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By

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Abstract

This research explores the reasons for antibiotic purchasing and consumption at retail pharmacies in rural China. Although an increasing amount of policy recommendations are put forward, empirical studies are still lacking on antibiotic purchasing over the counter and consumption of over the counter (OTC) antibiotics in China. My research addresses this evidence gap.

Firstly, a quantitative analysis was conducted on the structured observations data from the mixed-method research project *Pathways to optimising antibiotic use in rural China: identifying key determinants in community and clinical settings* 'Antibiotic Pathways study'. The aim was to investigate the prevalence of OTC antibiotics dispensing and consumption and the characteristics of medical encounters in retail pharmacies. Secondly, I conducted a qualitative analysis of in-depth interviews from the same research project. The aim was to explore the purchasing and consumption of antibiotics from retail pharmacies and to provide an in-depth exploration of customers' experience of OTC antibiotic consumption.

The findings suggest that local access to antibiotics for residents remains prevalent, as a result of the lack of restrictions on purchasing antibiotics without prescription at the lower levels of the healthcare system. Customers' perception of the 'convenient' purchase of antibiotics over the counter, short medical encounters and easy access in the retail sector, and policy implementation contributed to the prevalent purchasing and consumption of over-the-counter antibiotics.

This study provides additional support for policy recommendations on antibiotic stewardship in the retail sector. The findings suggest that addressing antibiotic stewardship in lower levels of the healthcare system requires a focus on policy implementation, and the variability of healthcare resources across regions should be taken into consideration to ensure the effective implementation of antibiotic stewardship in China.

Dedication and acknowledgements

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Author's declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and Code of Practice for Research Degree Programmes and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, the work is the candidate's own work. Work done in collaboration with, or with the assistance of, others, is indicated as such. Any views expressed in the dissertation are those of the author.

SIGNED: ....  ..... DATE: .....5 December 2023.....

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List of Abbreviations

ADR adverse drug reactions. 52
AMR Antimicrobial resistance. 1, 10, 14, 15, 19, 54
AMS antimicrobial stewardship. 1, 15
ASPs antimicrobial stewardship programs. 15

CFDA China Food and Drug Administration. 11
CHC community health centres. 11
CHS community health stations. 11
CNKI China National Knowledge Infrastructure. 8
CTPM Chinese traditional patent medicines. 47, 51, 52

LMICs low- and middle-income countries. 1, 7, 54, 60

NAPs National Action Plans. 14

OTC over the counter. i, 1–5, 7, 8, 18, 20, 22, 33, 39, 47, 49, 53, 55, 57, 58, 60

POM prescription-only medicine. 37, 41, 44, 46

RTI respiratory tract infection. 20, 30, 49, 52

SMA self-medication with antibiotics. 12, 13, 38, 40, 41, 50

TCM traditional Chinese medicine. 9, 11, 13, 47, 51, 52
THC township health centres. 9, 11, 13

URTI upper respiratory tract infection. 14, 15, 22
UTI urinary tract infection. 20, 22

VCs village clinics. 13, 50

WHO World Health Organisation. 14, 23, 50

Chapter 1

Introduction

Antimicrobial resistance (AMR) is a major and complex public health issue (Anderson, Schulze, Cassini, Plachouras, & Mossialos, 2019; Laxminarayan et al., 2020; World Health Organization, 2019). In China, evidence has shown that high volumes of antibiotic consumption are partly attributable to easy access to over the counter (OTC) antibiotics and non-prescription antibiotic use (Huttner, Harbarth, & Nathwani, 2014; Miller & Goodman, 2016; R. Sun, Yao, Zhou, Harbarth, & Lin, 2022; Zou et al., 2014), while antimicrobial stewardship (AMS) initiatives concentrate mostly on secondary and tertiary hospitals (Bao et al., 2015). Evidence in China from the past decades also indicates a consistently high percentage of OTC purchasing and use of antibiotics from retail pharmacies in rural areas (Chai et al., 2019; Chang et al., 2019; Gong et al., 2020; C. Sun et al., 2019; X. Wang, Xuan, Storella, & Zhou, 2020). In addition to a focus on interventions in secondary and tertiary hospitals, health policies on AMR tend to prioritise behaviour change above other issues such as the wide variety of economic, social, and health system contexts around the world (Tompson & Chandler, 2021). Previous studies on this topic also pay much attention to the classic analytical framework of knowledge, attitude, and practice, and lack further exploration of social and cultural factors contributing to the continuous high OTC antibiotic use in low- and middle-income countries (LMICs).

Over the past decade, evidence on behaviour change interventions in high-income countries has shown that training for doctors in township hospitals using guidelines produces positive but modest improvements in prescribing behaviour, whereas monitoring and feedback of prescribing behaviour achieve a slightly higher reduction (Arnold & Straus, 2005; Wei et al., 2017). Meanwhile, in China, studies indicate that treatment guidelines and protocols have yet to be fully adopted in community healthcare centres in

China (Kwiatkowska et al., 2020; Y. Song, Bian, Petzold, Li, & Yin, 2014). Despite the importance of behaviour change in tackling antibiotic misuse and overuse, there remains a paucity of empirical evidence on the social-cultural factors of the AMS implementation in China. Another limitation of current studies is that they focus primarily on the local comprehension of antibiotics, whereas my study attempts to capture the complexity of AMR-related information between antibiotic suppliers and consumers.

This thesis explores the reasons for antibiotic purchasing and consumption at retail pharmacies in rural China, using a mixed methods approach to a secondary dataset. The secondary data were collected for the mixed-method research project *Pathways to optimising antibiotic use in rural China: identifying key determinants in community and clinical settings* (henceforth referred to as 'Antibiotic Pathways study') (L. Zhao et al., 2019).

My interest in this study area has arisen from my previous fieldwork experience in the primary care setting, and my focus on local healthcare governance when revisiting the Antibiotic Pathways study grew as the COVID-19 pandemic policies were implemented in primary care in China. When COVID-19 local governance diverged in different local contexts and morphed into new local healthcare governance, it prompted me to consider whether implementing antibiotic stewardship following the form of a national campaign is an effective means for ensuring the safe and appropriate use of antibiotics from clinical settings to the retail sector and primary health care in China. My anthropological fieldwork experience also triggered me to adopt a holistic approach (Tompson & Chandler, 2021) when revisiting secondary data, utilising both semi-structured observation records and in-depth interview transcripts.

I therefore set out to look at OTC antibiotic purchasing and consumption at retail pharmacies in rural China. Firstly, I wanted to explore antibiotic dispensing and consumption through in-depth interview transcripts from retail pharmacies. Secondly, I wanted to utilise some of the structured observation records to provide a more holistic view of antibiotic purchasing in retail pharmacy settings.

1.1 Data source: Antibiotic Pathways study

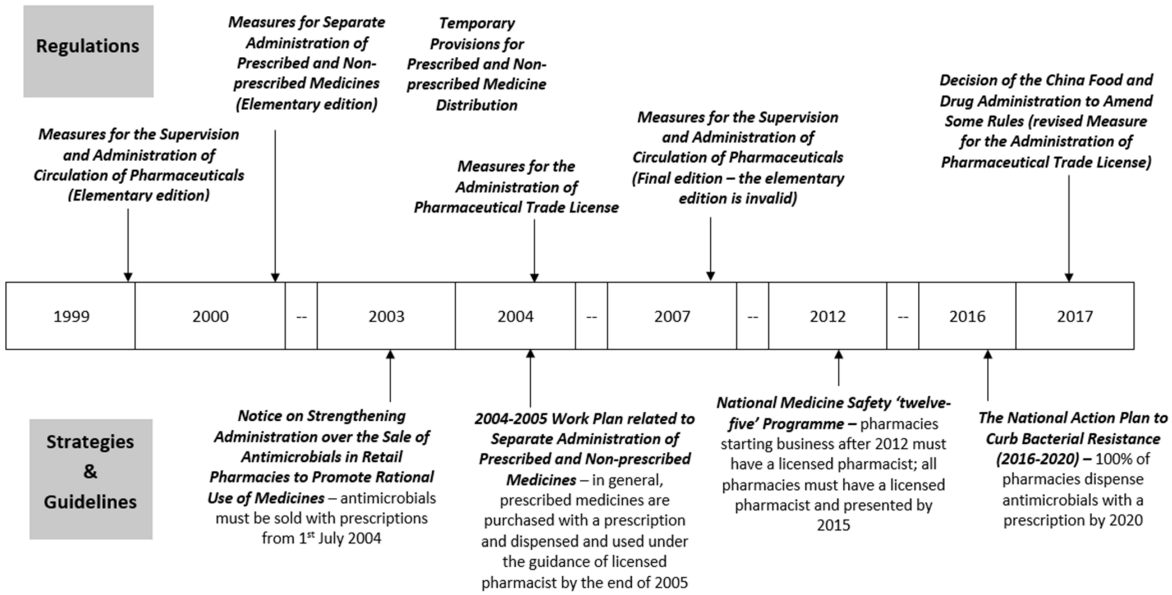
Secondary analysis is widely defined as the analysis of research data which has already been collected to answer a different question from the one asked in the original work, conducted either by the same researchers or by different researchers (Szabo & Strang, 1997;

Tripathy, 2013). While the utilization of secondary data, on the other hand, generally involves data collected before defining a specific research question (Newhouse & McClellan, 1998). Large secondary datasets have been used in medical research for a long time, but their use has grown in recent years, especially in comparative effectiveness and health services research (Cole, Friedlander, & Trinh, 2018). In this study, I utilized data from the pharmacy data subset of the Antibiotic Pathways project which has not previously been fully analysed or written up for publication (M. Chen, Kadetz, Cabral, & Lambert, 2020; Kwiatkowska et al., 2020; Shen et al., 2022, 2021; L. Zhao et al., 2019).

One reason for using the Antibiotic Pathways study dataset is that this dataset offers a unique advantage due to its comprehensive and systematic assessment of prescribing and purchasing practices in the context of China's unique health systems and policies, involving one village clinic, one township health centre and all local retail pharmacies within each of the three selected rural residential areas in Anhui province (L. Zhao et al., 2019). While prior research has primarily focused on antibiotic prescribing in hospital settings, there has been a relative lack of attention on the use of antibiotics in community settings. Given that data collected from retail pharmacies in this dataset were based on customers' and pharmacy staff's recollections of the medical encounter together with direct observation of antibiotic sales at community pharmacies, and additionally with results from observations and interviews at the participating clinics and health centres indicating the prevalence of prescription of antibiotics and considering the easy access of dispensing at the clinics and health centres pharmacies (M. Chen et al., 2020; Kwiatkowska et al., 2020; Shen et al., 2022, 2021), the subset of data collected at retail pharmacies in this dataset could better reveal the OTC sale of antibiotics without a prescription.

Another reason for using this dataset in this study is to investigate the pattern of OTC antibiotic purchasing and consumption at retail pharmacies in rural China before the COVID-19 pandemic and the dataset was also collected in the context of China's latest antibiotic sales policies. According to T. Zhang et al. (2022), there have been no major changes in the policies related to antibiotic sales in retail pharmacies since 2015 (see Figure 1.1). However, since the COVID-19 outbreak, there have been reports of changes in the pattern of OTC antibiotic use at retail pharmacies in China, with patients finding it more difficult to access treatment and seeking antibiotics to self-medicate for infections without a prescription. Therefore, my analysis of the Antibiotic Pathways study dataset, which covers the period of 2017-2018, would provide a reliable record of the OTC antibiotic purchasing and consumption pattern at retail pharmacies in rural China

Figure 1.1: Timeline of key policies related to antibiotic sales in retail pharmacies in China



Note. Reproduced from "Antibiotic Stewardship in Retail Pharmacies and the Access-Excess Challenge in China: A Policy Review," by Tingting Zhang, Helen Lambert, Linhai Zhao, Rong Liu, Xingrong Shen, Debin Wang and Christie Cabral, 2022, *Antibiotics*, *11*, p. 141. Copyright 2023 by MDPI. Reproduced with permission.

before COVID-19.

Using secondary data is also more practical in terms of both time and financial cost than collecting primary data for my master's project. In this project, I chose the Antibiotic Pathways study both for the dataset's accessibility and availability for my analysis of secondary data. The research output of the Antibiotic Pathways study has provided refreshing analyses of the varieties of knowledge in biomedical practice and the local interpretation of pathogenicity (Lambert, Chen, & Cabral, 2019) and of the cultural and economic forms of capital's influences on antibiotic prescribing in the clinical setting (M. Chen et al., 2020), and my analysis on the pharmacy data subset from the Antibiotic Pathways study explores OTC antibiotic use at the 10 retail pharmacies that were included in the study (L. Zhao et al., 2019).

1.2 Aim and objectives

The overall aim was to explore the reasons for OTC antibiotic purchasing and consumption at retail pharmacies and identify obstacles and facilitators to antibiotic stewardship in China.

The specific objectives were:

1. To investigate the prevalence of purchasing and consumption of OTC antibiotics and the characteristics of medical encounters in retail pharmacies.
2. To explore to what extent pharmacy staff and customers have a shared understanding of antibiotic purchasing and consumption at retail pharmacies.
3. To provide an in-depth exploration of customers' consumption of antibiotics from retail pharmacies.
4. To identify barriers and facilitators to addressing antimicrobial stewardship in China's retail sector.

I first conducted a literature review on historical and current practices of purchasing and consumption of antibiotics from retail pharmacies in China. Then I utilised both qualitative and quantitative secondary data to answer my research questions. First, structured observations on medical encounters at the selected retail pharmacies were analysed (a) to investigate the prevalence of over-the-counter antibiotics purchasing and characteristics of medical encounters in retail pharmacies, and (b) to support the findings from interpreting the in-depth interviews with observed records as opposed to self-reported ones from the interviews. Second, in-depth interviews with customers and pharmacy staff at the same group of retail pharmacies were analysed (c) to provide an in-depth exploration of over-the-counter antibiotic purchasing and consumption, and (d) to identify obstacles and facilitators to antibiotic stewardship in China in over-the-counter settings.

1.3 Outline of chapters

This Introduction chapter set the scene for the pharmacy research in the Antibiotic Pathways project and describes the analysis of this secondary dataset with aims and objectives detailed at the end of the chapter. In the next chapter, I will describe the methods of the literature review and establish the background to current antibiotic use from non-prescribed purchasing at retail pharmacies. Chapter Three describes the dataset included in the analysis and methods used in the analysis of the secondary data subset

from the Antibiotic Pathways study (L. Zhao et al., 2019). Chapter Four describes the key characteristics of informants and presents the findings from the data collected from the medical encounters and in-depth interviews with pharmacy customers and staff. Finally, in Chapter Five I will highlight the major findings, review the methods of analysing the secondary dataset, as well as considering the implications for antibiotic stewardship, strengths and limitations and further research.

Chapter 2

Literature Review

This chapter presents a literature background to my analysis of secondary data on OTC antibiotic purchasing and consumption at retail pharmacies in rural China. I will first detail the methods of the literature review, and then discuss the issues that currently surround antibiotic purchasing at retail pharmacies and antibiotic stewardship in LMICs and especially in China, and a brief discussion on auditing and governance mechanisms in China as a scope of my analysis. I will summarise key points from the literature review at the end of this chapter.

2.1 Methods of the literature review

The aim of the literature review was to determine what is known regarding the purchase and usage of OTC antibiotics in mainland China and evidence in other LMICs during the last few decades. To provide insights into antibiotic purchasing and consumption over the counter, it was necessary to be familiar with current practices and understand how existing regulations and stewardship action plans have influenced current antibiotic use from the retail channels, as well as the positions taken by governing bodies towards informed antibiotics purchasing based on their differing approach to the rational use of antibiotics. My literature review aimed to collect a relevant and high-quality body of literature according to the hierarchy of research evidence, including guidance papers from professional organisations and expert opinions to provide context for the empirical research. A set of mind maps was applied to concentrate the literature search in graphically organising my ideas and visualising relationships between various themes that emerged in answering my research questions.

An advanced search was carried out using electronic databases most likely to contain relevant literature; these included Web of Science, EMBASE, and PubMed. These databases were chosen as they were most likely to produce results that would identify existing evidence on OTC antibiotic purchasing and consumption in China and the review of the worldwide pattern. Due to the China-centric nature of the Antibiotic Pathways project, the China National Knowledge Infrastructure (CNKI), one of the most well-known Mandarin databases, was also screened. To better locate relevant literature, citation tracking was also used when scanning these databases.

Three categories of keywords were used interactively:

- "OTC" , "over the counter" , "non-prescribed" , "non-prescription" , "retail pharmacies" and their Mandarin equivalents ' 非处方 ', ' 零售药店 ';
- "Antibiotic prescribing" , "antibiotic use" , "antibiotic" and their Mandarin equivalents ' 抗生素 ', ' 抗生素使用 ';
- Given the data collection setting of the Antibiotic Pathways project, the terms "China" , "rural China" , "outpatients" and "community" and their Mandarin equivalents were also included to explore previous studies in similar settings as the Antibiotic Pathways project.

In order to expand the search, truncation and the inclusion and exclusion of hyphens were utilised. To isolate the relevant literature, the Boolean operators 'AND' and 'OR' were used to maximise the keywords selected. To capture a change in antibiotic stewardship policies and practices in China, the search included both English-language (using both American and British spelling) and Mandarin-Chinese publications and results from 2003 to 2023, to include some master's and doctoral thesis and reports from Chinese symposiums which are not covered in English publications.

The literature review was a continuous process that lasted until the submission of the final thesis. After writing up my Discussion chapter, the latest literature on OTC antibiotic use in China was incorporated. Research Rabbit, an online literature mapping platform for discovering and visualising relevant literature and scholars, was especially helpful in locating important background literature that was not uncovered by the advanced search. Also, a follow-up literature search was conducted concurrently with the writing of the Results and Discussion, such as publications on 'self-medication antibiotics'. This made sure that the most current and relevant literature was covered, so that an accurate overview of the concerns and practices related to over-the-counter antibiotic purchasing and

consumption could be delivered.

