, we are friends, we know them, they know us» so I don’t know how they manage all things but whenever we have a work with them like “don’t do this, you will get infected”. They say we “we are like this only, you left us like this.”

Despite the nurse’s inclination towards attributing the prevalence of healthcare-associated infection toward the patients, when asked directly how nurses can contribute to prevent the spread of infections, many would mention hand hygiene and aseptic techniques as important measures. Ajeeta described, “For all invasive procedures, we should not put any infection or something like this, to minimize the patient’s risk to get an infection. A patient can get infections by doing invasive procedures if we are not doing aseptic techniques.” Kavita additionally mentioned hand hygiene as an important measure, “Yes, we must do aseptic techniques and hand washing properly during or after any procedure.” Sonia was the only nurse more or less unsolicited expressing a connection between health personnel, healthcare-associated infections, and hand hygiene, “Many of the staff do not perform proper hand washing or use proper sanitizers while dealing with the patients. We can also give infection if we are naked handed. [...] Through proper use of sanitation and gloves, we can prevent ourselves and patients from cross-infections.” Sonia further emphasized what she perceived as the main obstacle to conducting hand hygiene, “when we have so many patients, we think that, how many times should we wash our hands?” When asked about prevention of antibiotic resistance, Maya reflected on the notion of healthcare providers as possible sources to cross-contamination “we can help by making thing clean on a daily basis. Cleaning with disinfectant […], so that, bacteria from us should not pass to the patient.”

The notion of transference of microorganisms from health personnel to patients were rarely communicated clearly by the nurses. At the end of the interview with Ajeeta, I therefore explicitly asked her, how can you as a nurse give infections to the patients? She replied, “how can I give? If I have a common cold or upper respiratory tract infection, then I will take a leave. We don’t do patient care, we take leaves, and what else matters?” She had earlier mentioned aseptic techniques, but it seemed that the idea of nurses contributing to cross-contamination was perhaps inappropriate or irrelevant.

During discussions about their tasks and responsibilities, the term "cleanliness" frequently arose among the nurses. Initially, I assumed that cleanliness referred to hygiene, but it became apparent that it was more focused on the visual appearance and cleanliness of both patients and their surroundings. Matrons often emphasized the importance of making beds properly to maintain tidiness and cleanliness. The nurses themselves considered cleanliness a significant responsibility, encompassing tasks such as bed-making, grooming, bathing, and scrubbing. However, they also highlighted the role of caregivers in assisting patients with their cleanliness or personal hygiene. In a conversation with the nurses in MMW1, Radha stated, "I think I might be sick and vomit if I had to attend the patient's personal hygiene. Their cleanliness is not good!" This statement reflected Radha's perception and reaction towards the hygiene of patients in the ward.

Although the patients are exposed to higher risk of acquiring infections in the hospital, I wondered how the nurses avoided getting infections while working in the hospital. Radha told me that her colleague got infected with tuberculosis, maybe from working at the hospital. She further reflected, "We are safe. We keep our distance and are not so close". Several of the nurses mentioned the importance of wearing a mask as protection. I asked Maya if she was ever afraid of catching infections at work, she replied, "I was in the beginning when I started working here three years ago. But now I'm not. In this line of work, there is no room for fear. We have to take care of the patients no matter what. They depend on us." She explained that nutrition was important and emphasized the significance of eating her breakfast before going to work. Furthermore, she described that she would change her clothes and shower before hugging her daughter at home. At last, she added, "And, of course, the handwashing, 100 times a day!"

While asking nurses how they perceived their opportunities to improve infection prevention in the ward, some expressed a sense of hopelessness. Krishna from the CHC replied: "I think for the procedures, there should be separate rooms and there should be enough time. But here, it is not possible. One staff nurse is handling so many patients. She is seeing the OPD (outpatient department) patients and side-by-side indoor patients also." Similarly, Ajeeta stated: "We can't prevent anything if it is spreading in the air." During fieldwork in the FMW, the ward with highest bed occupancy during my stay at the MCH, I asked Heena how they managed to maintain hygiene. She answered, "God knows!", laughed and continued her work. When paying a visit to some of the nurses from the MMW1, they openly told me that they had too many patients and needed more staff on duty. I asked them the same question, and one of the nurses replied, "there is no hygiene!" The

acknowledgement of hygiene scarcity in the ward was also confirmed by some of the doctors. A female post-graduate doctor stated, “There is no way to manage hygiene. Most patients get infections while they are here”. The notion of hopelessness and insufficiency related to infection prevention in the ward was occasionally coated with a humorous layer. When I asked Radha whether she ever worried about catching tuberculosis in the ward, she replied, “No, I am immune!” She laughed and looked away, maybe embarrassed, maybe uncertain, but at the same time persistent. I walked over to one of the senior nurses when she was preparing medicines in the FMW. She asked me how we usually fill the syringes and prepare the medicines in Norway. I didn’t want to interfere with the nurses’ practices, but at the same time I wanted to share from my experiences from nursing in Norway. I explained how we used an aseptic non-touch technique to prepare the medicine and that we disinfected the rubber membrane on the medicine vial with alcohol before piercing it. She and the other nurses listening started laughing and said, “Here, we don’t do that. No bacteria enter this ward without our permission!” I interpreted the statement as a joke, however, there is a grain of truth in every joke.

7.2 Nurses’ views on ABR and Antibiotics

Sonia described the importance of nurses’ role in the management of antibiotic treatment: “First line of treatment is given by us, so we should have the knowledge about antibiotics. [...] If we maintain proper dose, then only, the patient will recover. Sometimes, attendants also ask us «sister, which injection is this?», so we should have this knowledge.” Several nurses agreed that one of their main responsibilities in the ward was to give medicines to their patients.

Still, I encountered several misconceptions about the properties of the drugs and the difference between broad-spectrum and narrow-spectrum antibiotics. Some of the nurses believed that the amount of active ingredient in the different antibiotics would determine if a drug were broad or narrow spectrum. Ajeeta explained, “Well, you see, PipTaz is 4000 and 500 mg, but Cefotaxime is only 1.5g, so it is less broad-spectrum and more narrow-spectrum”. Although it is true that piperacillin and tazobactam (PipTaz) has a broader spectrum than cefotaxime, it is mainly the property of the drug and not the amount of active ingredient that determines the spectrum. A similar example was described by both Kavita and Renu. Kavita explained, “We have a 10ml injection, Ceftriaxone, that we are giving. But in some other, like Meropenem 1 gram, we are giving in 100ml infusion with normal saline. [...]

That antibiotic is broad-spectrum, and we cannot give it as an injection because that can cause some type of tachycardia." Administered too fast, most intravenous drugs can cause adverse effects, but the amount of fluid used in the drug reconstitution is not determined by or associated with the spectrum of the antibiotic.

When nurses were asked why a patient received antibiotics, their typical response was often limited to "because of infection" or "because of fever." They rarely provided further details about the specific type of infection. Similarly, patient records often only mention a diagnosis of "pyrexia," indicating a fever, without specifying the focus of the infection or the underlying cause.

Radha recognized the significance of antibiotics in her personal life. She had found them to be effective against a wide range of both bacterial and viral infections, "actually, we eat antibiotics from childhood. For fever, diarrhea, chicken pox, everything. We can't manage without it, because of exposure to pollution and infections". In her view, antibiotics seemed to be an indispensable remedy to cope with disease and environmental impact.

During fieldwork, I would often ask nurses to tell me about the different antibiotics used and the side effects of treatment. I rarely asked explicitly about antibiotic resistance and found that the subject was only raised if I brought it up. To better understand how the nurses viewed and thought of AMR and to make sure that we were talking about the same subject, I asked them during the interviews if they could explain how they understood ABR. Noor openly stated that she did not know what it was. Several nurses mistook antibiotic resistance for allergic reactions to antibiotics, which might not be so strange as the word *sensitivity* is repeated in different contexts. While *drug sensitivity* refers to adverse and allergic reactions, *antibiotic sensitivity testing* is performed to identify bacterial strains resistant to certain antibiotics. Sonia had previously explained ABR as resistance to antibiotics. Still, she later described it as an injection site reaction, "And due to antibiotics, the veins of the patient get affected [...] Like, there was one case today where we did cannulization and after some time we checked, and there was redness and swelling. The patient was irritated and think it's better to stay at home. So antibiotic resistance does affect our work."

When I asked the nurses to explain antibiotic resistance to me, they would use examples from their daily work and often describe a patient experiencing antibiotic treatment failure. Nirmala said, "So this is resistance, the patient is coming back to the same condition even after treatment". The nurses would often identify the *body* or the *antibiotic* to be sensitive or resistant rather than the *bacteria*, as Maya described, "If I'm a patient, and I'm getting my antibiotics for more than five or seven days and I am not recovering from my

condition, then my doctor need to change my antibiotic. Cause that particular antibiotic is not responding. My body is not responding and is getting resistant". Similarly, Sonia explained, "We keep a patient for very long and he is not responding to the antibiotic treatment given to him". Kavita explained "The doctor started with antibiotics for 10-15 days. After that they will resist in the body and will not react and will not give any affect. [...] To know which antibiotic is sensitive or resistant we have to do a blood culture". Krishna was the only nurse to describe the *bacterial* resistance to antibiotics, "If we take one antibiotic at maximum dose again, and again, and again, then a time will come that the bacteria will resist, and it will not stop growing when we increase the dose and that's how antibiotics stop working."

When I first asked the nurses about their experiences with antibiotic resistance in the hospital, all the nurses from both hospitals claimed that they had no experience with antibiotic resistance from their current jobs. However, I reminded Kavita about the patient record she had shown me where it was written that a patient was MRSA positive, and she recalled, "From the [Medical College and Hospital], yes, one patient is there, [...] with antibiotic resistance. Firstly, they gave Piptaz to her. Then, they stopped it and started Meropenem." As resistance was never, to my knowledge, discussed among the nurses, I asked some of the post-graduate doctors. They agreed that ABR was a problem in the hospital, and one of them told me that all the patients with amputations or complicated wounds in the surgical wards had MRSA.

As the nurses would claim they had no experience with antibiotic resistance in the hospital, I extended my questions about experiences of ABR to include failure of antibiotic treatment. Several of them acknowledged that they had experience with patients that had been prescribed one or more antibiotics that did not work before the doctors found an effective treatment. However, most nurses did not intuitively relate this to the possibility of antibiotic resistance. Parvati claimed, "I have not seen such a case (of antibiotic resistance)". The translator asked, if it ever happened that a patient did not respond to one antibiotic, so the antibiotic was changed? Parvati replied: "this I have seen. Recently there was one patient in ward. He was firstly given Amoxiclav injection and then after 2-3 days that was omitted and was given piperacillin. Then after some time she did not react to that antibiotic and then she was given injection of Cefuroxime with levofloxacin. It was 3rd antibiotic". Despite years of experience, Ajeeta claimed that she had never seen any cases of antibiotic resistance or antibiotic treatment failure in the hospital, "I have not seen such a patient whose antibiotic was changed."

Krishna displayed an informed understanding of ABR, but she did not think that ABR affected the nurses' daily work. However, she worried that it might have an impact on the future with high patient load in the hospitals "Bacteria would not stop, and they will grow and grow, there will be resistance and the infection will not be treated on time, the patient will not be sent home and the ratio of patients will be more for us". Ajeeta did not have concerns about the future impact of ABR: "Here, the resistance cannot be seen, it is very less. We have been working with antibiotics for so long but never heard of it!". Nirmala did not think that antibiotic resistance could affect the nurse's daily work, "No I do not think so. It depends on the doctor and his treatment. Our work is to give what he prescribes". Sonia did not believe ABR affected the nurses daily work and perceived it not to be part of their responsibilities, "our role is only to follow whatever is written in the prescription then only the patient will heal properly". However, she was aware that ABR might have an impact in the future: "If a patient becomes antibiotic resistant, then what treatment will we be giving? [...] So, if there is antibiotic resistance, then nurses will be affected because we will have less antibiotics and patient will also be affected because of this, because they will also get irritated after some point if we keep on changing their medicine." Similarly, Kavita did not think antibiotic resistance would impact the work and practice of nurses. Still, it would affect the patients' health, "If we do not find out that the patient is resistant to some antibiotics, then we will not know why he is not recovering, and it will affect his health. It will not affect our practice but the health of the patient". Parvati explained that antibiotic resistance impacted the nurses work because the patients could get annoyed if they had to buy antibiotics outside of the hospital, or if the doctors did not clearly state the duration of antibiotic treatment. Additionally, the changes of treatment affected the nurses work because it led to more paperwork.

7.3 Nurses' suggestions to prevent ABR

Although the nurses' notions, perceptions and recognition of antibiotic resistance and its impact varied, I chose to ask them how they believed nurses could contribute to prevent antibiotic resistance in the hospitals.

Krishna and Kavita mentioned the importance of notifying the doctors about changes in patient's status and signs and symptoms of infections. Kavita highlighted how nurses are present around the clock: "we explain the symptoms faced by the patient to the doctor, because we are with the patient 24 hours. We are the channel who is telling the doctor that the patient has a fever from this long duration and these many episodes. Also, like pus formation, because we can explain the signs and symptoms". Similarly, Krishna said "We can share the daily charting and remind the doctor that, this is the case, and the fever is still high and not getting down. And this is all, I think. Because everything is in the doctors' hands only." Kavita further explained that nurses could not suggest culture testing without a designated role, "We do not have a direct role for resistance of antibiotic. We should have written orders, then only we can do something". Nirmala suggested that nurses could remind the doctors to start with narrow-spectrum antibiotics. However, she experienced that the doctors would not listen to the nurses. "We sometimes tell the doctor to start with narrow spectrum [antibiotics] but they are more educated, what can we say to them. [...] They do not listen".

Parvati mentioned counseling and education to the patient as the nurses' primary contribution, "Nurses can only guide patients properly and counsel them on proper diet [...]. Also, they should tell the patient about proper hygiene so that the patient doesn't take more and more antibiotics but gets cured from infection on time. What else can we say to the patient. I think these things only. We can counsel only."

Sonia highlighted the importance of providing awareness to the public, "do not do self-treatment. If you have any kind of problem, then you should visit the hospital." She further suggested that the nurses needed more knowledge on the topic, "we should have the knowledge about it (ABR) so that we can help the doctors also. Because, if we know about it, then we can correct the doctor if any wrong treatment is being given to the patient. We are the one giving the treatment to the patient and the doctors will only prescribe. And the main interaction is ours with the patient."

