

UNIVERSITY OF THE WESTERN CAPE

**Assessment of prescribing practices in community pharmacies in Windhoek,
Namibia: A focus on antibiotics**



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KEYWORDS

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ABSTRACT

Background

Globally, medicine misuse is not something to be taken lightly. Moreover, the accelerated occurrence of antibiotic resistance is related to imprudent antibiotic use, which is extremely concerning. Low- and middle-income countries, like Namibia, are particularly vulnerable to misuse of medicines. Medicine use practices in public health settings often vary from those in private health settings, and in Namibia, whilst there is reasonable data on medicine use in public facilities, very little is available on the same in private facilities.

Aim

This study assessed the prescribing patterns in community pharmacies in Windhoek, Namibia, focussing on antibiotics to gauge the magnitude of the problem.

Methodology

A retrospective cross-sectional study was conducted using an adapted, validated WHO methodology. The study population consisted of all community pharmacies in Windhoek and the prescriptions for one year before the study. A multi-stage sampling method was used, with a stratification technique to randomly select 25 out of 71 community pharmacies and a systematic random technique to select 108 prescriptions per pharmacy, making a total of 2700 prescriptions. Data was retrospectively captured by the researcher and two trained research assistants using two data collection forms adapted from WHO-validated tools. Data analysis was conducted using the latest version of IBM's Statistical Package for Social Sciences (IBM/SPSS/Statistics/28.0) to describe prescribing indicators and identify irrational use practices, including antibiotic use patterns.

Results

Based on the sampled 25 community pharmacies and 2700 prescriptions, 8282 medicines were prescribed overall. The average number of medicines per prescription was 3.1, which is higher than the WHO optimal value of <2 and Namibia's acceptable value of 2.5. The percentage of medicines prescribed by generic name was only 6.9%, although the recommendation by WHO is 100% (all medicines to be prescribed by generic name), and Namibia's acceptable value is $\geq 80\%$. The percentage of prescriptions with an antibiotic was 38.6% (n=1043), which is above WHO's optimal value of <30% and Namibia's set target and acceptable values of 25% and $\leq 35\%$, respectively. The percentage of prescriptions with an injection was 2.4%, within WHO's optimal value of <20% and Namibia's set target of <10% and acceptable value of 15%. The percentage of medicines prescribed

from the Namibia Essential Medicines List (NEMLIST) was 38.5%, far short of WHO's recommended 100% and Namibia's acceptable figure of $\geq 80\%$.

Altogether, 1178 antibiotics were prescribed from 1043 prescriptions with an antibiotic. The number of antibiotics prescribed for each patient ranged from 1 to 4, with 89.5% (n=933) prescriptions having one antibiotic. The prescribed duration for antibiotics varied between 1 and 30 days, with the most prescribed duration being 5 days at 69% (n=813), followed by 3 days at 15.7% (n=185). In total, 21 different antibiotics were prescribed, of which amoxicillin + clavulanic acid (co-amoxiclav) was the most frequently used (30.4%, n=358) and azithromycin the second most prescribed (18.6%, n=219). Eleven classes of antibiotics were prescribed in total, the most common being penicillins at 41.3% (n=487), followed by macrolides at 24.2% (n=285) and fluoroquinolones at 10.4% (n=122). Just over half of the antibiotics were from the 'Access' class (54%, n=636), and just under half (44%, n=518) were from the 'Watch' class.

Conclusion

All prescribing indicators fell short of WHO and Namibia's recommendations, apart from the percentage of prescriptions with injections. Co-amoxiclav and azithromycin were the most commonly prescribed antibiotics, and penicillins and macrolides were the most commonly prescribed antibiotic classes. Fewer antibiotics from the 'Access' class and more from the 'Watch' and 'Reserve' classes were prescribed, which contrasts with WHO's recommendations. The findings from this study can provide valuable insights for policymakers, healthcare providers, and community pharmacies in Namibia to improve prescribing practices and reduce irrational medicine use, particularly of antibiotics.

DECLARATION

I declare that “Assessment of prescribing practices in community pharmacies in Windhoek, Namibia: A focus on antibiotics” is my own work, which has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been acknowledged by complete references.

Christopher Asimwe Oyaga

A handwritten signature in black ink, appearing to read 'Oyaga', with a stylized flourish at the end.

Signature:

Date: July 2025

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ACRONYMS AND ABBREVIATIONS

AMR	Antimicrobial Resistance
AMS	Antimicrobial Stewardship
ASP	Antimicrobial Stewardship Programme
AWaRe	Access, Watch, Reserve
BMREC	Biomedical Research Ethics Committee
CBD	Central Business District
CDC	Centre for Disease Control and prevention
CDDEP	Centre for Disease Dynamics, Economics & Policy
EDL	Essential Drugs List
FAO	Food and Agriculture Organisation of the United Nations
GARP	Global Antibiotic Resistance Partnership
HCW	Health Care Worker
HICs	High Income Countries
HPCNA	Health Professions Councils of Namibia
INRUD	International Network for the Rational Use of Drugs
LMICs	Low and Middle Income Countries
MOHSS	Ministry of Health and Social Services
NEMLIST	Namibia Essential Medicines List
NSTG	Namibia Standard Treatment Guidelines
OECD	Organisation for Economic Co-operation and Development
PHC	Primary Health Care
UAE	United Arab Emirates
UN	United Nations

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CHAPTER 1: INTRODUCTION

1.1 Introduction

Rational Medicine Use (RMU) refers to providing patients with medications that are appropriate for their clinical conditions at the most affordable cost to them as individuals and as a community, for a sufficient duration and in doses that meet their needs (WHO, 2002).

The primary objectives of RMU are to enhance patient care, reduce healthcare costs, prevent potential adverse reactions and drug interactions, and improve adherence to medication regimens (WHO, 2012). RMU promotes the safe, efficient, and cost-effective use of medications, involving proper prescribing by doctors, accurate dispensing by pharmacists, and effective use of medicines by patients to achieve specific therapeutic outcomes (WHO, 2002).

Practices that fall short of the WHO's definition of RMU are considered irrational medicine use. This irrational use can manifest in various ways, such as self-medication, unnecessary prescribing of multiple medications, irresponsible use of antibiotics, unnecessary prescribing of injections, prescribing against clinical practice guidelines, inappropriate dosage recommendations, and prescribing brand-name medicines instead of generics (WHO, 2002; Wendie *et al.*, 2021). Additionally, the use of substandard medicines, improper use of standard medicines, or obtaining high-scheduled medicines over the counter without a valid prescription are also considered irrational practices (Holloway & van Dijk, 2011).

Several factors drive these irrational practices. Geest *et al.* (1991) suggest that some factors are patient-based, while others can be attributed to medical professionals, their working environments, or medicine supply chain regulations. Furthermore, irrational prescribing may also stem from misinformation about medicines, cultural misunderstandings, profit-seeking intentions, and pharmaceutical marketing influence (Spurling *et al.*, 2010). Irrational medicine use is a significant public health issue worldwide, with potential negative consequences such as the wastage of health resources and adverse effects on people's health. This problem is most prevalent in low- and middle-income countries (LMICs) where healthcare systems are often fragile or fragmented, and adherence to standard treatment guidelines at Primary Health Care (PHC) levels averages below 40% and 30% in public and private health sectors, respectively (Holloway & van Dijk, 2011; Wendie *et al.*, 2021).

Namibia is classified as an upper-middle-income country by the World Bank. Previous studies indicate that the Namibia Standard Treatment Guideline (NSTG) are not effectively implemented in public healthcare facilities (Niaz *et al.*, 2018), highlighting an irrational medicine use issue in the country. Antibiotics are the most commonly prescribed medicines (Yimenu *et al.*, 2019) and have been effectively used either as prophylaxis or therapeutics for over 50 years (Chem, 2018). The irrational use or misuse of antibiotics poses a worldwide public health challenge and is linked to the development of antibiotic resistance (AMR) (Amaha *et al.*, 2019). Globally, antibiotic misuse is a problem particularly affecting LMICs (Holloway & van Dijk, 2011). According to CDDEP (2010) and the GARP-Kenya working group (2011), two-thirds of antibiotics are used inappropriately in Africa.

As there is a great risk of AMR associated with the use of antibiotics, it is imperative to prescribe, dispense, and administer them with greater caution than other medicines (Amaha *et al.*, 2019). The term AMR means the growing ability of disease-causing microorganisms to become untreatable by antimicrobial medicines to which they were originally susceptible (WHO, 2021). This ability can be natural or acquired by the irresponsible use of antimicrobials (WHO, 2021). Despite being a natural phenomenon, improper and overuse of antibiotics can accelerate it (Holloway & van Dijk, 2011; Amaha, 2019). Although AMR is a worldwide threat to human health, LMICs like Namibia are more likely to bear its burden (Lancet, 2022; WHO, 2021; Chem, 2018; MOHSS, 2017). Since 2016, more than 0.7 million annual deaths have been attributable to antimicrobial resistance (Tadesse *et al.*, 2017; CDDEP, 2015). Some 2019 estimates indicate that 4,950,000 deaths were a result of AMR (Lancet, 2022). Additionally, AMR raises healthcare costs, and therapy may be out of reach for most LMICs (WHO, 2002).

In a bid to curb AMR, the WHO urges nations worldwide to establish and operationalise Antimicrobial Stewardship (AMS) programmes (WHO, 2019). This is an endeavor by health service providers to improve patients' outcomes by optimising antimicrobial use. This effort results in relatively cheaper therapies and minimises unwanted effects of antibiotic use, such as antimicrobial resistance (MacDougall & Polk, 2005). Furthermore, the WHO developed a benchmark tool in which it categorises antibiotics into Access, Watch, Reserve (AWaRe) classes to be adopted by all countries to abate AMR (WHO, 2019). The 'Access' group includes antibiotics that should be widely available as they have a lower risk of contributing

to AMR. The 'Watch' group consists of antibiotics with a higher potential for resistance and should be used more cautiously. The 'Reserve' group includes antibiotics that should be preserved for treating multi-drug resistant infections and used only as a last resort. The WHO aimed for at least 60% of prescribed antibiotics to be from the 'Access' by 2023 (Sharland *et al.*, 2022). However, inappropriate prescribing remains a challenge due to knowledge gaps among physicians and patients (Chigome *et al.*, 2023). Studies indicate that in some regions, particularly in Africa, 'Watch' group antibiotics like ciprofloxacin (quinolones), which healthcare professionals should exercise caution when prescribing due to their higher resistance risk and potential side effects, are among the most frequently prescribed antibiotics (Yimenu *et al.*, 2019). This trend highlights a significant challenge in adhering to the WHO guidelines and underscores the need for improved antibiotic stewardship to prevent the escalation of AMR.

In order to address medicine use problems, one must first identify them. Assessing prescribing indicators such as the percentage of prescriptions with antibiotics, the average number of medicines per prescription, the percentage of prescriptions with injections, the percentage of medicines prescribed from the Essential Medicines List, and the percentage of medicines prescribed by generic name is one way of identifying the irrational use of medicines (WHO, 2002). Since there is a well-documented link between the use of antibiotics and AMR, this study aimed to assess the prescribing practices related to antibiotics in community pharmacies in Windhoek, Namibia.

1.2 Study setting

There are two health systems in Namibia: the public health sector and the private health sector. The population without health insurance (medical aid), which is the larger (82%), mostly utilises the public health sector, whereas the population with medical aid, which is the smaller (18%) tends to utilise the private health sector (Pereko *et al.*, 2015; Nghishekwa, 2018). Windhoek is the capital city of Namibia, with a population of 464,526 people (UN, 2024). It has a diverse population with varying health needs and access to healthcare services. It has 63% of all the private registered doctors in Namibia and 45% of all the community pharmacies in the country (within the private health sector) (Pereko *et al.*, 2016; Choi *et al.*, 2015). It also has most of the population in the country with medical aid, and this population seeks medical care mostly from the private health sector. Community pharmacies play a pivotal role in the healthcare system of Namibia, serving as accessible points for medication

dispensing to patients from private doctors' practices and, given their critical position, the prescribing practices of private doctors in these settings can significantly impact antibiotic use and resistance patterns.