In addition to the database searching and Research Rabbit mapping, some papers were gathered through conversations with university supervisors and a review of the references of significant peer-reviewed studies to find additional relevant references that were missed by the search strategy. With time limited, a systematic review was not feasible as part of my study –I lacked the peer support necessary to review huge numbers of publications and had limited time and capacity to finish the screening and synthesis.

2.2 Terminology, translation and knowledge complexity of antibiotics

To better understand the intensive use of antibiotics in China, several studies have investigated people's understanding of antibiotics and antibiotic use. Existing research recognises the processes of hybridisation of biomedicine coexisting with indigenous medical systems (Haenssgen et al., 2018; Khine Zaw, Charoenboon, Haenssgen, & Lubell, 2018). In earlier studies on antibiotic discourses in healthcare encounters in China, a variety of antibiotic phrases were found to be often used by physicians and patients in everyday conversation. In most medical encounters, especially in the local institutional and social-economic setting of rural health facilities, 'anti-inflammation medicine' (消炎药 *xiaoyan yao*) is more widely understood and referred to as antibiotics by local medical practitioners and their patients (M. Chen et al., 2020; N. Wang, 2017). While in official policy documents, antimicrobial usage and AMR policy texts used '*kangsheng su*' (抗生素), the acronym for 'antibiotic,' and '*kangjun yao*' (抗菌药), meaning 'anti-bacterial medicine' (implicitly a biomedical pharmaceutical) (Lambert et al., 2019).

Another significant aspect of antibiotic discourses in health care encounters in China is the overlaps in biomedicine knowledge (western medicine 西医/药) and traditional Chinese medicine (TCM 中医/药) heritages in medicine practised at rural health facilities such as the township health centres (THC) (卫生院 *weisheng yuan*) (Lambert et al., 2019), which could be viewed as part of the impact of barefoot doctor (赤脚医生)-based system [1] from the 1960s (X. Li et al., 2017; Su et al., 2017) and result from the mix of

[1]The barefoot doctors programme was introduced In 1968 as a national policy focused on quickly training paramedics to meet rural needs, in response to Mao Zedong's critics in 1965 of the urban bias of medical services and the stress placed on rural areas. (D. Zhang & Unschuld, 2008) One of the significant adverse impacts of this programme on AMR is that Western medicines including antibiotics were more

education and training background of the healthcare professionals at rural primary care settings (X. Li et al., 2020, 2017; W. Yip et al., 2019). In terms of access to antibiotics, it has also been demonstrated that inadequate education and experience level resulted in unrestricted sales of antibiotics (over the counter, without prescription) (Z. Feng et al., 2021).

A major limitation of the research described above is that they share a similar scope focusing primarily on the local understanding of antibiotics, whereas my study tries to capture the complexity of AMR-related information between those who provide antibiotics and those who consume them, which would involve not only the local perception of the medicine and the context of being implemented in the health facilities. My study tries to investigate a broader local perception of drug resistance, which may influence people's sense of the necessity of antibiotic stewardship. While the processes of hygiene as modernity and medical knowledge hybridisation have occurred in China since the nineteenth century (Rogaski, 2004) and the increased use of antibiotics with the popularization of barefoot doctors in the 1960s (Jin, Ely, Fang, & Liang, 2011; J. Xu, 2017) has increased public perception and misconception of antibiotic efficacy and easy access to antibiotics for self-limiting conditions (Lin, Sun, Yao, Zhou, & Harbarth, 2020), much less is known about if the processes of hybridisation with pre-existing medical knowledge also influence how people perceive the existence of AMR among 'invisible' germs.

2.3 Access to antibiotics, self-medication and household storage of antibiotics

Access to antibiotics from retail pharmacies without a prescription has been recognised as a key factor to AMR worldwide (Auta et al., 2019; Chang et al., 2019; J. Chen, Wang, Chen, & Hesketh, 2020; Morgan, Okeke, Laxminarayan, Perencevich, & Weisenberg, 2011; T. Zhang et al., 2022). In China, the supply of antibiotics requiring a prescription without a legitimate prescription has been prevalent in both online and community pharmacies, especially in community pharmacies in small cities and counties (Chang et al., 2019; J. Chen et al., 2020; Gong et al., 2020). Though it has been officially forbidden by the Chinese government since 2004 (Fang, 2014; X. Wang, Xuan, et al., 2020), the latest research shows that antibiotics are still easily accessible at retail pharmacies (Chang et al., 2017; X. Wang et al., 2017). The Chinese government mandated in 2007 that all

often prescribed than herbs and other alternative medicines by the barefoot doctors.

pharmacies hire a qualified pharmacist. According to official Chinese regulations, only licensed physicians and physician assistants may prescribe medications. This group of healthcare professionals have passed national exams for the Licensed Pharmacist Certificate and completed medical training (J. Chen et al., 2020). The China Food and Drug Administration (CFDA) and the Ministry of Human Resources and Social Security oversee the professional qualification system for licensed pharmacists (T. Zhang et al., 2022).

The for-profit nature of pharmacies also contributes to the remaining prevalent non-prescription antibiotic dispensing (Chang et al., 2019). The expanding market-oriented economy in China since the late 1970s has weakened Mao's community health and medical system and prompted several healthcare reforms to offer basic medical treatment to all residents via community health centres (CHC) and community health stations (CHS) in urban areas and THC and village clinics (VCs, officially designated 'health service stations') in rural regions (Shi, 1993; W. Yip et al., 2019). Among these different parts of the healthcare system, health professionals are found to have different training backgrounds - THC doctors have more solid biomedical training and half of them have a junior medical college level of education, whereas the majority of VC doctors have mainly TCM expertise and minimal biomedical training with a medical diploma after 3 year's medical training at a vocational college (Lambert et al., 2019; X. Li et al., 2020). Moreover, it has previously been noticed that former barefoot doctors in these primary care facilities often depended on drug sales income to make a livelihood (J. Xu, 2017). All these factors contributed to that, by 2017 when the Antibiotic Pathways project's field research began, these channels have been making up a large amount of antibiotic access in China (Coope et al., 2022).

Concerning the lack of training and regulation on antibiotic dispensing at retail pharmacies, by the end of 2015, there remained a nationwide shortage of pharmacists in China (Certification Center for Licensed Pharmacist of China Food and Drug Administration, 2015; J. Chen et al., 2020). In the latest national plan for drug safety in China, 'ensure the reasonable and legal selling of pharmaceuticals' is the defined function of pharmacists (The State Council of People' s Republic of China, 2012, 2021). Even though the regulations have been tightened in the past decades, retail pharmacies in China still frequently dispense antibiotics without a licensed pharmacist's oversight (J. Chen et al., 2020; Lin et al., 2020). A nationwide cross-sectional study in China shows that more than 80% of licensed pharmacists supplied antibiotics irrationally and illegally (J. Chen et al., 2020). Some scholars (Bishop, Yacoob, Knobloch, & Safdar, 2019; Blanchette et al., 2018) have critiqued the insufficient role of pharmacists in outpatient antibiotics stewardship, as over-

all outpatient use remains high (Huttner et al., 2014) and pharmacists are increasingly engaged in antibiotic decision-making in some healthcare settings (Broom, Broom, Kirby, Plage, & Adams, 2015).

Not only the heterogeneity of China's healthcare system and the for-profit structure of pharmacies, and also patient expectations about getting antibiotics together led to the continued administration of antibiotics without a prescription in China. One of the reasons people buy antibiotics over the counter is self-medication with antibiotics (SMA). It is a frequent practice in resource-constrained nations that exposes people to the danger of antimicrobial resistance and negative effects (Torres, Chibi, Middleton, Solomon, & Mashamba-Thompson, 2019) (Waseem et al., 2019) (Zhu et al., 2016), and it is one of the most prevalent types of antibiotic misuse and has emerged as a major contributor to antibiotic resistance (C. Sun et al., 2019; Torres et al., 2019; X. Yin et al., 2021). Antibiotic self-medication has been found to be driven by the availability of antibiotics without a prescription and the positive attitudes and lack of awareness of the general population about these medicines (Chang et al., 2017). Quantitative synthesis of research on factors influencing antibiotic use in communities in China indicates that in community settings, self-medication with antibiotics for treatment, over-the-counter antibiotic purchases, and household antibiotic storage all contribute to inappropriate antibiotic use (Lin et al., 2020). These investigations have also demonstrated the coexistence of over-the-counter antibiotics and leftover prescription antibiotics in the homes of Chinese residents (Lin et al., 2020; C. Sun et al., 2019; X. Wang, Lin, Xuan, Li, & Zhou, 2018; X. Wang et al., 2017).

To date, several studies have investigated the correlation between SMA and household storage of antibiotics worldwide (Abduelkarem et al., 2019; J. Hu, 2016; Skliros et al., 2010; R. Sun et al., 2022; X. Wang et al., 2017). In China, household storage of antibiotics is also one of the main sources of self-medication antibiotic use (C. Sun et al., 2019; M. Wang, 2018; M. Yu et al., 2014). Meta-analysis in China reveals attitudes conducive to antibiotic self-medication, relatives with medical backgrounds, older age, residence in rural regions, and antibiotic storage at home as risk factors for antibiotic self-medication (R. Sun et al., 2022). A cross-sectional study in China reports that nearly half of its participants store antibiotics at home, which is considered the main source of SMA (X. Yin et al., 2021).

Particularly for children's antibiotic use, self-medication antibiotic use is especially prevalent in China, with a relatively high incidence versus other countries (Kan, Wen, Liu,

& Li, 2016; N. Wang, 2017; Wu et al., 2021; M. Yu et al., 2014). The combination of keeping antibiotics at home and intending to self-medicate was a significant independent predictor of SMA in the preceding 12 months in a study covering 19 European countries (Grigoryan et al., 2006). Recent evidence suggests that more than half of Chinese parents have self-medicated their children with antibiotics (C. Sun et al., 2019; M. Yu et al., 2014), and, at the same time, household storage antibiotics at home trigger SMA (M. Yu et al., 2014). A qualitative study conducted by a team of researchers in a central Chinese province indicates that parental health perceptions are significantly associated with children's antibiotic self-medication; parents who reserve medications at home and those who acquire antibiotics without a prescription are more likely to self-medicate their children (Wu et al., 2021).

Collectively, these research findings provide evidence that outpatient access to non-prescribed antibiotics in China contributes to a substantial proportion of misuse and overuse of antibiotics. In addition to the lack of expertise and experience among primary care pharmacists, home storage antibiotics from pharmacies and medication leftover from previous prescriptions potentially prevalent self-medication when ill. In the next section, I will identify the gap in China's existing antibiotic stewardship, followed by the theoretical framework for this thesis.

2.4 Antibiotic stewardship in China

Many studies on antibiotic stewardship in China over the past decade have paid attention to the three-tiered hierarchical medical system (分级诊疗制度 *fengji yiliao zhidu*), in which the stewardship is conducted. Specifically, rural populations in China use a three-tier clinic-based service delivery network, with each tier operating at a different administrative level, from the county hospitals (including TCM hospitals) to THC and VCs; whereas Chinese urban residents use a hospital-based system (N. Wang, 2017; W. C. M. Yip, Hsiao, Meng, Chen, & Sun, 2010). Through these health delivery systems, intensive use of antibiotics in China is influenced by non-biomedical characteristics both within and outside clinical settings, according to the most recent studies (Coope et al., 2022; Lin et al., 2020; R. Sun et al., 2022). By 2017 when the Antibiotic Pathways project's field research began, China's antibiotic stewardship programmes implemented in the three-tier health delivery systems had their most effort and a main focus on secondary and tertiary hospitals, where significant reforms have been implemented (Bao et

al., 2015). In contrast, there was a limited amount of detailed or targeted policies about antibiotic use in primary care, which indicates that it is poorly regulated (X. Wang, Tang, et al., 2020). In China's Shandong province, for instance, a growing trend was found in the overall antibiotic consumption in urban primary healthcare facilities, indicating an immediate need for strengthened regulations on antibiotic usage in primary care (J. Yin, Li, & Sun, 2018).

When it comes to retail pharmacies, attempts to control excessive antibiotic use have been found to restrict access to these life-saving medicines for vulnerable members of society (Das & Horton, 2016; Mendelson et al., 2016), which makes retail pharmacy antibiotic management remain challenging (T. Zhang et al., 2022). These findings are in the same vein as previous research on China's dual pharmaceutical system challenges which both developing and developed countries face, including inadequate quality and affordability of medicines, common essential medicines being replaced by high-priced alternatives, and sustainable mechanisms of access to expensive medicines after achieving universal healthcare coverage (J. Sun, Hu, Stuntz, Hogerzeil, & Liu, 2018). In the retail sector, antibiotic stewardship in China focuses primarily on controlling antibiotic dispensing procedures at retail pharmacies, including restricting antibiotics to prescription-only conditions and ensuring that licensed pharmacists supervise the distribution of prescribed drugs (T. Zhang et al., 2022). Still, by the time the Antibiotic Pathways project finished data collection, antibiotics were easily obtainable with very limited barriers from 48.5% to 83.6% of local pharmacies across mainland China in the case of acute diarrhoea or upper respiratory tract infection (URTI) (Lin et al., 2020). One-fourth of the world's antibiotic consumption was generated in China's healthcare system and the intensive use of antibiotics in outpatient and community settings is particularly high (Lin et al., 2020; Tang et al., 2016; X. Wang, Tang, et al., 2020).

Several studies on the intensive use of antibiotics in China have focused on individual behavioural change and clinical interventions, while social science studies focus on the function of medicines in the social structure. Starting with the World Health Organisation (WHO) Global Action Plan and linked National Action Plans (NAPs) for tackling AMR (World Health Organization, 2015; Xiao & Li, 2016), these well-known public health strategies generally presume that 'communication, education, and training' will 'enhance awareness and understanding,' and that increased awareness and understanding will lead to individual behaviour changes that will help alleviate global health issues (Lambert et al., 2019). In China, a recent follow-up study on a clinical trial to modify

antibiotic prescribing in primary care showed that a package of interventions of evidence-based guidelines, peer-review meetings, enhanced doctor-patient communications, and the provision of succinct education to caregivers during consultations had reduced antibiotic prescribing for childhood URTIs (Wei et al., 2019). A 6-year prospective research at a Chinese tertiary hospital also indicated the effectiveness of antimicrobial stewardship programs (ASPs) paired with infection control programmes, notably co-implementation of behavioural change like hand hygiene among all patients with *P. aeruginosa* infection (L. Liu, Liu, Li, & Zhang, 2018). However, major AMS efforts on individual behavioural change and clinical interventions remain poorly understood by healthcare professionals, and excessive amount of antibiotics provided to patients remains prevalent in particularly the lower-level healthcare system and private health facilities in rural China (Coope et al., 2022; Wei et al., 2017).

Meantime, the strong emphasis on individual behavioural change of these public health plans and interventions compels social scientists to question these assumptions of behavioural change in the existing AMR action plans –qualitative research in health care is essential for providing a different perspective on the same social phenomena that have been quantitatively studied (Mays & Pope, 2019). Comparative analyses of knowledge hybrids and the semantics of antibiotic use suggest that it is hard to change the behaviour of a community or society by educating individuals - because collective change is a social process that depends on a certain set of social, cultural, and economic structures (Lambert, 2016; Lambert et al., 2019). Some of the anthropological reflections on AMR also put a step forward to the potential of more systemic solutions that have a greater chance of achieving equitable impact. Anthropologists Denyer Willis and Chandler conceptualize antibiotic use as an infrastructural 'quick fix', a notion that helps to understand the roles that antibiotics play beyond their immediate curative effects (Denyer Willis & Chandler, 2019). Like other social scientists' reflections on AMR action plans, they question public health assumptions that the overuse of antibiotics results from inappropriate 'patient demand'. The findings of qualitative studies suggest that these assumptions need to be revisited (Chandler et al., 2017; Pearson & Chandler, 2019; Tompson & Chandler, 2021). Moreover, they situate antibiotics as 'a quick fix for care in fractured health systems; a quick fix for productivity at local and global scales, for humans, animals and crops; a quick fix for hygiene in settings of minimised resources; and a quick fix for inequality in landscapes scarred by political and economic violence' (Denyer Willis & Chandler, 2019) –leading to a call for more systematic solutions to AMR.

Together, these findings demonstrate that antibiotic stewardship in China remains problematic. China's antibiotic stewardship has been criticised for its lack of emphasis on outpatient access to antibiotics and on the impact of social perception on the implementation of antibiotic stewardship. However, the mechanisms underlying the implementation of the antibiotic stewardship policy from the top down to the lower level of the healthcare system are not fully understood. Having discussed antibiotic stewardship in China, the next section of the literature review addresses the auditing and systematic aspect of implementing stewardship on antibiotic use in the retail sector.

2.5 Target-focused healthcare governance

In China, there is a tradition of employing a vast network of performance audits that become increasingly detailed and quantified as one progresses down the hierarchy (Kipnis, 2008; S. Zhao, Kipnis(eds.), & Smith(eds.), 2007). This is consistent with audits as a traditionally technical instrument claiming to provide systematic and independent evaluations of an enterprise's data, records, finances, operations, and performances to assess the validity and dependability of the provided information and examine an organization's systems for internal control (Power, 2000; Shore & Wright, 2015). Among these, stewardship is typical of the wider trend of quantification and numerical measurement as a tool for global health assessment and governance, including antimicrobial use measures, process measures, quality measures, costs and clinical outcome measures (Al-Hasan, Winders, Bookstaver, & Justo, 2019). Antibiotic stewardship requires a coordinated approach, including governance systems, guideline-driven practice, antibiotic restriction, audit and feedback and incorporation of behaviour change strategies (Cairns et al., 2021). Although antibiotic stewardship in China's retail sector has fewer penalties, with only warnings and small financial penalties, than the criminal penalties for the illegal clinical use of antibiotics (T. Zhang et al., 2022), it intends to be a national regulation applied widely and informed among most pharmacy staff.