Maya was the only nurse mentioning how nurses can contribute to improving hygienic conditions in the ward to prevent the spread and development of ABR: "We can

help by making things clean, because the bacteria, they are even in this chair and everywhere. Some bacteria are useful in our body, and some are not. Especially in hospitals, we are not aware what kind of bacteria and virus we are having all around, so we can help with making thing clean on a daily basis. Cleaning with disinfectant [...] so that, bacteria from us should not pass to the patient."

Despite suggesting several reasonable ideas on how nurses could prevent the spread and development of ABR, perceived boundaries to the nurse's role continued to occur. Anju said, "we can only assess". Noor continued, "Our work is only assessment and observation. We do not have that much involvement". Ajeeta described the nurse's role as restricted to following instructions from the doctor, "We have to give antibiotics if it is written in the file. So, how can we, we can't do anything. We have to do whatever is written in the file. We have to follow all the treatment. If it is written in file and the patient is having antibiotic resistance, I'll tell the doctor and he will manage".

7.4 Information to patients

During fieldwork, I watched nurses instructing caregivers on how to prevent pressure sores, how to use a feeding tube, how to prevent waterborne infections, and when to take the medicines. Most interactions between nurses, patients, and caregivers were brief, with limited time to communicate complex information. My limited ability to understand the language challenged my observations of communication between nurses and patients. I therefore chose to ask nurses in the interview about the information they usually provide the patients and caregivers regarding antibiotic treatment in the hospital and before discharge with an antibiotic prescription.

Sonia, Maya, Kavita, and Ajeeta, all told me that they used to tell the patients to complete their course of antibiotics. Additionally, most nurses would tell the patient what the tablet or injection is for, how and when to take it, and for how many days. Some nurses would mention possible side effects. Kavita described that the information nurses would provide depended on the patient's capacity to understand the content: "So, it depends on the understanding of the patient. If a patient is not understanding, then how can we explain? [...] Some patients are fine and their relative are also there and we will explain that this is antibiotic, this is pain killer".

Krishna and Sonia told me they would explain the importance of not ending the antibiotic treatment when symptoms improved but continuing the whole course and avoiding

over-the-counter drugs without a doctor's prescription. Maya described how some patients trust the healthcare providers blindly without the need for further explanation of the prescribed treatment. "They (patients) are like «we are here for the treatment, whatever you will give, that is fine». So, for that we have to explain to them. Sometimes. «Don't take it for a long time, your body can stop responding to the medicine». Then only, they are like «ok, for how many days can we take it?», and we instruct them.*"* Despite the inaccurate description of antibiotic resistance, Maya was the only one mentioning the possibility of treatment failure.

All the interview nurses agreed that most patients were unaware of antibiotic resistance. When asking Krishna, she said, "No, no. I do not think so. Here they are just taking medicines. Like if they feel that the medicine is not suiting them, then they will go to some other doctor and get some other medication prescribed". Similarly, Sonia agreed that the patients had little knowledge of antibiotic resistance. She further explained that inpatients in the hospital would be annoyed if they experienced treatment failure: "They will also get irritated after some point if we keep on changing their medicine because they want that they should be given injection for 2 or 3 days and then get discharged." Some nurses recommended the need to educate patients about antibiotic resistance. They highlighted that patients with lower levels of education and literacy, particularly the elderly from rural backgrounds, often lacked awareness on this topic. Nirmala specifically mentioned that the patients had no knowledge of antibiotic resistance. Furthermore, the nurses acknowledged the difficulty patients faced in understanding medical terms without a background in health sciences. They shared instances where patients resorted to using Google to research medical terms and conditions, leading them to question everything. This highlights the patients' proactive approach to gathering information but also emphasizes the challenge they face in comprehending complex medical terminology.

Chapter 8: Findings III - Determinants of practice

The previous two chapters of this study focused on presenting the findings from observations in the ward and the nurses' views on antibiotics, ABR, IPC, and medication management. These findings provided valuable insights into the roles and responsibilities of nurses within the hospital. Building upon these findings, the following chapter will draw from both the observations and the perspectives shared by the nurses to delve deeper into the determinants that impact the nurses' role and the practices they carry out.

8.1 Overcrowding and bed-sharing

On my first day in the surgical ward, there were two patients in almost all the beds in the first cabin and crowded with caregivers and hospital staff. I counted 40 people in cabin 1, a room filled with 9 beds with under 1 meter distance between the beds. It was common for patients to share a bed, and the space between the beds were limited. Several nurses identified bed sharing and overcrowding with patients and their families as significant barriers to infection prevention in the ward. Sonia associated the problem with high bed occupancy and low nurse-to-patient ratio. "If (bed) occupancy is high, then it is difficult for a nurse to care for all the patients. I think this is the one major problem". 29 agreed: "If occupancy is more, it is difficult for a nurse to do care for all the patients. I think this is the one major problem. Other problems we can manage to solve." Furthermore, Ajeeta described infection prevention as impossible: "Patients are accommodated tightly. On one bed there are two patients. All these things make it not possible to minimize infections". During a conversation with one of the matrons, I asked her if the hospital had an infection prevention and control program. She confirmed the nurses' concerns when she replied: "Yes, but it is impossible here. To crowded." Moreover, the nurses expressed how aseptic techniques and hand hygiene practices was compromised due to their heavy workload, as Sonia said "when we have so many patients then we think that, how many times should we wash our hands?"

Although infection prevention and control is a central topic to this study, overcrowding and bed sharing did not only affect hygiene and infection prevention but impacted other aspect of the nurses practices and patients safety. For example, Maya explained how patients' symptoms could be overlooked by the nurses: "If there are signs of redness or discoloration, sometimes it won't get noticed by us because we have to look after so many patients." She also described challenges with ensuring iv ports to all the patients: "The ward is full of challenges. Every one of us, if we are four or five (nurses) on duty, we

need to assess everybody with the cannulization". Furthermore, overcrowding combined with low staffing levels could be associated with the inconsistencies in vital sign measures, when and how patients received their medicines, the amounts of paperwork, and the limited opportunities for professional development for nurses.

8.2 Professional integrity

Several nurses expressed a strong sense of responsibility to care for the patients and treat them with respect: After inserting a peripheral venous catheter, Champa told me, "It is important to treat every patient as if they were my parents". Sonia paid attention to details when administrating medicines to a patient and expressed accountability for her actions: "We have to remove the air (from the syringe) to avoid air embolisms. These little things matter when dealing with patients". During the interview, she highlighted the responsibility of nurses toward their patients: "If we are doing any procedures, there should be aseptic techniques cause if we are dealing with lives".

Furthermore, Maya demonstrated high expectations towards her colleagues: "So, if I am doing it, I expect that my fellow members, my teammates, they should do it. We need to be aware of how it (the medicine) should be administered. I think nurses are there for this. This is their foremost duty, other than family. They are leaving everybody at home, and they are here (in the hospital) and must do it with their full heart". Maya further explained the importance of acting according to the patient's needs and rights: "It is their right to know what (medicine) they are getting, and it is our duty to inform them what we are giving them. Only then can they be aware. They trust us blindly."

Sonia and Maya described God as a witness to human behavior and conveyed a sense of moral integrity through religious beliefs. After Sonia discovered that she was about to dilute a drug with the wrong type of fluid she said, "Only God will know, but I don't want to live with such a mistake". When discussing aseptic techniques in the interview she expressed "We should maintain aseptic technique so that infection from our side does not spread to the patients. Because, we have to give answers to God also. Cause we are dealing with lives. If somehow, we are not doing the aseptic techniques, we will feel guilty that we are doing the wrong practice". Similarly, Maya expressed the nurses' responsibilities towards their patients, and how God is a witness to their moral behavior. "They (patients) are in our hands, don't forget. Even if no one is looking, if the doctor is not looking, your senior is not looking, don't forget God is there. He is watching if you are doing right or if you are doing wrong".

8.3 Professional relations and power dynamics

The following chapter presents the findings related to the professional relations and power dynamics between nurses and doctors, within the nursing profession, and the role of cleaning staff and ward boys in the hospital. Furthermore, the negotiation of responsibilities between nurses, patients and their caregivers will be described.

Nursing and medicine: different domains

During my fieldwork, I had the opportunity to observe various interactions between doctors and nurses. At the MCH, I noticed that the relationship between the nurses and junior doctors appeared to be quite relaxed. They would often answer each other's questions, engage in casual conversations, and the nurses would sometimes provide the junior doctors with briefings on how to conduct certain procedures. However, when the senior doctors entered the room for the "doctors round" where they reviewed the status and treatment plans of all the patients, one or more nurses would join them and stand at the back of the crowd of doctors. She would fold her hands behind her back and assist the doctors by fetching requested equipment such as hand sanitizer or bandages. Standing next to the nurses, I often found hearing what the doctors were saying difficult. The nurses did not participate in the examination of the patient or in discussing the patient's condition during the round.

On an almost daily basis, medical students and doctors would ask me about my presence in the hospital. I would outline the project's purpose, and they would often question why I was focusing on nurses and antibiotics. Before I could even respond, they would quickly assert, "Nurses are not prescribing antibiotics. They just do what the doctors prescribe". Heads of departments, microbiologists, and pharmacists asked similar questions. Some would take their time to listen, while others would not.

During an informal conversation with a postgraduate doctor in the surgical ward, the distinction between the status and rank of nurses and doctors was clearly articulated. The doctor mentioned that doctors would convene weekly to discuss newly published research articles and stay updated on advancements in research and treatment methods. When I inquired if nurses could benefit from similar meetings to stay updated in their field, he responded, "No, I don't think so. You see, nursing is not science. They are just caring for the patient and doing what the doctors tell them to." We briefly discussed the need for continuing education for nurses before being interrupted.

The attitude reflecting how “nurses do what the doctors tell them to” was not only prevalent among doctors but also echoed by nurses, as Krishna demonstrated, “Whatever the doctor prescribes, we have to give that. If we say «no,» then they will complain about us”. This fear of disagreement posed as one of many obstacles preventing nurses from engaging with doctors. When I asked Nirmala from the CHC if she could discuss prescription practices with the doctor, she replied, “Sometimes only. The doctor does not listen to us. He will do what he likes.” She further explained how she perceived the different levels of education as a barrier: “We [nurses] tell the doctors, sometimes, to start with narrow spectrum (antibiotics), but they are more educated, so what can we say to them?”. She went on to describe how doctors would dismiss nurses if they tried to confront them, as they wanted to maintain low bed occupancy, “We do tell them [doctors] sometimes not to give levofloxacin, but they will say, «No, no, the patient will get better sooner with this». They think that if the patients get better soon, then the patient number will decrease, so that is why.”

Maya demonstrated a higher level of confidence when interacting with doctors and discussing patient treatment. She also recognized how the workload of doctors impacted the nurses work: “If we are observing that the patient is not responding to (antibiotic) tablets, then we use to discuss it, «you need to change it, either go for the injection or change the antibiotic, cause the patient is not responding to (the drug) the way you have prescribed it.» So, this is how, sometimes, we use to ask the doctors. For a single doctor, it’s really difficult to take care of 40 patients, so we use to keep a note of it.”

Similarly, Sonia highlighted the benefits of discussions between nurses and doctors, particularly in gaining new knowledge. She emphasized that the true victims of poor communication were eventually the patients: “Yes, we do it (discuss patient treatment). We do question the doctor like, «You have given this antibiotic. Why so? Earlier, you gave Septran, and now Piptaz. Is Ceftriaxone not so effective?» [...] It is good that we are interacting with the doctors because we come to know about so many things [...] and stay up to date with the ongoing knowledge. We should maintain IPR (interpersonal relations) with the doctor. If we do not, then it is mainly the patient that will suffer”. Sonia further emphasized the importance of knowledge in engaging in such discussions and improving patient treatment, sharing an example of correcting a doctor's prescription mistake, “Sometimes the doctors make mistakes. Like, he will write Amoxyclav 500mg, and then we remind him that Amoxyclav is 625mg. Then he will say, «sorry sister, I forgot» and he will thank us. At that time, it makes us feel good that we have this knowledge and can question them. So, the knowledge is important.” Furthermore, Sonia noted differences in interest and

knowledge among nurses with different educational backgrounds, stating, “I think it depends on the person’s interest. We [nurses with] BSc ask them [doctors] because we have read about this in our classes, so we question them. The old ones with GNM, they do not take that much interest in this. [...] The doctor also thinks, «oh, this sister is active and knowledgeable,» so they share the knowledge with us.”

When I asked the nurses if it was possible to remind doctors to review antibiotic treatment after three days, I was surprised to learn that several nurses stated that they already reminded the doctors daily. Although I had been observing in the hospital for weeks, I was unaware that this was a routine practice in the ward. Eventually, I discovered that while some nurses verbally reminded the doctors, most would give indirect reminders by noting the duration of treatment in the patient's record, as confirmed by Noor and Anju. Noor said: “No, I do not remind them. We do not have that much IPR [Interpersonal relation] with the doctor. We only maintain the number of days in our file. Like, given two days antibiotic, or three days.” Similarly, Anju said: “I just note it in my file. Then it is checked by the doctor. This is not our work. This is only the work of the doctor”.

Continuing to discuss the nurses’ opportunity to engage in activities to prevent ABR with Anju and Noor, they both agreed it would interfere with the doctors’ professional field:

- Anju: we can only assess.
- Noor: Our work is only assessment and observation. We do not get involved that much.
- Anju: We cannot interfere in their work. It just does not look nice. We cannot work above the doctor.
- Noor: it [ABR] doesn’t affect us, and we are happy like this (laughs). We do not want to get much involved in this. We only do our duty, like assessment, observation, and administering injections. And we are fine with that.

During my interactions with nurses, I would occasionally inquire about the reasons behind specific medications prescribed to patients, especially when I encountered unfamiliar medical conditions and drugs. While assisting Jasmin in caring for an unconscious patient in the ICU, I noticed that the patient had been prescribed four different antibiotics. Curious about their purpose, I asked Jasmin for clarification. She mentioned pneumonia or encephalitis as possible reasons before stating, “If there is something you want to know about the patient’s treatment, you should ask the doctor. He is the one who knows this information”. Although the nurses were knowledgeable about administering medications, they rarely provided insights into the doctors' decision-making process.