Windhoek has approximately 71 community pharmacies (Choi *et al.*, 2015; HPCNA, 2020). Anecdotally, over 95% of prescriptions from private doctor's practices in Windhoek are filled and refilled in these pharmacies, since there are very few dispensing doctors unlike in the rural parts of the country. The law in Namibia mandates pharmacies to retain prescriptions for at least three years after the date of dispensing (Medicines and Related Substance Control Act, 2003). Previous surveys have shown that 98.1% of community pharmacies in Namibia keep prescription books or scheduled medicine registers and 96.3 % of all community pharmacies in the country keep prescriptions for three years after the last date of entry (Choi *et al.*, 2015). Pharmacies also retain prescription copies manually, or scan and keep them electronically, or both. This makes it easy to access prescription files in community pharmacies without interfering with the daily work of the pharmacies.

1.3 Problem statement

Assessing medicine use is one way of evaluating the quality of healthcare, which is gaining global recognition (Atif *et al.*, 2016; Kilipamwambu *et al.*, 2021). It also helps in identifying and gauging medicine use problems and their causes and informs interventions needed to mitigate medicine use problems (Atif *et al.*, 2016). However, although the evaluation of medicine use practices through WHO/INRUD indicators is on the increase in LMICs (Hogerzeil *et al.*, 1993, cited by Atif *et al.*, 2016), very few evaluations have been conducted in Namibia, and most of these, like in other LMICs, have been carried out in the public sector (Ansari, 2017; Chem, 2018; Amaha *et al.*, 2019).

In addition to general medicine use problems, irrational antibiotic usage at all healthcare levels is a major factor accelerating the development of resistance to antimicrobials globally (Amaha *et al.*, 2019; Chem *et al.*, 2018). The WHO rates AMR as a public health threat of growing concern that all stakeholders must pay immediate attention to (WHO, 2021). Moreover, the burden of AMR impacts LMICs like Namibia more than high-income countries (HICs) (Lancet, 2022; WHO, 2002). According to Pereko *et al.* (2015) and Niaz *et al.* (2018), public healthcare facilities in Namibia overused antibiotics. What is worrying is that studies from other settings confirm a proportionality between antibiotic use and the birth

of resistant microorganisms (Amaha *et al.*, 2019). Moreover, overuse of antibiotics in the private healthcare of Namibia is potentially higher than in the public health facilities. The community usage of antibiotics, to a large extent, contributes to general antibiotic use, therefore, outpatients or community pharmacies are good starting places to obtain information regarding it (Amaha *et al.*, 2019).

Assessing prescriber practices in general and their antibiotics prescribing habits, in particular, helps not only in identifying irrational prescribing behaviors but also in informing therapy-optimising interventions (Shankar *et al.*, 2003, cited by Amaha *et al.*, 2019). Therefore, this study sought to assess the antibiotic prescribing trends in Windhoek community pharmacies, which could potentially assist in introducing an Antimicrobial Stewardship Programme (ASP) in Namibian private healthcare to combat the irrational use of antibiotics and the consequences thereof.

1.4 Rationale for the study

The rationale for this study is based on Namibia's National Action Plan on Antimicrobial Resistance which highlights the urgent need to address the growing threat of antimicrobial resistance (AMR) in the country (MoHSS, 2017). This challenge is particularly significant in Namibia where irrational medicine use, including the misuse of antibiotics, is prevalent, especially in the private healthcare sector, which serves a substantial portion of the population. Community pharmacies in Windhoek, the capital city play a critical role in dispensing medications, often without the direct oversight of dispensing doctors, making them a key point for assessing antibiotic prescribing practices. The action plan emphasizes the implementation of Antimicrobial Stewardship (AMS) programmes to optimize the use of antibiotics and combat the development of resistant microorganisms. A key focus is improving adherence to Standard Treatment Guidelines, which are often neglected, particularly in the private healthcare sector. By targeting irrational prescribing practices, such as the overuse and misuse of antibiotics, the study aims to contribute to the reduction of AMR, improve public health outcomes, and mitigate the broader impact of AMR on healthcare systems and costs. Assessing antibiotic prescribing practices in community pharmacies in Windhoek is a critical first step in identifying and addressing the irrational use of antibiotics, which is a significant driver of AMR.

1.5 Thesis outline

In summary, this chapter lays the groundwork for the study by introducing the concept of RMU and highlighting the challenges associated with irrational medicine use, especially concerning AMR. It provides the study context, outlines the study setting, and emphasizes the issue of insufficient evaluations of medicine use practices in the private sector. This introduction sets the stage for the following five chapters, which delve into specific prescribing practices within community pharmacies in Windhoek, Namibia.

Chapter two presents an extensive literature review, examining past research on medicine use, antibiotic prescribing practices, and the impact of AMR both globally and within Namibia. Chapter three describes the research methodology, detailing the study's aim and objectives, design, study population, sampling methods, data collection and analysis techniques, as well as the study's validity, reliability, and ethical considerations. Chapters four and five presents the study findings and discussion that offer insights into current prescribing trends and their implications for public health. Finally, chapter six provides conclusions and recommendations aimed at enhancing RMU and addressing AMR in Namibia, potentially contributing to a more effective and sustainable health outcomes.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The WHO documented that over half of all medicines are inappropriately prescribed, dispensed, or sold and that a similar percentage of patients do not follow doctors' recommendations (Ofori-Asenso & Agyeman, 2016; WHO, 2004a). Disastrous repercussions are a high possibility for families if medicines are not used appropriately, especially in LMICs (Cameron *et al.*, 2009; Ofori-Asenso & Agyeman, 2016).

Several surveys on medicine use in Namibia point to the misuse of medicines at all levels of care (Kibuule *et al.*, 2017; Lates & Shiyandja, 2001). Irrational medicine use is a problem not limited to Namibia or LMICs as such but affects the entire world, including high-income countries (HICs) (Holloway & van Dijk, 2011). A good starting step to tackling the irrational use of medicines is to ascertain the magnitude and scope of the problem (Atif *et al.*, 2016; Wendie *et al.*, 2021). In this regard, medicine use assessment and evaluation gained global recognition because medicines play a crucial role in healthcare systems (Atif *et al.*, 2016). To this effect, there have been several studies conducted around the world to evaluate medicine use (WHO, 2004b). One way of identifying and quantifying a medicine use problem is by using the WHO core indicators, prescribing indicators (WHO, 1993; WHO, 2002).

Although Niaz *et al.* (2018) concluded that WHO core indicators showed inaccuracies in assessing prescribing practices in public Primary Health Care (PHC) facilities in Namibia, they concurred that antibiotic prescribing was the only covariate that significantly influenced compliance with Namibia Standard Treatment Guidelines (NSTG). The current study, therefore, explored in depth the current antibiotic prescription trends in community pharmacies in Windhoek. Consequently, global, regional, and local literature on the responsible use of medicines in general, and of antibiotics in particular, was reviewed to provide a basis for this study among the private health care setting in Windhoek, Namibia.

2.2 Prescribing indicators

The World Health Organization, together with the International Network for Rational Use of Drugs (INRUD), developed indicators to measure how healthcare facilities use medicines (WHO, 2002). These were adopted by the WHO member countries, and more than 850 studies globally have been carried out using these indicators (WHO, 2002). The most frequently used indicators are the prescribing indicators. The prescribing indicator framework

is a tool for determining if medicines are being used appropriately (WHO, 1993). There are five key prescribing indicators as follows: the average number of medicines per prescription, which is desired to be between 1.6 – 3.1 (WHO, 1993; WHO, 2002), the proportion of prescriptions with antibiotics, which should be less than 30% of all the prescriptions (WHO, 1993; WHO, 2002), the proportion of prescriptions with injections which should be less than 20% of the total prescriptions (WHO, 1993; WHO, 2002), percentage of medicines prescribed using generic name which should be 100% (WHO, 1993; WHO, 2002), and proportion of medicines prescribed from the essential medicines list which should also be 100% (WHO, 1993; WHO, 2002; Isah *et al.*, 2002).

Studies conducted retrospectively using the WHO prescribing indicators at public primary health centres in China (Dong *et al.*, 2010), a public hospital in Pakistan (Atif *et al.*, 2016) and community pharmacies in Nepal (Ansari, 2017) were able to reveal evidence of irrational use of drugs in those countries mostly manifested in overuse of injections and antibiotics. In Pakistan, a study that retrospectively assessed antibiotic prescription patterns using WHO prescribing indicators and AWaRe categorisation of antibiotics at a private teaching hospital revealed polypharmacy at a mean of six drugs prescribed per encounter, and an excessive usage of antibiotics (72%) (Mushtaq *et al.*, 2021). In Egypt, apart from the percentage of prescriptions with injection and average number of medicines per prescription, all the other prescribing indicators were outside the WHO standard values, according to a public primary healthcare facilities study in Alexandria (Akl *et al.*, 2014). Cross-sectional studies in health centres and in outpatient private community pharmacies in Ethiopia (Bilal *et al.*, 2016; Yimenu *et al.*, 2019; Alehegan *et al.*, 2021), and Cameroon (Chem *et al.*, 2018) that collected prescribing data retrospectively discovered the need to improve on some prescribing indicators most notably the prescribing practice of antibiotics. A combination of both retrospective and prospective studies in a public healthcare facility in Ethiopia found antibiotic prescribing at 73.85 % (Sema *et al.*, 2021) and a systematic review of drug use studies in public healthcare facilities in Ethiopia found all prescribing indicators divergent from the WHO standard values (Mekonnen *et al.*, 2021).

Most of the above studies were predominantly retrospective and mainly conducted in public health facilities. However, the results of a prospective descriptive cross-sectional study using WHO prescribing indicators in six community pharmacies in Eritrea generated findings

similar to findings for studies conducted retrospectively with the most worrisome problem being the overuse of antibiotics (Amaha *et al.*, 2019).

In Nepal, a prospective study at a public teaching hospital showed a high rate of polypharmacy at an average of 5.85 medicines per prescription, high antibiotic prescription (64.1%), high injection use (71%) of patients receiving injections, a very low rate of prescriptions written by generic names (16.94%) of medicines that were prescribed by generic names and prescribing of medicines outside the Essential Medicines List (EML) (47.6%) (Shrestha & Dixit, 2018). Another prospective cross-sectional study in Sudanese hospitals and community pharmacies revealed polypharmacy with an average number of medicines per prescription being 4.18 in hospital pharmacies, 3.87 in community pharmacies, and excessive antibiotic prescribing at a rate of 54 % and 53.7% of prescriptions having an antibiotic in hospital and community pharmacies respectively (Rabie & Kheder, 2020).

In Kenya, a study using WHO/INUD medicine core indicators found an average number of medicines per prescription at 2.9, and 27.7% of medicines were prescribed by generic names. The percentage of prescriptions with antibiotics was 84.8%, the percentage of prescriptions with injections was 24.9%, and the percentage of medicines prescribed from the Kenyan Essential Medicines List was 96.7% (Nyabuti *et al.*, 2020). According to a similar study conducted in a western Ugandan secondary health care hospital, the average number of medicines prescribed was 3.2, reasonably close to WHO standard values for the percentage of medicines prescribed by their generic names and essential medicines at 90.48% and 96.43%, respectively (Goruntla *et al.*, 2023), however, the percentage of prescriptions containing antibiotics at 66.22% and those containing injections at 25.22% were significantly below WHO standard values (Goruntla *et al.*, 2023).

In Zambia, a combined prospective and retrospective study that examined the presence of antibiotics and their use at primary-level health facilities revealed a fair mean of medicines per prescription at 2.94, but generic name use was relatively low (36.7%), and there was a fairly high percentage of prescription with antibiotics at 36.2% (Phiri, 2016).

