such as hypertension, diabetes, respiratory tract infections, and pain-related syndromes. However, evidence from primary care studies indicates that drug-related problems (DRPs) are highly prevalent in community populations, including inappropriate drug selection, irrational dosage or treatment duration, and poor medication adherence, with the proportion of affected patients exceeding 70% in some studies (Ni et al., 2022). In real-world retail pharmacy settings, medication use is often organized around "medication combinations," whereby consumers select multiple drugs during a single purchase to address a specific symptom or symptom cluster. The formation of such medication combinations is jointly influenced by disease spectrum, empirical medication pathways, pharmacists' recommendations, patients' knowledge and perceptions, and drug availability (Do et al., 2025). Existing research has demonstrated that polypharmacy is significantly associated with an increased risk of drug-related problems; nevertheless, when supported by adequate evidence, rational combination therapy can also play an important role in improving the control of complex symptoms (Xiao et al., 2023; Meng et al., 2023).

This study aims to explore the value of analyzing medication structures in retail pharmacies from a "medication combination" perspective in elucidating real-world medication decision-making processes. Compared with analyses focused on single drugs, a medication combination approach is better suited to capturing the characteristics of medication practices in primary care settings. The concentration of medication combinations reflects the dominance of a limited number of commonly used regimens in actual practice, whereas heterogeneity indicates the degree of dispersion among different combinations in terms of composition and potential risk profiles. Given that existing studies have largely focused on prescription structures in medical institutions or on aggregate pharmaceutical sales at the macro level, quantitative analyses of medication combination structures in real-world retail pharmacy contexts remain relatively scarce. Based on real sales and electronic dispensing data from Xiongcheng Jianmin Pharmacy in Zhuji City, Zhejiang Province, from 2023 to 2024, this study systematically examines the concentration and heterogeneity of medication combinations for common diseases in retail pharmacies, compares structural differences across disease categories, and identifies potential risks associated with inappropriate medication combinations, with the aim of providing empirical evidence to support the optimization of primary pharmaceutical management and the formulation of rational drug use policies.

2 Data and Research Methods

2.1 Data sources

The data used in this study were obtained from the health insurance settlement sales detail records of Xiongcheng Jianmin Pharmaceutical Co., Ltd. in Zhuji City, covering the period from January 2023 to December 2024. Transaction records served as the basic unit of analysis, encompassing all health insurance–reimbursed medication purchase activities that occurred at the pharmacy during the study period. The dataset exhibits a high degree of completeness and reliability. The main variables include the name of the medical institution, settlement date, disease code, drug name, drug category, sales volume, unit price, and payment structure. Among these, disease codes provide an approximate indication of the disease type associated with each purchase, while drug expenditure data offer a quantitative basis for analyzing medication-use structures and concentration (Fourkiotis and Tsadiras, 2024; Iqradiya and Wijayanti, 2025).

The study period was defined from January 1, 2023, to December 31, 2024, covering two consecutive complete calendar years. A total of 19,661 valid sales/dispensing records were included, with 10,080 records from 2023 and 9 581 from 2024. The transaction volumes across the two years were comparable, with no significant discontinuities or abnormal fluctuations observed. The cumulative sales revenue during the study period amounted to approximately RMB 4.376 million, with an average transaction value of about RMB 222.6, indicating that the pharmacy maintained a relatively stable scale of operation and service demand structure throughout the study period.

2.2 Analysis of medication combination concentration for common diseases

2.2.1 Diseases with high concentration

For certain common chronic diseases, medication combinations exhibit a highly concentrated pattern. For example, in conditions such as hypertension, hyperlipidemia, and some cardiovascular-related diseases, patients'