At the CHC, Krishna and Parvati showed me a patient record where treatment with three different antibiotics (metronidazole, levofloxazin, piptaz) had been started and stopped over a span of four days. When I asked them why the changes occurred, they told me that they did not know why. The same patient was prescribed “nil by mouth,” meaning no food or water intake. I again asked them why, and Krishna replied that, “The doctor just writes this.” However, Krishna read the patient record and deduced that the changes were likely due to loose stools.

While some nurses conformed to the notion of medicine and nursing as separate domains, a few others resisted the subordinate role assigned to nurses in relation to doctors. Sonia expressed frustration with attitudes that underestimated the nursing profession. One morning, as she was busily organizing a patient record between patient visits, a doctor handed her another patient record and instructed her to untie it and add some new pages. Sonia turned to me and vented, “Doctors think we are their assistants. They make us tie all the papers and clean up after them. In India, this will never change. It undermines our profession, and we don’t have any time for the patients”. During the interview, she continued to voice discontent with the relationship between doctors and nurses and the persistently low status of nurses. Nevertheless, she anticipated encouraging changes for the future: “They [doctors] do not value our work. They do not. An also I know, up to few years, they will not value our work. But as we are becoming more BSc students and MSc students, changes are coming, and they will soon start valuing our work. What we are doing is not limited to just making beds for the patient. We are the ones interacting with the patient, and if they ask us questions, we are the ones answering that. [...] If you have knowledge, then only you will be able to stop the narrow mentality of the people, and we can make a good image of nurses. [...] It will take time, but the change will happen”.

The hierarchy within the nursing profession

Through a conversation with Radha, I gained insight into the hierarchy within the nursing profession, which was primarily based on seniority and caste. Radha explained that job promotions were determined by the reservation system implemented by the government, where a certain percentage of promotions were reserved for historically disadvantaged groups or "backward castes". It was interesting to note that Radha was the only hospital staff member who mentioned caste in any context. While the reservation and caste system were not easily observable to me, the hierarchy based on seniority was evident in various settings. Power dynamics became apparent in the hospital ward whenever someone with authority entered the room, whether it was the ward sister, the matron, or a senior doctor. All the nurses would immediately stop what they were doing and stand up as a sign of respect.

Additionally, I frequently witnessed instances where nurses were reprimanded by the matron or ward sister. When I asked the nurses about their relationship with their superiors, they would sometimes admit to being a bit scared of the matron, and they would often try to appear busy when the ward sister entered the room to avoid being scolded or even find ways to take a break from the constant comments and reprimands. When I asked Jasmin why she always stood up and pretended to be busy when the matron entered the ward, she answered: "It's because she always tells us to be by the patient's bedside! And she scares me a bit."

However, Sonia attributed the authority of the ward sister to improving the nurses' knowledge: "We nurses still have knowledge because our ward sisters are very strict." However, she also acknowledged that the hierarchy sometimes prevented junior nurses from raising questions or expressing concerns, "I think speaking up is important. This is the mentality that «You are junior. You can't question us!» [...] Some seniors dominate the juniors, and some juniors don't react". She furthermore predicted positive changes within the hospital and explained that as more nurses obtained their Bachelor's degrees, they would be better equipped to bring about changes when their seniors retired, "It is improving day by day as more BSc students are coming. Our seniors will retire, and most freshers are from BSc, so, maybe we can create some changes in the hospital."

Negotiating roles: caregivers, patients, and nurses

Having one or more caregivers for the patient present at the hospital at all times was common and often required. The hospital staff referred to the caregivers as "attendants." Nurse Radha explained: "The patients are very sick. They are allowed to have one attendant present and two if the patient is bedridden". Observations from the ward revealed how the presence of caregivers was essential to ensure patient care, as the caregivers undertook several significant tasks, including the collection of urine samples from catheter bags, assisting the patient with personal hygiene, providing physical mobilization and movement, getting food and water, emptying urine bags, buying and giving oral medicines to the patient throughout the day, and measure the patient's body temperature. Some caregivers were also responsible for preventing and caring for pressure ulcers (bed sores). Furthermore, I often observed healthcare professionals communicating primarily with the caregiver rather than directly with the patient, possibly leaving decisions and information about patient treatment with the caregiver.

After encountering the following incident in the ward, I wanted to learn more about how the relationship between patients, their caregivers, and the nurses affected the nurses' role and practices in the ward. During their night shift, Kavita and another nurse struggled to insert a peripheral venous catheter. They tried several times without puncturing the vein. A patient's caregiver talked briskly to them. Kavita turned away and whispered to me, "they, think we are nothing. Nurses are nothing to them!". However, when I asked Kavita about this in the interview, she assured me that most patients and caregivers would appreaciate the nurses' work as long as nurses "behave good, do good care, and communicate nicely with the patients and their attendants."

During the interview, Noor described how some patients would treat the nurses as insignificant: "There are many challenges, like some patients are very VIP [very important persons]. They do not think that we are persons, they think we are servants, and they do not behave properly with us." Noor and Anju continued discussing how some well-educated patients believed that nurses conducted shoddy work. Contradictory, they continued to convey how other patients believed the nurses were doctors and therefore appreciated their work. Nevertheless, Sonia expressed a longing for change in the underestimated view on nurses: "People have this perception that nurses only do bedding, but they do not know that we also know about the treatment. So, we need to break this mentality."

Krishna emphasized the importance of good communication between nurses and patients, the benefits of nurses' ability to speak the local language, and their constant presence in the ward: "Patients are not so comfortable in sharing their things [problems] with the doctors. They do this with the staff nurses because the patient can explain to us in their local language. Most of the time, it is the staff nurse that remains with the patient as compared to the doctor. [...] The work of doctors is writing prescriptions and not administration, and people know that if there will be an emergency, then staff nurses will be coming first."

The perceptions of how patients and caregivers appreciated the nurses work varied, and so did the perceptions of how the nurses viewed the presence of the caregivers in the hospital. Maya expressed frustration when she experienced that patients and their caregivers would not take advice from the nurses: "If we explain to them, «don't do this» they are like, «No no, we are fine, we are ok». So, actually, you can't correct the mentality of the patients that are here. [...] We can't explain to everyone." Several of the tasks' caregivers were responsible for or involved in could impact the patient's health during hospitalization. Urine samples can be contaminated if not collected appropriately, maintenance of the patient's hygiene related to indwelling urinary catheters is crucial to prevent healthcare-associated urinary tract infections, mobilization can prevent pneumonia and deep vein thrombosis, temperature measurements can indicate exacerbations in the patient's status, and dispensing antibiotic tablets on time can impact the effectiveness of treatment. Several of these tasks require knowledge, practice, and thorough information and training from skilled professionals.

Sonia emphasized the importance of providing caregivers with information and education to protect them from infectious diseases. By that, she acknowledged their value in the ward: "We should also give education to the attendants so that they do not get infections from the patients. [...]. They should also use gloves whenever they discard patient waste, be it any fluid, urine, or blood. [...] The attendants are also at risk, so proper education should also be given to them." Most caregivers wore face masks in the ward, and some brought small bottles of hand sanitizer to keep on the nightstand. However, they were accommodated tightly in the ward and slept on plastic mats between the hospital beds during the night.

Despite the nurses' awareness of the importance of educating caregivers to ensure the patient's health, this was not their foremost priority. Maya described the caregivers' role, "You know, it is the attendants' job to help the patients with their cleanliness and sponging and all. We tell them that they have to do it, but still, they don't always do it. We can't see to

all that. We have other important things to do, like maintaining all the files and giving the medicines." Despite occasional miscommunications and disagreements between nurses and their caregivers, the nurses and the hospital heavily depended on caregivers as indispensable resources to ensure patient care.

Ward boys and cleaning staff

The ward boys were crucial for maintaining the workflow in the ward. They would transport patients, medical equipment and medicines between wards, microbiological samples to the lab and test results back to the wards, and tools and bandages between the autoclave room. They had no formal education and did not usually speak or understand English. However, I often observed approving interactions between the nurses and ward boys, as their work contributed to facilitating the nurses' work.

The cleaning staff were all female. They swept the floor of food crumbs, food packaging, and medical equipment between patients' beds every morning. After that, they gathered garbage disposed of by nurses while preparing medicines behind the nurses' reception. After thoroughly sweeping the floor, the cleaning staff washed the floor with a string mop soaked in a bucket with water and detergent, leaving a distinctive chemical smell around the hospital. They were not directly involved in patient care but played a significant role in keeping the ward clean.

8.4 Continuous professional development

Several nurses took great interest in extending their knowledge and keeping up to date with practices. They showed awareness that their knowledge was outdated and called for training and educational sessions facilitated by the hospital. Maya explained: "We are not in touch with our books now. Whatever we are learning is through the internet or something like that. If something is changing, the dosage or the treatment or the immunization schedule, we should be aware of that, and that can only happen if the team arranges a few classes for the nurses. […] Our seniors, they have not been in touch with the books in the last 15 or 18 years. What they learned back then has changed. They also want to learn new things."

Similarly, Sonia described the need for education to keep up to date on new knowledge: "There should be training every six months. Then, we will get proper knowledge about everything. If we do not know, what is the purpose of doing the job? If someone asks us about something and we do not know it, it feels very embarrassing. So, classes are must."

Additionally, she specified the need for updated pharmacological information among the nurses: "We are the ones who are interacting more with the patient. But we should have classes related to antibiotics. If we have one class of pharmacology in six months, we will know that "this antibiotic is for this" because different departments use different antibiotics." She continued to describe workload as a barrier to participation in education and training, "Actually, our ward is usually busy, so we send less staff for training. Cause, who will do the duty then?".

Although most nurses acknowledged that knowledge and practice require continuous development, some nurses expressed that their former education equipped them with sufficient knowledge. On the first day I met her, Ajeeta stated that "I love studying". However, during the interview she additionally expressed confidence in her educational background: "I know all the procedures. I have studied it during my GNM."

Some nurses recognized that knowledge could fade with time, indicating the need for continuous education. Krishna explained: "The topic of hospital-acquired infections is very vast. We have read about it, but I do not remember much." Similarly, Parvati stated: "We remember it for some time and then forget about it."

I asked the nurses when they last attended any training, classes, or education in the hospital. From the MCH, Maya explained: "No, it's not like that. Because of so many patients and tight schedules, we don't get these things. But it is something we really want." Ajeeta received training on ventilator care 7-8 months back. Sonia received training in

biomedical waste segregation one year before. Anju participated in ventilator training three months ago while Noor never attended any training sessions during her five years of employment. Kavita started working in the hospital ten months earlier and had not participated in any training or educational sessions.

The nurses from the CHC reported that they received training more frequently. Krishna participated in education on adolescent health 3-4 months back. Nirmala went on a session provided by DAKSH (nursing college) two years back, and Parvati went on training related to patient safety with a focus on delivery and newborn care one month before.

Almost all the nurses said the internet was their most common source of information. Ajeeta stated: "Google is very helpful. Google will tell everything." Other common sources of information described by the staff nurses were asking senior nurses, ward sisters, matrons, and doctors. However, these sources were only sometimes effective, as explained by Maya: "If we are not aware, we have to wait for the senior doctors to come on round and then we can ask «why are we not aware of this, should it be this way or some other way?» They explain «it should be like this». We would really appreciate it if something [education/training] started for the nurses in Tanda [MCH]."

A few nurses mentioned books as sources of information. However, books were unavailable in the hospital ward and had to be acquired from the library and read outside working hours. One nurse noted that the package leaflet that comes with medicines contains information about the specific drug. Furthermore, some nurses expressed that they had received training from previous jobs in the private sector, and some nurses would sometimes learn new procedures and techniques from novice nurses. Additionally, one nurse from the CHC identified staff at the MCH as a source of information.

Maya mentioned the need for training and education among nurses repeatedly during the interview. At the end of the interview, she emphasized the desire for opportunities to engage in continuous professional education: "You can learn things until your last breath so you should learn whatever you get."

8.5 Paperwork and task division

During their shifts, the nurses spend a significant amount of time on paperwork and administrative tasks. While some of this work is directly related to patient treatment, such as rearranging patient files, updating the treatment register, or collecting information for the diet register, a a large portion of the paperwork consists of administrative and bureaucratic duties. These include updating registers for oxygen consumption, biomedical waste (which records the weight of all garbage), and various stock registers, including medicine inventory in the ward. In one of the wards, I counted 27 different register books, most of which had to be filled out during each shift, with only 11 directly related to patient care.
Sonia expressed her frustration after registering the oxygen consumption which had to be done every morning. She stated, «this is a waste of time. Nurses are confined to paperwork only». After completing the paperwork, she then proceeded to prepare and administer medicines.

On one morning, Maya was assigned the responsibility of registering injections and medicines in stock. This involved going to each bed, examining every patient's file to record the patient admission number and the medicines administered in the past 24 hours. This process took approximately 2.5 hours, including a few interruptions. Some nurses explained the importance of the injection register as a form of "proof" in case legal action was taken against the nurses or the hospital regarding the administration of medicines.
The patients' personal medical records consist of a list of medical treatments, monitoring charts, daily notes from doctors and nurses, and diagnostic test results. In the Maternal and Child Health (MCH) department, the patient records were tied with gauze and had to be untied and rearranged every morning, after each doctor's round, and whenever a new document needed to be attached. In the Community Health Center (CHC), the patient records were organized in clip file folders, making it easier to rearrange and add new files. The nurses described this paperwork as "habitual," an integral part of their daily routine. However, it is a tedious task that consumes valuable time that could be spent observing and monitoring patients or engaging in professional development.

Furthermore, I observed instances of data duplication. For example, patients' prescribed medications were copied from their records into the treatment registers. Nurses would then refer to the treatment register to create an injection list, saving time during evening and night shifts instead of consulting the patient records. Such duplication of information has the potential to lead to medication errors.

8.6 Access to resources

Insufficient resources emerged as a factor impacting the role and practices of nurses in IPC and the management of antibiotic treatment. Krishna, a nurse at the CHC, highlighted several key aspects that she considered crucial for maintaining hygiene and patient safety. However, she expresses concerns about the lack of availability and accessibility of the following resources: “I think, for the procedures, there should be separate rooms, and there should be enough time. But here, it is not possible. One staff nurse is handling so many patients. She is seeing the OPD patient in addition to the inpatients. [...] Due to ongoing construction work, there is no proper space for handling an emergency. We have only one bed for both ECG and emergencies. So, there should be proper space, room, and equipment. Handwashing is the most important. There should be a proper water supply and soap for it.” In addition to Krishna’s insights, observations in both hospitals and statement from several nurses further support the need for improved resources. The subsequent section will describe the resources requested by the nurses.