In Namibia, medicine use indicators remain suboptimal in public health facilities (Kibuule *et al.*, 2017). A review, over an eight-year period, of the effects of standard treatment guidelines on medicine use indicators in public healthcare facilities with limited resources found 2.9 to be the average number of medicines per prescription, 48.1% as the percentage of

prescriptions with an antibiotic, and 74.0% was the percentage of medicines prescribed by generic name (Kagoya *et al.*, 2021). Niaz *et al.* (2018), in their study to validate WHO prescribing indicators, reported below optimal values for most of the indicators, including antibiotic prescribing in Namibia's primary public healthcare facilities. Although their study concluded that it is time to consider indicators other than WHO indicators for studying irrational medicine use, little or no literature on studies of medicine use using WHO prescribing indicators in private healthcare facilities in Namibia is available. There was a low use of generic names (64%), and a high use of antibiotics (69%) among Namibian public healthcare facilities according to a study that interviewed both the prescribers and exiting patients (Niaz *et al.*, 2020).

2.3 Antibiotic use practices

According to Holloway & van Dijk (2011), there is a concern that antibiotics are being misused and overused throughout the world. Although misuse may be greater in LMICs compared to HICs, there are differences in antibiotic use even within HICs. France, for example, was reported to be using nearly three times as many antibiotics as the Netherlands (Goossens *et al.*, 2005 in MSH, 2012). There could also be differences from one country to another within LMICs, as well as differences between the different health sectors within the same country.

When comparisons are made between the different health sectors, most studies find overprescribing of antibiotics worse in the private than the public health sector (Ab Rahman *et al.*, 2016; Mohanta & Manna, 2015, cited by Oluase, 2019). However, most of the research on the misuse of antibiotics and efforts to combat it has been focused on the public sector, with little or no research conducted in the private ambulatory setting (cited by Oluase, 2019). A Nigerian study indicated that 77% of irrational medicine use evaluations occurred in the public sector and only 4.1% of in the private sector (Oluase, 2019). Several studies in public health facilities in Namibia have already revealed a high usage of antibiotics above the WHO-recommended figures (Pereko *et al.*, 2015; Pereko *et al.*, 2016; Nghisheka, 2018; Niaz *et al.*, 2018; Kagoya *et al.*, 2021).

The general rise in antibiotic use is partly attributable to increased access to antibiotics and improved economies (CDDEP, 2015). Unfortunately, the more antibiotics are used the more the risk of developing antimicrobial resistance (CDDEP, 2015; Pereko *et al.*, 2015; Amaha *et al.*, 2019; WHO, 2021). Rational use of antibiotics which WHO refers to as “the cost-

effective use of antibiotics” is paramount because it helps to get the best therapeutic effect from these medicines with minimal adverse effects and AMR (WHO, 2001 as cited by Atif *et al.*, 2016).

It is common for LMICs to use antibiotics inappropriately (Adebayo & Hussain, 2010 cited by Oluase, 2019). Studies in Pakistan (Atif *et al.*, 2016) and Nepal (Ansari, 2017) which are developing countries like Namibia, revealed a very worrying trend in the use of antibiotics. Indications by the WHO show a big problem of medicine misuse in Africa (WHO, 2002), with the excessive use of antibiotics as one of the most worrying problems. With a closer look at the results from Namibia and Botswana, it is evident that Botswana was doing better than Namibia (WHO, 2002) yet the two are comparable in terms of their health systems, population, and economic growth.

In resolving the irrational use of medicines problem, antibiotics inclusive, establishing its size and predisposing factors is a key step (Holloway & van Dijk, 2011; Oluase, 2019). In Namibia, there are not so many studies that have been carried out about antibiotics misuse, especially by evaluating and analysing the prescribing practices. Nonetheless, all the few studies that have been conducted reveal irrationality, most notably the overuse of antibiotics. A study by Pereko in 2015 showed that 80% of the respondents (n = 446) reported having used antibiotics in the past year, especially for flu and cold symptoms (Pereko *et al.*, 2015; Pereko *et al.*, 2016). However, Namibia is not the only country to use antibiotics for self-limiting upper respiratory tract infections. Most use of antibiotics in Nigeria and Uganda was for such viral infections (Oluase, 2019). In neighboring Zimbabwe, widespread irrational prescribing and high use of antibiotics among medical professionals were revealed among the drug use problems (Dixon *et al.*, 2020). An analytical cross-sectional survey by Nakwatumbwa *et al.* (2017) indicated that penicillins were the most prescribed antibiotics at a national referral hospital in Namibia and compliance with the Namibia Standard Treatment guideline was sub-optimal. A study in other public primary healthcare facilities also revealed non-compliance to the Namibia Standard Treatment Guidelines (NSTG) (Niaz *et al.*, 2018). In a web-based cross-sectional survey, results revealed high antibiotic usage and a low consideration of local antimicrobial sensitivity and non-adherence to NSTG (Pereko *et al.*, 2015). In the same survey, it was concluded that prescribers in the private sector are less regulated in how they choose medicines (Pereko *et al.*, 2015). None of these studies used

patients' prescriptions. The current study may give another insight into the medicine use problems, particularly antibiotic use in Namibia.

2.3.1 Antibiotic Use and Antimicrobial/Antibiotic Resistance

As a result of the discovery of penicillin in the late 1920s by Alexander Fleming, the practice of medicine has been profoundly altered. Since the invention of antibiotics, millions of lives have been saved, and infectious diseases have been prevented prophylactically. Despite this, many antibiotics no longer work and are ineffective. As a public health issue of this century, antimicrobial resistance poses a threat to modern medicine (Sartelli *et al.*, 2017, cited by Sartelli *et al.*, 2020). As microorganisms evolve, antimicrobial resistance occurs naturally, but human activities have changed how rapidly resistant bacteria develop and spread (Septimus *et al.*, 2011, cited by Sartelli *et al.*, 2020). Among the factors contributing to AMR are both inadequate infection control measures and inappropriate antibiotic use (Sartelli *et al.*, 2020). It is well established that the ways in which antibiotics are prescribed and the rate which resistant microorganisms emerge are interlinked (Sartelli *et al.*, 2020). Antibiotic misuse and abuse play a key role in the isolation of resistant microorganisms in patients, and to the global spread of AMR (Sartelli *et al.*, 2020).

There has been an increase in antibiotic usage in LMICs due to rapid economic development and greater access to antibiotics (Van Boeckel *et al.*, 2014). In addition, communicable and noncommunicable diseases are prevalent throughout sub-Saharan Africa (Campbell *et al.*, 2021; Fenollar, 2018). A growing number of infections originate in Africa, as do rising rates of AMR caused by inappropriate and excessive use of antimicrobials (Fenollar, 2018; Tadesse *et al.*, 2017). AMR has catastrophic consequences. For example, according to estimates, bacterial AMR directly caused 1.27 million deaths in 2019, with a total of 4.95 million deaths potentially caused by bacterial AMR (Murray *et al.*, 2022).

Due to a large number of infectious diseases, Namibians use excessive amounts of antibiotics (Nkwatumbah *et al.*, 2017). An analysis of antibiotic usage in Namibia found that females, people living in urban centres, and those aged 18–45 had higher antibiotic usage, and yet over 80 percent were broad-spectrum penicillins, macrolides, and cephalosporins, which may contribute significantly to resistance patterns (Pereko *et al.*, 2016). Although Namibia has a robust system and policies to ensure that medicines are used properly, antibiotic use

indicators remain suboptimal according to another 2016 medicine use survey, which identified azithromycin, cotrimoxazole, and amoxicillin as the most commonly used medicines in 2016 but also noted that those medicines, however, were facing increasing resistance (55.9%-96.7%) (Kibuule *et al.*, 2016). In another Namibian study at Katutura Health Center, the antibiotic prescribing rate in patients with upper respiratory tract infections (URTIs) was 78% (Kunda, 2014). It is a matter of great concern since 80% of URTIs infections are viral, requiring no antibiotic treatment (Mazur, 2010).

Excessive use of antibiotics is not unique to Namibia. In Tanzania, antibiotic use was higher than the WHO recommended with penicillin accounting for just under half of all prescribed antibiotics compared with other antibiotic groups (Mdoe *et al.*, 2018; Kilipamwambu *et al.*, 2021). In Botswana, antibiotic prescribing rates overall were high at 42.7%, with the number of antibiotics prescribed ranging between 1 – 4 (Marshalla *et al.*, 2017).

Furthermore, the COVID-19 pandemic exacerbated the overuse and misuse of antibiotics, although bacterial superinfections rarely complicate this problem (Moja *et al.*, 2024). This is evidenced by an increase in the prescribing of azithromycin and ceftriaxone among adults associated with the peak of COVID-19 cases (Nandi *et al.*, 2022, cited by Moja *et al.*, 2024).

A South African publication noted an increase in resistance of infectious organisms across all levels of care in 2005, with tertiary care facilities experiencing the highest rates (Essak *et al.*, 2005). In Namibia, reduced susceptibility to penicillinase-resistant penicillins and cephalosporins by staphylococcus aureus was documented (Simeon, 2022). However, AMR problem can be reduced by prudent antibiotic use (CDC, 2012). Especially in LMICs, where other challenges might aggravate the problem, physicians must comply with antibiotic prescribing standard practices (Sartelli *et al.*, 2020).

2.3.2 Antimicrobial Stewardship Programme and WHO AWaRe approach

In any ASP, antibiotics must be used appropriately in order to decrease the risk of AMR emerging and spreading, and to ensure optimal clinical practice and patient safety (Sartelli *et al.*, 2020). Even though medical professionals alone cannot control AMR, they never-the-less play a pivotal role in containing the problem (Sartelli *et al.*, 2020). In HICs and LMICs alike, antibiotic misuse and overuse are common problems and, since LMICs experience the

greatest levels of antibiotic abuse, the need to formulate, communicate, and adopt rigorous antimicrobial policies is more pressing in these countries (Sartelli *et al.*, 2020).

In the past, WHO used indicators such as the percentage of prescriptions with an antibiotic, with a reference cut-off of <30% (Ofori-Asenso *et al.*, 2016). However, it is difficult to evaluate progress in prescribing appropriate antibiotics based on these results since they do not consider the indication, how severe is or is not the infection, or whether the patient belongs to a special-risk group (Sharland *et al.*, 2022). To address these limitations, the WHO introduced the AWaRe classification, which stands for Access, Watch, and Reserve. The AWaRe tool categorizes antibiotics into three groups (WHO, 2019; Moja *et al.*, 2024):

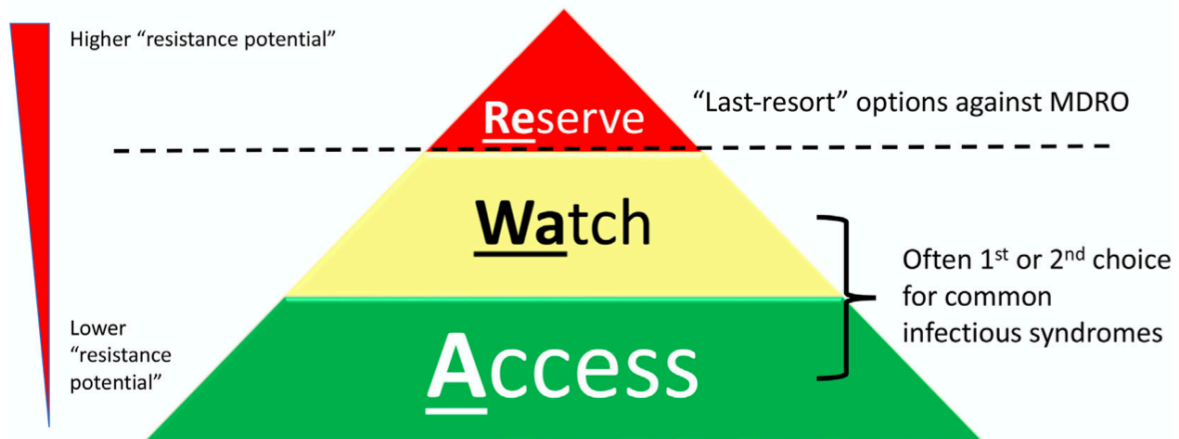
1. 'Access': These are antibiotics that should be widely available, affordable, and of high quality. They are considered first- or second-choice treatments for a variety of common infections. Examples include amoxicillin, amoxicillin/clavulanic acid combination, doxycycline, metronidazole, among others (WHO, 2019; MoHSS, 2016).
2. 'Watch': This group includes antibiotics that have a higher potential for resistance. They should be prescribed more cautiously and are typically used for specific infections. Examples include cefuroxime and most third and all fourth generation cephalosporins, azithromycin, clarithromycin, ciprofloxacin, among others (WHO, 2019; MoHSS, 2016).
3. 'Reserve': These antibiotics are considered last-resort options, to be used only in severe cases where other treatments have failed, to preserve their effectiveness for critical situations. Examples include meropenem-meropenam, fosfomycin injection, minocycline injection, among others (WHO, 2019; MoHSS, 2016).