More generally, awareness of governance in China is not recent –a large amount of research in Chinese bureaucracy has emphasised the relationship between local governments and the central government, from historical studies on the structure, process and crisis of imperial governance in China in the late Qing Dynasty (Kuhn, 1992, 1995), to organizational sociology study on the stable institutional logic of governance in China (X. Zhou, 2017, 2022). These researches highlighted the institutional logic that relies on

the centralization dilemma - the central government made all key decisions and ruled from the palace to every aspect of society, with all officials acting on its behalf (X. Zhou, 2020). However, this institutional logic creates a fundamental conflict between centralization and effective, local problem-solving –thus centralised resource allocation and top-down mobilisation impair local problem-solving (X. Zhou, 2010).

When it comes to healthcare governance, campaign-style mobilisation contributed to the implementation of the patriotic public health campaign (爱国卫生运动 *aiguo weisheng yundong*) started in the 1950s, which successfully mobilised citizens to improve environmental sanitation and to change health behaviours (Yuan, Jian, Martinez-Alvarez, McKee, & Balabanova, 2020; X. Zhao, Yuan, Yu, & Jian, 2019; X. Zhou, 2022). This calls into question the static definition of mobilisation as a process of deliberate disruption to achieve utopian goals - the significance of campaign-style mobilisation stems from its ability to interrupt the regular and typical speed of the bureaucratic process, forcing it to become a closely connected system with a high response rate (X. Zhou, 2017, 2022). In the post-revolutionary era after the Reform and Opening-up of the 1970s, the purpose of mobilisation is to ensure the responsiveness of local governments to higher-level initiatives and to achieve party efforts to reorder the established institutions and routines. However, 'crisis and attack' are replaced by a culture of orderly determination –mobilisation moves from a permanent revolution to a vital tool for bringing about substantial change and sustaining political orthodoxy (White, 1990).

One example to elaborate how target-focused healthcare governance in the form of a campaign-style mobilisation can be efficient and problematic at the same time is the 'one-child policy'. There is no doubt regarding the program's universality and success as a statewide, unified approach involving hundreds of millions of families in many professions and units. In an era distinguished by the collapse of the planned economy and the reduction of state control over society, the Chinese Communist Party relentlessly pushed its 'one-child policy' for more than three decades (W. Feng, Gu, & Cai, 2016). With its radical objective and collectivist beliefs, it is the most extensive and intrusive population control programme in human history, and a prime example of the massive social engineering programmes executed by the Chinese government (Nie, 2014; White, 1990). Specifically, the 'one-child policy' has survived several eras of immense political, economic, and social transformation in China from the 1970s to more than thirty years later - the sharp decline in China's birth rate and the proportion of only-child families are evidence of the policy's effects (X. Zhou, 2017, 2022).

I choose to share the 'one-child policy' here because what it represents sheds light on the policy implementation side of antibiotic stewardship in China. It could be highlighted as a 'successful' example of a centralised system carrying out the state's aims in the healthcare sector. The 'one-child policy' could also serve as a cautionary tale of what might occur when a healthcare policy is a major 'area' in which the state's aims have been executed through the monolithic system –forced abortion, precisely speaking coerced induced birth, and other 'presumed necessary sacrifice to help achieve the nation's demographic goals and the presumed common social good this would make possible' (Nie, 2014). Hence, besides what the antibiotic sales policies are focusing on, the implementation of the policy itself is a vital factor when researching antibiotic purchasing over the counter and consumption of OTC antibiotics in China.

2.6 Key points from the background literature

Taken together, these studies support the notion that antibiotic stewardship in the retail sector remains inadequate. It has been determined that policy implementation and governance issues, such as a primary focus on stewardship on clinical antibiotic prescribing and low-skilled healthcare personnel in villages and towns, all contribute to the prevalence of over-the-counter access to antibiotics in China. Significant policy reforms have been implemented to address the issue by modifying the system of supply-side incentives; yet antibiotic misuse rates remain high. This raises the question of whether behavioural change models focusing on the provider side of antibiotics adequately explain China's high incidence of antibiotics sold over the counter. Specifically, do healthcare sector governance factors also contribute to this issue? All these questions motivate this thesis.

There are few articles that approach antibiotic stewardship in China as a component of healthcare governance, discuss its consistency across different healthcare sectors and decades, and provide solid action recommendations from a more systematic perspective. Needs for a system-wide and multisectoral intervention have been raised, while more empirical studies to examine policy recommendations are required. Having provided examples of top-down governance in China's healthcare, I will critique the effectiveness and side-effects of this strategy of policy implementation when discussing the action recommendations for antibiotic stewardship in the retail sector.

Chapter 3

Methods and dataset

This chapter sets out the methods for the analysis of both the secondary qualitative and semi-quantitative data used in this thesis. I first summarise the characteristics of the dataset, then explain the methods I used to analyse this retail pharmacy data subset from the Antibiotic Pathways project. The results of the analysis are presented in the next chapter.

3.1 Description of dataset

3.1.1 The 'Antibiotic Pathways' study

The primary study was a cross-disciplinary project combining qualitative, microbiological and epidemiological methodologies to investigate levels of antibiotic prescribing and the burden of AMR in rural areas in China and identify key drivers of antibiotic use for common infections in the community. The research was implemented in three rural residential areas in Anhui province, China, including one village clinic, one township health centre and all local retail pharmacies within each area. The study protocol was published in *BMJ Open* (L. Zhao et al., 2019) and data collection took place in 2017 and 2018. The dataset including quantitative and qualitative information on over-the-counter purchasing of antibiotics from retail pharmacies collected through direct observations, exit surveys, pharmacy worker interviews and customer interviews is kept in the data.bris Research Data Repository with an access level Restricted not available via direct download but must be requested (Lambert, Cole, Cong, & Cabral, 2022).

Study outputs include a comparative analysis of pathogenicities, knowledge hybrids

and the semantics of antibiotic use (Lambert et al., 2019), a qualitative analysis of institutional context and clinical realities of these rural health facilities (M. Chen et al., 2020), a quantitative analysis of the accuracy of electronic health records (Kwiatkowska et al., 2020) and epidemiological papers on relationships between diagnosis, bacterial isolation, and antibiotic prescription in outpatients with respiratory tract infection (RTI) symptoms (Shen et al., 2022, 2021) but data from the pharmacy sub-study used in this thesis has not previously been fully analysed or written up for publication.

Other publications from the study (Shen et al., 2022, 2021) show that the vast majority of clinic attendees fill their prescriptions at the pharmacy attached to the clinical facility during their visit, so it can be assumed that almost all purchases of antibiotics at retail pharmacies are OTC sales without a prescription. Hence, in the description of secondary data and presentation of the results and discussions of this dissertation, the ′antibiotic dispensing′ mentioned refer to mostly OTC sales of antibiotics without a prescription.

3.1.2 Description of secondary data

Qualitative data include in-depth interviews with customers, shop assistants and pharmacists at the retail pharmacies. The interviews were conducted by a Lecturer from the School of Health Services Management at Anhui Medical University in 2018. This researcher have taken the Introduction to Qualitative Research Methods short course from the University of Bristol from February to March 2018 and the UK colleagues from the Antibiotic Pathways Project had delivered essential training to these fieldworkers prior to the interviews. The interviews were conducted at the 10 retail pharmacies from the three selected areas - a total of 10 retailed pharmacies from three study areas were selected and there were no retail pharmacies in the villages. All customers who requested antibiotics or medicines associated with RTI or UTI at the selected retail pharmacies were approached to seek their consent for a qualitative interview. A total of 15 customers visiting the selected retail pharmacies participated in the qualitative interview during the study period when they are free. Pharmacy staff, including pharmacists and shop assistants, who were involved in antibiotic sales or non-prescription medicines in the recruited retail pharmacies, were invited to participate in the interview. A total of 8 pharmacy staff (1 licensed pharmacist and 7 shop assistants) participated in the interview (L. Zhao et al., 2019).

Semi-quantitative data include exit surveys and structured observations of medical encounters. The exit surveys and structured observations were collected by three research-

Table 3.1: Dataset description

Country	China
Primary study title	Pathways to optimising antibiotic use in Anhui: Identifying key determinants in community and clinical settings
Objectives	The primary study aimed to investigate levels of antibiotic prescribing and the burden of AMR in rural areas in China and identify key drivers of antibiotic use for common infections in the community.
Participants	Customers and staff (n = 2385) at 10 retail pharmacies
Methods and data	• Semi-structured observations: records of customer-worker interactions (n=2385) • In-depth interviews with customers (n=15) • In-depth interviews with staff (n=8)
Year	2017-2018
Participant and institutional consent	Participation of patients and doctors was voluntary and written informed consent was sought from all participants.
Funding	This study was supported by the Newton Fund [UK Research and Innovation (UKRI)] and the National Natural Science Foundation of China (NSFC, Grant Number 81661138001 and 81861138049) under the UK-China Antimicrobial resistance Partnership Initiative, Grant Number MR/P00756/1.

ers from the School of Health Services Management at Anhui Medical University from February to July in 2018, all of whom have also taken the Introduction to Qualitative Research Methods short course from the University of Bristol from February to March

2018 and received further bespoke training. These fieldworkers went into the field mostly 7 days a week and had most of the observations done in March, April, and July 2018. They spent the first week at the pharmacies to familiarise themselves in the sites without recording any observations in an effort to minimise Hawthorne effect (McCambridge, Witton, & Elbourne, 2014). Observations used a worksheet and documented daily encounters between customers and pharmacy staff including the health problems presented, medicines and information asked for by the customers, suggestions made and medicines and information given by the staff (L. Zhao et al., 2019). Exit surveys were carried out with observed customers reporting possible URTI (coughs, colds, sore throat) or urinary tract infection (UTI) following their visit to a retail pharmacy (L. Zhao et al., 2019). With time limit, the exit survey was not included in the analysis of this study. The dataset description is presented in Table 3.1.

The Biomedical Ethics Committee of Anhui Medical University has provided full ethical approval for this study (reference number: 20170271). Participation in the study was fully voluntary for customers and pharmacy staff. Written informed consent was obtained from all interviewees, and permission was obtained from pharmacy owners and local Food and Drug Administration officials to conduct observations in the pharmacies (L. Zhao et al., 2019).

3.2 Analysis of pharmacy observations (quantitative)

The semi-structured observations included both descriptive records of customers' medical encounters, including the reason for their visits and the medicines they purchased at the 10 retail pharmacies from townships in the three selected areas , and brief exit surveys in the form of brief conversations between the researcher and customers outside the pharmacies (L. Zhao et al., 2019). With limited time, I chose the structured observation data only for descriptive analysis because it is a richer dataset (n=2385) than the exit surveys (n=579), which potentially provides insights into the general situation regarding the use of OTC accessed medicines including OTC antibiotics at the selected pharmacies. In addition, it allowed me to compare insights generated from the analysis of the structured observations and from the in-depth interviews. With this, I could explore any discrepancies between observed and informants' self-reported behaviour in purchasing/selling antibiotics at the selected retail pharmacies. In general, descriptive statistics were used to identify characteristics of medical encounters at retail pharmacies, to support the inter-

pretation of the interview data.

I conducted the data translation and cleaning with reference to the bilingual observation guide (see Annex A and B). Details of antibiotic purchasing categories with reference to the latest WHO AWaRe classification (WHO, 2021) were summarised. For the statistical analysis, responses of 'not applicable' were combined with 'no' when analysing

- if customers purchased medicine,
- observation of if a customer asks for certain medicine,
- if customers purchased more than one antibiotic,
- and the four sectors on drug usage information provided to customers or not (see question 3.1 to 3.5 in Annex B).

Percentages were calculated to present variables such as age, gender, and length of medical encounter. The chi-square test of independence was used to test the relationship between potentially important factors, such as age, gender, length of medical encounter, who they requested the medicine for, whether the medicine was directly requested or not, and drug usage information provided by pharmacy staff, and the purchase of antibiotics at retail pharmacies. The p-values were considered as two-tailed and a p-value of < 0.05 was set as significant. Wherever a p-value of 0.000 was reported in the software, it was presented as < 0.01 in the results. All analyses were conducted in SPSS 29.0.0.0 for Windows statistical package and Microsoft Excel (Version 2212 Build 16.0.15928.20278).

3.3 Analysis of pharmacy interviews (qualitative)

Interviews at retail pharmacies were transcribed in Chinese by an experienced University of Bristol approved transcriber and both English and Mandarin copies were transferred to secure servers at the University of Bristol. All written secondary data were anonymised before the analysis (Chatfield, 2020). At the beginning of the analysis of the interview data, transcripts were read and re-read to aid familiarity. Details on how the original interviewer framed questions and approached the research focus in these interviews were also coded, to capture the context of informants' answers and be more reflective on the data collection process. This focus on the context of interviews also helped me to overcome the limitation of not having been involved in the original data collection process.

23 Mandarin Chinese transcripts, including 4 bilingual transcripts, were entered into

NVivo 12 software and files were classified into two categories: bilingual transcripts for initial coding and anonymised interview transcripts in Mandarin Chinese. Thematic analysis was selected as the most appropriate approach to identify patterns and broad themes from the data (Braun & Clarke, 2019; Chatfield, 2020; W. Xu & Zammit, 2020). I analysed the interviews thematically using a combination of inductive and deductive coding. The socio-demographic characteristics of the pharmacy study participants were elaborated in descriptive summaries written alongside coding during data analysis.

3.3.1 Coding, reviewing, and naming themes and sub-themes

Thematic analysis in this study involved an iterative process of close reading of the data, coding, comparison and elaboration of emerging codes and themes (Braun & Clarke, 2019, 2021). Codes represent features of the recorded data relating to an inference of information collected in a study. Coding is also a process of data management and sorting the data into meaningful units, to make sense of the content (W. Xu & Zammit, 2020) and identify key insights which may help to answer the research question (Ritchie, Lewis, Nicholls, & Research, 2014).

Four bilingual transcripts of the interviews were initially coded in English line-by-line for an independent review of the initial codes. This allowed me to familiarise myself with the pharmacy interviews (Mays & Pope, 2019) and to generate an initial codebook in English. Once the initial coding was completed, I began to connect the initial codes into different categories (Braun & Clarke, 2006) and moved on to generating themes from the rest of the Mandarin Chinese transcripts. Codes I gerneated with the use of the NVivo 12 software were compared to look for areas of agreement and discrepancy and alongside I modified the codebook and recoded the initially coded transcripts. As I started to familiarise the codes and generate themes, patterns began to form between pharmacy staff and customers' interviews. Throughout the coding process, I recorded the new codes identified as each interview was analysed and sought to achieve data saturation when no additional codes would be identified (Braun & Clarke, 2021).

The use of descriptive summary for each participant also help to retain my understanding of each case as a whole. My descriptive summaries generated in the process of coding and theme development was an overview of my data and they helped as a recall of the data throughout the analysis process. As well as exploring emerging themes and patterns I sought out apparently contradictory quotes and examples, which were coded

and noted as summaries in NVivo and Word documents. I met regularly with my supervisor to discuss my understanding of the data and developing themes. Categories of data and thematic relationships were identified and written up as descriptive and interpretive accounts, supported by interview excerpts. When coding interviews with pharmacy staff and customers with the same codebook, I began to make comparisons between interviews with these two groups of informants, with a focus on the context of why they perceived and phrased the same or similar practice in a different way.

3.3.2 Reflexivity

In addition, following the recommendation to ensure rigour in the analysis of secondary qualitative data (Martins Pereira, Fradique, & Hernández-Marrero, 2018), measures were taken as shown in Table 3.2.

Table 3.2: Measures to ensure rigour in the analysis of secondary qualitative data

Recommendation to ensure rigour in the analysis of secondary qualitative data	**Measures taken**
Information about the discursive context of the interviewee's responses and observations.	Detailed transcriptions of interviews and field notes, transcribed verbatim, are fully available.
Information about the discursive history of the interviewee's responses and observations.	Interviews and field notes are available.
Information about background characteristics of the interviewer, interviewees, and observed teams.	Limited details are available in the dataset.
Information about the place, time, and setting of interviews and observations.	Information included in the field-note summaries, and these were made available to the researcher of this study.
Information about the composition of the secondary dataset.	Composition of the primary studies described above.
Funding of the primary and secondary work.	The findings reported in the primary study are supported by the Newton Fund, through the UK Medical Research Council (MRC) and the National Natural Science Foundation of China (NSFC). The author received financial support from the University of Bristol as an institutional contribution to the UK-China AMR Hub for this qualitative secondary data analysis.
Information about informed consent.	Ethics and informed consent available from the primary studies, as described above.
Rationale for approach used in analysis and description of the analysis procedure.	Rationale and description are provided in the methods section.
Information about how the data were managed.	Data was managed using Nvivo 12 qualitative data analysis software in both the primary studies and the analysis.
Information about how the rigour of the analysis was established.	Details are provided in this table.
Details of limitations.	Limitations are outlined in the analysis.

Chapter 4

Results

This chapter presents results from the analysis of a subset of secondary data from the Antibiotic Pathways study.

4.1 Results from semi-structured observations

4.1.1 Descriptive characteristics of the study population

As shown in Table 4.1, a total of 2385 customers meeting the inclusion criteria of the Antibiotic Pathways study (L. Zhao et al., 2019) were observed with the permission to observe at the selected retail pharmacies taken from the pharmacy owners. Of these 2208 (92.58%) purchased medicines at the pharmacy, including 347 customers who bought antibiotics (14.55%) from retail pharmacies.

More female customers (52.72%) than males (42.05%) were observed in the selected retail pharmacies, paralleling the gender percentages of medicine purchasing. Among the four estimated age groups, people aged 20-60 (80.89%) visited retail pharmacies more often than older (19.25%) and younger people (3.40%) (Table 4.1).