Access to medicines

While most medicines were covered by the patient’s health insurance, there were instances where certain drugs had to be purchased by patients from private pharmacies outside the hospital. This was partly due to supply chain challenges that resulted in the hospital running out of stock for these medications. Unfortunately, patients had to bear the out-of-pocket expenses for these drugs.

This situation could lead to delays in antibiotic treatment if patients were unable to afford the medication due to unexpected costs, financial constraints, or the inability to send someone to the pharmacy. As a result, physicians might have to prescribe alternative medications, which could result in suboptimal antibiotic treatment.

During my observations, I witnessed a few instances where patients were given oral antibiotic tablets instead of intravenous medicines because they could not afford the full-priced drugs from outside the hospital. The barriers to accessing antibiotic medicines not only caused delays in treatment but also resulted in missed antibiotic doses, suboptimal administration routes, and suboptimal treatment choices.

Access to medical equipment

During my observations at the CHC, the nurses shared with me their concerns about the ongoing shortage of infusion sets. They informed me that they were instructed to reuse the same infusion sets at least three times before disposing of them.

While I cannot definitively state that there was a lack of access to medical equipment at the MCH, I frequently witnessed the reuse of single-use equipment such as endotracheal suction catheters, nasogastric feeding tubes, and gloves. Some nurses mentioned that this practice was adopted to minimize unnecessary consumption. However, it is important to note that these items are specifically manufactured and labeled as single-use disposables. Reusing them might compromises patient safety by increasing the risk of infections.

The nurses expressed a pressing need for adjustable hospital beds with backs that can be elevated to support patients with feeding tubes or respiratory distress. Currently, such beds were not available, which made it challenging to provide optimal care for these patients.

Additionally, I observed nurses frequently waiting or searching for blood pressure monitors and pulse oximeters before they could assess a patient's condition. There were only one to three monitors available in each ward, causing delays in patient care.

Space and bed capacity

The issue of overcrowding and bed-sharing and its implications for hygiene is presented in the beginning of this chapter. The nurses further identified space and bed capacity as crucial resources in addressing this problem. However, Sonia pointed out that simply increasing the number of beds will not be effective without a corresponding increase in the healthcare workforce. Parvati explained that they confronted these challenges head-on, "If we are short of beds, bed sheets or gloves, or some things needed for a procedure, then we have to face the challenge at that time". Additionally, the nurses acknowledged the high rate of admissions but stressed the importance of not denying care to those in need.

Clinical guidelines

During my conversations with the nurses, it became apparent that they were familiar with the concept of infection prevention and control but were unaware of specific guidelines pertaining to this area. Interestingly, some ward sisters, matrons, and the infection prevention nurse acknowledged the existence of such guidelines but were unable to provide the information I sought. In my quest to obtain these guidelines, I made several attempts and eventually approached one of the department heads in the hospital. He made three phone calls before informing me that the hospital did not possess local guidelines but instead relied on "standard procedures" and government-provided information. However, he later mentioned that the hospital was currently in the process of developing combined infection prevention and antibiotic stewardship guidelines. This situation highlights a gap in the availability and accessibility of specific IPC guidelines within the hospital. However, it was encouraging to learn that the hospital is actively working towards developing guidelines that encompass both infection prevention and antibiotic stewardship.

Workforce capacity

The nurse-to-patient ratio varied from shift to shift, day to day, and ward to ward. Nevertheless, all nurses expressed workforce capacity, high bed occupancy and workload as challenging. Ward sisters also voiced their concerns, with one stating, “The nurse-to-patient ratio is very high. Today we have 28 patients and only eight nurses. Nevertheless, we manage to provide every patient with nursing care and medicines.”

During my visit to the MSW one morning, Anju informed me that there were only five nurses on duty for 25 patients. She explained that fewer nurses were available due to a holiday. I asked if they had to prioritize certain duties due to the staff shortage. The nurses, along with a junior doctor, explained that they had a shared understanding of giving colleagues time off on holidays. They said, “The staff on duty will work twice as hard so our co-workers can have the day off, and next time, it might be our turn to have the day off.”

On another morning in the medical wards, there were 12 nurses on duty and 44 admitted patients. The nurse-to-patient ratio was significantly lower than usual. However, the high level of staff on duty seemed to provide the nurses with ample time to conduct paperwork and administrative tasks at the nursing reception.

Throughout my stay at the MCH, I observed the average nurse-to-patient ratio. The following table represents the nurse-to patient ration on morning and evening shifts, excluding the night shift where two to three nurses were on duty.

Hospital/Ward	**Nurse-to-patient ratio**
Male Medical Ward 1	1:6
Female Medical Ward	1:9
Male Medical Ward 2	1:4
Intensive Care Unit	1:1,5
Male Surgical Ward	1:4
Female Surgical Ward	1:4
Community Health Center	1:5

The medical wards had a higher average nurse-to-patient ratio compared to the surgical wards. However, the ICU had a significantly lower ratio to cater to the acute and critical care needs of the patients. The upcoming holiday, Diwali, may have contributed to the lower ratio in the surgical ward. While the medical wards were generally more occupied, there were periodic variations where the surgical ward had higher bed occupancy. Nurses and other hospital staff members explained how bed occupancy and patient flow changed throughout the year due to seasonal shifts and holidays.

In addition to the heavy workload of nurses, they also faced challenges related to security. The lack of security guards made it difficult to enforce visiting hours and led to overcrowding with visitors in the hospital.

Furthermore, there was only one infection prevention nurse responsible for the 800-bedded MCH. During our conversation, she expressed the severe lack of capacity to reach out to all staff members, difficulties in gathering data on healthcare-associated infections, and feeling overwhelmed with work.

Maya from the male medical wards expressed her frustration, stating, “I really need more manpower.” Similarly, Sonia agreed to her statement, “There should be a proper nurse-patient ratio so that hospital-acquired infections can be reduced. You have spent up to 2-3 months, and you have seen the reality of how the nurses work here.”

8.7 A call for management

Several nurses expressed the need for action from hospital authorities and management to address issues such as high bed occupancy, understaffing, and lack of training.

Sonia worked in the female medical ward, where the nurse-to-patient ratio was significantly higher than in the other wards during the time of fieldwork. She identified administrative issues as one of the barriers to infection prevention and control: “If the administration ensures a properly bedded ward and proper staff involved, it [IPC] will be maintained.” She continued to highlight the barriers to infection prevention, with the call for management in focus: “We (nurses) can improve, but as I have said, it is the lack of administration. If we have a proper nurse-to-patient ratio and adequate staff [...], then we can interact with the patient with proper sanitization and hand washing.”

During a quiet moment on a busy day in the medical ward, she shared her experience of the disparity between what was taught in nursing school and the realities of clinical practice. She explained that due to the lack of time and resources, procedures were often carried out with less precision than ideal. She attributed this to administrative issues: “we must maintain a certain efficiency and don’t have time to do it properly. Either the patient gets their medication like this, or they won’t get it at all. [...]. We don’t have the space, and we don’t have the staff to maintain good hygiene. This is clearly an administrative issue.”

When discussing factors that could facilitate infection prevention at the MCH, Maya suggested involving department heads. However, she emphasized that this approach had been attempted in the past without any resulting measures being taken. Similarly, Nirmala, who worked at the CHC, voiced her frustration, saying, “The highest officers here don’t take action. We cannot do anything. We can only give the treatment prescribed by the doctor. The higher authorities do not do anything. It is a small station hospital, so no one asks here. If there were some good authorities, then something could be done.” Maya and Nirmala’s statements highlight the frustration and disappointment among the nurses regarding the lack of response and follow-through from the hospital management.

Chapter 9: Discussion

Through participant observation and interviews with nurses, this study aimed to identify the determinants guiding and influencing hospital staff nurses practices related to antibiotic use and antibiotic resistance in India. Participant observation provided insight into the social world of the hospitals where nurses work and how they navigate professional relations with co-workers, patients, and caregivers, and how antibiotics and hygiene were incorporated into their daily work. The interviews with nurses added valuable insight into their views and perspectives on antibiotic resistance, hygiene, interprofessional relations, and identified a need for continous education. Looking at the nurses' practices through a social practice theory perspective, the meanings, materials, and competencies encompassing their actions will stand as a theoretical contribution to this chapter.

The following discussion will be presented in four parts. The first part will adress the determinants influencing the nurses practices related to infection prevention and control, and the prevention of antibiotic resistance. In the second part, the nurses perceptions of antibiotic resistance and the power dynamics influencing their practices will be discussed. The third part will adress the nurses practices and views related to medication management and antibiotics, followed by the fourth part debating the determinants affecting nurses practices concerning patient monitoring and vital sign assessment.

9.1 Infection prevention and control

Infection prevention and control aim to reduce healthcare associated infections and protect patients from acquiring infections during hospitalization, through invasive procedures or directly from health professionals. Health professionals hand hygiene is considered the most effective single intervention to reduce the risk of HAIs and the spread of antibiotic resistant bacteria (Mouajou et al., 2022). One of the implemented material tools advising the nurses practices was the WHO's "Five Moments of Hand Hygiene". The Five Moments of Hand Hygiene is a set of evidence-based recommendations defining indications for hand hygiene to reduce the transmission of microorganisms by healthcare providers (World Health Organization, 2009, p. 99-102). Through observations in the hospitals, it became evident that hand hygiene practices were inconsistent and insufficient when evaluated against the Five Moments of Hand Hygiene guideline. These findings are in accordance with studies measuring hand hygiene compliance in India (Biswal et al., 2013; Sahni et al., 2015; Tyagi et al., 2018). However, compliance with handwashing and sanitation is a challenge reaching

further than India; despite solid evidence of the benefits of hand hygiene and comprehensive efforts and interventions to increase the compliance rates, performance of hand hygiene persists to be inadequate (Gould et al., 2018; Kingston et al., 2016; Lambe et al., 2019). While quantitative observational studies provide effective statistical evidence of compliance rate, this study gives insight into the nurses perceived challenges to IPC and hand hygiene in the two hospitals where they were working.

The Five Moments of Hand Hygiene was known by most nurses and included in this research project based on a poster promoting the tool in one of the wards along with its longstanding recognition among health professionals and educational institutions. Central to the Five Moments of Hand Hygiene is the separation of the healthcare environment into two care zones: the patient zone and the healthcare zone (World Health Organization, 2009, p. 99-102). The nurses in this study navigated crowded settings where patients and their caregivers or relatives were accommodated in small spaces. They became acquainted and was sharing beds, blankets, and personal belongings. Despite efforts to clear the room before conducting procedures, one caregiver would always remain with the patient, leaving less space for the nurses to perform their work. Although the Five Moments of Hand Hygiene tool has been implemented in healthcare settings worldwide, Salmon et al., (2015), found that the delineation between the patient zones was challenging to healthcare providers in hospital settings were patients were sharing beds and the distance between the beds were so small that the healthcare provider struggled to identify the separated zones and the indication for hand hygiene (Salmon et al., 2015). This highlights the importance of considering the social and contextual challenges in implementation of tools promoting hand hygiene.

In overcrowded healthcare settings, it is difficult to completely prevent the transmission of a patient's microbial flora when they share a single bed. However, healthcare providers still have opportunities to reduce the spread of infections through proper hand hygiene practices. Salmon et al. developed a guide called "Five Moments of Hand Hygiene in Overcrowded Settings" based on the WHO Guidelines, which provides specific instructions for hand hygiene in these challenging environments (Salmon et al., 2015; World Health Organization, 2009). Training programs that focus on understanding the concept of delineated patient zones and promoting hand hygiene compliance are essential, but need these strategies needs tailoring to fid local contextual challenges (Salmon et al., 2015). From a social practice theory perspective, the infrastructure of hospitals plays a significant role in shaping behavior and compliance with infection prevention measures. Nurses identified overcrowding, high bed occupancy, time pressure, and patient bed-sharing as major barriers

to prevent infections. These material arrangements create challenges for healthcare professionals to adhere to hand hygiene practices. Furthermore, a lack of training and continuous education kept the nurses from being updated on new research and evidence. Similarly, both Barker et al (2017) and Diwan et al (2016) identified heavy clinical workload, limited time to train staff members, and lack of access to scientific information as barriers to hand hygiene in Indian hospitals. These factors demonstrate how institutional policies and material arrangements can shape hygiene practices.

Despite the potential for microbes to transmit between patients and caregivers in an overcrowded ward, the nurses seldom mentioned the possibility of cross-contamination where health professionals transmit infections to patients. Instead, they primarily attributed the risk and occurrence of healthcare-associated infections to patients infecting each other. This emerged as a shared belief among the nurses, perhaps to absolve healthcare personnel of blame or responsibility for the burden of HAIs. This highlights the role of cultural meanings in shaping hand hygiene practices and the need to address these notions in interventions. While the transmission of infections among patients may be influenced by factors such as bedsharing and limited space, it is important to acknowledge that healthcare providers' management of indwelling devices and hand hygiene also plays a significant role in preventing HAIs.

Apart from patients, nurses, and other healthcare professionals, another significant group in the hospital was charged with significant responsibilities related to both patient treatment, wellbeing, hygiene, and infection prevention: The patients' caregivers' constant presence was arguably of utmost importance for both the patients' health and the hospitals' ability to treat the patients. They were expected to assist the patients with personal hygiene, wound care, prevention of pressure ulcers, physical activity, and mobilization during hospitalization. The nurses would give them instructions in cases requiring special concerns, e.g., when the patient was bedridden, had an indwelling urinary catheter, or received ventilation support. This highlights the importance of considering and recognizing the role of different stakeholders in shaping and implementing infection prevention and control interventions. In a South Indian hospital, Surendran et al. (2022) discovered that the role of caregivers in infection prevention was crucial yet often overlooked. They emphasized the necessity of providing training to caregivers to support their involvement in infection prevention. Additionally, they emphasized the importance of revising infection prevention and control policies to align with the socio-cultural context and acknowledge the significant contributions of caregivers (Surendran et al., 2022).