For more information, you can refer to the WHO's Essential Medicines List and the AWaRe classification tool available at the following links: (WHO Essential Medicines List 2023) <https://www.who.int/publications/i/item/WHO-MHP-HPS-EML-2023.04> and (AWaRe classification list) <https://aware.essentialmeds.org/list>:



AWaRE : Antibiotics are categorized into three groups

Essential Access, Watch and Reserve antibiotics need to be equally accessible and affordable for those who need them



The traffic light WHO AWaRe categorization approach.

Figure 1: AWaRE classification (Adapted from Moja et al., 2024)

According to published studies in South Africa, antibiotics were prescribed to patients with acute respiratory infections in an appreciable percentage, ranging from 52.9% to 78% or more in different health sectors. However, most antibiotics prescribed, even when inappropriate, belonged to the 'Access' group of antibiotics within the AWaRE classification rather than to the 'Watch' group (Chigome *et al.*, 2023). Inappropriate antibiotic prescribing in primary care is worsened by the lack of latest knowledge regarding evidence-based antibiotic practices among physicians and patients alike (Chigome *et al.*, 2023).

The 'Watch' antibiotics have a greater risk of resistance and side effects, so healthcare professionals across all sectors need to be cautious when prescribing them (Murray *et al.*, 2022). This aligns with the recommendations in the AWaRE report (Sharland *et al.*, 2022). As an international goal, the WHO recommended a minimum of 60 percent of antibiotics prescribed to be from the 'Access' class by 2023 (Sharland *et al.*, 2022). Antibiotic 'Reserves' are the last option for treating multidrug-resistant bacteria infections, which is a key objective of antimicrobial stewardship campaigns (Moja *et al.*, 2024). By improving antibiotic use, ASP reduces resistance to antibiotics (Akpan *et al.*, 2024).

However, in Nigeria, while approximately 57% of medical professional participants in a study knew what antimicrobial stewardship meant, over half of them could not correctly identify the description of AMS, and AMS was available in only 47% of the hospitals. In the same study, 79% of the participants did not know about the AWaRe classification of antibiotics, and only 20.9% of those who knew about it could correctly classify antibiotics into the AWaRe categories (Akpan *et al.*, 2024). To reduce antimicrobial resistance, educational interventions targeted at healthcare professionals from different cadres are necessary (Akpan *et al.*, 2024).

In Zambia, the majority of healthcare workers (HCWs) (90.6%) said their hospitals had multidisciplinary antibiotic management teams and used the WHO AWaRe classification (Mudenda *et al.*, 2024). In another Zambian study, it was revealed that in 99.2% of the cases, antibiotics were used, and 40.9% of them were used appropriately (Ngoma *et al.*, 2024).

In conclusion, this literature review highlights the pervasive issue of inappropriate medicine use globally, with a particular focus on the misuse of antibiotics. The studies reviewed underscore the widespread nature of this problem, affecting both LMICs and HICs alike. Despite the existence of WHO prescribing indicators designed to measure and improve the rational use of medicines, many countries and healthcare settings still fall short of these standards. The overprescribing of antibiotics, in particular, emerges as a significant concern, with studies indicating higher rates of misuse in private healthcare sectors compared to public ones. This review also identifies a gap in the literature regarding the use of WHO prescribing indicators in private healthcare facilities in Namibia, suggesting a need for further research in this area. Overall, the findings emphasize the critical need for ongoing efforts to monitor and promote the rational use of medicines, particularly antibiotics, to mitigate the potential individual and societal risks associated with their misuse.

CHAPTER 3: METHODOLOGY

3.1 Aim of the study

The study aimed to assess prescribing practices in community pharmacies in Windhoek, Namibia, with a focus on antibiotics.

3.2 Objectives of the study

1. To determine the prescribing practices in community pharmacies in Windhoek.
2. To determine the antibiotic prescribing practices in the community pharmacies in Windhoek.
3. To assess the level of compliance with WHO-AWaRE guidelines for antibiotic use in community pharmacies in Windhoek.

3.3 Study design

The design was a retrospective cross-sectional study in which community pharmacy prescribing practices, with an emphasis on antibiotics, were assessed. The study was based on WHO-standardised methodologies, tools, and indicators (WHO, 1993). The WHO/INRUD prescribing indicators offer a standardised framework for evaluating prescribing practices, allowing for consistent and comparable assessments across various healthcare settings. This standardisation is particularly crucial in Windhoek's community pharmacies, which serve Namibia's private health sector, where practices may vary widely and no study has yet been conducted using WHO/INRUD prescribing indicators. Moreover, these indicators capture multiple aspects of prescribing, such as the average number of medicines per encounter, the percentage of medicines prescribed by generic name, and the percentage of encounters with an antibiotic prescribed. This comprehensive approach helps identify specific areas needing improvement, such as the over-prescription of antibiotics or the underuse of generic medicines.

By employing internationally recognized indicators, Namibia can benchmark its private sector prescribing practices against global standards. This comparison can pinpoint areas where Namibia aligns with or deviates from best practices, guiding targeted interventions. The WHO/INRUD indicators emphasize rational medicine use, which is essential for improving health outcomes and reducing unnecessary healthcare costs. In the private sector, where profit motives might influence prescribing practices, these indicators help ensure that patient care remains the priority. Overall, utilizing WHO/INRUD prescribing indicators in

Windhoek's community pharmacies provides a robust framework for assessing and improving prescribing practices within the private health sector, ultimately enhancing the quality of healthcare delivery. In addition, this design was considered appropriate for this study because prescription copies are readily available and easily accessible in all community pharmacies in Namibia, as the law mandates that these records should be kept and retained for at least three years after the date of dispensing (Medicines and Related Substance Control Act, 2003).

3.4 Study population

The study population included all 71 community pharmacies in Windhoek (Choi *et al.*, 2015; HPCNA, 2020), provided they had been in existence for at least one year at the time of data collection. These were the primary sampling units. All prescriptions dispensed during the study period, from 1st September 2022 to 31st August 2023, were included in the secondary sampling units.

3.4.1 Inclusion criteria for prescriptions

Prescriptions for medicine items, from 1st September 2022 to 31st August 2023 regardless of gender, age, and diagnosis were included in the study.

3.4.2 Exclusion criteria for prescriptions

The study excluded prescriptions for pharmaceutical items other than medicines.

3.5 Sampling

A multi-stage sampling method was employed in two stages where: stage one was for the selection of community pharmacies, and stage two was for selecting prescriptions in the sampled pharmacies.

3.5.1 Community pharmacies

Twenty-five (25) pharmacies were selected for this study using a stratification technique based on three areas in the city of Windhoek - Central Business District (CBD), Suburbs, and Townships. Using online information obtained from <https://www.brabys.com/na/namibia/windhoek/pharmacies> (accessed on 13th September 2022), the distribution ratio of pharmacies in Windhoek is approximately 3:2:1 between the CBD, Suburbs, and Townships respectively. Therefore, for this study, 13 pharmacies were selected from the CBD, 8 from the Suburbs, and 4 from the Townships. According to the WHO recommended methodology for studying drug use indicators, at least 20 facilities

should be used (WHO, 1993) hence, 25 community pharmacies for this study extended this recommendation. The pharmacies were selected randomly by putting the names of all the pharmacies in a respective area in a hat and then pulling at the required numbers for each area as detailed above. If any pharmacies declined to participate in the study, they were replaced by another pharmacy by drawing a new name from the hat.

3.5.2 Prescriptions

To select the prescriptions from each participating pharmacy's files, a systematic random method was employed. After separating the prescriptions written for the past year, 108 representative prescriptions (9 prescriptions per month) were systematically randomly selected in each participating pharmacy using an interval based on the total of prescriptions for that period. This gave a total prescription encounter of 2700 which is above the minimum 600 (20 facilities, 30 encounters in each) encounters recommended by WHO (WHO, 1993) and was within the resources of the researcher for this mini-thesis project.

3.6 Data collection

The data was collected at community pharmacies, in a secluded area away from the dispensary, by reviewing the prescription files for the past year. The prescribing data from each sampled prescription was assessed and recorded on two forms: a WHO/INRUD Prescribing indicator form (WHO, 1993) (Appendix 1) - a standard data collection form recommended in the assessment of medicines use, and an antimicrobial data collection tool developed for this study using the WHO Antimicrobial Resistance Stewardship criteria to capture the antibiotic use patterns (Appendix 2).

Two research assistants (locum Pharmacist Assistants) were recruited through the help of the Pharmaceutical Society of Namibia Secretariat and were trained for one day by the researcher (who is a registered practicing pharmacist in Namibia) on how to use the two data collection tools. After the training, the research assistants pre-tested the data collection tools in two community pharmacies (from two different areas of the city of Windhoek) not selected as part of the study to make sure that they understood how to use the tools and to ensure that the tools captured all the desired data for the study. The pre-test also provided insights into the data collection processes, since the two community pharmacies, like the rest of the pharmacies in Windhoek, follow the same operational regulations of the Pharmacy Council of Namibia.

In the build-up to data collection, the researcher visited potential pharmacies and met respective managers or in-charges to ask if they would be willing to participate. Informed consent was obtained in writing from each of the willing pharmacies. Each day during data collection, each of the research assistants and the researcher visited different individual participating pharmacies. For every participating pharmacy, the operational manager for the day was approached and requested for the prescription files for the intended period, 1st September 2022 to 31st August 2023, and for a secluded area from where prescriptions could be analysed for data.

3.7 Data management and analysis

After each pharmacy's data collection session, the researcher meticulously reviewed the data collection tools to ensure completeness. The collected data were then entered into an IBM SPSS spreadsheet, with all variables clearly labeled for accurate analysis. The researcher performed a thorough counter-check of the entered data, implementing data cleaning procedures as necessary to ensure accuracy and consistency.

For the coding of antibiotics according to the WHO AWaRe classification, the researcher followed a systematic approach. Each antibiotic listed in the data was identified by its name and then matched to its corresponding class. The WHO AWaRe classification system (WHO, 2019), which categorises antibiotics into Access, Watch, and Reserve groups, was used to assign each antibiotic to the appropriate category. This classification helps in understanding the usage patterns and stewardship of antibiotics.

The coding process involved cross-referencing each antibiotic with the latest WHO AWaRe list (WHO, 2019) to ensure accuracy in classification. This step was crucial for identifying the distribution of antibiotic use across the Access, Watch, and Reserve categories and determining the antibiotic class. The researcher also recorded additional details such as the number of antibiotics, the duration of antibiotic use, and any relevant notes about the prescribing context.