4.1.2 Antibiotic and other medicine dispensing

Of the 347 customers who purchased antibiotics in pharmacy shops, the majority of them were people aged between 40-60 (45.53%); followed by people aged 20-40 (37.05%) (Table 4.2). The chi-square test of independence here is to decide if two categorical variables - age group and antibiotic purchasing in pharmacy shops - might be related or

Table 4.1: Socio-demographic characteristics of customers, n (%)

	Total	**Medicine purchasing**
Gender		
Male	1003 (42.05)	934 (42.30)
Female	1366 (57.27)	1263 (57.20)
Missing	16 (0.67)	11 (0.50)
Estimated age (years)		
<20	88 (3.69)	81 (3.67)
20-40	818 (35.30)	770 (34.87)
41-60	968 (39.59)	887 (40.17)
>60	483 (19.25)	447 (20.24)
Missing	28 (1.17)	23 (1.04)
Total	2385 (100)	2208 (100)

not; the null hypothesis is that the proportion of people who purchased antibiotics in pharmacy shops is independent of the age group. The result shows that age was a factor related to antibiotic dispensing at the retail pharmacies (n=347, p <0.001), and as shown in Table 4.2, of these customers with antibiotic dispensing (n=347), it appears that older customers (>40) tended to get dispensed antibiotics (n=234, 67.44%) more often than younger customers (n=108, 31.12%).

The proportion of female customers who purchased antibiotics (52.45%) was slightly higher than that of male customers (46.40%), while among those who did not purchase antibiotics, a larger proportion of females (63.62%) was observed compared to males (45.24%). In terms of age group, there was a larger difference among customers who purchased antibiotics (31.12% vs. 67.44%) compared to those who did not purchase antibiotics (42.88% vs. 65.39%), as shown in Table 4.2.

Most of the antibiotic dispensing involved only one antibiotic (94.52%), while 19 customers were observed to have purchased more than one antibiotic. Customers from the age group 41-60 observed significantly more both singular and combined antibiotic use than the other two groups from the retail pharmacies. Percentages appeared similar between gender and age subgroups was evident in the combined antibiotic purchasing rate (Table 4.3).

From the structured observations, the most frequently purchased antibiotics in the selected pharmacies were amoxicillin (25.07%), erythromycin (8.36%), levofloxacin (7.20%),

Table 4.2: Socio-demographic characteristics of customers who purchased medicines, n (%)

	Medicine purchasing (n=2208)	
	With antibiotic purchasing	**Without antibiotic purchasing**
Gender		
Male	161 (46.40)	842 (45.24)
Female	182 (52.45)	1184 (63.62)
Missing	4 (1.15)	12 (0.64)
Estimated age (years)		
$\leq$ 40	108 (31.12)	798 (42.88)
>40	234 (67.44)	1217 (65.39)
Missing	5 (1.44)	23 (1.24)
Total	347 (100)	1861 (100)

Table 4.3: Socio-demographic characteristics of antibiotic purchasing, n (%)

	Category of antibiotic dispensing (n=347)	
	Singular antibiotic use	**Combined antibiotic use**
Gender		
Male	153 (46.65)	8 (42.11)
Female	172 (52.44)	10 (52.63)
Missing	3 (0.91)	1 (5.26)
Estimated age (years)		
<20	8 (2.44)	2 (10.53)
20-40	911 (27.74)	7 (36.84)
41-60	151 (46.06)	7 (36.84)
>60	72 (21.95)	3 (15.79)
Missing	5 (1.52)	0
Total	328 (100)	19 (100)

metronidazole (7.20%), and gentamicin (6.63%). Purchasing multiple antibiotics existed among customers purchasing amoxicillin (2.02%), metronidazole (0.86%), cefradine (0.58%), cefixime (0.58%), erythromycin (0.29%), gentamicin (0.29%), ofloxacin (0.29%), azithromycin (0.29%), and clarithromycin (0.29%). More customers who bought amoxicillin had combined antibiotic purchasing and possibly combined antibiotic use (2.02%), followed by 3 of the customers who bought metronidazole also bought a second antibiotic (0.86%). The summary of all antibiotics purchasing observed at the selected retail pharmacies with reference to the 2021 AwaRe classification (WHO, 2021) is shown in Table 4.4.

I explored the characteristics of medicine, including antibiotic, purchasing and found that of customers who purchased antibiotics (347/2385), the most frequently reported symptoms were 'cough' (21.61%), 'cold' (10.66%), 'sore throat/throat discomfort' (8.64%), 'running nose/nose discomfort' (2.30%), and 'headache' (1.15%) (see Table 4.5). In other words, around 40% of customers who purchased antibiotics indicated RTI symptoms (cold, cough, fever, sore throat, nose discomfort, etc.), whereas normally antibiotic use on those occasions is unnecessary (Godman et al., 2020; Lambert et al., 2019), and around 30% of them didn't indicate any symptoms. At the same time, about 30% of customers got provided antibiotics at retail pharmacies without indicating any symptoms. The rate of reporting symptoms in medical encounters at retail pharmacies was higher among female customers (52.5%) than male customers (46.4%). The rate of not indicating any symptoms among customers who purchased antibiotics over the counter was slightly lower than among customers who purchased other medicine (30.26% vs. 35.15%), which implies that customers were more likely to mention their symptoms when requesting antibiotics.

Independent retail pharmacies were the main source of non-prescription antibiotic sales here (81.84%) (Table 4.5); meantime, the latest nationwide cross-sectional study indicates that there were no significant differences in where antibiotics were accessed in terms of pharmacy ownership, independent or part of a chain at city, county and township/village level (J. Chen et al., 2020). As detailed in the Methods chapter, the sampling process of local retail pharmacies within each area in the Antibiotic Pathways study did not specify the type of pharmacy since all retail pharmacies in the area were included, this interesting result of the majority of independent retail pharmacies providing access to non-prescription antibiotic sales may partly be explained by the fact that chain pharmacies, some of which have branches across the country, would be more likely to comply with prescription-only regulations.

Table 4.4: Frequently prescribed antibiotics, by AwaRe classification, n (%)

Antibiotic	**Class**	**Category**	**Antibiotic dispensing**	**Combined antibiotic use**
Amoxicillin	Penicillins	Access	87 (25.07)	7 (2.02)
Erythromycin	Macrolides	Watch	29 (8.36)	1 (0.29)
Levofloxacin	Fluoroquinolones	Watch	25 (7.20)	0
Metronidazole	Imidazoles	Access	25 (7.20)	3 (0.86)
Gentamicin	Aminoglycosides	Access	23 (6.63)	1 (0.29)
Cefradine	First-generation-cephalosporins	Access	21 (6.05)	2 (0.58)
Norfloxacin	Fluoroquinolones	Watch	21 (6.05)	0
Cefixime	Third-generation-cephalosporins	Watch	18 (5.19)	2 (0.58)
Spiramycin	Macrolides	Watch	14 (4.03)	0
Roxithromycin	Macrolides	Watch	12 (3.46)	0
Ofloxacin	Fluoroquinolones	Watch	11 (3.17)	1 (0.29)
Amoxicillin/clavulanic-acid	Beta-lactam/beta-lactamase-inhibitor	Access	10 (2.88)	0
Cefalexin	First-generation-cephalosporins	Access	8 (2.31)	0
Chloramphenicol	Amphenicols	Access	8 (2.31)	0
Chlortetracycline	Tetracyclines	Watch	7 (2.02)	0
Azithromycin	Macrolides	Watch	5 (1.44)	1 (0.29)
Cefaclor	Second-generation-cephalosporins	Watch	4 (1.15)	0
Penicillin G Sodium	Penicillins	Access	4 (1.15)	0
Mupirocin		Not listed	3 (0.86)	0
Clarithromycin	Macrolides	Watch	2 (0.58)	1 (0.29)
Lomefloxacin	Fluoroquinolones	Watch	2 (0.58)	0
Tobramycin	Aminoglycosides	Watch	2 (0.58)	0
Cefprozil	Second-generation-cephalosporins	Watch	1 (0.29)	0
Cefuroxime	Second-generation-cephalosporins	Watch	1 (0.29)	0
Ciprofloxacin	Fluoroquinolones	Watch	1 (0.29)	0
Lincomycin	Lincosamides	Watch	1 (0.29)	0
Oxytetracycline	Tetracyclines	Watch	1 (0.29)	0
Tinidazole	Imidazoles	Access	1 (0.29)	0

About half of the customers who purchased antibiotics were buying them for themselves (53.74%), overlapping a smaller group of customers visiting retail pharmacies for antibiotics for both themselves and their families (34.01%). There was a minimal gender difference in terms of antibiotics purchasing for customers themselves, while the number of females there for their children's access (8.93%) and other family members' need (12.39%) to antibiotics at retail pharmacies were about double that of male customers buying antibiotics for children (table see Annex E).

Table 4.5: Characteristics of antibiotic and other medicine purchasing, n (%)

	Total	**Medicine purchasing (n=2208)**	
		Antibiotic purchasing	**Other medicine**
Symptoms			
Cold	265 (11.53)	37 (10.66)	233 (12.52)
Cough	410 (17.19)	75 (21.61)	324 (17.41)
Fever	93 (3.90)	1 (0.29)	82 (4.41)
Sore throat/throat discomfort	114 (4.78)	30 (8.65)	79 (4.25)
Running nose/nose discomfort	55 (2.31)	8 (2.31)	45 (2.42)
Headache	20 (0.84)	4 (1.15)	14 (0.75)
Suspected UTI	4 (0.17)	2 (0.58)	2 (0.11)
Other symptoms	574 (24.07)	85 (24.50)	737 (39.60)
Not indicated	840 (35.22)	105 (30.26)	654 (35.15)
Pharmacy Type			
Independent	1698 (71.19)	286 (82.42)	1323 (71.09)
Chain	686 (28.76)	61 (17.58)	537 (28.86)
Missing	1 (0.04)	0	1 (0.05)
Medical encounter length (minute(s))			
<1	420 (17.61)	57 (16.43)	314 (16.87)
1-5	1649 (69.14)	241 (69.45)	1303 (70.02)
6-10	195 (8.18)	33 (9.51)	150 (8.06)
>10	63 (2.64)	8 (2.31)	51 (2.74)
Missing	58 (2.43)	8 (2.31)	43 (2.31)

Reasons for purchasing antibiotics			
for themselves	1239 (51.59)	183 (52.74)	962 (51.69)
for their children	521 (21.84)	48 (13.83)	438 (23.54)
for their families other than children	295 (12.37)	71 (20.46)	207 (11.12)
Missing	353 (14.80)	51 (14.70)	271 (14.56)
Patient requested medicine			
Yes	1434 (60.13)	220 (63.40)	1103 (59.27)
No	951 (39.87)	127 (36.60)	758 (40.73)
Missing			
Drug usage information provided by pharmacy staff	1067 (44.74)	183 (52.74)	877 (47.13)
Dose explained	444 (18.62)	83 (23.92)	357 (19.18)
Duration explained	599 (25.12)	102 (29.39)	492 (26.44)
How to take medication explained	206 (8.64)	59 (17.00)	144 (7.74)
Precautions explained	265 (11.53)	37 (10.66)	233 (12.52)
Total	2385 (100)	347 (100)	1861 (100)

The majority of antibiotics sales (69.43%) occurred during brief interactions with sales staff lasting 1 to 5 minutes, with little difference between genders. Notably, 16.4% of sales were completed in just 1 minute and 85.8% of antibiotics sales were made within 5 minutes. These encounters were significantly shorter than the time required to obtain prescribed antibiotics at clinics and hospitals, which typically involve patient consultations, clinical diagnoses (M. Chen et al., 2020; Shen et al., 2021), and possibly microbiological tests (Shen et al., 2022). Prior research has found a strong association between long wait times for medical care and OTC purchasing of antibiotics, highlighting the perceived need for quick and easy access to treatment (Al Baz, Law, & Saadeh, 2018; R. Sun et al., 2022). In this study, over half of the consumers (63.40%) who purchased antibiotics directly requested the antibiotics they needed, with no significant gender difference. Taken together, these suggest that many residents in rural China believe that antibiotics reduce the duration of illness and self-medicate for infections with antibiotics purchased

from retail pharmacies without a prescription, consistent with prior studies on differing interpretations of antibiotic efficacy (Lambert et al., 2019; T. Zhang et al., 2021) and in-depth interviews with the same retail sector.

In terms of the assistance these consumers received from retail pharmacy workers about their antibiotic purchases, approximately half of them (52.74%) had the antibiotic dosage conveyed to them, while the remainder (29.39%) did not and the duration was only mentioned in a minority of purchases (23.91%). Only in a small percentage of these antibiotic purchases (17.00%) were any risks mentioned. Furthermore, there is little variation between the genders in antibiotic consumption information provided by a pharmacist or staff. The results, as shown in Table 4.5, show that only a small fraction of customers were advised how to take antibiotics appropriately (duration), which might result in a large number of antibiotics left over for future self-medication at home, the relations which have been reported in the literature (Abduelkarem et al., 2019; J. Hu, 2016; Skliros et al., 2010; R. Sun et al., 2022; X. Wang, Xuan, et al., 2020). Customers were also not advised about the risks of using antibiotics. In sum, antibiotic stewardship is generally poor in rural retail pharmacies.

4.2 Results from in-depth interviews

Key information of all informants in the in-depth interviews is shown in Table 4.6.

Table 4.6: Descriptive statistics for interview informants

Identifier	**Group**	**Reason of visiting**	**Medicine requested**	**Pharmacist license and career path**
2PC1	Customers	Cold	Cold medicine	N/A
2PC2	Customers	Cold	Cold medicine	N/A
2PC3	Customers	Respiratory symptoms	Further dose of antibiotics	N/A
2PC4	Customers	Coughs and hypertension	Antibiotics and OTC medicine for coughs and hypertension	N/A
3PC1	Customers	Child's common cold	Cold medicine	N/A

3PC2	Customers	Toothache	Toothache medicine	N/A
3PC3	Customers	Toothache	Toothache medicine	N/A
3PC4	Customers	Child's cough	Cold medicine	N/A
3PC5	Customers	Mother's heart disease	heart disease medicine	N/A
3PC6	Customers	Child's fever	Cephalosporins and OTC cold medicine	N/A
3PC7	Customers	Bandages	Bandages	N/A
3PC8	Customers	Husband's stroke	Stroke medicine	N/A
3PC9	Customers	Husband's lung disease	Lung disease medicine	N/A
3PC10	Customers	Child's common cold	Cold medicine	N/A
3PC11	Customers	Gastrointestinal disease	Gastrointestinal medicine	N/A
2PW2	Staff	N/A	N/A	Working at the township hospital's radiology department
2PW3	Staff	N/A	N/A	unlicensed
2PW4	Staff	N/A	N/A	Had taken regular training on policies and regulations on the use of medicine
2PW6	Staff	N/A	N/A	Retired from the pharmacy department before working at the retail pharmacy; unlicensed
3PW1	Staff	N/A	N/A	Unlicensed

3PW2	Staff	N/A	N/A	Worked in the pharmacy department at the hospital; unlicensed
3PW3	Staff	N/A	N/A	Had families working in the hospital; unlicensed
3PW4	Staff	N/A	N/A	With an education background in traditional Chinese medicine (TCM); licensed

Eight topics were identified from the thematic analysis of interviews with both customers and pharmacy staff, including antibiotic use and antibiotic resistance, the basis of requesting medicine, convenience, healthcare system hierarchy, relations between retail pharmacies and customers, prescription, price and quality, risk and safety, and training and career. These key topics and related sub-topics were often connected in the analysis, and were discussed by both customers and pharmacy staff.

These topics were then synthesised into five interpretive themes. In the following sections, I will provide quotes that are representative of the key themes generated. Discussion of the findings in comparison to existing literature, the study's strengths and limitations and implications for antibiotic stewardship are covered in the Discussion chapter.

4.2.1 Researcher characteristics and reflexivity

In qualitative study, the researcher's background, experience, knowledge, possible biases, assumptions, position, education influence all aspects of the research process (Byrne, 2022; Van Hecke, 2017). I was mindful that my personal, cultural and experiential background in medical anthropology would bring in biases and values that could affect saturation.

As mentioned in the Introduction chapter, my anthropological fieldwork experience triggered me to adopt a holistic approach (Tompson & Chandler, 2021) when revisiting

secondary data. I also kept a code of 'Influence of researcher on site' when I went through the secondary data to help me understand how the way of researchers who collected the data affected participants' responses.

My previous fieldwork experience in the rural clinics in China and my review on other publications from the study (Shen et al., 2022, 2021) also gave me a brief impression of the rather easy access to antibiotics in the area where these secondary data was collected, therefore when I first approached the secondary dataset from the Antibiotic Pathways study I had initial interest at participants' responses on their perspective to their access to antibiotics. I also applied an iterative approach to data analysis by continuously going through cycles of analysis until no new perspectives and explanations were coming from the data, and I collaborated with my supervisor (HL) in refining the coding strategy and developing the thematic framework to minimise possible biases.

4.2.2 Experience and symptoms as the basis of requesting medicine

Customer informants were invited to discuss the basis of requesting medicine at the retail pharmacies. Their symptoms and experience were most frequently citepd as reasons why customers went to the retail pharmacy for medicine, including sometimes to obtain prescription-only medicine (POM) such as antibiotics without prescriptions. Considering antibiotic use, although most staff at these retail pharmacies emphasised that antibiotics were no longer provided at their pharmacy, quite a few customers shared their experience of buying antibiotics without prescriptions from the pharmacies.

> *Basically, cephalosporins are dispensed at pharmacies. (3PC8)*

Customers with respiratory symptoms made up a large group of the informants, and they tended to prioritise antibiotic use with their respiratory symptoms. Previous 'family experience' of the use of unprescribed antibiotics from the retail pharmacy for respiratory symptoms tended to trigger further non-prescribed antibiotic purchasing at retail pharmacies. This is also evidenced in the structured observations analysis results (see Table 4.5).