Despite the caregivers indespensable presence and proximity to the patient, the continuing discussion will focus on the nurses and health professionals practices and roles in IPC. It is therefore necessary to bring to attention one of the major and most common reasons for low compliance to hand hygiene in health facilities, which is the overuse of gloves (Boudjema et al., 2017; Kurtz, 2017). Gloves are important in health care facilities to protect both health professionals and patients from infections. A 2015 systematic review found that the most common break in compliance with glove use was failure to change gloves between procedures on the same patient (Picheansanthian & Chotibang, 2015). Accordingly, the nurses rarely entered the ward without wearing a pair of gloves and daily observations revealed that they often used the same gloves for multiple procedures and different patients. This practice could lead to the transfer of microbes between patients and compromise aseptic techniques during sterile procedures. It is important to note that different types of gloves serve different purposes. Clean gloves should be used when anticipating contact with mucous membranes, blood, body fluids, or non-intact skin, while sterile gloves are meant for aseptic procedures and should be free from microorganisms. However, the nurses, cleaning staff, and other healthcare professionals tended to use sterile gloves regardless of the task at hand. As a result, the sterile gloves would come into contact with surfaces, medical equipment, multiple patients, and their surroundings before being used for aseptic procedures. Consequently, the meaning of the material, the sterile gloves, would no longer be free from viable microorganisms, undermining their intended purpose.

Through observation of misuse of gloves along with inconsistent hand washing and sanitation in the ward, these practices seemed mainly to be a measure to protect the staff against microbes and dirt, rather than protecting patients from healthcare-associated infections. These findings correlate with Flores et al., (2020) who found that the main motivation for hospital staff to wear gloves was for personal protection. Self-protection is of course an important aspect of glove use, but when overused or misused, missed opportunities to conduct hand hygiene leaves the patients with higher risks of healthcare-associated infections as healthcare providers function as vectors for microbial transmission (Flores et al., 2020; World Health Organization, 2009).

Jackson and Griffiths (2014) conducted semi-structured interviews with registered nurses in the United Kingdom of Great Britain and found that one of the main drivers for use of gloves was fear of contact with dirt from unknown patients and their surroundings. Glove use was carried out to reduce what the nurses perceived as a threat and were used for self-protection rather than infection prevention. The term “cleanliness” was frequently

encountered during fieldwork. As one of the nurses explained during a conversation about nurses' responsibilities towards patient care "I think I might be sick and vomit if I had to attend the patient's personal hygiene. Their cleanliness is not good." Interestingly, Jackson and Griffith found that nurses view on dirt among patients were more profound in the beginning and reduced after they got to know the patient. This was confirmed at least once during fieldwork where a long-term patient with a MRSA infection was closely cared for by the nurses, with and without gloves. While the feeling of disgust towards dirt can be an automated hygiene behavior and reaction, Jackson and Griffiths (2014) argue that what nurses perceive as dirt is not always in accordance with a rational response to infection. This demonstrates how social norms and perceptions shape the use of gloves and hand hygiene practices. The overall widespread use of gloves in the MCH and CHC can be interpreted as an embodied competency, reaching all the way to the sensation of the hand, and therefore embedded in both physical sensations and socially constructed perceptions of cleanliness, dirt, and hygiene. Hence, strategies to improve hand hygiene can benefit from consideration of the social constructions of dirt and the response it evokes.

When health professionals wear gloves, their perception of dirty and clean fades as a nitrile rubber membrane protects their skin from exposure to visible dirt and invisible microorganisms (Flores et al., 2020). Gloves seem to become a substitute for hand hygiene. Even though the gloves can provide much needed protection against blood or other bodily fluids when used correctly, they can also provide a dangerous false sense of security in the hospital since health professionals often do not clean their hands as often when wearing gloves. But in fact, wearing gloves require just the same frequency and accuracy for hand hygiene as when working with bare hands. This highlights the importance of understanding the embodied competency and physical sensations associated with glove use in shaping hand hygiene practices. Flores et al., (2020) recommend the development of multi-modal interventions including behavior change and development of safety climate interventions to address the misuse of personal protective equipment (Flores et al., 2020).

Furthermore, the availability and accessibility of appropriate gloves also play a role in shaping hand hygiene practices. In resource-limited settings, the reuse of gloves may be necessary due to limited availability (Arora et al., 2015). This demonstrates how material constraints and contextual factors influence the use of gloves and hand hygiene practices, highlighting how implementation of interventions needs careful adaption to the context and the availability of personal protective equipment. As a response to the increased need for personal protective equipment during the COVID-19 pandemic, researchers looked into the

possibilities to desinfect gloves and found that barrier properties of the gloves were not reduced when desinfected up to 10 times (Esmizadeh et al., 2021). In the present study, sanitation of gloves were observed occationally, but not routinely. Sanitation of gloves can save essential material resources and the time it takes to change gloves between patients and procedures, and not least, reduce the risk of transferrance of microorganisms between patients and thus decrease the risk of HAIs (Vogel et al., 2021). Furthermore, sanitation of gloves can contribute to reduce the tremendous amount of waste generated in hospitals.

Nurses in this study were observed unpacking various medical supplies at the start of their day, including syringes, gloves, intravenous sets, and urine bags. The discarded packaging would be thrown in the dustbin or placed on the floor near the nurses' reception and between patient beds. The cleaning staff would later clean up the litter from the floor. It appeared that generating waste was a routine part of the nurses' daily activities. It is worth noting that some nurses from the MCH had recently attended a seminar on biomedical waste management, suggesting institutional efforts to address waste management practices. The nurses' awareness of the importance of source separation into different color-coded bins after estimating the weight of the waste and used equipment reflect the influence of institutional norms and regulations shaping their practices and affecting how their time is spent.

Over the last years, growing attention has been directed towards the hospitals carbon footprint, as the huge amounts of plastic packaging and single-use medical equipment generate greenhouse gases when incinerated or while decomposing in landfills and oceans (Joseph et al., 2021). Interestingly, the main driver behind disposable plastics in medical practices in the 1950s was not to improve hygiene, but rather due to the reliable and durable properties of plastics (Hodges, 2017). Furthermore, disposable plastic syringes proved to be useful in vaccination campaigns and encouraged their mass use. However, when contagious diseases such as AIDS, Ebola, and SARS emerged during the late twentieth century, a renewed sense of vulnerability and uncertainty towards infection came into view. Although disposable plastics were already to be found in most areas of medical practice in the 1980s, it was first during the 1990s that disposable plastics were portrayed as means to improve hygiene and plastic disposable began to represent hygienic safety. Gradually, single-use disposables became a powerful symbol of hospital hygiene and in addition became indispensable as they replaced the need for reliable supply of electricity and clean water as prerequisites of modern medical practice (Hodges, 2017). The dependency on single-use equipment contributed to changing the meaning of hygiene and the hospitals' infrastructure and is comparable to the trajectory of antibiotics from exclusive tools for treating and

preventing bacterial infections to acting as a quick fix for hygiene and substitute for adequate infection prevention and control (Chandler, 2019; Denyer Willis & Chandler, 2019) While the backside of antibiotics is the evolving bacterial resistance, the consumption of single-use devices has changed the ecology of everyday medicine and increased the hospital's material outputs, rendering hospitals factories of medical garbage (Hodges, 2017).

The production of waste in hospitals increased drastically during the covid-19 pandemic (Khosla et al., 2022) and stories of people collecting and selling biomedical waste from landfills to subsist during lockdowns emerged (Kapoor, 2022). To avoid that potentially contagious medical equipment was reused and sold in the hospital or from the garbage heap, nurses in several wards would consistently cut a hole in gloves and facemasks. Needles and syringes would be broken and sometimes even disinfected before disposal.

Despite the widespread use of disposables in the hospital and efforts to avoid people from collecting and reselling used and potentially contagious medical equipment, the nurses would often initiate measures to avoid unnecessary use of plastics. Several nurses demonstrated reasonable actions to avoid unnecessary use of plastic syringes when preparing medicines. They would give instructions on how to store nasogastric feeding tubes and endotracheal suction catheters for reuse. Some of them would explain how the reuse of equipment had been instructed from their superiors. Waste reduction and cost efficiency appeared to be the drivers behind reuse of single-use equipment. However, it is paradoxical that the practice of reusing medical equipment can actually contribute to healthcare-associated infections, increased expenses, and longer hospital stays (Enany et al., 2013)**.** This highlights the complex nature of social practices, as the pursuit of waste reduction and cost efficiency can have unintended consequences on patient safety and healthcare outcomes.

Furthermore, most medical equipment requires chemical or thermal sterilization, depending on its material or design, in order to be safely reused without the risk of transmitting microbes. It was therefore unfortunate to see that disposable endotracheal suction catheters in the intensive care unit and high dependency unit were stored in a plastic container with saline solution in between uses, with no safe methods to disinfect the catheters, exposing the patient to risk of developing ventilator associated pneumonia (VAP). Nurses were responsible for intermittent endotracheal suctioning of patients on mechanical ventilation. However, by avoiding reuse of single use suction catheters, nurses can significantly decrease the incidence of VAP in intensive care units (Enany et al., 2013). Intermittent tracheal suctioning was conducted by nurses routinely on fixed times throughout the day. Every time a catheter was inserted into the airway, the risk of infections increased

and updated recommendations suggests that intermittent suctioning should only be performed if necessary to avoid VAP (Speck et al., 2016). The inconsistent and outdated routines demonstrate a lack of guidance and guidelines, indicating the need for improved protocols and professional development among nurses (Getahun et al., 2022).

Applying social practice theory to the discussion on IPC and hand hygiene practices in hospitals reveals the influence of various factors on these practices. These factors include social constructions of cleanliness and dirt, the false sense of security created by gloves, how gloves become a substitute for hand hygiene, the availability and accessibility of personal protective equipment, and the representation of single-use medical equipment as hospital hygiene. Interventions to improve and implement IPC interventions should consider these factors and address the cultural norms, embodied competencies, institutional policies, safety climate, material resources, and the roles of different stakeholders that shape health professionals' practices. By understanding the complex interplay of these factors, strategies beyond individual behavioral change can be developed to promote better hand hygiene compliance and infection prevention in hospitals.

9.2 Antibiotic resistance prevention and power dynamics

By examining power dynamics within social systems, social practice theory contributes to uncover how power relations influence the establishment, maintenance, and transformation of social practices (Maller, 2015). It emphasizes the role of power in shaping social norms, behaviors, and interactions, and how these dynamics can either reinforce or challenge existing practices. Importantly, social practice theory recognizes that practices are not solely determined by individual choices but are also influenced by broader social structures, including power dynamics and infrastructure.

Widespread use of broad-spectrum antibiotics has become a part of the hospital infrastructure in low- and middle-income countries as it compensates for the lack of sanitation, sterile equipment, beds, and space to maintain hygiene, and IPC (Denyer Willis & Chandler, 2019). Antibiotic resistance was a term known by most nurses, but the phenomenon was often misunderstood and seemed to be of little concern to many of them. Correspondingly, one of the nurses expressed how antibiotics had been used for a very long time without encountering antibiotic resistance. The consecutive invisibility of ABR experienced by the staff nurses is perhaps a result of the trust in the persistent effectiveness of

antibiotics, the low awareness and understanding of ABR, and the lack of capacity and routines to conduct susceptibility testing for antibiotic resistant strains of bacteria in the hospital. Furthermore, the challenge of defining and measuring ABR reinforces the concealed notion of resistance. The wide range of antibacterial drugs that can target various strains of bacteria with different resistance mechanisms makes ABR a phenomenon challenging to define. Combined with limited surveillance and testing capacity in human, animal, and environmental sectors, accounting for ABR is difficult. Therefore, most data assessing the burden of ABR is based on estimates that can be criticized for being more political than scientific, adding little accuracy to the scope of the problem (Chandler, 2019). These logistical and definitional issues have made it challenging to stabilize AMR through an actuarial approach where the impact is accurately accounted for. Instead, a sentinel approach has emerged, where AMR is emphasized and projected as a global threat to economies, the developed infrastructure, and modern biomedicine. The sentinel approach has gained attention and funding on a global political scale but is still competing with other diseases and global challenges, such as climate change (Chandler, 2019). However, the sentinel approach to address ABR has yet to reach the clinical practice of the nurses in this study as ABR appeared concealed behind the widespread use of broad-spectrum antibiotics, indicating a disconnect between global priorities and local healthcare practices.

The nurses were rarely directly involved in decision-making and discussions related to antibiotic treatment, reflecting the influence of power dynamics within the hospitals. Furthermore, many were unaware of antibiotic resistance as a possible driver behind the frequent change in patients' prescriptions. The disconnectedness between the domain of doctors and the domain of nurses contributed to generating a blurred perception of antibiotic resistance among the nurses, and the only noticeable sign of ABR in their day-to-day practice was patients' complaints and additional paperwork when doctors kept changing the antibiotic course to find an effective drug. Nevertheless, findings from this study showed how nurses argued their importance in providing medicines to patients and considered their role in antibiotic treatment as crucial. Similar findings have been reported in a quantitative survey from West Bengal, where 98.9% of the nurses claimed that knowledge of antibiotics where vital to them as healthcare providers (Nair et al., 2019a).

The nursing profession is in most nations dominated by women, and nurses represent the largest and most feminized section of the health professions globally (Kodoth & Jacob, 2014). In India, religious orders and colonial hierarchy in nursing have shaped and influenced the occupation, constructing a heavily feminized and submissive structure that continues into

the present (Nair & Healey, 2009; Walton-Roberts et al., 2017). Furthermore, the traditional notion of purity and pollution in traditional Hindu rituals and spiritual practices has impacted how nurses are viewed in India, because the nurses work involve intimate touch and proximity to different caste members and stigmatizing contact with bodily fluids. The nursing occupation thereby crossed the perceived boundaries between purity and pollution, rendering nurses as low-status work typically undertaken by women from lower castes (Nair & Healey, 2009). In modern times, the notion of ritual purity and pollution has diminished in impact, and the view on nurses has changed with prospects to work abroad followed by increased earning potential, financial security, and possibilities to pursue a career. This has contributed to improving the status of nurses in India (Carter, 2019)

Sharma et al. (2020) analyzes and reflect on nurses' status in India and describe how Indian nurses are still confined to patient care and vital signs measurements in contrast to nursing as a respected profession in Western countries where nurses are included in healthcare teams and inherit responsibilities for advanced medical procedures. They further argue how a continuous downfall in the status of Indian nurses, together with prospects of improved living conditions and quality of life abroad, inspire Indian nurses to look for jobs overseas, contributing to the shortage of nurses in India (Sharma et al., 2021). On the other hand, Kodoth & Jacob (2014) suggests how the opportunities to work abroad can positively contribute to increase the competency among nurses and further elevate their professional and societal status in India (Kodoth & Jacob, 2014). Nevertheless, the idea about nursing in Western countries is not unanimous, as gender discrimination and hierarchies continue to impact the evolution of nurses' roles and education across the globe in the 21st century (Lewis, 2022). Furthermore, several recent studies are underpinning how nurses are underutilized and unrecognized in antimicrobial stewardship programs worldwide (Kirby et al., 2020; Mathew et al., 2020; Monsees et al., 2019; Mostaghim et al., 2017).