Data analysis was facilitated by the most recent version of the Statistical Package for Social Sciences (IBM SPSS Statistics 28.0). The WHO prescribing indicators were analyzed, focusing on antibiotic use variables such as name, class, number, duration, and WHO AWaRe classification. Descriptive statistics, including frequencies, averages, and percentages, were employed to summarise the data and provide insights into prescribing

patterns. This comprehensive analysis allowed for a detailed understanding of antibiotic use in the study population, highlighting areas for potential improvement in prescribing practices.

3.8 Validity

Validity was ensured so that the results of the study are reproducible. This was achieved by making sure that the sampling procedures explained above were adhered to in order to reduce or prevent selection bias. The study also used data collection tools adapted from validated WHO tools (WHO, 1993; MacDougall & Polk, 2005; WHO, 2019) to make sure that valid data is obtained.

The research assistants used in this study were Pharmacist Assistants who have knowledge of medicines and were trained over one day by the researcher to ensure that they were familiar with the use of the study's data collection tools. In addition, the tools were pre-tested by the trained research assistants to make sure that the required data was captured, and measurement bias was minimised.

3.9 Reliability

The prescription files were scrutinised for data in a secluded area away from the dispensing area to give the research assistants ample time to concentrate on the data they were capturing.

Reliability of the study was assured by periodic observations of the research assistants as they capture the data and counterchecking their data collection forms by the researcher for data completeness and quality (WHO, 1993).

Although the research assistants were trained and first participated in a pilot study, they carried with them a procedure document showing them how to chronologically arrange the prescriptions and systematically select cases for the sample and also reminding them of the definition of antibiotics and generic names for the study to avoid introducing in unwanted biases (WHO, 1993).

Furthermore, the researcher and the two research assistants maintained an active WhatsApp group for the three throughout the data collection period where the classification of medicines and or their EDL/NEMLIST statuses would be confirmed by the researcher if the research assistants were not sure by reference to the NEMLIST (MoHSS, 2016).

3.10 Ethical considerations

Ethical approval was obtained from the University of the Western Cape Biomedical Research Ethics Committee (BMREC Reference Number: BM22/10/36) (Appendix 8), and the Namibian MOHSS's Department of Research granted authorisation for this study to be conducted in community pharmacies in Windhoek (Appendix 9).

The information sheet for this study (Appendix 3) was shared with the potential participating pharmacies. In addition, the study aim and objectives were explained to the pharmacy managers and/or proprietors by the researcher so that he could obtain informed written consent for their participation in the study (Appendix 4). The researcher also explained and made it clear to the consented participating pharmacies that it was their right to withdraw from the study at any time without any consequences thereof.

This study did not involve patients directly. Nonetheless, prescription information may be sensitive and confidential hence the two research assistants for this study were registered Pharmacist Assistants with pharmacy ethical obligations and were further trained in the handling of prescriptions during this study to avoid possible breaching of confidentiality.

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), no personal or prescriber information was collected and processed for this study, except the name of the pharmacy and the name of the in-charge consenting on its behalf. These names are only accessed by the researcher and do not appear in the study results/report. The code numbers that were assigned to the different pharmacies by the researcher during data entry appear in the results/report.

Careful measures were taken to treat all the data obtained during this study with confidentiality. The data collection tools containing raw data were locked up in a cupboard accessed by only the researcher, who did the computer data capture himself using his personal computer. The computer is password protected with only the researcher knowing the password, but in addition, the data files were encrypted. A 5-year period will be allowed for the data to be discarded after the study is completed. Hard copies of the documents will be shredded, and computer data will be permanently erased.

The study's final report will be shared and discussed with all the stakeholders from the Namibian MOHSS, including Pharmaceutical Services and the private health sector service providers through a dissemination channel that shall be advised by the ministry.

CHAPTER 4: RESULTS

4.1 Introduction

In this chapter, two major sections present the findings of a retrospective cross-sectional study that reviewed 2700 prescriptions in 25 community pharmacies in Windhoek to determine prescribing practices using WHO prescribing indicators and further examine antibiotic prescribing practices.

The first section presents general prescribing practices. Initially, the general characteristics of the sampled prescriptions are presented before a summary of the WHO/INRUD prescribing indicators is presented to give an overall picture of the study findings. After that, the prescription indicators are unpacked in more detail as follows: distribution of the different numbers of medicines on prescriptions and the frequency of medicines prescribed by generic names per prescription.

The second section presents antibiotic prescribing practices. Here, a summary of the numbers of antibiotics prescribed per prescription is presented first, followed by a summary of the prescribed and dispensed durations of antibiotics, followed by the frequency of the most common antibiotics prescribed, the frequency of the most common classes of the prescribed antibiotics, and lastly the frequency of the most commonly prescribed antibiotics by WHO AWaRe classification.

4.2 General prescribing practices

4.2.1 Characteristics of the sampled prescriptions

Table 1 below presents the characteristics of prescriptions collected from community pharmacies in Windhoek. The analysis shows that a significant majority of the prescriptions were non-repeat prescriptions, and were for adults.

Table 1: Characteristics of prescriptions from community pharmacies in Windhoek (n=2700)

Prescription Type	Frequency (n)	Percentage (%)
Non-repeat prescription	2622	97.1
Repeat prescription	78	2.9
Age of Patient		
Adult	2077	77
Child (≤ 12 years)	623	23

4.2.2 Prescribing indicators in community pharmacies in Windhoek

Table 2 below summarises the WHO prescribing indicators analyzed across the 25 pharmacies. In total, 8282 medicines were prescribed on 2700 prescriptions. The average number of medicines per prescription was notably higher than the WHO optimal value, with only a small percentage prescribed by generic name. Additionally, a substantial portion of prescriptions included antibiotics, and a limited percentage of medicines were from the Essential Medicines List (NEMLIST).

Table 2: Summary of prescribing indicators from community pharmacies in Windhoek (n=2700)

Prescribing Indicator	Average/ Percentage	WHO/INRUD optimal value (WHO, 1993, 2002)
Average number of medicines per prescription	3.1	<2
Percentage of medicines prescribed by generic name	6.9%	100%
Percentage of prescriptions with antibiotics	38.6%	≤30%
Percentage of prescriptions with injection	2.3%	≤20%
Percentage of medicines from EDL/NEMLIST	38.5%	100%

Table 3 below highlights the distribution of medicines per prescription, revealing that a large portion of prescriptions contained multiple medicines, with a significant number having three or more.

Table 3: Number of medicines per prescription in community pharmacies in Windhoek (n=2700)

Number of medicines/prescription	Frequency (n)	Percentage (%)
1	486	18.0
2	594	22.0
3	608	22.5
4	519	19.2
5	332	12.3
6	106	3.7
7	32	1.2
8	20	0.7
9	2	0.1
10	1	0.0

Table 4 below indicates that the majority of prescriptions did not include any medicines prescribed by their generic names, underscoring an area for potential improvement in prescribing practices.

Table 4: Number of medicines prescribed by generic name per prescription in community pharmacies in Windhoek (n=2700)

Generic name(s) of medicines/prescription	Frequency (n)	Percentage (%)
0	2249	83.3
1	351	13.0
2	84	3.1
3	12	0.4
4	3	0.1
5	1	0.0

4.3 Antibiotic prescribing practices

As reported in the general prescribing practices section above, 38.6% (n=1043) of the 2700 prescriptions had at least one antibiotic prescribed. This section describes the prevailing antibiotic prescribing habits in more detail.

In total, 1178 antibiotics were prescribed from 1043 prescriptions. Table 5 below shows that most prescriptions with antibiotics had only one antibiotic, while a smaller percentage included multiple antibiotics.

Table 5: Number of antibiotics per prescription with antibiotic in community pharmacies in Windhoek (n=1043)

Number of antibiotics	Frequency (n)	Percentage (%)
1	933	89.5
2	89	8.5
3	17	1.6
4	4	0.4

Table 6 below lists the most frequently prescribed antibiotics, with Co-amoxiclav being the most common, followed by azithromycin and amoxicillin.

Table 6: Most common antibiotics prescribed in community pharmacies in Windhoek (n=1178)

Name of antibiotic	Frequency (n)	Percentage (%)
Co-amoxiclav (amoxicillin/clavulanate)	358	30.4
Azithromycin	219	18.6
Amoxicillin	120	10.2
Ciprofloxacin	118	10.0
Metronidazole	110	9.3
Cefuroxime	85	7.2
Clarithromycin	65	5.5
Doxycyclin	29	2.5
Cefpodoxime	25	2.1
Fosfomycin (Urizone)	12	1.0
Cloxacillin	8	0.7
Ceftriaxone	7	0.6
Cefixime	6	0.5
Clindamycin	5	0.4
Nalidixic acid	2	0.2
Nitrofurantoin	2	0.2
Erythromycin	2	0.2
Moxifloxacin	2	0.2
Ampicillin + cloxacillin (Ampiclox)	1	0.1
Cotrimoxazole	1	0.1
Levofloxacin	1	0.1

Table 7 below categorises antibiotics by class, with penicillins being the most frequently prescribed class, followed by macrolides and fluoroquinolones.

Table 7: Most common classes of antibiotics prescribed in community pharmacies in Windhoek (n=1178)

Class of antibiotic	Frequency (n)	Percentage (%)
Penicillins	487	41.3
Macrolides	285	24.2
Fluoroquinolones	122	10.4
Nitromidazoles	111	9.4
2 nd Generation Cephalosporins	85	7.2
3 rd Generation Cepharosporins	39	3.3
Tetracyclines	29	2.5
Phosphonics	12	1.0
Lincosamides	5	0.4
Nitrofurantoin	2	0.2
Trimethoprim + Sulphonamide	1	0.1

Finally, table 8 below presents the distribution of the 1178 prescribed antibiotics that were coded into “Access”, ‘Watch’, and ‘Reserve’ according to the WHO AWaRe classification (WHO, 2019), highlighting that the majority were from the Access and Watch categories, with very few from the Reserve class.

Table 8: Prescribed antibiotics in community pharmacies in Windhoek by WHO AWaRe classification (n=1178)

WHO AWaRe class	Frequency (n)	Percentage (%)
Access	636	54.0
Watch	518	44.0
Reserve	23	1.9
Not Recommended	1	0.1

CHAPTER 5: DISCUSSION

5.1 Introduction

In general, rational prescribing plays a key role in the rational use of medicines, especially in LMICs. This retrospective cross-sectional descriptive study, which analysed 2700 prescriptions from 25 community pharmacies, with a cumulative total of 8282 medicines, was designed to examine prescribing practices in community pharmacies in Windhoek, Namibia, according to WHO/INRUD prescribing indicators, and with a focus on the antibiotics use practices. The study findings are expected to provide insights into how private healthcare providers prescribe medicines, particularly antibiotics, and will serve as the basis for developing evidence-based recommendations to mitigate the misuse of medicines with an emphasis on prudent antibiotic prescribing by private healthcare providers. As far as polypharmacy, generic name prescribing, antibiotic and injection usage, and essential medicines prescribing practices are concerned, this study was generally consistent with published literature from LMICs. However, when compared to most studies conducted in public healthcare, the use of antibiotics in the AWaRe category was significantly different. This chapter discusses prescribing practices before discussing in detail how private healthcare providers in Windhoek, Namibia prescribe antibiotics.

5.2 Prescribing practices

This study used the WHO/INRUD prescribing indicators to assess private healthcare providers' prescribing practices. The indicators examined included the average number of medicines per prescription, the percentage of medicines prescribed by generic names, the percentage of prescriptions with antibiotics, the percentage of prescriptions with injections, and the percentage of medicines prescribed from the EDL (Namibia Essential Medicines List – NEMLIST). The study revealed that private healthcare facilities were prone to irrational medicine use, as evidenced in the study results in the previous chapter.