> *When cold and cough (···) I often buy in this pharmacy. Sometimes when I have a cough and cold, I myself go to a pharmacy to buy just those several anti-inflammatory drugs (*xiao yan yao*) - seem to be cephalosporin, cephalosporin anti-inflammatory drugs (*xiao yan yao*). (3PC7)*

Some customers with respiratory symptoms chose to wait for about three days before going to a pharmacy and some staff reported that they would not recommend antibiotics to these customers with respiratory symptoms,

> *For example, if the customer has a cold and feels that he must take some cold medicine, he can go directly to the pharmacy to get some cold medicine –just come in and say, "I have a cold, please get me some cold medicine". (3PW3)*

> *When it is very, very low fever, generally having some cold medicine with Chai Hu [thorowax root, a Chinese medicine commonly used in cold medicines] would be good (⋯) when it is only a slight nasal congestion, it is a process of cold and will take at least a few days to recover; generally I will tell the customer to drink more water. (2PW3)*

When deciding where to get the medicine needed, some customers preferred a familiar pharmacy and their decisions tended to be based on their previous purchasing experience and 'request the medicine by name' (2PC3) instead of consulting the pharmacists with symptoms. In accordance with the present results, previous studies have demonstrated that the prevalent self-medication with antibiotics is likely to be related to customers' familiarity with a certain pharmacy and their experience in using certain medicine (X. Yin et al., 2021).

> *Because my family often (go there for medicine), I myself have also been buying medicine there for decades. Now I know which medicine is good for me and request them, and I know where I should use those medicine. Every time I'm here, I request the medicine by name. (2PC3)*

Among customers who intended to self-medication with antibiotics (SMA), families with children tended to be 'more experienced in medicine needed for cough and colds' (3PC7). This corroborates the findings of a great deal of the previous work on the prevalence of SMA among parents, especially those with more than one child, in China (Bi, Tong, & Parton, 2000; Hui, Li, Zeng, Dai, & Foy, 1997; M. Yu et al., 2014). Antibiotics use in relation to the understanding of antibiotic effects and resistance will be explored in a subsequent section below.

4.2.3 Convenience with over-the-counter purchased and leftover antibiotics

Customers mentioned that retail pharmacies were a 'more convenient option' for them to seek healthcare services (2PC3, 3PC3). When customers talked about the 'convenience' of visiting retail pharmacies, they referred to various things –including retail pharmacies with geographical accessibility, or the time saved from not seeing qualified healthcare professionals to obtain the medicine.

Some customers generally preferred retail pharmacies as a convenient option, such as,

> *If I were to get medicine for a cold, I would go to the pharmacy and get some. (3PC6)*

> *Usually we don't go to the township hospital, it's too much trouble. (3PC8)*

Some customers emphasized the convenience of over-the-counter antibiotic purchasing in terms of buying medicine, including antibiotics, conveniently (*fang bian*) and faster from the retail pharmacies without prescriptions. The majority of short medical encounters at the retail pharmacy is also evidenced in the structured observations analysis results (see Table 4.5).

> *Pharmacies are just places where you can go to buy medications and there are no doctors. They don't carry out any examinations (*kan/ting*) of children; you just go in and say you want to buy a certain type of medicine and they give it to you. If you don't want a certain type then they won't give it to you. (3PC10)*

Other customers emphasized the convenience (*fang bian*) of storing leftover medicine, including antibiotics, at home. These antibiotics stored at home included those that were obtained, sometimes without prescriptions, from retail pharmacies. In accordance with the present results, previous studies have demonstrated that the prevalent household storage of antibiotics principally originated from OTC sales and leftover prescriptions (Lin et al., 2020; C. Sun et al., 2019; M. Wang, 2018; X. Wang et al., 2017). Previous research in China indicates OTC sales as a risk factor for storing antibiotics at home (Lin et al., 2020; Wun, Lam, Lam, Ho, & Yung, 2015).

Then put it (the medicine) away. I'm afraid I'll have a relapse in the future (···) when I'm physically exhausted, or when I'm undressed and have a cold (···) The medicine is not yet invalid so why to bother throwing it away - that's a waste, isn't it. (2PC3)

I asked him to provide it (the medicine) on purpose. Sometimes adults just sneeze and think they have a cold, and drinking the medicine could prevent it (to become serious) for a while. (3PC1)

Among this home storage of leftover antibiotics, most customers store leftover medicine at home for treatment or prophylaxis, often related to their cold or fever symptoms. This is consistent with a systematic review of antibiotic use in outpatient settings in China (Lin et al., 2020), which indicates a prevalence of SMA for prophylaxis ranging from 10.3% to 30.6%.

Among the informants, customers with children more often talked about leftover medicine at home in case of a sudden illness of the children. This correlates with the finding of the prevalence of SMA among parents with more than one child as mentioned above.

I'm a bit worried because I take care of two children on my own and sometimes they would get a fever at night. (3PC6)

In terms of the way to store leftover medicines, some customers stored their leftover antibiotics in the fridge (3PC4, 3PC7) without further explanation of the reason for doing so. A possible explanation for this might be an analogy with keeping food fresh in the fridge, while it might simply be a consequence of following the instruction leaflets.

Some medicine can be put in the fridge and some can't - it's all stated and talked through. We follow that medicine (instruction). (3PC7)

Some customers reported storing antibiotics purchased over the counter in their medicine kit at home. For them, antibiotics were one of the essential medical supplies to keep at home together with other first aid items.

There are gauze, anti-inflammatory drugs, salve, and band-aid. There's also the ointment that sometimes used when kid's father's back hurts. And there's the child's (···) gauze and the tape, and also the scissors, cotton swab etc. (3PC4)

Some shop assistants at these retail pharmacies expressed their awareness of the prevalence of SMA and reported avoiding providing multiple doses of the same POMs to customers.

Some people may have multiple uses of medicine - they buy medicine both at the hospital and at the pharmacy. Sometimes they take the same medicine repeatedly - they can take two servings of the same medicine. So we usually ask very clearly (···) "do you have the medicine at home", "did you have the medicine at the hospital before", and the customer has to say "yes". Sometimes we ask if the customer has it (the medicine) at home, (if) he says "yes", usually we go as "(it's okay) if you have it at home", and usually we don't sell it (in such cases) - this can't be sold easily. (2PW4)

4.2.4 Risk and safety concerns with antibiotic use

Previous research indicates that individuals' perception of risks has an impact on the occurrence of 'improper' behaviours (Becker, 1974). At these retail pharmacies, customers' and shop assistants' concerns about the risk in the use of medicine, especially antibiotics, lay in the following aspects: leftover and expired medicine; taking medicine, especially antibiotics, without prescriptions; and the use of instruction leaflets with the flow of responsibilities for 'proper' use of medicine between pharmacy and customers. Although storing leftover medicine at home was common among the interviewed customers, most of them would still dispose of expired medicine or return expired medicine to pharmacies for disposal, out of concern about the potential risks of taking expired medicine.

I throw it (the medicine) away after the expiry date and don't eat it. (···) There is no harm in taking leftover medicine. (···) but you can't take them after the expiry date, and if you continue to take them after the expiry date, then (···) I'm afraid it's harmful and not caring for the body ..... (2PC3)

(INT: So if the pharmacy allows and you have leftover medicine you can give it back to them, then they will refund you?) Yes. (3PC1)

Some customers considered the disposal of leftover medicine as a waste, but the concern of safe use of medicine overcame the cost-saving desire not to waste 'leftover medicine'. For example, some customers disposed leftover medicine due to particular worries about the medicine's expiry and unpredictable side effects.

> *(INT: So if you were prescribed several days of medicine, and the medicine was not all taken, what do you usually do with it?) Throw it away. (INT: Throw it away? You don't leave them at home?) No, because by then I don't know what kind of medicine it will become and how can I eat it. So I just throw it away. (3PC2)*

Guidance based on either verbal advice from pharmacy staff or the instruction leaflet that came with the box of medicine was a vital part of customers' understanding of the safe use of medicine. Apart from one customer with healthcare-related working experience who followed the instruction leaflets rather than guidance from the retail pharmacy, most customers took both instruction leaflets and verbal advice from the shop assistants as guidance.

> *It has instructions to tell you to eat in the morning. For those who generally illiterate, they (the pharmacy staff) wrote on the box that in the morning and evening to eat a few tablets; for those who literate, they know that how to eat in the morning and evening or before and after meals - the instructions are there. (···) I read the instructions (···) the staff told me how to take it. It's on top of this bag (···) written on it for you, isn't it? (INT: So you think that's they told you how to eat it? Did they tell you about the precautions?) Well, this is not. It's just that if they gave me two kinds of medicine, they would tell me to take it a few minutes apart, nothing else. (3PC1)*

When the pharmacy staff did not provide specific advice on taking medicine, the instruction leaflets were then what customers would rely on, other than the customers' or customers' families' experience of using the same medicine.

> *(INT: Did the staff explain it to you?) I looked at the instruction leaflet. (2PC2)*

4.2.5 Understanding antibiotic effects and resistance

The customers on the whole refer to their previous experience of 'convenient' access to over the counter purchased and leftover antibiotics, and these factors may explain

their understanding of antibiotic effects and resistance in terms of side effects, tolerance, and 'safer' alternatives. On the other hand, the shop assistants also hold a mix of local understanding and public health explanations of antibiotic effects and resistance.

Some customers had heard from doctors during their appointments at township hospitals that they should restrict the number of antibiotics used. The staff in clinics and pharmacies tended to be more reluctant to use some of the frequently used antibiotics such as cephalosporin and amoxicillin than before, according to customers.

> *When I went to the pharmacy to buy it, they all said amoxicillin and penicillin (···) not very good (···) so they were afraid to use it (···) so they did not keep using cephalosporin. That's what they said when we went to buy it. (3PC7)*

Out of concern about the risk of providing unnecessary antibiotics, some pharmacy shop assistants self-reported that they did not sell antibiotics to customers when they were not certain that antibiotics were medically required.

> *In the case of upper respiratory tract infections, we generally do not recommend antibiotics in the first place. (2PW2)*

> *Because of our limited conditions, we don't have prescription medicine (···) We really don't sell this medicine (antibiotics) in our pharmacy (···) I don't think we're qualified to talk about prescription medicine anymore. (2PW3)*

When explaining the difficulties to reduce the use of non-prescribed antibiotics, some shop assistants highlighted how customers relied on the use of antibiotics for common conditions and would proactively request antibiotics, such as amoxicillin. Especially for customers with children, these parents would put the hope of 'immediate recovery' on antibiotics.

> *One of their concerns is the need for healthcare –some people need immediate treatments when they have a little cough. They think that without immediate treatment they would get infection –this is a misconception on how effective antibiotics are, which is quite common in the past. Some people misunderstand that their children could recover faster with antibiotics. (2PW4)*

*Well, I feel that generally when there is a high fever (*gaoshao*), it is serious, and so, I give some antibiotics, but I don't generally use them. (2PW6)*

One interesting case is that, when the researcher approached the issue of antibiotics sales at the pharmacy repeatedly in different parts of one interview, a pharmacy shop assistant (2PW3) insisted that no more antibiotics were sold, and explained in the same way that these were POM.

I said again and again that we didn't have any antibiotics. (2PW3)

Considering most shop assistants at these pharmacies were trained on medicine use by local health authorities or pharmaceutical companies but effectively had the same role as a licensed pharmacist, there are several possible explanations for the gap between shop assistants' denial that they sold antibiotics without prescriptions and customers' shared experience of being able to purchase antibiotics over the counter. Few interviewed customers shared experiences of not being able to get antibiotics from retail pharmacies.

I decided to buy it myself (···) Cephalosporin is what we used to take for colds. (3PC6)

A possible explanation for this discrepancy might be that these pharmacy shop assistants are more conscious about the 'proper use of antibiotics' than their customers, or about the role of retail pharmacies in the healthcare system in China. Another possible explanation is that the shop assistants were suspicious and cautious about the researcher repeatedly approaching the topic of antibiotic use in retail pharmacies, due to their awareness of the new antibiotic stewardship regulation and plan for pharmaceutical trade right (T. Zhang et al., 2022). One customer noticed the influence of researchers from the medical university being on site.

Actually, normally, beside the other day you were there, if we go to the pharmacy normally, he would give me the medicine (···) Usually he would have given it (the antibiotics) to me without us having to say anything. (3PC6)

When asked why antibiotic use should be restricted, most interviewed customers and some staff understood antibiotic resistance as the body's 'tolerance' to medicine, instead of the medicine becoming ineffective as a result of microbial resistance, such as 'drug

resistance (*kang yao xing*) is when organisms have developed resistance from a drug being used a lot' (2PC2).

> *If you keep using the same medicine, something (in the body) would get used to it and the medicine could not work as usual. (3PC5)*

> *Sometimes the customers would said that "I have used the medicine for a long time but could not feel it works" and "I wonder if it's because I have taken the medicine for too long, and the drug resistance (*nai yao xing*) reduce the effectiveness of the medicine" . (3PW3)*

Besides taking 'resistance' as 'tolerance', regarding the understanding of antibiotic resistance discrepancy appears between customers and pharmacy shop assistants. Some customers also took 'resistance' as a kind of drug addiction, while some shop assistants' understanding is closer to the definition of antibiotic resistance in public health.

> *That is, ugh, becoming too reliant on the medicine. (3PC4)*

> *Drug resistance (*kang yao xing*)···drug resistance (*nai yao xing*)···someone has said that, the patients have said this (···) they would said that they have got prescribed somewhere for some doses, and the medicine did not have the desired beneficial effect. (2PW2)*

> *There is also the development of drug resistance (*kang yao xing*). I rarely use (antibiotics), now in our country, most colds are viral colds, or rarely one percent or two percent of people with concurrent respiratory infections need antibiotics, while more than 90 percent do not need to use antibiotics. I told you most cases do not need to use (antibiotics), but some pharmacies casually sell antibiotics. But still we do not recommend using (antibiotics), because (···) when I have customers with throat discomfort, 90 percent of them do not need to use antibiotics. (3PW4)*

The perception of antibiotic resistance as 'tolerance' was also related to the concern with side effects of the medicine –close to the Chinese saying that 'as a medicine, it is more or less poisonous'.

> *If we sell medicines, we usually don't give him two kinds of the same medicine, such as just two kinds of anti-inflammatory medicine, we will only give him one kind of medicine. (···) so the customer should be at a lower risk, right? (···) Otherwise, if you give them two kinds of medicine, they will have a side effect if they put them together, and that will be a problem. So we suggest customers would better to take one (kind of medicine). Let's say the customer is not allergic to a certain medicine, we suggest them would better to take the one - safety is the higher priority. (3PW3)*

Allergies were also perceived as one of the 'side effects' of medicine by the shop assistants. These staff were aware of the prevalence of allergies to some antibiotics such as amoxicillin (NHS, 2021) and cephalosporins (Khan et al., 2019) –these were also two of the most commonly used antibiotics in China (Y. Song, Han, Song, & Zhen, 2020). The prevalence of over-the-counter purchases of amoxicillin is also indicated in the structured observations at these retail pharmacies.

> *Previously in our pharmacy (we have prescription-only medicine), and we don't have prescription-only medicine in our pharmacy now. Previously, our pharmacy had the license to sell antibiotics and anti-inflammatory drugs. But usually (···) would ask them if they have a history of allergies and try not to take this type of medicine that may cause allergies. And is to say that because they were not allergic before does not mean that they are not allergic now and will not be allergic later. (2PW3)*

> *I rarely use cephalosporin and amoxicillin because I'm afraid of people being allergic. Allergies are terrible and you can't mess with allergies. (3PW4)*

In general, more shop assistants than customers were aware of the need to restrict the use of antibiotics. The pharmacy staff who were aware of the regulations on restricting the sale of antibiotics emphasized that their retail pharmacy no longer sold any antibiotics over the counter, and sometimes they explained that antibiotics were POM. Contrarily, customers were less aware of and had limited experience with the reduced availability of over-the-counter antibiotics.

4.2.6 Perception and use of traditional Chinese medicine and antibiotics

One unanticipated finding was that most customers and pharmacy staff mentioned the use of TCM and Chinese traditional patent medicines (CTPM), which was not the main topic in the interview topic guides of the original study. Their understanding of antibiotics and antibiotic resistance was also linked to their understanding and use of TCM. Some of the informants equated antibiotics to TCM, and for this informant quoted below, both antimicrobial and antiviral properties were vaguely linked to the effect of TCM.

> *Generally speaking, danshentong (tanshinone) is anti-microbial (*kang jun*). As a Chinese medicine, danshentong is anti-microbial, and also antiviral. (3PW1)*

This accords with earlier studies, which showed the prevalence of TCM, especially OTC TCM, in self-medication without the advice of pharmacists or physicians (M. Song et al., 2017). The finding in this study also broadly supports the work of other studies in this area linking the perceived safety of TCM to the widespread use of OTC TCM (M. Song et al., 2017). The current study found that some customers and shop assistants at retail pharmacies took TCM and CTPM as 'safe' alternatives, with concerns about antibiotic resistance, the body's 'tolerance' to antibiotics or side effects of using antibiotics.

> *The best we can do (to reduce this resistance) now is to use Chinese medicines as far as possible, but we can still use antibiotics if the infection goes really serious. (2PW4)*

Given that TCMs were available in pharmacies, prior studies have noted the importance of pharmacists' responsibility to ensure the safe and correct usage of traditional medicines (Harnett, Ung, Hu, Sultani, & Desselle, 2019; Ung, Harnett, & Hu, 2018; Zheng et al., 2019). However, there was a lack of clarity on the pharmacists' role in drug safety associated with the use of TCM in China (Yao, Hu, Harnett, Hu, & Ung, 2020). Also, training and qualification acquired regarding OTC TCM among pharmacy staff were complicated in China, and the current pharmacist workforce consisted of licensed pharmacists specialized in TCM, licensed pharmacists specialized in Western Medicines, and non-licensed pharmacists (Yao, Hu, Harnett, Hu, & Ung, 2020). Pharmacy staff in this study also showed a mix of backgrounds in terms of training on the use of TCM and a lack of expertise in both herbal medicine and conventional medicines (modern biomedicine).