Despite prospects of improvements in gender roles and hierarchies in the medical sector in India, the interpretation of the nursing profession as inferior to doctors was, to a certain extent, confirmed in the present study by both nurses and doctors through informal conversations and interviews. Committed to following the prescriptions and wary of questioning the doctors' decisions, some nurses believed there was little they could do to prevent antibiotic resistance. Conversely, several nurses suggested relevant ideas such as notifying the doctors about changes in the patient's condition, reminding the doctors to switch to narrow-spectrum antibiotics, improving hospital hygiene, educating patients and caregivers, and inform them to avoid over-the-counter treatment outside the hospital. The

nurses further explained how doctors were unwilling to listen to their suggestions and that new designated roles within the nursing profession required written instructions. The hierarchical structure of the medical sector tends to render nurses with limited opportunities for involvement in multidisciplinary discussions, including the development of antimicrobial stewardship programs, and with few opportunities for education and training. These findings are in accordance with several articles suggesting how longstanding power dynamics in the medical sector constrain the role of nurses (Garner et al., 2014; Kodoth & Jacob, 2014; Lewis, 2022; Mathew et al., 2020; Monsees et al., 2019).

This discussion sheds light on the impact of power dynamics on nurses' status within the hospital and society, and their opportunity to engage in antibiotic resistance prevention practices. The disconnectedness between the domain of doctors and nurses along with the nurse's reluctance to interfering with the doctors' sphere renders the nurses with limited opportunities to actively engage in antibiotic stewardship interventions. Understanding the social dynamics allows for a deeper analysis of how power relations can perpetuate inequalities and limit opportunities for change and transformation. Strategies should focus on promoting collaboration, communication, and mutual respect between health professional groups, assigning, and implementing nurses' designated roles in hospital guidelines, and designing systems to ensure professional development and training for nurses to enhance their knowledge of antibiotic resistance and empower them to actively contribute to AMS programs. To quote one of the nurses, «If you have knowledge, then only you will be able to stop the narrow mentality of the people, and we can make a good image of nurses. [...] It will take time, but the change will happen». Taking social structures, gender, and power dynamics into account can promote more equitable and inclusive social practices to ensure equitable and effective healthcare practices.

9.3 Medication management and antibiotics

Through hours of observations in the hospital, it became evident that nurses support and contribute to the management of the patients' antibiotic treatment. Nurses prepare, administer, and dispose the drug, give the test dose, ensure the patients intravenous port, inform the patients about the antibiotic course, measure vital signs, receives information on the patient status by caregivers, and report information about changes in the patient's condition to the doctors. Looking closely at every step of this complex treatment process, several areas could benefit from enhancement in practices and routines to reduce the risk of spread and development of ABR and improve patient outcomes.

When nurses prepared and administered intravenous antibiotics, breaks in aseptic techniques occurred routinely and injections were often administered rapidly and sometimes undiluted, as the reconstitution did not get sufficient time to fully dilute. Adverse events related to rapid intravenous push administration of third generation cephalosporines have been reported in the literature. Rapid administration of ceftriaxone injections (under one minute) has been associated with potentially life threatening tachycardia, heart palpitation, restlessness, diaphoresis and shivering in adults (I.Lossos, A. Lossos 1994 in (Spencer et al., 2018). Furthermore, ceftriaxone given between 3 to 5 minutes has been associated with adverse effects in children, such as biliary pseudolithiasis (Schaad et al., 1988). By following the instructions in the package leaflet or through accessible and reliable sources on preparation and administration of the specific drugs in question, nurses can ensure safe injection practices, enhance the efficacy of the drug, and reduce the risk of adverse drug events. The package leaflet is easily accessible and provides important information on how to reconstitute and prepare the antibiotic. Unfortunately, this information is often incomplete and rarely provide all necessary information (Longuet et al., 2016), highlighting the need for accessible secondary sources.

Some nurses expressed awareness of their shortcuts in patient treatment and briefly explained that their actions were suboptimal. However, they rarely expressed concern regarding the possible negative consequences their practices could impose on the patient. The nurses mentioned time pressure, overcrowding, and high nursing workload as drivers to perform procedures effective and fast, suggesting that organizational factors shape the way nurses carry out their tasks. Nevertheless, the time saving methods was not exclusively conducted in times of crowded wards and understaffing, but continued to take place in times where fewer patients were admitted in the ward. The consistency of suboptimal practice was

explained by “being a habit” although I would argue that such uninformed “habits” can be changed by adding awareness of the risks to patient safety and by providing tools to ensure effective but safe procedures. Such tools can be the non-touch-technique to improve compliance to aseptic techniques (Clare & Rowley, 2018) or standardized and accessible procedure guidelines to limit medication errors and ensure safe medication processes.

Furthermore, proper preparation and administration of antibiotics requires solid knowledge on the physical and chemical properties of the drug, and possible incompatibilities between different medicines that can affect the quality of the drugs (Longuet et al., 2016). Pharmacological knowledge was lacking among the participants in this study, and several nurses expressed confusion and misunderstandings related to broad-and narrow-spectrum antibiotics in addition to the side effects of the drugs.

Medication management is a complex process reaching further than to the content of the package leaflet, pharmacological knowledge, and techniques to prepare and administer the drug. It requires solid routines and interdisciplinary collaboration, and nurses play a pivotal role in coordinating and conducting practices that prevents medication errors (Costa et al., 2022; Gorgich et al., 2016). The Five Rights of medication administration are a set of principles to guide nurses in preventing medication errors and to safeguarding the quality in medication management. The tool is widely adopted around the world and aim to guide nurses to give the right drug, to the right patient, in the right dose, by the right route, at the right time (Martyn et al., 2019). The tool was known among the nurses participating in the current study.

Following the standards of the Five Rights tool, the findings from fieldwork reviled several flaws and risk of errors related to medication management. Additionally, personal factors affected the medicine administration process, such as errors in dosage calculation, the nurses drug preparation and reconstitution techniques, and the doctor’s prescriptions and transcriptions. These findings are in accordance with studies reporting that most medication errors were related to increased workload, errors in drug calculation and techniques, administration of the wrong dose or at the wrong time (Costa et al., 2022). One of the observed risks of error was how handwritten prescriptions could be hard to interpret. Accordingly, Zirpe et al., (2020) found transcription and prescription errors to be the most common errors in patient records at a tertiary care hospital in India. Furthermore, the drug class most prone to medication errors was found to be antibiotics (Zirpe et al., 2020). As intravenous antibiotics are preferred by both doctors and patients in India, high responsibilities are placed on nurses to conduct safe injection practices and dosage

calculation (Janjua et al., 2016). The therapeutic success and prevention of adverse effects rely on the proper administration of antibiotics and depend on the nursing team's skills, familiarity with the respective drug, and the relevant procedures and techniques (Hoefel & Lautert, 2006). However, the nurses often experienced high workload with interruptions from colleagues, patients, and caregivers, disrupting their workflow and creating opportunities for errors to occur. The respondents highlighted how organizational factors such as time pressure and lack of nursing staff impacted clinical practice.

Administering the right dose of the antibiotic at the right time is important to ensure the therapeutic effect of the drug (van Huizen et al., 2021), but was affected by variation in the routine of when and how to administer medicines, availability of the prescribed antibiotic, and reduced staff capacity, especially during the night. Hence, a study from Australia suggested how the nurses negotiated and adjusted the Five Rights according to the patients circumstances and individual needs (Martyn et al., 2019). While the Five Rights can contribute to guide medication administration, the linearity of the tool does not encompass individual patient needs, the organizational factors affecting nurses' practices, and the context they work in. Thus, the nurses' medication practices and management extend beyond the scope of the Five Rights, requiring nurses to have solid knowledge and access to information on pharmacological properties of the drug, dosage calculation, injection practices, and aseptic techniques in order to make evidence-based decisions to ensure patient safety.

Another important role of the nurses in both hospitals were to conduct the antibiotic "test dose" where a small amount of the antibiotic was injected intradermally or subcutaneously to detect hypersensitivity reactions. The nurses highlighted this practice as of great responsibility towards the patient's safety. Skin testing of antibiotics is rarely practices in western countries, but is implemented as a routine practice in health care facilities across India (Narayan & Rupert, 2019). However, the practices observed in this study was not standardized and was conducted with variations in the drugs concentration, amount, and time from injection to assessment. Evidence of the skin tests ability to reduce anaphylactic reactions is lacking, and there are no clear recommendations to substitute patient allergy focused clinical history to determine drug allergies with antibiotic skin testing (Narayan & Rupert, 2019). On the contrary, the practice of skin testing antibiotics can generate false-positive test results, resulting in suboptimal choices of antibiotic drugs, compromising the quality of care because the alternative antibiotics may be less effective (Macy et al., 2017; Maguire et al., 2020). The practices related to the antibiotic test doses can result in suboptimal antibiotic treatment and contribute to antibiotic resistance. It is important to

recognize that nurses' interpretation and performance in conducting test doses are influenced by organizational factors including the lack of standardized guidelines and implementation of evidence-based practices to ensure safe and optimal procedures.

Nurses' management of antibiotics can lead to exposure and contamination of antibiotic agents and resistant genes both inside and outside the hospital (Hocquet et al., 2016; van Huizen et al., 2021). The nurses' preparation techniques of antibiotic reconstitutions routinely exposed them to concentrated powdered antibiotics, increasing the risks of allergic reactions and development of ABR. No ventilation or exhaust fans were available in the wards to control occupational exposure to antibiotics or other drugs. Moreover, the nurses' practices sometimes included disposal of antibiotics directly on the floor between the patients' bed or in the hospital sink. Hospitals sinks serves as output for both antibiotics and food waste, generating good conditions for bacterial growth (Franco et al., 2020). With only one sink in the ward, the sink is a common touchpoint for all staff members, increasing the risk of healthcare-associated infections with antibiotic resistant bacteria in the hospital (Hocquet et al., 2016; Sukhum et al., 2022). Furthermore, wastewater contaminated with antibiotic-resistant genes can have far-reaching consequences on nearby communities, impacting human, animal, and environmental health both inside and outside the hospital (Fouz et al., 2020; Hocquet et al., 2016; Zhang et al., 2020). However, interviews and daily observations of medication management practices reveal that nurses lack awareness of the professional risks associated with regular exposure to antibiotic agents, as well as the broader effects of antibiotics in the environment.

Analyzing the nurses' practices related to antibiotic management through a social practice theory lens highlights the influence of power dynamics, hospital infrastructure, available resources, and competency development. The nurses' restricted knowledge regarding pharmacology and environmental exposure of antibiotics might be attributed to power dynamics within the healthcare system, where nurses may feel limited agency or face hierarchical pressures that discourage questioning current practices. Equipping nurses with knowledge, tools, and learning resources can empower them to ensure safe medication practices, enhance the efficacy of antibiotic treatment, and challenge and improve existing practices. By evaluating nurses' practices within their social context, it becomes evident that interventions to promote antibiotic treatment should go beyond individual behavior change and consider the wider social and environmental implications of antibiotic use to improve the quality and safety of medication administration, prevent medication errors, and improve antibiotic treatment management.

9.4 Clinical observations and assessment of vital signs

The collection of vital sign data is crucial for gaining valuable insights into a patient's condition. It provides information on their response to treatment, early detection of infections, and any signs of deterioration. Assessing vital signs is therefore essential to ensure patient safety and the delivery of quality care (Elliott, 2021). Both nurses and junior doctors were responsible for measuring vital signs. However, due to factors such as workload and understaffing, neither of them had the capacity to consistently follow up on regular vital sign measurements, especially during night shifts. As nurses spend more time in the hospital ward than most other health providers, they often became the first to observe, identify, detect, and report symptoms of infections. This role is crucial for patient advocacy and can impact antibiotic prescription and usage (Carter et al., 2018; Monsees et al., 2019). Additionally, one of the key advantages of the nurses participating in this study was their ability to effectively communicate with patients and their families. They were able to speak and understand the local language, which was preferred by the majority of their patients. This not only made the nurses valuable translators but also enabled them to serve as effective communicators between the patients and doctors.

The nurses in both hospitals included in this study were present in the wards around the clock and expressed concern about the heavy workload of the doctors. This led to a sense of responsibility for the patients and a commitment to communicating any changes in the patient's condition to the doctor. However, due to time and resource constraints, the nurses were unable to personally check the vital signs of all patients. As a result, this task was partially delegated to the caregivers who kept thermometers by the bedside and occasionally measured the patient's body temperature. The nurses had to prioritize checking on those who reported a fever, leaving significant responsibility with the caregivers.

Regardless of whether the patient had a fever or not, nurses in several wards of the MCH engaged in the routine practice of entering fabricated vital measurements in patient records, a practice appearing both meaningless and inappropriate. Reporting fabricated or inaccurate vital signs is considered professional misconduct, as highlighted in previous studies (Birks et al., 2018; Kellett & Sebat, 2017). However, the majority of nurses participating in the current study demonstrated a strong sense of moral and professional integrity and responsibility towards the patient, evidently withholding them from conscious misconduct that could potentially harm the patient. This observation highlights the potential gap between espoused values and actual behavior, emphasizing the challenge of translating

abstract principles into practical actions. Furthermore, the practice of routinely fabrication of vital signs can be explained by unfolding organizational factors such as understaffing during the night shift, limited nursing capacity, lack of standardized routines and guidelines, and non-optimized task division.