Based on this study's findings, the average number of medicines per prescription in Windhoek community pharmacies (3.1) was suggestive of poly-pharmacy practices. A benchmark of fewer than 2.0 medicines per prescription is recommended by the World Health Organisation (WHO, 2012; WHO 1993), and although Namibia's target is the same,

according to the MOHSS, an average of 2.5 medicines per prescription is acceptable (Niaz *et al.*, 2018), which is still below the value found by the study. Similar studies in Namibia's public healthcare facilities revealed medicines per prescription averages of 3.0 ± 1.1 (Niaz *et al.*, 2020) and 2.9 ± 0.1 (Kagoya *et al.*, 2021), higher than the WHO's recommended number. This study's findings are similar to that in rural community pharmacies in India, which was 3.7 (Aravamuthan *et al.*, 2017) but different from those of a prospective study in Eritrean community pharmacies (1.76) (Amaha *et al.*, 2019). However, all six community pharmacies in which the Eritrean study was conducted were government-owned, unlike all the privately owned community pharmacies in Windhoek in which this study was conducted. This, along with other study setting differences, may account for the disparity in findings, although both studies were conducted in community pharmacies. A more comparable Ethiopian study conducted in private community pharmacies, reported an average of 1.77 medicines per prescription (Anagaw *et al.*, 2023), suggesting that polypharmacy in private community pharmacies in Windhoek may stem from the availability of medical aid and that practitioners may wish to prescribe higher numbers of medicines to increase sales.

The findings from public health facilities in other LMICs on the continent, such as Zambia, Kenya, Uganda, Sudan, and Nigeria, also revealed polypharmacy practices in those countries (Phiri, 2016; Nyabuti *et al.*, 2020; Goluntla *et al.*, 2023; Rabie & Kheder, 2020; Olalere, 2011). Researchers have reported similar findings from the Asian continent in Cambodia, India, Nepal, and Pakistan, as well as from other African countries such as Burkina Faso, Ethiopia, and Morocco, where medicines were prescribed at an average between 2.2 to 4.8 per prescription (WHO, 2006). According to American studies, children were prescribed 2.7 medicines per prescription on average, indicating worldwide concerns regarding medicine use (WHO, 2006). Nonetheless, studies from other Asian countries like Lebanon and Bangladesh reported rational antibiotic prescribing of not more than 1.6 medicines per prescription (WHO, 2006). Polypharmacy signals the need for education among prescribers (WHO, 1993). Prescriptions that exceed two medicines per patient encounter are more likely to result in drug interactions, dispensing errors, and confusion among patients regarding dosage schedules (WHO, 2006).

This study's low percentage of medicines prescribed by generic name (6.9%) is alarming, as it contradicts global best practices advocating for generic prescribing to enhance accessibility and reduce healthcare costs (WHO, 2002). This finding is also significantly lower from

previous studies in Namibia's public health sector, which reported prescribing by generic names to be 74.0% (Kagoya *et al.*, 2021), and 64% (Niaz *et al.*, 2020). Lower rates were found in a similar study in rural community pharmacies in India, where only 2.5% of the medicines were prescribed by generic name (Aravamuthan *et al.*, 2017). However, the study's findings are significantly lower compared to a study from government-owned community pharmacies in Eritrea, which found prescribing by generic names at 83.14% (Amaha *et al.*, 2019).

Generally, this study's findings were consistent with those from other LMICs. Public sector studies from Asian countries such as India, Lebanon, Nepal, and Pakistan, as well as African countries such as Ghana, Ethiopia, Zambia, Kenya, and Uganda, reported a wide range of prescribing with generic names, from 2.9% to 90.4% (WHO, 2006; Phiri, 2016; Nyabuti *et al.*, 2020; Goluntla *et al.*, 2023). It appears from this study that the private pharmaceutical industry may exert considerable influence over prescribing in the private sector, whereby prescribing doctors are swayed by pharmaceutical distributors to prescribe specific brands. This practice can make medicines more expensive if highly priced brands are prescribed and may mislead practitioners into thinking that certain medicines are unavailable at the facility (WHO, 2006).

According to this study's findings, prescribing using generic names in community pharmacies in Windhoek was 92.1% below the WHO optimal value. It is documented that medicines are more affordable and easier to manage when prescribed using generic names, and it also improves their accessibility and availability (WHO, 2002). The WHO, therefore, recommends that all medicines (100%) should be prescribed by generic names (WHO, 1993; Isah *et al.*, 2002; WHO, 2012).

A concerning finding of this study was the significant number of prescriptions (38.6%) that contained antibiotics, which is above the WHO recommended threshold of 30% and Namibia's target of 25% (WHO, 1993; WHO, 2002; Isah *et al.*, 2002; Niaz *et al.*, 2018). This over-prescribing of antibiotics is a growing concern, as it contributes to antibiotic resistance, a critical public health issue (Sartelli *et al.*, 2020). Although the finding was lower than the 69% antibiotic prescribing found in Namibia's public health facilities (Niaz *et al.*, 2020), it was higher than that of a similar study in rural community pharmacies in India, which found that 22% of prescriptions had antibiotics (Aravamuthan *et al.*, 2017). However, a prospective study in Eritrea that also used prescribing indicators in government-owned community

pharmacies found antibiotic use at 53.1% (Amaha *et al.*, 2019), a figure far higher than this study's findings in Windhoek, Namibia. Additionally, a similar study in private community pharmacies in Ethiopia found antibiotic usage very high at 71% (Anagaw *et al.*, 2023) compared to this study's finding.

According to other studies conducted in public health facilities in India, Cambodia, Morocco, Ethiopia, Ghana, and Nigeria, antibiotic use ranged between 47.5% and 100% (WHO, 2006). In contrast, Bangladesh, Lebanon, Nepal, and Tanzania prescribed antibiotics less frequently, ranging from 17.5% to 35.4% (WHO, 2006). Similarly, Mexico, Canada, and the USA reported higher percentages of antibiotic usage at 77%, 74%, and 43%, respectively (WHO, 2006), indicating a worldwide antibiotic use problem across LMICs and HICs. In other Indian studies, the figure was reported as 64%, and in Nigeria, Indonesia, Bangladesh, and Pakistan, it was reported as 58% to 96% (WHO, 2006). More studies in China, Pakistan, and Nepal (Dong *et al.*, 2010; Atif *et al.*, 2016; Ansari, 2017) also revealed higher than WHO-recommended percentages of antibiotic use, as did studies from other African LMICs like Zambia, Kenya, Uganda, Sudan, Nigeria, Ethiopia, South Africa, and Botswana (Phiri, 2016; Nyabuti *et al.*, 2020; Goluntla *et al.*, 2023; Rabie & Kheder, 2020; Olalere, 2011; Sema *et al.*, 2021; Chigome *et al.*, 2023; Tiroyakgosi *et al.*, 2018).

However, studies that use WHO core medicine use indicators have limitations. Many core issues outside the coverage of prescribing indicators affect the quality of patient examinations and treatment (WHO, 2006). About half of antibiotics prescribed worldwide are not necessarily appropriate (WHO, 2006). Thus, this study explored in detail the antibiotic prescribing practices in private health facilities in Windhoek, as will be discussed in the next section.

The percentage of prescriptions containing injections (2.3%) was within acceptable limits set by both WHO and Namibia (WHO, 1993; WHO, 2002; Niaz, *et al.*, 2018), indicating a cautious approach to injectable medications. Injection use does not seem to be a big medicine use problem in Namibia, although some studies have found it to be relatively higher in the public health sector (10.8%) (Niaz *et al.*, 2020). Researchers found that injection prescribing in Eritrea's government-owned community pharmacies was 7.8% (Amaha *et al.*, 2019), similar to the percentage of prescriptions with injections in rural community pharmacies in India, which was 7.2% (Aravamuthan *et al.*, 2017). These are more than three times that in privately owned community pharmacies in Windhoek. However, in comparison to a similar

study in private community pharmacies in Ethiopia, the use of injections was very similar to this study finding at 2%. Nonetheless, excessive use of injectable medicines is a common problem in other African countries like Nigeria, Ethiopia, Ghana, Morocco, Tanzania, and Zimbabwe, as well as in Asian countries like Pakistan (Ojalere, 2011; WHO, 2006; Atif *et al.*, 2016). The practice has negative consequences, including increased treatment costs and heightened risks of spreading bloodborne infections like hepatitis B and HIV, hence the need to curb it in the affected countries.

According to this study, a low percentage of prescribed medicines (38.5%) were from the Namibia Essential Medicines List (NEMLIST), significantly below the WHO optimal value of 100% (WHO, 1993; WHO, 2002; Isah *et al.*, 2002) and the Namibian acceptable value of >80% (Niaz *et al.*, 2018). A similar prospective study in community pharmacies in Eritrea found that 98.39% of the medicines were prescribed from the country's EDL (Amaha *et al.*, 2019), a figure drastically higher than this Windhoek study's but in line with an Indian study finding conducted in rural community pharmacies where 99.8% of the prescribed medicines were from the EDL (Aravamuthan *et al.*, 2017). This difference might be explained by the differences in the study settings, for example, the community pharmacies in this Windhoek study are privately owned, whereas those in the Eritrean study were government-owned. Conversely, study findings from public health facilities in Namibia and other African countries like Zambia, Kenya, Uganda, and Ethiopia found compliance with prescriptions from the Essential Drugs List in the ranges of 70% - 95%, at least 30% higher than the current study result. This study finding may indicate that in the private health sector, less care is taken to prescribe from the EDL, which may be influenced by the pharmaceutical marketers and, or greed for profit. However, this may be unique to Namibia, considering that a similar study in private community pharmacies in Ethiopia found that 99.6% of the medicines were from the EDL (Anagaw *et al.*, 2023). One way to rationally prescribe medicines is by prescribing from the EDL. WHO (2006) maintains that safe, effective, and economical use of medicines will ensue if primary care practitioners prescribe medicines from the EDL. However, if essential medicines are unavailable, practitioners may choose not to prescribe from the EDL, which may increase the price of some drugs. Also, as a result of an inadequate supply of EDL copies, prescribers may not be able to choose medicines that are included in the EDL (Atif *et al.*, 2016).

5.3 Antibiotic use practices

This study did not stop at analysing the prescribing indicators but further went on to scrutinise the antibiotic use practices developed based on the WHO antibiotic classification and classification of antibiotics according to the WHO's AWaRE (Access, Watch, Reserve) system (WHO, 2019; WHO, 2021). This discussion is based on the relevant literature on the development of antimicrobials in conjunction with emerging medicine resistance, antimicrobial prescribing, and global public health threats. In order to determine the context, the number of antibiotics prescribed per prescription, the duration of antibiotics prescribed and dispensed, the most common antibiotics prescribed, the most common antibiotic classes prescribed, and the AWaRE classification of antibiotics were used.

In addition to contributing to antibiotic resistance, the overuse and misuse of antibiotics also lead to the waste of limited resources. In LMICs, this issue is largely driven by the lack of adequate laboratory facilities for culture sensitivity and resistance testing, which complicates the selection of appropriate antibiotic treatments (Ayukekbong *et al.*, 2017). Globally, this problem exacerbates microbial resistance, leads to adverse drug reactions, and increases hospitalizations (Dhingra *et al.*, 2020).