(INT: So, do you have a pharmacist licence?) Yes, I have that. (INT: Does that mean you are a licenced pharmacist?) No, I'm not licenced pharmacist. I'm just a pharmacist. (2PW3)

(INT: Among the twenty to thirty years, you open this pharmacies, in addition to three years of study at the College of Traditional Chinese Medicine, have you participated in some other training?) That is the Drug Administration training (···) pharmacy staff certainly need pre-service training. (INT: What kind of training is generally provided?) On the use of drugs, the knowledge of rational use of drugs, or how to talk about the management of pharmacies. (INT: Have you obtained a pharmacist license?) Yes (···) no it's not on (the use of) Chinese medicine - I am a Western medicine pharmacist (···) I was trained in (Chinese medicine), but the countryside is not suitable for working with Chinese medicine. (3PW4)

A note of caution is due here since I work on secondary data without further exploration of this topic in the interviews beyond the quotations above, and I lack the socio-demographic details of the license status of all staff informants.

Chapter 5

Discussion

This chapter addresses the results within the context of recent literature, as well as the strengths and limitations of analysing the secondary pharmacy data subset from the Antibiotic Pathways study. I will first synthesise the key findings of my analysis from both the observations and interviews at the retail pharmacies from the Antibiotic Pathways study, in relation to the overarching purpose of my thesis, which is to investigate the reasons why customers in rural China obtain antibiotics without a prescription from retail pharmacies. This chapter concludes with recommendations for actions in the context of China's target-focused healthcare governance.

5.1 Summary of main findings

5.1.1 Unrestricted sale of antibiotics remained prevalent

The first question in this study sought to investigate the prevalence of OTC antibiotics dispensing and consumption and the characteristics of medical encounters in retail pharmacies. While prior research has demonstrated the ease of access to antibiotics in retail pharmacies in China (Fang, 2014; T. Zhang et al., 2022), our results show that despite the prominently announced goal of prescription-only antibiotics by 2020, there has been little apparent progress towards the goal in 2017 and 2018. Though non-prescription antibiotic sales at community pharmacies did not predominate among all medicine purchases observed at the selected pharmacies (14.55%), the percentage of potentially inappropriate antibiotic sales remains high –around 40% of customers who purchased antibiotics indicated RTI symptoms and around 30% who did not indicate any symptoms were provided

antibiotics.

Regarding the categories of antibiotics accessed over the counter, nine antibiotics on the WHO Access list (53.89%) and 18 on the Watch list of antibiotics (45.24%) were observed being sold at the 10 participating retail pharmacies. No antibiotics from the Reserve group, which stewardship programmes assess and restrict to maintain their effectiveness (WHO, 2021), were observed being sold. At these retail pharmacies, the most often requested and sold antibiotic, amoxicillin (25.07%), is in the Access list of antibiotics held to have the best therapeutic value and least potential for resistance (World Health Organization, 2020); on the other hand, amoxicillin purchasing more often occurred with combined antibiotic use among all non-prescription antibiotic sales observed (2.02%).

Both the structured observation and in-depth interviews revealed that the vast majority of antibiotic sales in pharmacies occurred in a short medical encounter. At the same time, many of these non-prescription antibiotic sales occurred when customers directly requested a certain medicine (63.40%), corroborating the findings of the in-depth interviews on experience and symptoms as the basis for requesting medicine. This together indicates that customers who knew which antibiotic they wanted and could ask for it by name were more likely to receive it than customers who simply described symptoms. With these unrestricted sales of antibiotics at community pharmacies, SMA was one of the main reasons people keep antibiotics at home or acquired them without a prescription. This is also consistent with earlier observations of self-medication in China, namely that self-medication in China is primarily the result of customers believing they can care for themselves and that self-perceived disease, economic conditions, and education are positively correlated with self-medication (Fang, Yang, Zhou, Jiang, & Liu, 2013; M. Yu et al., 2014). In addition, the shop assistants and pharmacists at village retail pharmacies were often locals who get to know most customers from the village and nearby areas. Similar to practitioners at VCs (M. Chen et al., 2020), they were often born and raised in the same community in which they and, in some cases, their families had practised medicine for decades. Hence, as medical encounters happening in rural society rest on familiarity (Fei, 1992), it would be difficult for shop assistants and pharmacists to directly refuse someone they know when customers directly request a certain medicine over the counter.

Consistent with the literature, the results of this study demonstrate a substantial correlation between antibiotics used in children without prescriptions and non-prescription sales at community pharmacies, as well as antibiotics left over (Chang et al., 2018). Pre-

vious studies evaluating antibiotic use in retail pharmacies found that an acute cough is a significant condition for inappropriate antibiotic dispensing - pharmacy staff made insufficient inquiries about the medical history of customers and instead focused more on potential side effects in children (Shi et al., 2020; Sulis et al., 2020; Wei et al., 2019; T. Zhang, 2018). Similarly, in China's primary care facilities, practitioners' fear of complications and caregivers' demand for antibiotic therapy primarily influenced the choice to prescribe antibiotics (Z. Zhang et al., 2016). In the wider literature, studies evaluating clinicians' decision-making processes when faced with 'at-risk' children with acute respiratory illness (Ashdown et al., 2016; Cabral, Horwood, Hay, & Lucas, 2014; Cabral, Lucas, Ingram, Hay, & Horwood, 2015; Y. Hu, 2016) reveal that the lack of a monitoring system, clinicians' uncertainty on diagnosis and fear of dissatisfaction of parents and caregivers, and parents' fear of bad consequences of symptoms were the most influential factors in the decision to prescribe antibiotics for children (Coxeter, Mar, & Hoffmann, 2017; Y. Hu, 2016). Prior studies gave a plausible reason for this, namely that children are typically considered an intrinsically vulnerable group (Frankenberg, Robinson, & Delahooke, 2000) and thus, as Faircloth (Faircloth, 2010) points out, parents feel keen to avoid poor parenting practices and hazards to their children (Cabral et al., 2015; Casiday, 2007; Faircloth, 2010; Lee, Macvarish, & Bristow, 2010).

5.1.2 Perception of antibiotics and alternative medicine as substitutes

The second and third questions of this study were to assess the awareness of antibiotic purchasing and consumption at retail pharmacies and to conduct an in-depth analysis of non-prescription antibiotic sales at Chinese rural community pharmacies. This study shows that community pharmacy antibiotic sales exist alongside a lack of awareness of antibiotic resistance of both providers and consumers in the retail sector. A few participants perceived antibiotic resistance as the body's tolerance to the medication, while others were concerned about the adverse consequences of antibiotic usage and the definition of antibiotic resistance used by public health authorities. In the majority of this study's cases, TCM and CTPM were recommended by pharmacists for the treatment of common colds and coughs. This finding corroborates the findings of a great deal of the previous work on the provision of over-the-counter traditional Chinese medicine (Fang et al., 2013; M. Song et al., 2017; Yao, Hu, Harnett, & Ung, 2020).

Prior research has found that a large proportion of the Chinese populace believes herbal remedies to be 'natural' and, therefore, 'safe' or to pose a minimal risk (Chung et

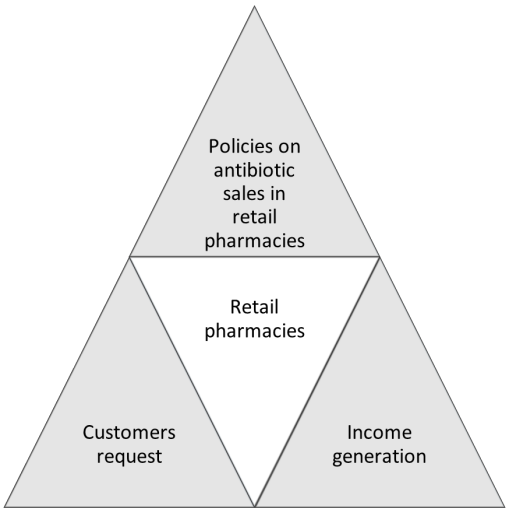


Figure 5.1: Factors of antibiotic dispensing at retail pharmacies

al., 2014; W. Xu, Towers, Li, & Collet, 2006), despite the fact that adverse drug reactions (ADR) associated with the use of herbal medicines remain common in China (Yao, Hu, Harnett, & Ung, 2020). This relates to another unexpected finding about the usage of alternative medicine in that TCM and CTPM were viewed as safer options to antibiotics that have a "quick impact but safety concerns" (3PW1) and the prevalent use of CTPM for customers who indicated RTI symptoms (cold, cough, fever, sore throat, nose discomfort, etc.) seen in the structured observation. Clinically, in recent years, TCM has proven some effectiveness in the treatment of adult acute respiratory infections and several non-infectious disorders, although well-designed studies are still required to verify its efficacy and safety (X. Y. Hu et al., 2017; Pang et al., 2020; Y. Yu, Zhang, Han, & Huang, 2020). Culturally, these results are likely associated with the localised understanding of antibiotics from the biomedicine system and the traditional medical knowledge system, as well as the semantics and translations underlying antibiotic use (Lambert et al., 2019).

5.1.3 Retail sector constraints to antibiotic stewardship

One of the most intriguing findings from the interview was the discrepancy between antibiotic sales over the counter as reported by shop assistants and the experiences of customers in similar settings –the majority of shop assistants denied that dispensing of non-prescribed antibiotics occurred in their pharmacy. As shown in Figure 2, several factors in the operation of retail pharmacies were found to contribute to non-prescription antibiotic purchasing at the studied pharmacies.

Firstly, the inconsistency in reported unrestricted sales of antibiotics among customers and shop assistants may be explained by the 'independent and profit-driven nature' (T. Zhang et al., 2022) of retail pharmacies in China, which can lead to pharmacy employees' perception of their 'role' as more concerned with meeting the requirements of customers - that in certain circumstances includes the sale of antibiotics without prescription - than with providing a professional healthcare service. This study largely complements the findings of earlier research in this field that connect the significance of the supply-side incentive of the consultation to the accessibility of antibiotics in retail pharmacies (Chang et al., 2019; J. Chen et al., 2020; Do et al., 2021; Lin et al., 2020; N. Wang, 2017; X. Yu, Li, Shi, & Yu, 2010; Z. Zhou et al., 2021). In recent decades, the role of pharmaceuticals in China has shifted, which may explain why retail pharmacists see their 'service' more in terms of meeting the demands of their consumers. After the late 1970s, economic reforms boosted private capital and competition and gave the pharmaceutical sector decision-making authority, while the Chinese government's healthcare department (after 2013 the Ministry of Health) became a weaker regulator (H. Li & Sun, 2014; T. Zhang et al., 2022).

With this shift in pharmacies' stand, the findings of this study accord with the results of previous research that community pharmacy personnel in China have good knowledge and awareness of antimicrobials, but lack the perception of the long-tern consequences such as the medical cost to treat resistant infections and actions toward antibiotic stewardship initiatives (Z. Feng et al., 2021; Hayat et al., 2019). Since 2012, new regulations and plans for licensed pharmacists in China have restricted retail pharmacies that are not owned or managed by a registered pharmacist from engaging in the pharmaceutical trade (T. Zhang et al., 2022). At the same time, with its profit-driven nature, retail pharmacies in China have taken unrestricted sales of antibiotics as an important source of income and profit for the past decades (Fang et al., 2013; T. Zhang, 2018). Although most antibiotics are off-patent, relatively inexpensive, such as amoxicillin which in the Antibiotic Pathways study most customers relied on for common conditions and would proactively request, and therefore likely to have lower profit margins compared to on-patent drugs (Boston Consulting Group, 2022), the literature reports a correlation between the profit margin on several antibiotics at retail pharmacies and pharmacists' responsiveness to antibiotic demand (J. Chen et al., 2020; Laxminarayan et al., 2013). The good knowledge and awareness of antimicrobials the community pharmacy personnel in China, together with the profit margins of OTC antibiotic sales, may explain why most shop assistants did not report OTC antibiotic use without prescriptions to medical university interviewers - they

may be concerned about getting into trouble for not following existing antibiotic use regulations, or about the potential negative impact on their future at these retail pharmacies, as they demonstrated to some extent awareness of illegal antibiotic provision.

Secondly, this observed prevalence in unrestricted sales of antibiotics at retail pharmacies also naturally raises concerns about the role of pharmacies in the intensive use of antibiotics and stewardship. In spite of official assertions that China has achieved significant advances in the development of a hierarchical healthcare delivery structure, the reality falls short of the expectations of a functioning referral system (Yuan et al., 2020). Not only do rather few residents tend to follow the hierarchical medical system when they're unwell, but also medical facilities get funding based on their administrative status, as China's health care system is primarily supported by the government, and more densely inhabited and economically developed cities have more hospitals and better medical treatment (W. Yip et al., 2019). Hence, the primary care tier of the hierarchical healthcare system has the fewest resources and the least well-equipped team of healthcare professionals (X. Li et al., 2017). Such limitations in the medical system may lead people to continue to resort to buying antibiotics over the counter –powerful commercial pharmaceutical industries in many LMICs countries exist to compensate for poor health systems; antibiotics purchased without a prescription are often the initial step in seeking treatment for an infection (Heyman, Cars, Bejarano, & Peterson, 2014). Collectively, the lack of knowledge and awareness of antibiotic resistance among the staff and the shortage of licensed pharmacists at retail pharmacists in this study corroborates earlier findings (J. Chen et al., 2020; Z. Feng et al., 2021; Gong et al., 2020; Lin et al., 2020). Findings from this study are in accordance with previous studies which have highlighted concern over the role of the pharmacy profession in antibiotic stewardship (J. Chen et al., 2020; Z. Feng et al., 2021; Lin et al., 2020; X. Wang, Xuan, et al., 2020) and a nationwide cross-sectional study revealed that nearly one-third of pharmacies in China lacked a licensed pharmacist (J. Chen et al., 2020).

Thirdly, this study reinforces evidence from prior studies (Chang et al., 2017; Coope et al., 2022) showing that a licensed pharmacist on-site is associated with a reduction in the dispensing of non-prescription antibiotics in this region. The majority of regular staff in the selected pharmacies were not licensed pharmacists, while licensed pharmacists were only present for a portion of the workday. The results also demonstrate that a pharmacist shortage persisted and health workers at retail pharmacies lacked proper training and knowledge on the implications of unnecessary antibiotic use and AMR. In Table 4.5, it

suggests that only 10.66% of customers who got antibiotics were informed on "precautions" of taking antibiotics. The only licensed pharmacist (3PW4) who participated in the Antibiotic Pathways study provided additional comments on antibiotic stewardship policies and his understanding of their implementation: "the policies are definitely feasible, but when it comes to rural settings, it simply cannot work a hundred percent." Although he still allowed certain OTC antibiotic sales at his pharmacy, his example illustrates that licensed pharmacists had a greater grasp of antibiotic resistance and why antibiotic stewardship should be adopted, and was less inclined to sell needless medicines at retail pharmacies. This suggests that training to become a licensed pharmacist could improve understanding of antibiotic use and stewardship.

5.1.4 Systemic constraints to antibiotic stewardship

This study shows that current legislation and techniques for restricting antibiotic sales in the retail sector were ineffective in limiting OTC antibiotic sales. As mentioned above, this study evidences the concern over the role of the pharmacy profession in antibiotic stewardship (J. Chen et al., 2020; Z. Feng et al., 2021; Lin et al., 2020; X. Wang, Xuan, et al., 2020), which can be explained by the fact that, compared to the regulations on the rational use of antibiotics in clinical settings in China, measures and fines to monitor retail pharmacy activities are less explicit and less heavily enforced among both rural and urban China (Chang et al., 2017; M. Chen et al., 2020; C. Liu, 2021; X. Wang, Tang, et al., 2020; T. Zhang et al., 2022). These pharmacy staff were less likely to follow the regulations on prescription-only access to antibiotics but 'balanced' between the demand for and regulation of antibiotic sales over the counter.

Another systemic reason for the excessive access to antibiotics over the counter is that it has become a 'convenient' (2PC2, 3PC2, 3PC3, 3PC6, 3PC8) means of access to this necessary medicine in the villages. This study reinforces evidence from prior observations in low- and middle-income countries, including China, which suggest that the pharmaceutical retail sector compensates for deficient health systems by treating infections in individuals who can purchase antibiotics without a prescription (Heyman et al., 2014; WHO, n.d.; T. Zhang et al., 2022). The licensed pharmacist (3PW4) informant in the Antibiotic Pathways study also witnessed how retail pharmacies in rural areas provided access to antibiotics when village clinics and township hospitals were unavailable and also when customers relied on certain type of antibiotics and could not get prescription from clinics and township hospitals. Customers viewed retail pharmacies as providing easier

access to antibiotics than village clinics and township hospitals, where the prescription process for antibiotics was more complicated and time-consuming.

5.2 Strengths and limitations

The main strength of this study was the availability of both direct observations and in-depth interviews with both providers and consumers in the Antibiotic Pathways dataset. The use of both observed records and interview data facilitated me to have a holistic approach to the secondary dataset, and my previous fieldwork experience in anthropological research contributed to a more comprehensive approach to the pharmacy dataset. As anthropologists study culture, it is assumed that they may provide advice on how to alter 'misconceptions,' promote adherence and influence 'irrational' behaviour through culturally appropriate interventions (Pool & Geissler, 2005). Nevertheless, anthropologically speaking, culture is far more complex; individuals do not just obey norms; they improvise and are creative. Therefore, to comprehend what individuals do and why, it is preferable to analyse praxis and executed processes (Singer & Baer, 2014). Using this approach, researchers have been able to reveal the current patterns of antibiotic use are the result of socio-cultural, economic and systems drivers within a medical context that draws on precepts from both biomedicine and local medical knowledge (Lambert et al., 2019). Much of the anthropological research on antibiotic stewardship has also focused on identifying and evaluating antibiotic use as an infrastructural 'quick fix', a notion that helps to understand the roles that antibiotics play beyond their immediate curative effects (Denyer Willis & Chandler, 2019) –they question public health assumptions on the overuse of antibiotics as a result of inappropriate 'patient demand' (Chandler et al., 2017). I found this methodology particularly useful when I revisited the pharmacy data subset from the Antibiotic Pathways study. As the interviews were based on customers' and pharmacy staff's recollection of the medical encounter, rather than direct observation of the antibiotic sales at community pharmacies, I utilised the structured observation records as the observed data in comparison with the interviews as the self-reported data, to have a more holistic approach to the dataset.