The observations in the ward revealed that nurses dedicate a significant amount of time to administrative tasks and paperwork, which ultimately hampered their availability to provide clinical care. By alleviating nurses of routine administrative paperwork, they can redirect their time and effort towards meeting patients' needs, administering medical treatments and conducting clinical observations. Furthermore, spending more time and resources on providing essential information and guidance to caregivers might contribute to improved patient care, as the nurses rely on caregivers to report changes in the patient's condition.

The challenges related to accurately assessing vital signs can be attributed to various factors. One of these factors is the pressure to prioritize other tasks, leading to a lack of time and resources for proper vital sign assessment. Inadequate professional development and training programs also contribute to nurses limited awareness and knowledge regarding the importance of regular and accurate vital sign measurements**.** In accordance with the present study, other researchers have found that the assessment of vital signs is often inaccurate (Philip et al., 2013), incomplete (Cardona-Morrell et al., 2016; Ludikhuize et al., 2012), or estimated based on previous records (Cooper et al., 2014). Although the reason for this is not entirely clear, several contributing factors have been identified. Philip et al., (2013) suggests that nurses perceived lack of time, confidence, and proper training as barriers to proper assessment of respiratory rate. Additionally, Mok et al., (2015) found that nurses perceived assessment of vital signs a time-consuming and sometimes overwhelming task (Mok 2015). Another contributing factor to suboptimal vital sign assessment practices is the influence of established practices and norms within healthcare settings. Burchill et al. (2015) found that nurses often rely on tradition and ritual rather than updated research and clinical judgment when it comes to vital sign assessments. This suggests a need for nurses to critically evaluate and question their practices, considering new evidence-based approaches (Burchill et al., 2015). On the contrary, (Cardona-Morrell et al., 2016) found that nurses would rely on their clinical judgment and availability of time rather than on policy mandated frequency. The perception of vital signs assessment as a time-consuming and overwhelming task highlights the impact of workload and time constraints on nurses' practices. The organizational context, including staffing levels and workload expectations, plays a significant role in shaping the

prioritization and completion of vital sign assessments. Nurses' ability to perform thorough and accurate vital sign assessments appear to be influenced by the resources and support provided by their healthcare organizations.

Although respiratory rate is one of the most sensitive measurements and important indicators for clinical deterioration, nurses counting respiratory rate was never observed during fieldwork. Philip et al., (2013) found that nurses perceive respiratory rate not to be important and therefore not prioritized. The ICU in the current study was equipped with monitors that automatically registered the patients' respiratory rate. However, on two occasions during fieldwork, the patients' respiratory rate did not agree with the number displayed on the monitor. When discussing these clinical observations with the nurses, they all demonstrated a high level of confidence in the monitors rather than their own clinical gaze. Despite the fact that respiratory rate is often the first sign of clinical deterioration or acute changes in the patient condition, this vital sign is often underestimated, down prioritized and nurses often rely solely on oxygen saturation (Cooper et al., 2014; Elliott, 2021; Kallioinen et al., 2021; Mok et al., 2015). The reliance on patient monitoring systems and the reluctance to manually measure vital signs through direct observation or touch can be seen as a response to the increasing use of technology in healthcare, generating a physical distance between nurses and patients. This shift towards technology-mediated care may be influenced by factors such as concerns about hygiene or discomfort with intimate situations. It may also reflect the changing status and professional identity of nurses as they embrace advanced technologies in their practice.

Despite the different explanations for nurses' vital sign assessment practices, Mok et al. (2015) suggests that continuous education should focus on the physiological and pathological processes that changes in vital signs express, to enable nurses to interpret early signs of clinical deterioration. Updated and renewed knowledge can contribute to improve nurses attitudes toward the importance of vital signs assessment (Mok et al., 2015). Furthermore, the practices surrounding vital sign measurements are shaped by a complex interplay of social, organizational, structural, and technological factors. Interventions should consider the established practices within the healthcare setting, the professional relations, available resources, and technological advancements that shape nurses' behaviors and attitudes towards vital sign assessment. This may involve providing adequate training and resources to promote evidence-based practices, and addressing workload and time constraints to ensure the accurate and timely assessment of vital signs.

9.5 Strengths and limitations

The methods applied in this study generated detailed information on the nurses' work, explaining the complexity of infection prevention and control practices, the management of antibiotic treatment, and the determinants affecting the inclusion of nurses in stewardship programs. The methodology enabled me to encompass in-depth insight from nurses from two hospitals: a tertiary care and secondary care facility. Although the qualitative data have given a rich insight into the views and practices of the nurses and the social life in the hospital, a potential limitation of this form of research concerns the validity and generalizability of the findings.

One of the strengths of this study was combining observations and interviews. Studying practices is more effective through observations than interviews, as people tend to not always do what they say. Furthermore, the interviews provided opportunities to encompass the nurse's perspectives and reflections, generating a comprehensive picture of their practices and the social world of the hospital where they carried out their practices.

The focus of the study was to engage in the nurses' perspectives, and only staff nurses were included to participate in the study. However, it would be interesting to conduct formal interviews with ward sisters, matrons, physicians, and the hospital management to get a broader understanding of the power dynamics and possibilities for change and development of the nurse's role in the hospital.

Furthermore, we have seen how the nurses' practices can impact patient safety and the spread and development of ABR bacteria in a wide variety of ways. Studying nurses' practices can arguably contribute to merely pointing out their wrongs and rights. This study has therefore focused on identifying structural and organizational factors determining and influencing the nurses' approaches to avoid isolating their practices and rendering them solely responsible for their actions. However, looking into their activities, daily routines, performance of procedures and techniques has been an essential means of learning what constitutes their role and responsibilities and identifying the need for improvement to support nurses as professionals and experts in their field.

Chapter 10: Conclusion

This research has shed light on the determinants influencing nurses' practices in antibiotic use and antibiotic resistance prevention within two public hospitals in India. The findings demonstrate the nurses' key role and opportunities in managing antibiotic treatment and preventing healthcare-associated infections. Furthermore, determinants that impact nurses' ability to effectively contribute to antibiotic resistance prevention efforts have been analyzed.

This study showed how nurses understand and consider their importance in providing medicines to patients and their role in antibiotic treatment. Furthermore, their practices were found to be influenced by socially constructed notions regarding IPC and hygiene. Despite the nurses' dedication to their work and strong sense of professional integrity, high nursing workload and time limitations significantly impact their practices. This often led to shortcuts in hospital hygiene, medicine administration techniques, and assessment of vital signs, potentially compromising patient safety. In the ICU setting, it was observed that nurses increasingly rely on technological patient monitoring systems rather than on their own clinical judgment. This shift towards technology-mediated care may reflect the evolving status and professional identity of nurses as they embrace advanced technologies in their practice. However, careful adaption is required to maintain the safety of patients. Furthermore, power dynamics within the hospital setting were found to create a disconnect between the domains of nurses and doctors. These dynamics appear to impact nurses' autonomy, perpetuate inequalities, and restrict their ability to participate in efforts to prevent antibiotic resistance. Despite the nurses' readiness to learn, petrified professional hierarchies and limited opportunities for professional development hinder their capacity to stay updated on the latest advancements and best practices in antibiotic resistance management.

To address these findings, strategies should promote collaboration, communication, and mutual respect between health professional groups to facilitate nurses' involvement in antibiotic stewardship interventions. Assigning and implementing nurses' designated roles in hospital guidelines and providing professional development and training can enhance their knowledge of antibiotic resistance and empower them to actively contribute to antimicrobial stewardship programs. In the context of infection prevention and control practices, interventions should consider various factors, such as social constructions of hygiene and the availability of medical and personal protective equipment. Cultural norms, institutional policies, workflow processes, material resources, and the roles of different stakeholders, such as the patient caregivers, further shape the nurses' practices. Understanding these factors can

inform strategies beyond individual behavioral change to promote ABR prevention in hospitals.

Empowering nurses as crucial stakeholders in ABR prevention requires a collaborative approach that involves multidisciplinary teams, including nurses, physicians, pharmacists, microbiologists, administrators, and policymakers. By addressing the determinants identified in this research, healthcare systems can be developed to provide an environment that supports nurses in their crucial role in ABR prevention. This, in turn, can contribute to the overall efforts in combating antibiotic resistance and improving patient outcomes.

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Appendices

Appendix A: Dr. RPGMC Institutional Ethics Committee

Dr. Rajendra Prasad Government Medical College (Dr. RPGMC)
Kangra at Tanda, Himachal Pradesh, India – 176 001
Institutional Ethics Committee (IEC)
Registration No. EC/NEW/INST/2021/2081 and ECR/490/Inst/HP/2013

Chairperson
Padmashri Dr. Kshama Metre
National Director CORD (Tapovan Dharamsala)
+ 91 94180 36987

Member Secretary
Dr. Dinesh Kumar
Associate Professor (Community Medicine)
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E mail: *iecdrpgmc@gmail.com*

Alternate Member Secretary
Mr. Satya Bhushan Sharma,

Basic Medical Scientists
Dr. Sunil Kumar Raina,
Dr. Atal Sood,
Mr. Sushant Sharma,

Clinicians
Dr. Seema Sharma
Dr. Pradeep Makkar
Dr. Ashish Garg

Legal Expert
Mr. Yashpal Kachroo

Social Scientist
Dr. Shabab Ahmed

Lay Person
Mr. Ashok Raina

No. HFW- H DRPGMC/ Ethics /2022/31 *Dated: 30.07.2022*

The IEC of Dr. RPGMC reviewed and discussed the protocol (**No: IEC/22/2022)** entitled "Antibiotic use and antimicrobial resistance prevention in India: exploring nurses' practices, perspectives, and knowledge" submitted by Dr. Sunil Kumar Raina, Professor and Head, Community Medicine, Dr. RPGMC, Kangra at Tanda, Himachal Pradesh in meeting held on **07/06/2022**.

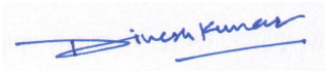
Decision: The committee approves the research work to be conducted in its present form and with the direction that;

Data will be collected only after receiving letter of approval from IEC as per submitted undertaking by the applicant

The IEC needs to be informed about;

- Patient information sheet and consent forms duly filled and signed
- Any serious adverse event occurring during the study
- Final report of the study

The IEC has to be informed and permission taken before any changes in the protocol, patient information sheet, informed consent, Site of Study or Investigator.
It is to be ensured that there shall no financial burden on the research participants because of participation in the study and no direct cash incentives are given to the participants.
Please note that members of IEC have the right to monitor the study in any phase.



(Member Secretary)
Member Secretary
Institutional Ethics Committee
Dr. RP Government Medical College,
Kangra at Tanda (HP)

Appendix B: Information letter and consent form Hindi

सूचना पत्र और सहमति प्रपत्र

क्या आप अनुसंधान परियोजना "भारत में एंटीबायोटिक उपयोग और एंटीमाइक्रोबियल रेजिस्टेंस की रोकथाम: नर्सों की प्रथाओं, दृष्टिकोणों और ज्ञान की खोज" में भाग लेने में रुचि रखते हैं?

यह एक शोध परियोजना में भागीदारी के बारे में एक पूछताछ है जिसका उद्देश्य एंटीबायोटिक उपयोग और एंटीमाइक्रोबियल रेजिस्टेंस की रोकथाम के संबंध में नर्सों की भूमिका का पता लगाना है। इस पत्र में, हम आपको परियोजना के उद्देश्य और आपकी भागीदारी के बारे में जानकारी देंगे।

परियोजना का उद्देश्य

एंटीमाइक्रोबियल रेजिस्टेंस संक्रमण की प्रभावी रोकथाम और उपचार के लिए एक खतरा है। यह अनुशंसा की जाती है कि अस्पतालों में रोगाणुरोधी प्रतिरोध के विकास और प्रसार को रोकने के लिए डॉक्टर, फार्मासिस्ट, माइक्रोबायोलॉजिस्ट और नर्स एक साथ काम करें। हालांकि, भारत में एंटीबायोटिक उपयोग और एंटीमाइक्रोबियल रेजिस्टेंस से संबंधित प्रथाओं में नर्सों की भूमिका से जुड़े अध्ययनों की आवश्यकता है। यह शोध इस बात की अंतर्दृष्टि प्रदान करेगा कि नर्सों के साथ प्रतिभागी अवलोकन और साक्षात्कार के माध्यम से नर्स एंटीबायोटिक उपयोग और संक्रमण की रोकथाम के प्रबंधन में कैसे योगदान करती हैं।

यह अध्ययन :-

- यह समझने में योगदान दें कि नर्सें एंटीबायोटिक के उपयोग और एंटीमाइक्रोबियल रेजिस्टेंस की रोकथाम को कैसे प्रभावित करती हैं।
- पहचानें कि नर्सें कहाँ जानकारी चाहती हैं और योग्यता विकास के लिए उनकी कथित आवश्यकता क्या है।
- एंटीबायोटिक के उपयोग में सुधार और एंटीमाइक्रोबियल रेजिस्टेंस को रोकने के लिए हस्तक्षेपों में नर्सों की भविष्य में भागीदारी के लिए एक नींव स्थापित करें

मैं नॉर्वे की एक नर्स हूं और ओस्लो विश्वविद्यालय में मास्टर्स की छात्रा हूं। यह शोध परियोजना मेरे मास्टर्स की थीसिस का हिस्सा है।

1

अनुसंधान परियोजना के लिए कौन जिम्मेदार है?

ओस्लो विश्वविद्यालय और स्वास्थ्य और समाज संस्थान परियोजना के लिए जिम्मेदार संस्थान हैं।

आपको भाग लेने के लिए क्यों कहा जा रहा है?

आपको इस अध्ययन में भाग लेने के लिए कहा गया है क्योंकि आप डॉ. आरपी सरकारी मेडिकल कॉलेज टांडा में कार्यरत एक पंजीकृत नर्स हैं । लगभग छह नर्सों को भाग लेने के लिए कहा जाएगा, और विभिन्न वर्षों के कार्य अनुभव वाली नर्सों को शामिल करना वांछनीय है।

भागीदारी में आपके लिए क्या शामिल है?