5.3.1 Number of antibiotics prescribed per prescription

The antibiotic prescribing practices revealed that the majority of prescriptions (89.5%) included only one antibiotic, which is a positive trend; however, the overall prevalence of antibiotic prescriptions remains concerning. A noteworthy finding was that 10.5% (n=111) of prescriptions included two or more antibiotics, with a maximum of four antibiotics prescribed. This aligns with findings from public primary healthcare facilities in Cameroon, where 87% of antibiotic prescriptions were for one antibiotic, 11.5% for two, 1.01% for three, and 0.01% for four antibiotics (Chem *et al.*, 2018). Similarly, a study in inpatient departments of public hospitals in Lesotho reported that nearly three-quarters of prescriptions included either one (44.0%) or two (33.3%) antibiotics, while a quarter contained three (16.0%), four (6.2%), or more than four (0.65%) antibiotics (Adorka *et al.*, 2016). In contrast, a study in Namibia at the Katutura Health Centre, a public health facility, found that two was the highest number of antibiotics prescribed, with most prescriptions containing only one antibiotic (Kunda, 2014). This suggests that prescribing three or more antibiotics is more prevalent in Namibia's private health sector than in the public health sector. This concerning

as the inappropriate prescribing of multiple antibiotics is often linked to antibiotic overuse and the emergence of resistance (Adorka *et al.*, 2016). Moreover, the number of antibiotics prescribed does not necessarily correlate with improved treatment outcomes. Prescribing multiple antibiotics might yield similar results to appropriately prescribed antibiotics, potentially obscuring healthcare providers' awareness of prescription appropriateness, which could explain the prevalence of multiple antibiotic prescriptions in clinical practice (Adorka *et al.*, 2016).

5.3.2 Most commonly prescribed antibiotics

The analysis of 1,043 prescriptions resulting in 1,178 antibiotics reveals a pattern that resonates with existing literature on antibiotic prescribing practices. Co-amoxiclav (amoxicillin/clavulanic acid) was the most frequently prescribed antibiotic, comprising 30.4% of prescriptions, followed by azithromycin at 18.6%. This finding aligns with a Namibian private sector study utilizing sales and claim data, which also identified amoxicillin/clavulanic acid as the predominant antibiotic (Pereko *et al.*, 2016). Similarly, research from community pharmacies in the UAE reported amoxicillin/clavulanic acid as the leading prescription, albeit at a lower percentage of 22.4% (Rabbani *et al.*, 2023). In contrast, earlier studies present varying trends. For instance, a study at the Katatura Health Centre in Namibia found amoxicillin to be the most prescribed antibiotic at 65.5%, with azithromycin only at 4.2% (Kunda, 2014). This suggests a shift in prescribing practices over time or differences between healthcare settings. Similarly, a prospective study in government-owned community pharmacies in Eritrea identified amoxicillin as the leading antibiotic at 42.2%, followed by ciprofloxacin and co-trimoxazole, indicating regional variations in antibiotic preferences (Amaha *et al.*, 2019). In Kenya, primary healthcare facilities predominantly prescribed amoxicillin, surpassing co-trimoxazole and metronidazole (Nyabuti *et al.*, 2020). An examination of antimicrobial imports into Tanzania highlighted doxycycline as the most consumed antibiotic, indicating varied preferences in antibiotic use across countries (Mbwasi *et al.*, 2020). Meanwhile, a study at a Zambian teaching hospital reported ceftriaxone as the most prescribed antibiotic, showcasing differences in hospital versus community prescribing patterns (Mudenda *et al.*, 2024). These findings suggest that in Namibia's private health sector, there is a tendency to prescribe broader-spectrum antibiotics more frequently than in the public sector. This trend may be influenced by the widespread use of health insurance

(Medical Aid) among private healthcare patients, facilitating access to these medications with minimal financial burden. Additionally, there may be insufficient adherence to the Namibian Standard Treatment Guidelines (NSTG) by prescribers when selecting first-line antibiotics, a concern highlighted in previous studies (Pereko *et al.*, 2015; Pereko *et al.*, 2016).

5.3.3 Most common class of antibiotic prescribed

This study's findings on antibiotic prescription patterns reveal a predominant use of penicillins at 41.3%, followed by macrolides at 24.2%, and fluoroquinolones at 10.4%. These results align with existing literature, such as the study conducted at Katutura Health Centre in Namibia, where penicillins were also the most prescribed antibiotic class at 90.4%, followed by macrolides at 5.8% (Kunda, 2014). This consistency suggests a common preference for penicillins across different healthcare settings in Namibia.

Further supporting this trend, a study examining outpatient care in the Namibian private sector found a reliance on broad-spectrum antibiotics, particularly penicillins, cephalosporins, and macrolides (Pereko *et al.*, 2016). Similarly, research in Malaysia's private and public primary health sectors reported penicillins as the most prescribed class at 30%, followed by cephalosporins and macrolides (Ab Rahman, 2016). This indicates a broader regional preference for these antibiotic classes.

However, contrasting findings are observed in other regions. A study in Cameroon's primary healthcare facilities identified penicillins as the most prescribed class but found trimethoprim plus sulphonamide as the second most prescribed (Chem *et al.*, 2018), differing from the current study where it was the least prescribed. This variation could be due to differences in healthcare settings, with the current study focusing on private community pharmacies in Windhoek, while the Cameroonian study was conducted in public primary healthcare facilities.

Additionally, a study at a university teaching hospital in Faisalabad, Pakistan, reported cephalosporins as the most prescribed class, followed by fluoroquinolones and nitroimidazoles, with penicillins ranking fourth (Mushtaq *et al.*, 2021). This discrepancy may be attributed to the hospital's secondary and tertiary care status, which deals with more complex cases than primary healthcare facilities like those in Windhoek community pharmacies.

5.3.4 WHO AWaRe classification of the prescribed antibiotics

This study's results indicate that nearly half (54%,) of the antibiotics prescribed were from the 'Access' class, with just under half (44%,) from the 'Watch' class, and only 1.9% (n=23) from the 'Reserve' class. Additionally, 0.1% (n=1) of the prescribed antibiotics were a fixed-dose combination (ampicillin + cloxacillin – ampiclox) classified as 'Not Recommended' by the WHO AWaRe framework (WHO, 2019).

These findings align closely with similar studies conducted in Ethiopia and Zambia. In Ethiopia, 55.29% of prescribed antibiotics were from the 'Access' class, 43.03% from the 'Watch' class, and 1.68% from the 'Reserve' class (Dereje *et al.*, 2023). Similarly, the Zambian study reported 55.5% from the 'Access' group, 43.1% from the 'Watch' group, and 1.4% from the 'Reserve' group (Mudenda *et al.*, 2024). In the UAE, a comparable study showed 59% from the 'Access' class and 41% from the 'Watch' class, with none from the 'Reserve' class (Rabbani *et al.*, 2023).

Conversely, a study in Eritrean government-owned community pharmacies reported a higher proportion of 'Access' antibiotics at 77.8%, with the remaining 22.2% from the 'Watch' class (Amaha *et al.*, 2019). In Tanzania, the majority (>90%) of antimicrobial consumption was from the 'Access' class, with 'Watch' and 'Reserve' classes accounting for 10% and 1%, respectively (Mbwasi *et al.*, 2020).

In South Africa, both public and private healthcare sectors predominantly prescribe 'Access' antibiotics, with minimal use of 'Reserve' antibiotics (Chigome *et al.*, 2023). This trend is concerning in LMICs where 'Watch' antibiotics are often overprescribed in ambulatory care, contributing to antimicrobial resistance (Chigome *et al.*, 2023; Moja *et al.*, 2022).

According to Moja *et al.* (2024), 'Access' antibiotics should be widely available due to their effectiveness against common bacteria and lower resistance potential. 'Watch' antibiotics, however, should be monitored closely as they are more likely to lead to resistance and have higher costs and toxicity (WHO, 2019). 'Reserve' antibiotics should be reserved for treating confirmed multidrug-resistant infections, a key aspect of antimicrobial stewardship programs (Moja *et al.*, 2024). The WHO recommends that 'Access' antibiotics constitute at least 60% of total prescriptions, with 'Watch' and 'Reserve' classes making up no more than 40% (WHO, 2019).

Despite these guidelines, this study reveals that 'Watch' antibiotics are being excessively prescribed, and 'Reserve' antibiotics may be inappropriately used in private healthcare

facilities in Windhoek. The presence of a 'Not Recommended' fixed-dose combination, albeit minimal, raises concerns about prescribers' adherence to WHO guidelines. Similar issues of inappropriate antibiotic prescribing have been noted in Botswana and South Africa (Tiroyakgosi *et al.*, 2018; Chigome *et al.*, 2023).

5.4 Limitations of the study

While this study provides valuable insights into prescribing practices in community pharmacies in Windhoek, several limitations should be acknowledged. Firstly, the study's retrospective design may introduce biases related to the accuracy and completeness of the prescription records analysed. Inaccuracies in documentation can lead to misinterpretations of prescribing patterns and practices. The retrospective nature of the study also limited the ability to collect detailed information on prescriber behavior or patient characteristics. Furthermore, the data collection relied on prescription records, which may not always reflect the actual medications dispensed or consumed.

Secondly, the study focused exclusively on community pharmacies in Windhoek, which may not fully represent the situation at community pharmacies across the broader regions of Namibia.

Thirdly, the reliance on WHO/INRUD prescribing indicators, while established, may not capture all relevant aspects of rational prescribing. Factors such as patient demographics, clinical conditions, and the context of prescribing decisions were not assessed, which could provide a more nuanced understanding of the prescribing landscape.

Additionally, the study did not evaluate the outcomes of the prescribed medications, such as patient adherence, effectiveness, or adverse effects, which are critical in assessing the overall quality of prescribing practices. The lack of follow-up data limits the ability to draw conclusions about the impact of these prescribing behaviors on patient health outcomes or the underlying reasons for the observed trends.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

In conclusion, this study provides valuable insights into the prescribing practices within community pharmacies in Windhoek and highlights significant areas for improvement. The study highlights substantial shortcomings in prescribing practices, with all prescribing indicators falling short of WHO and Namibia's recommendations, apart from the percentage of prescriptions with injections.

The over-prescribing of antibiotics and the low rate of generic prescribing are critical issues that require immediate attention. By addressing these challenges, stakeholders can work towards enhancing the quality of care provided to patients and ultimately improving health outcomes in the community. The antibiotic prescribing practices revealed that the majority of prescriptions included only one antibiotic, which is a positive trend; however, the overall prevalence of antibiotic prescriptions remains concerning.

The most commonly prescribed antibiotic, co-amoxiclav, aligns with its broad-spectrum efficacy, while the presence of other antibiotics such as azithromycin and ciprofloxacin reflects common choices in community settings. However, the reliance on certain classes of antibiotics, particularly penicillins, may necessitate ongoing monitoring to prevent resistance development.

The WHO AWaRe classification indicates that a significant proportion of prescribed antibiotics fell under the 'Watch' category, and fewer were from the 'Access' category, which highlights areas for improvement in prescribing practices to ensure that antibiotics are used judiciously. Overall, the findings of this study underscore the need for targeted interventions to promote rational prescribing practices in community pharmacies.

6.2 Recommendations

The following recommendations are made for improving rational prescribing of medicines, particularly antibiotics:

- Continuous education and training programmes should be conducted for private prescribers and pharmacists to enhance their knowledge of WHO prescribing indicators and the rational use of antibiotics.
- Policymakers should consider the findings of this study to develop and implement policies that promote rational prescribing practices and adherence to WHO-AWaRe guidelines, particularly within the private health sector in Namibia.
- Regular monitoring and evaluation of prescribing practices in community pharmacies should be conducted to ensure sustained compliance with WHO and Namibia country-level guidelines and to identify any emerging issues related to irrational medicine use.
- Campaigns to raise public awareness about the rational use of antibiotics and the dangers of antibiotic resistance should be initiated. This can help in reducing the demand for unnecessary antibiotics and promote responsible use.
- Additional research should be conducted to explore the factors influencing irrational prescribing practices by private practitioners and to develop interventions that can address these issues effectively.

By implementing these recommendations, it is hoped that prescribing practices in community pharmacies in Windhoek can be improved, leading to better healthcare outcomes and a reduction in antibiotic resistance.

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APPENDICES

Appendix 1: WHO/INRUD Prescribing Indicator form

PRESCRIBING INDICATORS FORM										
Location:										
Investigator:								Date:		
Seq. #	Type (R/P)	Date of Rx	Age (yrs)	# Drugs	# Generics	Antib. (0/1)	Injec. (0/1)	# on EDL	Diagnosis (Optional)	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
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24										
25										
26										
27										
28										
29										
30										
Total										
Average										
Percentage										
					%	%	%	%		
					<i>of total drugs</i>	<i>of cases</i>	<i>of total cases</i>	<i>of total drugs</i>		

* 0=No 1=Yes

Appendix 2: Antimicrobial data collection form

Name of Pharmacy.....