In contrast to secondary analysis, which employs previously collected data to investigate a new research objective (Martin, Wharf Higgins, Pauly, & MacDonald, 2017), the use of secondary data does not involve a separate study focus from that of the original work. The use of large secondary datasets in medical research is not new in healthcare

research, but it has increased, notably in comparative effectiveness and health services research (Cole et al., 2018). While administrative datasets, electronic health records, health surveys and clinical trials are some of the key sources for secondary analysis in health services research (Cole et al., 2018), this thesis followed the research questions of the Antibiotic Pathways study and has innovation in revisiting secondary data from a research project with multiple components and practical challenges in analysing and publishing all data.

This study also potentially contributes to the existing literature in the following ways: First, this study systematically examines customer-shop assistant medical interactions and the system and governance factors on over-the-counter antibiotic use in China. Although the high prevalence of the over-the-counter antibiotic problem has drawn a lot of research attention in recent years, none of the existing studies are based on empirical data about what happens in retail pharmacies. This study provides insights from the perspectives of the pharmacy staff who most of the time dispensed the medicines. The only licensed pharmacist (3PW4) was the main informant on the policy implementation of the antibiotic stewardship policies in the whole group of informants in the Antibiotic Pathways study. Although the licensed pharmacists hired in these retail pharmacies would come to visit during working hours, none of the pharmacy shop assistant informants were licensed pharmacists - one explained that he/she was too old to take the exam (2PW6), and another explained that the pharmacy owner took a few years to pass the exam but had not succeeded to get the license yet (3PW1).

The main limitation is the lack of opportunity for follow-up interviews with informants when new themes emerged from analysing the secondary dataset. Regarding this, I cross-referred between the latest studies on possible interventions or policy changes that might make a difference, to answer the third question in this study which was to identify barriers and facilitators to antibiotic stewardship in China in the retail pharmacies, for instance, enforcement of existing restrictions on OTC sale of antibiotics and education of the general public regarding the management of self-limiting illness (X. Wang et al., 2017). Further action recommendations are discussed in the following section.

Due to the limitated scope of the structured observation data, information on whether a valid prescription was used or not by customers was not available, therefore the study is limited in what it can conclude about the actual prevalence of OTC purchase of medicines. Meantime, a plausible assumption can be made that almost all purchases of antibiotics at

retail pharmacies are OTC sales without a prescription, as mentioned in Methods chapter, other publications from the study (Shen et al., 2022, 2021) show that the vast majority of clinic attendees fill their prescriptions at the pharmacy attached to the clinical facility during their visit.

Another limitation is the limited scope of descriptive statistics to describe the patterns of antibiotic seeking and sales observed in these pharmacies –only a portion of the structured observation data was employed for the observational aspect of my analysis of antibiotic purchasing and consumption at retail pharmacies. Patterns of OTC antibiotic access in relation to age, education, knowledge of the drug and drug usage, and leftovers could have been better revealed by including the customer exit survey data that exists in the dataset in my analysis. Patterns of self-medication and customers' understanding of AMR could also be better understood by analysing these exit surveys. Another direction of future analysis could be an inductive statistical analysis of factors associated with antibiotic use. After screening through the documented medical encounter records, logistic regression, a type of regression that predicts a probability of an outcome given one or more independent variables, can be utilised to analyse the factors that may influence customers' antibiotic use at retail pharmacies (Bruce & Bruce, 2017; Simpson, 2015).

5.3 Recommendations for action

Findings of this study further evidence some of the policy recommendations from the latest studies with empirical studies on antibiotic access at retail pharmacies. This is critical because China is a huge country with vastly varying levels of development across regions; therefore, even with a strong political will, it is very difficult to execute a top-down policy in a short period of time (Yuan et al., 2020), where ongoing empirical studies to provide up-to-date insights for both ongoing policies and future policy recommendations is also needed.

Firstly, this study provides evidence on some of the implications for national policy from previous studies on the enforcement of existing restrictions on the OTC sale of antibiotics and education of the general public regarding the management of self-limiting illness (X. Wang et al., 2017). The study from Wang's team shows that measures and fines to monitor retail pharmacy activities are less explicit and less heavily enforced than ones in clinical settings and indicate potential antibiotic leftovers for future self-medication at home. However, their recommendation for addressing antibiotic stewardship followed

the common path of a national campaign, whereas the results of this study indicate that addressing antibiotic stewardship as a national campaign might not be a effective way.

Most healthcare targets have been embedded in the form of national campaigns in China (Yuan et al., 2020). China's Patriotic Health Movement (L. Wang, Wang, Ma, Fang, & Yang, 2019; X. Zhao et al., 2019) and the one-child policy both indicate how a unified system that implemented national intentions in the healthcare sector could be effective and problematic at the same time (Davidson, 2022; X. Zhou, 2017, 2022). In the case of antibiotic stewardship, it has been implemented in hospitals and supervision and inspection procedures have been implemented to meet policy targets in healthcare by the end of each year (Bao et al., 2015; Xiao, 2018). Meantime. one of the pharmacy staff interviewed pointed out, 'I understand that the policy is absolutely feasible, but it cannot be a hundred per cent specific to rural areas'. When antibiotic stewardship has been implemented and became one of the healthcare responsibilities of the local healthcare sector, retail pharmacies have healthcare responsibilities together with their independent and profit-driven nature (T. Zhang et al., 2022). Local health facilities face the requirement of meeting targets and other bureaucratic logics (X. Zhou, Lian, Ortolano, & Ye, 2013) as well as providing healthcare, which would lead to the problematic behavioural patterns characteristic of muddling through (X. Zhou, 2017, 2022) when facing a numerical target of antibiotic stewardship. In light of the 'one-child policy' as an example of how a target-focused national campaign in healthcare in China can have rather serious unintended consequences, recommendations for action in antibiotic stewardship in China can be more cautious when proposing implementing antibiotic stewardship as a national campaign, as a mobilisational national campaign can be effective in China's context, but it has the adverse potential to, according to the observations of X. Zhou (2022), 'disrupting a delicate balance between the centralisation of authority and effective, local adaptation' and to ensure the safe and appropriate use of antibiotics from clinical settings to the retail sector and primary health care. Therefore, when addressing antibiotic stewardship at the lowest level of the Chinese 'three-tier' health delivery system, instead of following the common path of a national campaign in China that was partly successful in meeting previous healthcare targets, a more precise design to fit the healthcare resources at the local level is needed.

This study also supports evidence from previous policy recommendations on pharmacy education in the consultation role of the pharmacist and academic detailing, "structured visits by trained personnel to health care practices to deliver tailored training and

technical assistance to health care providers to help them use best practices" (Bishop et al., 2019; Mazmanian & Davis, 2002). Strategies such as Integrated Community Case Management, which relies on community health workers with brief training and education to increase access to medicines in poor and rural areas, has been a common practice in LMICs and has been shown to increase infectious disease treatment coverage, limit antibiotic use, and improve access to trained personnel and rapid diagnostic tests (Young, Wolfheim, Marsh, & Hammamy, 2012; T. Zhang et al., 2022). A lack of information about proper antibiotic consumption provided by a pharmacist or staff has been shown in this study; incorporating educational materials into patient consultations has been found to enhance the patient's understanding of proper antibiotic use in an earlier study (Gotsch & Liguori, 1982).

In spite of the fact that the findings of this study indicate the necessity to examine governance mechanisms in regulating the availability of over-the-counter antibiotics, this does not mean that behavioural modification has no effect. Biological processes and social factors that either promote or inhibit these biological pathways are both significantly responsible for antimicrobial resistance (ESRC Working Group, 2014; Tompson & Chandler, 2021). However, governance considerations can also contribute to the adoption of antibiotic stewardship and reduction in the continued high rates of antibiotics sold over the counter in China, in addition to previous policy recommendations concentrating on human perception and behaviour.

5.4 Conclusion

The overall aim of this thesis was to explore antibiotic purchasing and consumption at retail pharmacies in rural China. This helps answer one of the objectives of the original study that created the dataset I analysed, which is 'to understand what drives antibiotic provision, particularly antibiotics purchased without prescription at lower levels of the informal (retail pharmacies) health care system' (L. Zhao et al., 2019). Results of this study show that antibiotics sales without prescription from retail pharmacies were perceived as 'convenient' access for rural residents and self-medication partly contributed to purchasing and consumption of OTC antibiotics.

Unnecessary antibiotic use remains common in these settings with limited constraints on OTC antibiotic sales and the profit-driven characteristic of retail pharmacies. This partly resulted from the fewest resources at the primary care tier of the healthcare sys-

tem and the limited training of healthcare professionals in these settings. This study also indicates that local access to antibiotics for residents has its negotiation and resilience to top-down national healthcare policies, while at the same time, antibiotic stewardship has been mainly focused on antibiotic prescriptions in the hospitals and lacks implementation at the lower levels of the healthcare system. Therefore, the findings of this study can be of interest to policymakers or government healthcare sectors wanting to reduce unnecessary antibiotic dispensing through retail pharmacy channels, and can support policy recommendations on antibiotic stewardship in the retail sector with results from a solid empirical study.

Considering the timeline of the data collection and the analysis on the secondary dataset, my analysis of the Antibiotic Pathways study dataset which covers the period of 2017-2018 can also serve as a comparison to the potential changed pattern post-COVID-19. To understand the impact of COVID-19 on the use of antibiotics in the community, future studies are recommended to include pharmacy staff and customers as the community pharmacy is an important source for rural residents to access essential medicines and antibiotics (T. Zhang et al., 2022).

At a social-cultural level, this work raises unanswered questions about the mechanisms of governance in healthcare in China. Mobilisation as a governance framework may be acknowledged as an effective practice nationwide, but it may not apply to the experiences of the primary care tier of the healthcare system regarding access to antibiotics – campaigns can focus all efforts on the target of that campaign, leaving few resources or effort available for other important issues when implementing the goals into local settings. Therefore, when addressing antibiotic stewardship in the lower levels of the healthcare system, resources may need to be redirected in order to ensure the effective implementation of national policies.

Appendix A

Pharmacy observation guide [Chinese version]

观察清单二：顾客-店员互动/交流

药店名称:

研究人员:

顾客编码 ID: 2□-2018-□□-□□-□□□

2.1 顾客在药店停留的大概时间:

□ A. 少于 1 分钟
□ B.1-5 分钟
□ C.6-10 分钟
□ D.10 分钟以上

2.2 顾客性别

□ A. 男
□ B. 女

2.3 估计顾客的年龄

□ A.20 岁以下
□ B.20-40 岁
□ C.41-60 岁
□ D.61 岁以上

2.4 顾客是为谁买药的？

☐ A. 给自己
☐ B. 给孩子（性别_____ 年龄_____ 岁）
☐ C. 给其他人_____（性别_____ 年龄_____ 岁）

2.5 顾客和药店销售人员交流过程中是否提到了症状？

☐ A. 是
☐ B. 否

2.5.1 如果是，提到的症状是什么?（请勾选所有符合的选项）

☐ A. 感冒
☐ B. 咳嗽
☐ C. 发烧
☐ D. 喉咙疼/喉咙不舒服
☐ E. 头疼
☐ F. 尿道感染症状（尿频，尿疼等）
☐ G. 鼻子不适
☐ H. 其他_____

2.5.2 如果是，这些症状是怎样提到的？

☐ A. 顾客主动提到
☐ B. 药店员工主动提
☐ C. 在顾客和药店员工互动中提到

2.6 是否有讨论药物（包括抗生素）的选择？

☐ A. 是
☐ B. 否

2.7 药物（包括抗生素）的选择是如何决定的？

☐ A. 顾客决定
☐ B. 顾客根据药店营业员建议决定
☐ C. 顾客根据药店药师建议决定
☐ D. 药师/营业员建议，但顾客决定买其他

2.8 顾客有没有指定要买具体的药物？

☐ A. 是
☐ B. 否

2.8.1 如果有指定药物，这是

☐ A. 某一类药物
☐ B. 某一具体药物

2.9 药师或店员是否使用了任何诊断工具?

☐ A. 是
☐ B. 否

2.9.1 如果是, 有哪些?（请勾选所有符合的选项）

☐ A. 血压计
☐ B. 听诊器
☐ C. 号脉
☐ D. 体温计
☐ E. 压舌板
☐ F. 其他_____

2.10 顾客是否被要求出示身份证或社保卡?

☐ A. 是
☐ B. 否
☐ C. 出示医保卡付费

2.11 顾客最终买药了吗?

☐ A. 是
☐ B. 否

2.11.1 如果是, 在下表记录研究人员听到或观察到的药名和数量。 注：仅在此表记录有四种症状的病人买的药物：急性保卡支气管炎、咳嗽及咽喉痛，尿道感染/**或者直接购买抗生素的病人**。

	药名	**数量**
1	头孢拉定胶囊	
2	头孢氨苄甲氧苄啶胶囊	
3	头孢克洛颗粒	
4	头孢呋辛酯胶囊	
5	头孢颗粒	
6	头孢克肟分散片	
7	阿莫西林胶囊	
8	阿莫西林克拉维酸钾	
9	阿莫西林双氯酚西林胶囊	
10	盐酸左氧氟沙星胶囊	
11	诺氟沙星胶囊	
12	琥乙红霉素颗粒	
13	红霉素软膏	
14	盐酸左氧氟沙星滴眼液	
15	氧氟沙星滴耳液	
16	诺氟沙星滴眼液	
17		
18		
19		
20		
21	病人购买了其他慢性病药物比如高血压，或非相关症状药物如清凉油之类非抗生素类药物，则不必记录具体药名。	

2.12 药店员工是否向药师咨询任何治疗建议?

☐ A. 是
☐ B. 否
☐ C. 未咨询药师，咨询坐诊医生

2.13 顾客是否向药师咨询任何医学治疗建议？

☐ A. 是
☐ B. 否
☐ C. 未咨询药师，咨询坐诊医生

2.14 （如 2.12 和 2.13 均否）药师是否向顾客主动提供医学建议？

☐ A. 是
☐ B. 否
☐ C. 坐诊医生主动提供

2.15 药师或店员是否解释了服药剂量/持续服用时间/服药方式？ [1]

☐ A. 是
☐ B. 否

2.16 药师或店员是否提到任何服药禁忌？

☐ A. 是
☐ B. 否

[1]这是一个复合问题，即在一个问题中询问了三件不同的事。在数据收集过程中，这三个问题的答案被分别记录在工作表的三列中。同注于本问题的英文版本中，详见 Annex B。

Appendix B

Pharmacy observation guide [English translation version]

Objectives:

- To document characteristics of pharmacies/medicine shops where patients obtain medication for self-treatment
- To record characteristics of those seeking antibiotics and for what reasons
- To observe client-pharmacist or client-shop assistant interactions and behaviours
- To estimate numbers of antibiotic purchases for all reasons and for symptoms characteristic of RTIs and UTIs

It would be useful to focus particularly on people who have acute bronchitis, cough or sore throat who received antibiotics without prescription.

Wherever possible, two researchers may be stationed at the same pharmacy / medicine shop at the same time so that one of them can follow up customers outside the shop for more detailed conversation after the medicine purchase. The researcher inside the pharmacy / medicine shop should find an unobtrusive spot to position themselves to discreetly observe interactions between employees and customers.

All pharmacies/medicine shops in the study area will be visited and observed for a half day for a general mapping (using checklist 1 below). Then observations to record all customer-seller encounters (using checklist 2 below) and conduct exit interviews (using checklist 3 below) will be conducted at each pharmacy/shop during one round of data collection in each study area.

Observation checklist I: General setting information and built environment analysis

.....

Observation checklist II: Customer-shopkeeper encounters

Name of medicine shop:

Name of Researcher:

Participant ID: 2-yyyy-mm-dd-001

2.1 Approximate time customer stayed in the shop:

☐ Less than 1 minute
☐ 1-5 minutes
☐ 6-10 minutes
☐ Over 10 minutes

2.2 Gender

☐ Female
☐ Male

2.3 Estimated age:

☐ Under 20
☐ 20-40
☐ 41-60
☐ 61 and over

2.4 Any symptoms mentioned during the customer- pharmacy staff encounter?

☐ Yes
☐ No

If yes, what are they? [List all symptoms mentioned]:

☐ Cold
☐ Cough
☐ Fever
☐ Sore throat

☐ Uncomfortable
☐ headache
☐ UTI symptoms
☐ Others _____

2.5 In what way is/are the symptom(s) mentioned?

☐ Initiated by the customer
☐ Enquiry by the pharmacy staff
☐ Mentioned in the interaction

2.6 How is choice of medicines (including antibiotics) discussed, if any Does customer ask for certain medicine?

☐ Yes
☐ No

If yes, is it

☐ A general type of medicine
☐ A specific medicine

2.7 How is choices of medicine (including antibiotics) decided?

☐ By customer
☐ By sales staff
☐ By pharmacist
☐ Pharmacist/staff suggest, but decided by customer

2.8 Does pharmacist/shop assistant use diagnostic tools?

☐ Yes
☐ No

If yes, which ones?

☐ Blood Pressure cuff
☐ Stethoscope
☐ Pulse taking
☐ Thermometer

☐ Tongue spatula
☐ Other

2.9 Is customer asked to show any ID cards/Insurance cards?

☐ Yes
☐ No

3.0 Are medicines sold to the customer?

☐ Yes
☐ No

If yes, record the name and quantity of each medicine as heard/observed by the researcher

	Name	Quantity
1		
2		
3		
4		

3.1 Do sales staff request any medical advice from the pharmacist?

☐ Yes
☐ No

3.2 Does pharmacist offer any medical advice without being requested?

☐ Yes
☐ No

3.3 Does customer ask for any medical advice from the pharmacist?

☐ Yes
☐ No

3.4 Does pharmacist/shop assistant explain dosage/duration/administration? [1]

[1]This is a multi-part question that asked about three different issues in one question. In the data collection, answers for 'Does pharmacist/shop assistant explain dosage?', 'Does pharmacist/shop assistant

☐ Yes
☐ No

3.5 Do they explain any precautions of taking the medicine?

☐ Yes
☐ No

explain duration?', and 'Does pharmacist/shop assistant explain administration?' are documented separately in three columns in the spreadsheet.