यदि आप परियोजना में भाग लेना चुनते हैं, तो इसमें यह शामिल होगा कि मैं, थिया मैरी टेवेट, आपके काम के घंटों के दौरान 3-4 दिनों के लिए आपका अनुसरण करती हूं। मैं आपके दैनिक कार्य का पालन करुंगी, और मुझे नर्सों द्वारा एंटीबायोटिक दवाओं के उपयोग और वार्ड में उनकी जिम्मेदारियों में दिलचस्पी है। मैं एक नर्स हूं और दिन में विभिन्न कार्यों में सहायता कर सकती हूं।

आपको एंटीबायोटिक उपयोग, एंटीबायोटिक प्रतिरोध, और अस्पताल के अन्य स्टाफ सदस्यों और रोगियों के साथ संबंधों के बारे में एक साक्षात्कार में भाग लेने के लिए भी कहा जाएगा। साक्षात्कार 30-60 मिनट तक चलेगा और इलेक्ट्रॉनिक रूप से ऑडियो-रिकॉर्ड किया जाएगा। आपकी पसंद के अनुसार साक्षात्कार हिंदी में एक शोध सहायक द्वारा, या अंग्रेजी में मेरे द्वारा आयोजित किया जाएगा।

भागीदारी स्वैच्छिक है

परियोजना में भागीदारी स्वैच्छिक है। यदि आप भाग लेना चुनते हैं, तो आप बिना कारण बताए किसी भी समय अपनी सहमति वापस ले सकते हैं। फिर आपके बारे में सारी जानकारी गुमनाम कर दी जाएगी। यदि आप भाग नहीं लेने का निर्णय लेते हैं या बाद में वापस लेने का निर्णय लेते हैं तो आपके लिए कोई नकारात्मक परिणाम नहीं होंगे। यह आपके रोज़गार या कार्यस्थल को प्रभावित नहीं करेगा।

आपकी व्यक्तिगत गोपनीयता - हम आपके व्यक्तिगत डेटा को कैसे संग्रहीत और उपयोग करेंगे

हम इस सूचना पत्र में निर्दिष्ट उद्देश्य (उद्देश्यों) के लिए केवल आपके व्यक्तिगत डेटा का उपयोग करेंगे। हम आपके व्यक्तिगत डेटा को गोपनीय रूप से और डेटा सुरक्षा कानून (सामान्य डेटा संरक्षण विनियमन और व्यक्तिगत डेटा अधिनियम) के अनुसार संसाधित करेंगे।

डेटा तक पहुंच रखने वाले एकमात्र व्यक्ति हैं

- शोधकर्ता थिया मैरी ट्वेड्ट
- अनुसंधान सहायक… .....
- मुख्य पर्यवेक्षक: क्रिस्टोफ़ ग्रैडमैन
- सह-पर्यवेक्षक: अरुणिमा सहगल मुखर्जी

मैं आपकी व्यक्तिगत गोपनीयता की रक्षा के लिए आपके नाम और संपर्क विवरण को एक कोड से बदल दूंगी। नामों की सूची, संपर्क विवरण और संबंधित कोड शेष एकत्रित डेटा से अलग संग्रहीत किए जाएंगे। ऑडियो रिकॉर्डिंग एक एन्क्रिप्टेड पासवर्ड से सुरक्षित कंप्यूटर पर संग्रहीत की जाएगी। प्रकाशित परिणामों को गुमनाम और प्रस्तुत किया जाएगा ताकि निष्कर्षों से उम्र, लिंग और वर्षों के अनुभव का खुलासा करके आपकी पहचान न की जा सके। आपका नाम और संपर्क जानकारी प्रकाशित नहीं की जाएगी।

शोध परियोजना के अंत में आपके व्यक्तिगत डेटा का क्या होगा?

यह परियोजना 01.07.2023 को समाप्त होने वाली है। ऑडियो रिकॉर्डिंग और व्यक्तिगत जानकारी प्रोजेक्ट के अंत में हटा दी जाएगी।

आपके हक

जब तक आप एकत्रित डेटा में पहचाने जा सकते हैं, तब तक आपके पास यह अधिकार है:

- आपके बारे में संसाधित किए जा रहे व्यक्तिगत डेटा तक पहुंचें
- अनुरोध करें कि आपका व्यक्तिगत डेटा हटा दिया जाए
- अनुरोध करें कि आपके बारे में गलत व्यक्तिगत डेटा को सही/सुधारा गया है
- अपने व्यक्तिगत डेटा (डेटा पोर्टेबिलिटी) की एक प्रति प्राप्त करें, और
- अपने व्यक्तिगत डेटा के प्रसंस्करण के संबंध में डेटा सुरक्षा अधिकारी या नॉर्वेजियन डेटा सुरक्षा प्राधिकरण को शिकायत भेजें

आपके व्यक्तिगत डेटा को संसाधित करने का हमारा क्या अधिकार है?

हम आपकी सहमति के आधार पर आपके व्यक्तिगत डेटा को संसाधित करेंगे। ओस्लो विश्वविद्यालय के साथ एक समझौते के आधार पर, डेटा प्रोटेक्शन सर्विसेज ने मूल्यांकन किया है कि इस परियोजना में व्यक्तिगत डेटा का प्रसंस्करण डेटा संरक्षण कानून के अनुसार है।

और अधिक जानकारी कहां से मिल सकती है ?

यदि परियोजना के बारे में आपके कोई प्रश्न हैं, या अपने अधिकारों का प्रयोग करना चाहते हैं, तो संपर्क करें:

• मास्टर छात्र: थिया मैरी ट्वेड्ट।

दूरभाष. +47 99103935. ई-मेल: t.m.tvedt@studmed.uio.no

•ओस्लो विश्वविद्यालय में मुख्य पर्यवेक्षक: क्रिस्टोफ़ ग्रैडमैन।

दूरभाष: +47 22850615 ई-मेल: christoph.gradmann@medisin.uio.no

• ओस्लो विश्वविद्यालय में सह-पर्यवेक्षक: अरुणिमा सहगल मुखर्जी।

दूरभाष +47 48644320। ई-मेल: arunimam@ifi.uio.no

• हमारे डेटा सुरक्षा अधिकारी: रोजर मार्कग्राफ-बाय

ई-मेल: personvernombud@uio.no

• डेटा सुरक्षा सेवाएं

ईमेल द्वारा: personverntjenester@sikt.no **या टेलीफोन द्वारा: +47 53 21 15 00**

सादर,

प्रोजेक्ट लीडर
(शोधकर्ता/पर्यवेक्षक)

छात्र (यदि लागू हो)

.....

सहमति पत्र

मुझे "एंटीबायोटिक के उपयोग और एंटीमाइक्रोबियल रेजिस्टेंस की रोकथाम में नर्सों की भूमिका की खोज" परियोजना के बारे में जानकारी प्राप्त हुई है और मुझे प्रश्न पूछने का अवसर दिया गया है।

मैं सहमति देता/देती हूं:

☐ सहभागी प्रेक्षण में भाग लेने के लिए

☐ साक्षात्कार में भाग लेने के लिए

मैं अपने व्यक्तिगत डेटा को परियोजना की समाप्ति तिथि तक संसाधित करने की सहमति देता/देती हूं, लगभग। जुलाई 2023

.....

(प्रतिभागी द्वारा हस्ताक्षरित, तिथि)

Appendix C: Information letter and consent form English

Are you interested in taking part in the research project "Antibiotic use and antimicrobial resistance prevention in India: exploring nurses' practices, perspectives, and knowledge"?

This is an inquiry about participation in a research project where the purpose is to explore the role of nurses regarding antibiotic use and prevention of antimicrobial resistance. In this letter, we will give you information about the purpose of the project and what your participation will involve.

Purpose of the project
Antimicrobial resistance threatens the effective prevention and treatment of infections. It is recommended that doctors, pharmacists, microbiologists and nurses work together to stop the development and spread of antimicrobial resistance in hospitals. However, studies involving the role of nurses in practices related to antibiotic use and antimicrobial resistance in India are needed. This research will provide insight into how nurses contribute to manage antibiotic use and infection prevention through participant observation and interviews with nurses.

The study will

- Contribute to understand how nurses affect antibiotic use and prevention of antimicrobial resistance
- Identify where nurses seek information and their perceived need for competency development
- Establish a foundation for future involvement of nurses in interventions to improve antibiotic use and prevent antimicrobial resistance

I am a Norwegian nurse and a master's student at the University of Oslo. This research project is part of my master's thesis.

Who is responsible for the research project?
The University of Oslo and the Institute of Health and Society is the institution responsible for the project.

Why are you being asked to participate?
You are asked to participate in this study because you are a registered nurse working at Dr. RP Govt. Medical College Tanda. Approximately six nurses will be asked to participate, and it is desirable to include nurses with different years of working experience.

What does participation involve for you?
If you choose to take part in the project, this will involve that I, Thea Marie Tvedt, follow you for 3-4 days during your working hours. I will follow your daily work, and I am interested in the nurses' use of antibiotics and their responsibilities in the ward. I am a nurse and can assist in different tasks during the day.

You will also be asked to participate in an interview about antibiotic use, antibiotic resistance, and relations to other hospital staff members and patients. The interview will last for 30-60 minutes and will be audio-recorded electronically. The interviews will be conducted in Hindi by a research assistant, or in English by me, according to your preference.

Participation is voluntary
Participation in the project is voluntary. If you choose to participate, you can withdraw your consent at any time without giving a reason. All information about you will then be made anonymous. There will be no negative consequences for you if you chose not to participate or later decide to withdraw. It will not affect your employment or place of work.

Your personal privacy – how we will store and use your personal data
We will only use your personal data for the purpose(s) specified in this information letter. We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act).

The only persons who will have access to the data is

- The researcher Thea Marie Tvedt
- The research assistant …..
- The main supervisor: Christoph Gradmann
- The co-supervisor: Arunima Sehgal Mukherjee

I will replace your name and contact details with a code to protect your personal privacy. The list of names, contact details and respective codes will be stored separately from the rest of the collected data. The audio recordings will be stored on an encrypted password-protected computer. The published results will be anonymized and presented so that you will not be identified, by disclosing age, gender, and years of experience from the findings. Your name and contact information will not be published.

What will happen to your personal data at the end of the research project?
The project is scheduled to end 01.07.2023. The audio recordings and personal information will be deleted at the end of the project.

Your rights
So long as you can be identified in the collected data, you have the right to:

- access the personal data that is being processed about you
- request that your personal data is deleted
- request that incorrect personal data about you is corrected/rectified
- receive a copy of your personal data (data portability), and
- send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority regarding the processing of your personal data

What gives us the right to process your personal data?
We will process your personal data based on your consent. Based on an agreement with the University of Oslo, Data Protection Services has assessed that the processing of personal data in this project is in accordance with data protection legislation.

Where can I find out more?
If you have questions about the project, or want to exercise your rights, contact:

- Master's Student: Thea Marie Tvedt. Tel. +47 99103935. E-mail: t.m.tvedt@studmed.uio.no
- Main supervisor at the University of Oslo: Christoph Gradmann. Tel: +47 22850615 E-mail: christoph.gradmann@medisin.uio.no.

- Co-supervizor at the University of Oslo: Arunima Sehgal Mukherjee. Tel +47 48644320. E-mail: arunimam@ifi.uio.no
- Our Data Protection Officer: Roger Markgraf-Bye: personvernombud@uio.no
- Data Protection Services, by email: (personverntjenester@sikt.no) or by telephone: +47 53 21 15 00.

Yours sincerely,

Project Leader (Researcher/supervisor) Student (if applicable)

Consent form

I have received and understood information about the project "Exploring nurses role in antibiotic use and prevention of antimicrobial resistance" and have been given the opportunity to ask questions. I give consent:

- ☐ to participate in participant observation
- ☐ to participate in interviews

I give consent for my personal data to be processed until the end date of the project, approx. July 2023

(Signed by participant, date)

Appendix D: Observation guide

The observation guide is intended as a tool to remind the observer of key points and topics of interest during the observation process. It is worth noting that unexpected themes and observations that arise in the field can provide valuable insights and require continuous evaluation of the observation guide.

- Management of antibiotics: preparation, administration, and disposal. Techniques and medical equipment. The five rights.
- IPC practices. Hand hygiene, personal protective equipment, disinfection techniques
- Use and removal of indwelling devices
- Techniques and timing for collection of specimens (blood, urine, stool, wound secretion, sputum)
- Interprofessional relations and dynamics
- Interactions between doctors and nurses, e.g., reporting of patient symptoms, discussing treatment options, calling for evaluation of the patient
- Interactions with microbiology and pharmacists
- Information to patients and interactions
- Opportunities for professional development
- Availability and use of clinical procedures and learning resources

Appendix E: Interview guide

The interview guide intends to cover a range of topics and are not a fixed set of questions.

The interviewer can alternate between the questions to explore the interviewees perspectives.

Professional profile and demographic data

- Age, gender, position, hospital ward, years of experience and education
- Why did you become a nurse, and what are your fields of interest within nursing?

Perspectives on practices related to antibiotic use (ABU) and antimicrobial resistance (AMR)

- Can you describe what nurses usually do if they suspect that a patient has an infection?
- How would you describe your role in managing antibiotics in the ward?
- What is your experience of AMR where you practice?
- How would you say AMR affects your daily work?
- How do you see resistance impact your practice in the future?
- How do you think nurses can stop the development and spread of AMR?

Nurses perceived need for competency development

- If you or your co-workers from the nursing staff want to find out something about antibiotics or AMR, where do you turn to find that information?
- Is there something you wish to know about AMR/ABU but think you don't have access to the information?
- Do you have suggestions for areas where your colleagues might need more information about AMR/ABU?
- What are your sources of information regarding clinical procedures?
- Are there topics you wish you had more information about that could strengthen your confidence in antibiotic use/AMR, obtaining cultures, sterile procedures?
- Do you think that your colleagues see a relationship between antibiotic use and resistance?

Interprofessional relations

- Do you sometimes discuss prescription practices with doctors?
- How do you think your nursing colleagues can influence prescribing practices?
- How do you experience discussing lab results and antibiotic use with doctors and personnel from the laboratory?
- Do you have any ideas of how the nursing staff can contribute to improve the antibiotic treatment for patients?
- In what ways can your working conditions be more supportive of how you engage in antibiotic use and AMR?

Patient demands – nurses perceived needs for AMR literacy among patients

- What kind of information would you give to a patient when they get discharged with an antibiotic prescription? Would you give information? What information does the patient need?
- Do you think that the patients see a relationship between antibiotic use and resistance?