Ppn#	#of antibiotics prescribed	Name of antibiotics prescribed	Class of antibiotic	AWaRe class	Prescribed duration of therapy(days)	Dispensed duration of therapy(days)
1.		1.				
		2.				
		3.				
2.		1.				
		2.				
		3.				
3		1.				
		2.				
		3.				
4.		1.				
		2.				
		3.				
5.		1.				
		2.				
		3.				
6.		1.				
		2.				
		3.				
7.		1.				
		2.				
		3				

Appendix 3: Research Information sheet



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E-mail: soph-comm@uwc.ac.za

INFORMATION SHEET

Project Title: Assessment of prescribing practices in community pharmacies in Windhoek, Namibia: A focus on antibiotics

What is this study about?

This is a research project being conducted by Christopher A Oyaga, a Master of Public Health student at the University of the Western Cape. We are inviting you to participate in this research project because you *are a community pharmacy in Windhoek*. The purpose of this research project is to assess the prescribing practices at community pharmacies in Windhoek, Namibia and report the antibiotic use patterns in the same context.

What will I be asked to do if I agree to participate?

You will be asked to provide the research assistant(s) with access to the prescription records for the past one year (from 1 September 2022 to 31 August 2023). The research assistant(s) will systematically randomly select 108 prescriptions (9 prescriptions per month) to examine and capture data into the data collection tools (Appendix 1 and Appendix 2). They will collect information about the name of the drugs, quantity and classes of drugs, including antibiotics. This may take the research assistants approximately 3 hours and will be done in a secluded place in the pharmacy designated by you.

Would my participation in this study be kept confidential?

The researchers undertake to protect your identity and the nature of your contribution. To ensure your anonymity, no personal or pharmacy names will be included in the results of this study.

To ensure your confidentiality, only the researcher will have access to the completed data collection tools which will be locked in filing cabinets and captured and stored on a password-protected computer only accessible by the lead researcher.

If we write a report or article about this research project, your identity will be protected.

What are the risks of this research?

There may be some risks from participating in this research study. It will take the research assistant(s) about 3 hours examining the prescription records to capture the required data. This may interrupt your daily activities in the pharmacy a little but we will minimize this by making

sure that our research assistants are trained to capture all the required data in the shortest time possible.

What are the benefits of this research?

This research is not designed to help you personally, but the results may help the investigator learn more about medicine use problems like the overuse and misuse of antibiotics, at community pharmacies in Windhoek. We hope that, in the future, other people might benefit from this study through improved understanding of medicine use problems especially antibiotic use practices and to inform solutions that will improve medicines use.

Do I have to be in this research and may I stop participating at any time?

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), personal information will be collected and processed:

What type of personal information will be collected?

Pharmacy name
Name of the consenting manager/in-charge and their signature
Address of the pharmacy

Who at UWC is responsible for collecting and storing my personal information?

The researcher, Christopher Asimwe Oyaga, student number 3908580

Who will have access to my personal information outside of UWC?

No one

How long will my personal information be stored?

Not more than four months after the last date of data collection

How will my personal information be processed?

It will not be processed at all since it will not be part of the study's final report

What if I have questions?

This research is being conducted by Christopher A Oyaga, School of Public Health at the University of the Western Cape. If you have any questions about the research study itself, please contact Christopher A Oyaga at: 10 John Ya Otto Street Avis Windhoek, +264816923514, chrisoyaga@gmail.com

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Prof Uta Lehmann
Head of Department: School of Public Health
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Prof Anthea Rhoda
Dean: Faculty of Community and Health Sciences
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This research has been approved by the University of the Western Cape's Biomedical Research Ethics Committee.

Biomedical Research Ethics Committee
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Appendix 4: Consent Form



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CONSENT FORM

Title of Research Project: Assessment of prescribing practices in community pharmacies in Windhoek, Namibia: A focus on antibiotics

The study has been described to me in language that I understand. My questions about the study have been answered. I understand what my/our pharmacy participation will involve and I agree to its participation of my own choice and free will. I understand that my/our pharmacy identity will not be disclosed to anyone. I understand that my/our pharmacy may withdraw from the study at any time without giving a reason and without fear of negative consequences or loss of benefits.

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), personal information will be collected and processed:

- I hereby give consent for my personal information to be collected, stored, processed and shared as described above
- I do not give consent for my personal information to be collected, stored, processed and shared as described above.

Name of pharmacy.....

Head pharmacist's Name.....

Head pharmacist's Signature.....

Date.....

Appendix 5: Request for permission from Namibia Ministry of Health and Social Services



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Ministry of Health and Social Services Research Ethics Committee

To whom it may concern

Re: Request for permission to conduct research

Title of Research Project: Assessment of prescribing practices in community pharmacies in Windhoek, Namibia, with a focus on antibiotics.

This is a research project being conducted by Christopher A Oyaga, a Master of Public Health student from the University of the Western Cape. The purpose of this project is to assess the prescribing practices at community pharmacies in Windhoek, Namibia and report the antibiotic use patterns in the same context. I am requesting permission to approach and engage potential pharmacies in Windhoek for this study.

Community pharmacies keep prescription records for at least three years. Data for this study will be extracted from these prescriptions. In this study, secondary data is used and therefore the risks to the patient are minimized. No patient personal or prescriber information will be captured and processed for this study. Nonetheless, the researcher will ensure that while the data collection tools are being used, that they are stored in a locked space to ensure confidentiality and that computer documents are protected by passwords. Pharmacy names will not be included in the study's results/report.

We hope that results of this study can be used not only to identify irrational prescribing behaviours but also in informing interventions to make therapy in the private health sector more rational and cost effective. This will improve the quality of antibiotic use and reduce the rate of antimicrobial resistance development. The main medical aid administrators, Methealth Namibia, might also use results of this study to limit irrational prescribing by the private practices.

If there be any questions about the research study itself, please contact Christopher A Oyaga at 0816923514 or chrisoyaga@gmail.com. Should there be any questions regarding this study

and your rights as an institution providing access to the pharmacies or if you wish to report any problems experienced related to the study, please contact:

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This research has been approved by the University of the Western Cape's Biomedical Research Ethics Committee.

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Appendix 6: Request for permission from Pharmacy owners/administrators



UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2809 Fax: 27 21-959 2872

E-mail: soph-comm@uwc.ac.za

The managing director

Pharmacy

Dear Sir/Madam,

Re: Request for permission to conduct research at your pharmacy

Title of Research Project: Assessment of prescribing practices in community pharmacies in Windhoek, Namibia, with a focus on antibiotics

This is a research project being conducted by Christopher A Oyaga, a Master of Public Health student from the University of the Western Cape. The purpose of this project is to assess the prescribing practices at community pharmacies in Windhoek, Namibia and report the antibiotic use patterns in the same context. I am requesting permission to conduct this study at your pharmacy.

Community pharmacies keep prescription records for at least three years. Data for this study will be extracted from these prescriptions. In this study, secondary data is used and therefore the risks to the patient are minimized. No patient personal or prescriber information will be captured and processed for this study. Nonetheless, the researcher will ensure that while the data collection tools are being used, that they are stored in a locked space to ensure confidentiality and that computer documents are protected by passwords. Pharmacy names will not be included in the study's results/report.

We hope that results of this study can be used not only to identify irrational prescribing behaviours but also in informing interventions to make therapy in the private health sector more rational and cost effective. This will improve the quality of antibiotic use and reduce the rate of antimicrobial resistance development.

If there be any questions about the research study itself, please contact Christopher A Oyaga at 0816923514 or chrisoyaga@gmail.com. Should there be any questions regarding this study

and your rights as an institution providing access to the patients' records or if you wish to report any problems experienced related to the study, please contact:

Prof Uta Lehmann
Head of Department: School of Public Health
University of the Western Cape
Private Bag X17
Bellville 7535
South Africa
ulehmann@uwc.ac.za

Prof Anthea Rhoda
Dean: Faculty of Community and Health Sciences
University of the Western Cape
Private Bag X17
Bellville 7535
South Africa
chs-deansoffice@uwc.ac.za

This research has been approved by the University of the Western Cape's Biomedical Research Ethics Committee.

Biomedical Research Ethics Committee
University of the Western Cape
Private Bag X17
Bellville
7535
South Africa
Tel: 021 959 4111
research-ethics@uwc.ac.za

Appendix 7: Biomedical and Research Ethics Committee approval letter



UNIVERSITY of the
WESTERN CAPE

Directorate: DVC: Research and Innovation
Research and Postgraduate Support
Tel: +27 21 959 4111
Email: research-ethics@uwc.ac.za

02 June 2023

Mr CA Oyaga
School of Public Health
Faculty of Community and Health Sciences

BMREC Reference Number: BM22/10/36

Project Title: Assessment of prescribing practices in community pharmacies in Windhoek, Namibia: A focus on antibiotics

Approval Period: 31 May 2023 – 30 May 2024

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above-mentioned research project.

Any further amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit an annual progress report at least two months before expiry date. Failure to submit your annual progress report on time will result in the immediate lapse of your ethics approval and you will have to resubmit an entirely new ethics application.

For permission to conduct research using student and/or staff data or to distribute research surveys/questionnaires please apply via: <https://sites.google.com/uwc.ac.za/permissionresearch/home>

The permission letter must then be submitted to BMREC for record keeping purposes.

The Committee must be informed of any serious adverse event and/or termination of the study.

A handwritten signature in black ink, appearing to read 'Josias'.

Ms Patricia Josias
Officer: Research Ethics
University of the Western Cape

NHREC Registration Number: BMREC-130416-050

University of the Western Cape, Robert Sobukwe Road, Bellville 7535, Republic of South Africa

Appendix 8: Approval letter from the Namibian Ministry of Health and Social Services



REPUBLIC OF NAMIBIA

MINISTRY OF HEALTH AND SOCIAL SERVICES

Ministerial Building
Harvey Street
Private Bag 13198, Windhoek

OFFICE OF THE EXECUTIVE DIRECTOR

Tel: No: 061 -203 2507
Fax No: 061-222 558
Andreas.Shipanga@mhss.gov.na

Ref: 22/3/1/2
Date: 14 July 2023

Enquiries: Mr. A. Shipanga

Mr. Christopher A. Oyaga
10 John Ya Otto Street, Avis
Windhoek

Dear Mr. Oyaga

Re: Academic Research Proposal Approval – University of Western Cape – Master of Public Health.

Title: Assessment of prescribing practices in community pharmacies in Windhoek, Namibia: A focus on antibiotics.

1. Reference is made to your application to conduct the above-mentioned study.
2. The proposal has been evaluated and found to have merit.
3. **Kindly be informed that permission to conduct the study has been granted under the following conditions:**
 - 3.1 The data to be collected must only be used for completion of the Master of Public Health;
 - 3.2 No other data should be collected other than the data stated in the proposal;
 - 3.3 No any specimen should be collected from Human Subjects;
 - 3.4 Stipulated ethical considerations in the protocol related to the protection of Human Subjects' information should be observed and adhered to; any violation thereof will lead to termination of the study at any stage;
 - 3.5 A quarterly report to be submitted to the Ministry's Research Unit;
 - 3.6 Preliminary findings to be submitted upon completion of the study;
 - 3.7 Final report to be submitted upon completion of the study;
 - 3.8 Separate permission should be sought from the Ministry for the publication of the findings.
4. All the cost implications that will result from this study will be the responsibility of the applicant and **not** of the MoHSS.

Yours sincerely,

BEN NANGOMBE
EXECUTIVE DIRECTOR



All official correspondence must be addressed to the Executive Director.