Appendix C

Pharmacy customer interviews topic guide

Opening Questions Since you last went to XX pharmacy to purchase medicine (when you agreed to participate in our research), how has your recovery been?

- Have your symptoms improved or worsened?
- Are you still taking the medicine you bought last time from the pharmacy? OR: How much longer do you need to take the medicine? [Find out the length of time during which they took the medicine, and whether or not they were taking any other medications (especially Western medications) at the same time?

At that time, what made you decide to go to the pharmacy to buy medicine? How did you decide to buy this particular medication? A. At that time, how did you know that you needed this/these medications? [If the customer indicated that they wanted to buy a certain specific medicine when they had visited the pharmacy]? B. When you were in the pharmacy, how did you make the decision to buy this/these medications? [If the customer bought certain medication after interacting with the pharmacy staff]

- Did you consult/discuss with anyone at the pharmacy?
- Could you say a little about what you discussed?
- Do you feel that this discussion/consultation was useful/helpful for you?

In general, what did you think about the suggestions that were given to you by the pharmacy staff/ pharmacist as to what medication you should buy?

1. Attitudes towards medication/ "anti-inflammatories (*xiao yan yao*)" and their effects Do you know what the medication that you were given was, or what category of medication it was? [Make sure to find out the names of any antibacterial-type medications or other possible medication. The information given to you by the informant at this stage is very important, and you will need to use it in the rest of the interview]

- Have you heard of these medicines before?
- Is this the first time you have taken these medicines?
- How did the pharmacist/pharmacy explain to you that you should take the medication? (Did they explain how long you should take the medication for, or if you should finish all of it?)
- Do you think the medicine was effective/helpful?
- If yes, how do you think it works? If no, why not? (Find out what their understanding is in detail) When did you stop taking the medication? OR: Have you finished taking the medication? [If they have already stopped] Why? Did the pharmacist explain at what point you should stop taking it? What did you do with any remaining medication?
- What do you do with any leftover medication after you have finished with it? Do you keep any for next time? Why? Do you think there is anything potentially harmful in taking leftover medicines? Why?
- Would you ever give any leftover medication to someone else? If yes, then under what circumstances?

2. Sequence of events in the treatment process Could you explain the whole process you went through in falling ill that led you to go to XX pharmacy to buy medication?

- In what ways were you feeling unwell?
- When did you start to feel unwell?

Last week (or two weeks ago - look at what the exact time was) when you began to feel unwell, what did you do first (find out in detail what the steps they took for treating the illness were)? If the researchers think it is helpful, then the informant's process of treating the illness can be noted down on a blank piece of paper. According to the sequence of events, you should find out particularly what elements triggered the visit to the pharmacy, especially any self-medication that was carried out using antibiotics (*kang sheng su*) before they went to the pharmacy.

Three key points to record are as follows:

- Types of treatment/ types of medication received (if applicable):
- Where the treatment/medication came from (family/friends/pharmacy/doctor's prescription):
- The sequence of events in treating the illness:

What you think was the cause of your illness? [Find out in detail whether or not they think the disease is contagious; find out what their understanding of having a "cold (*gan mao*)" is] When you went to the pharmacy did you actively ask for a certain medication? Why did you want a certain medication by name? Are you aware that in the country there are certain medicines that are prescription and others that are non-prescription? Are there any risks involved when buying prescription medication from the pharmacy without a prescription? What are the differences between a pharmacy and a clinic? Do you think that there is ever a difference between the two places in terms of the quality/price of drugs? Why did you come to the pharmacy to buy them? Do you buy a lot medication as a matter of course?

3. Day to day medicines kept at home (in the medicine cabinet)? Do you generally keep any commonly used medicines at home? What common medicines/types of medicine do you have at home? [Pay attention to the names and types of any drugs] Where did you get these medications from? Do you take/use different medicines in different situations? How do you decide?

- Do you know which ones are anti-inflammatories (*xiao yan yao*)?

What effect do these medicines have? [If they mention any antibiotic (*kang sheng su*) brand names, find out what they think these do] How did you know how to take these medications? [If the informant uses the words "anti-inflammatories (*xiao yan yao*)" or 'antibacterials (kang jun yao)' at any point during the course of the interview, then you can enquire more deeply as to what the informant's understanding of 'anti-inflammatories (*xiao yan yao*)' is, as well as their thoughts, habits/behaviours in taking them, depending on the words that were used previously in the discussion. Questions about "anti-inflammatories (*xiao yan yao*)", "antibacterials (*kang jun yao*)", and "antibiotics (*kang sheng su*)", depending on the vocabulary used in the previous discussion. Have you ever heard of anti-inflammatories (*xiao yan yao*)? What drugs do you think are anti-inflammatories (*xiao yan yao*)? (In your understanding, which drugs belong to the anti-inflammatories (*xiao yan*

yao) category?) [If by this point in the interview the informant has not mentioned anti-inflammatories (*xiao yan yao*) or other related words, then the researcher conducting the interview should actively bring up the topic of anti-inflammatories (*xiao yan yao*)] How do you judge whether or not you need to take anti-inflammatories (*xiao yan yao*)?

- Could you explain what your understanding is of the term "anti-inflammatories (*xiao yan yao*)" as it is commonly used?
- Can you explain how these anti-inflammatories (*xiao yan yao*) actually work? What do you think "inflammation (*yan*)" and "inflammatory illness (*yan zheng*)" actually refer to?

Under what circumstances would you or your family members go directly to the pharmacy to buy anti-inflammatories (*xiao yan yao*)? [Ask about possible reasons: as a preventative medicine; in order to recover from the illness more quickly; whether or not it is a matter of convenience, cost, or quality of the medication]

- Are more expensive drugs better?
- Do you have any misgivings about taking these medications? [If yes, then what are they?] What side effects do you get after taking them?

4. Concerning "Drug Resistance" (AMR) [I've heard that in 80s there was a villager who started using penicillin. At first the results were very good. They would have a penicillin drip for a cold (*gan mao*) or fever (fa shao), but now when they use penicillin the results are not as obvious as before.] Have you ever experienced anything like this before?

- If yes, then what do you think is the reason for this? What causes it? [If no, then enquire about "drug resistance (*kang yao*)"] Have you heard of "drug resistance" (*kang yao*) (or tolerance (nai yao))? What is your understanding of "drug resistance" (*kang yao*) or tolerance (nai yao)? Do you know what causes drug resistance (*kang yao*)?

Appendix D

Pharmacy staff interviews topic guide

Research Introduction

Thank you for agreeing to participate in our study. I am a researcher from Anhui Medical University. We are very interested in your pharmacy, and would like to ask for some insights from your experience here and some of your opinions.

As we go, we will ask you a few questions. There are no so-called standard answers or correct responses to these questions because what we would like to understand is your own personal experience and perspective.

This interview should last 1-2 hours but you may stop at any time if you wish. The content of the interview will only be seen by our research personnel. During the course of any discussions related to this research project, we will keep your name and work address anonymous.

The information you provide is very important for our study. In order to not omit anything, may I use an audio recorder? Once we have transcribed the recording, the audio file will be deleted. This interview transcription will only be seen by research personnel.

May we begin?

Part 1 Normal Practice

Please describe the whole process you will go through when serving a customer who has come to buy medicines.

- Would you ask the customer about their symptoms?

- Would you carry out a diagnosis of the customer after they arrive?
- Enquire as to why they do things this way

Normal Practice in the Pharmacy

What are some of the common health problems experienced by customers who come here to purchase medicines?

- What is the most common infection (*gan ran*) that your customers have?
- Do you know which types of infections (*gan ran*) they have? What exact work does a professional pharmacist do? In what way does the exact role of a professional pharmacist differ from other ordinary workers in the pharmacy? (Suggest: How is guidance for using medication given?)

How do you think the pharmacy can gain more customers or repeat customers? What does a pharmacy need to do in order to have a good reputation in the long term?

Sale of Antibiotics (*kang sheng su*)

The process staff go through in deciding to issue antibiotics (*kang sheng su*)

- Which medications do you usually recommend to customers suffering from coughs (*ke sou*) (especially upper respiratory tract infections/bronchitis/colds (*gan mao*))?
- Which medications do you usually recommend to customers suffering from sore throats?
- Which medications do you usually recommend to customers suffering from urinary tract infections?

How do you make the decision about which drugs to recommend?

What are the symptoms or indicators that a customer may have for which you think they would need to take "anti-inflammatories (*xiao yan yao*)/antibiotics (*kang jun su*)/anti-infection (*kang* gan ran) drugs" (Choose the particular vocabulary you use based on the answers given to you by the informant for the above questions, or the words that you normally hear them use in the pharmacy)?

- Suggest: Fever (*fa shao*), a noise in the chest cavity/lungs, asthma, pain, coloured sputum (green or yellow), spots on the tonsils; any other signs of something wrong in the body? How many days has the illness lasted?
- Under what other circumstances would you suggest that the customer takes anti-

inflammatories (*xiao yan yao*)/antibacterials (*kang jun yao*)?

- Which customers would you recommend go to hospital?
- Which customers would you recommend don't need medication? What are the drugs that you most often recommend for the above symptoms (coughs (*ke sou*), sore throat, fever (*fa shao*), chest infection (*shang gan*))? (Amoxicillin and cephalosporin? How do you differentiate these two when making recommendations?)
- When you are not sure whether or not the patient should be given antibiotics (*kang sheng su*), what do you do? (Do you ask the professional pharmacist, resident doctor, or anyone else?)

What situations fall under the category of those where "anti-inflammatories (*xiao yan yao*)/antibiotics (*kang sheng su*) could either be used or not not used"? (What do you generally recommend that customers buy in these situations?) When selling antibiotics (*kang sheng su*), are you concerned that there might be risks? What kinds of risks?

- If yes, please could you give examples?

Would you ever give customers TCM preparations to treat infections? For instance qingkailing. Under what circumstances would you recommend that customers buy TCM preparations? What kind of effects do you feel qingkailing and other TCM preparations have?

Please talk about your understanding of the common cold (*pu tong gan mao*). Because there are a lot of customers who come here with the common cold, is that right?

According to your understanding, what symptoms are associated with the common cold (pu tong *gan mao*)?

What would you normally recommend customers buy who have a "common cold (*pu tong gan mao*)"?

- Do you think the common cold (*pu tong gan mao*) is an infection? If so, then what type of infection?

How can you tell if a customer has an infection? Can you distinguish between different types of infection? Can you distinguish between viral and bacterial infections? How?

- Would you ever recommend that a customer buys medications to treat both viral and bacterial infections at the same time? Under what circumstances would you

make this recommendation?

- Do you think this is common practice? Might this have any consequences?

How do you think "anti-inflammatories (*xiao yan yao*)/antibacterials (*kang jun yao*)/antibiotics (*kang sheng su*)" actually work? Under what circumstances would you recommend that a customer buy a type of "anti-inflammatory (*xiao yan yao*)"? Please give examples Under what circumstances would you recommend that a customer buy two or more types of antibiotics (*kang sheng su*)? Please give examples

Customers influencing prescriptions of "antibacterials (*kang jun yao*)/anti-inflammatories (*xiao yan yao*)"

Do customers ever specifically ask to buy certain drugs or any particular types? How do you deal with any pressure from customers? Suggest: e.g. Do customers with self-limited diseases (such as colds (*gan mao*)) ask for "antibacterials (*kang jun yao*)"? Does this affect the reputation of the pharmacy? Have you ever refused a customer's request for "anti-inflammatories (*xiao yan yao*)"?

- If yes, under what circumstances? Any specific examples?
- Do you feel it is difficult to refuse a customer's requests? Why? If you have ever refused a customer's request to buy a certain medication before, did you try to explain the reasons to the customer? How would you say it?
- Generally speaking, do customers listen to your explanations or advice?

Do you ever suggest that customers buy cheaper medications? Why? Under what circumstances would a customer need to show their ID before they could buy medications? Under what circumstances would a doctor's prescription be required before you would sell something to a customer? Under what circumstances might a professional pharmacist "supplement the prescription"?

Part 2: Conversations with Pharmacy Workers and Customers

Relationships with customers

Whereabouts do your customers mainly live?

- Do you know most of them?

Discussions between pharmacy staff and customers/ between staff themselves concerning "anti-inflammatories (*xiao yan yao*)" or "antibiotics (*kang sheng su*)"

What would you call this type of medicine [the researcher should point to a commonly found antibiotic (*kang sheng su*) medication in the pharmacy, e.g. a cephalosporin-type drug or penicillin] and other medications for treating (bacterial) infections?

- Do you use these words in discussions with customers?
- What words would you use when talking to customers?
- What words would you use when talking with other pharmacy staff? Do you think that "antibiotics (*kang sheng su*)" and "anti-inflammatories (*xiao yan yao*)" have the same meaning?
- Please specifically state in what scenarios you would use "anti-inflammatories (*xiao yan yao*)"; and in what scenarios you would use "antibacterials (*kang jun yao*)/antibiotics (*kang sheng su*)"
- If these are different, then how do you differentiate them? Do you use any other words? E.g.: anti-viral (kang bing du) drugs, anti-infection (*kang* gan ran) drugs, antibacterial (*kang jun yao*) drugs?
- When would you use them and why?
- Do you differentiate their usage? How?

Do you think you need to tell a patient how they should take antibiotics (*kang sheng su*)? Or to pay attention to the instructions?

Why do you think some customers ask for certain drugs? Do you think that this could be a problem?

Do you think it is important to ask customers what their symptoms are? To ask what their symptoms are?

Do you feel there are any differences between your pharmacy and others? What is the situation with other places selling medications?

Why do you think people come to your pharmacy for medications when they are ill? Why don't they go to others?

Concerning your knowledge of pharmacy supervision and administration, how do you understand that a prescription is required to get medicines? Do you think other pharmacies ask for prescriptions before selling medicines?

Which drugs are broad-spectrum antibiotics (*kang sheng su*) and which are narrow-spectrum?

Do you think that the amount of antibiotics (*kang sheng su*) given to patients is too much or not very much? If the amount a patient wants is too much or too little, would you address with them? Why? How?

Understanding of Drug Resistance (AMR) (*kang yao xing*)

Have you heard of "drug resistance (*kang yao xing*)"? (If the informant has not mentioned it up until now)

- Where did you first hear of it?
- In your pharmacy work, have you ever taken note of anything related to "drug resistance (*kang yao xing*)"? What do you think drug resistance (*kang yao xing*) is?
- Do you think that customers should be concerned about drug resistance (*kang yao xing*)? Why?
- Are you concerned about drug resistance (*kang yao xing*)? Do you feel this is a problem?

What do you think the main causes are of drug resistance (*kang yao xing*)? How does it arise and how does it spread?

- Have you ever not sold antibiotics (*kang sheng su*) to a customer because you were concerned about the risks of drug resistance (*kang yao xing*)? In your opinion, what can be done to reduce "drug resistance (*kang yao xing*)"? Have you ever explained drug tolerance (*nai yao xing*) to a customer?
- Do you think that customers understand the concept of tolerance (*nai yao xing*)? In your opinion, do you feel that pharmacies need to reduce the amount of "antibacterials (*kang jun yao*)" they are selling? Why?

Professional Experience and Specialisms

Your education: (Suggest: do you have a medical background: when, where, for how many years did you study; what did you specialise in?) Your professional career/work experience

- How long have you worked here? What types of work had you done previously? Have you ever worked in another pharmacy?
- Have you ever studied anything related to medicine before? Before you or any of the other the staff started working in this pharmacy, did you need to undergo any training? What was the content of the training? Where did the training happen?

(E.g. Paying attention to medicine instructions/ which medicines are for which symptoms?)

- Do you have a professional pharmacist's certificate? What kind of preparation is needed to qualify as a pharmacist?

Appendix E

Characteristics of antibiotic purchasing, by gender, n (%)

	Total	Gender	
		Female	Male
Symptoms			
Cold	37 (10.66)	21 (6.05)	16 (4.61)
Cough	75 (21.61)	39 (11.24)	36 (10.37)
Fever	1 (0.28)	1 (0.29)	0
Sore throat/throat discomfort	30 (8.64)	14 (4.03)	16 (4.61)
Running nose/nose discomfort	8 (2.30)	5 (1.44)	0
Headache	4 (1.15)	2 (0.58)	2 (0.58)
Suspected UTI	2 (0.57)	2 (0.58)	0
Other symptoms	129 (37.18)	73 (21.04)	56 (16.14)
Not indicated	105 (30.26)	52 (14.99)	52 (14.99)
Type			
Independent	284 (81.84)	149 (42.94)	135 (38.90)
Chain	61 (17.85)	33 (9.51)	26 (7.49)
Medical counter length (minute(s))			
<1	57 (16.43)	30 (8.65)	26 (7.49)
1-5	241 (69.43)	125 (36.02)	113 (32.56)
6-10	33 (9.43)	20 (5.76)	13 (3.75)
>10	8 (2.43)	3 (0.86)	5 (1.44)
Missing	8 (2.43)	4 (1.15)	4 (1.15)
Reasons for purchasing antibiotics			
for themselves	183 (53.74)	84 (24.21)	95 (27.38)
for their children	48 (13.83)	31 (8.93)	17 (4.90)
for their families other than children	70 (20.17)	43 (12.39)	27 (7.78)
Missing	51 (14.70)	28 (8.07)	23 (6.63)
Patients requested medicine			
Yes	220 (63.40)	11 (31.99)	105 (30.26)
No	73 (21.04)	39 (11.24)	34 (9.80)
Missing	54 (15.56)	32 (9.22)	22 (6.34)
Drug usage information provided by a pharmacist or staff			
Dose explained	183 (52.74)	99 (28.53)	81 (23.34)
Duration explained	83 (23.91)	47 (13.54)	35 (10.09)
How to take medication explained	102 (29.39)	54 (15.56)	46 (13.26)
Precautions explained	59 (17.00)	30 (8.65)	29 (8.36)

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