

CHAPTER I

INTRODUCTION

This chapter describes the basis and direction of the research conducted. The first section discusses the background explaining the current condition of pharmaceutical management in health installations, the problems encountered, and the urgency of developing a website-based information system using the K-Nearest Neighbor (K-NN) method as a solution. The subsequent sections present the problem formulation as the research focus, the scope and limitations that define the boundaries of the work, the research objectives to be achieved, and the research benefits both theoretically and practically for the pharmacy installation of X Hospital.

1.1 Background

The rapid development of information technology has brought significant transformation to the healthcare sector, including pharmaceutical service management. Information systems play a crucial role in improving operational efficiency, recording accuracy, drug distribution security, and data-driven decision-making. Hospital pharmacy installations are vital medical support units responsible for providing pharmaceutical supplies within hospital environments. Referring to the Regulation of the Minister of Health of the Republic of Indonesia Number 72 of 2016 concerning pharmaceutical service standards in hospitals, all pharmaceutical service activities must be carried out systematically and in a structured manner, making pharmacy information systems highly necessary [1]. The World Health Organization (WHO) also emphasizes that health information systems must be able to integrate service data, management, and logistics to support the improvement of service quality [2].

The reality in many healthcare facilities in Indonesia, particularly in medium-scale hospitals and pharmacies, reveals significant problems in pharmaceutical management, including manual or semi-digital recording, delays in drug stock updates, inventory data discrepancies, and risks of drug expiration due to inaccurate planning. The main challenges of pharmaceutical service systems include limited human resources, inadequate infrastructure, and suboptimal management systems, which directly impact patient waiting times and service satisfaction. Based on data obtained in 2022-2023 at X Hospital, regarding drug supplies and Consumable Medical

Materials (BMHP), 193 expired items were recorded, reaching 9.64% of the total available items. This condition was caused by a stock management system that was still conducted manually, resulting in delays in data input processes, stock calculation errors, and low accuracy in drug procurement planning. This condition confirms the urgency of developing a more reliable drug stock management information system at the pharmacy installation of RSU X.

Previous research has proven the effectiveness of website-based information systems in addressing similar problems. Zainudin (2024) successfully developed a web-based drug inventory information system at Bina Kasih Hospital using PHP and MySQL, resulting in an 80% reduction in recording errors and a 50% acceleration in reporting [3]. Aini et al. (2025) developed a PHP-MySQL-based drug inventory system that integrates seven main functions including real-time stock monitoring and stock classification based on specific methods [4]. Furthermore, research on a web-based drug stock management system using the Lean Software Development (LSD) method successfully built an automatic drug expiration status classification feature into three categories: Safe, Near Expiration, and Expired [5].

In the context of website-based technology development, the use of the Laravel framework has proven to accelerate the development process of medium to large-scale information systems. Sinlae et al. (2024) demonstrated that Laravel has advantages in its structured MVC architecture, Eloquent ORM that facilitates interaction with MySQL databases, and strong built-in security features [6]. Marli'aini and Anggoro (2024) proved that the implementation of the Laravel framework in an inventory information system produced an efficient system with good usability scores based on System Usability Scale (SUS) testing [7].

To enhance system intelligence in drug management and classification, this research integrates the K-Nearest Neighbor (K-NN) algorithm as a method for classifying drug contents and types as well as a drug substitution recommendation feature. The K-NN algorithm has proven effective in the pharmaceutical context. Fauzie and Supatman (2024) successfully classified National Health Insurance drug procurement data using K-NN with the highest accuracy reaching 98% at $k=7$ and $k=9$ [8]. Ma'rifat et al. (2024) proved that K-NN is capable of predicting drug sales categories based on historical data with a high accuracy level, thus assisting in more precise and efficient drug procurement planning [9]. Azis et al. (2024) also

demonstrated that K-NN successfully identified the best-selling drugs and medical devices in hospitals, helping optimize stock availability and reduce waste from overstock or stock shortages from stockout [10].

Based on the description of problems and previous research reviews mentioned above, this research develops a website-based pharmacy information system using the Laravel 12 framework that integrates the K-NN algorithm for classifying drug contents and types at the pharmacy installation of RSU X. The system is developed using the Waterfall method, which was chosen because the system requirements were clearly defined from the beginning through analysis of the existing system conditions developed during the Field Work Practice (PKL). Zainudin, Hadi, and Priyadi (2024) and Marli'aini and Anggoro (2024) also applied the Waterfall method in web-based information system development and proved that this method is effective for projects with a clear scope, well-defined requirements from the outset, and a structured timeline [3] [7]. Testing was conducted using Black Box Testing to verify the functionality of all system features. By integrating K-NN into the website-based pharmacy information system, the developed system is expected to significantly improve drug management accuracy and support the digital transformation of healthcare services at RSU X.

1.2 Problem Formulation

Based on the background described above, the problem formulations in this research are as follows:

- 1) How to design and build a website-based pharmacy information system capable of managing drug stock in real-time at X Hospital?
- 2) How to implement the K-Nearest Neighbor (K-NN) algorithm in classifying drug contents and types to automatically recommend drug substitution products in the pharmacy information system developed at RSU X?
- 3) How to verify that all critical features of the developed pharmacy information system function according to functional requirements specifications based on Black Box Testing results?

1.3 Research Objectives

Based on the problem formulations established, the objectives of this research are:

- 1) To design and build a website-based pharmacy information system capable of managing drug stock in real-time at X Hospital.
- 2) To implement the K-Nearest Neighbor (K-NN) algorithm for classifying drug contents and types so that the system can automatically recommend drug substitution products based on the similarity of active substance content (strength) and price (HET).
- 3) To verify the functionality of critical features of the developed pharmacy information system using the Black Box Testing method to ensure the system operates according to the established functional requirements specifications.

1.4 Research Benefits

This research is expected to provide the following benefits:

a. Theoretical Benefits

- 1) To provide scientific contributions in the form of empirical evidence of K-NN method application in the context of website-based pharmacy information systems in hospitals.
- 2) To provide additional research references for the development of website-based pharmacy management information systems for future research.

b. Practical Benefits

- 1) To provide a digital solution for the pharmacy installation of X Hospital in improving drug stock management efficiency, reducing the risk of drug expiration, and accelerating reporting.
- 2) To assist pharmacy staff in automatically classifying drug contents and types using the K-NN method, thereby reducing the potential for medication errors.
- 3) To support the digital transformation of healthcare services at X Hospital toward an integrated and data-driven information system.

1.5 Scope and Limitations

To ensure this research is more directed and focused, the following scope and limitations are established:

- 1) The pharmacy information system is developed as a website-based system using the PHP programming language with the Laravel framework, CSS, JavaScript, and MySQL database.
- 2) The research location is at X Hospital, with the drug data used sourced from the hospital's pharmacy installation.
- 3) The K-NN method is specifically used for classifying drug contents and types, not covering electronic medical records modules or external drug procurement systems.
- 4) System features include drug data management (master), transactions (drug incoming and outgoing), drug type/content classification with K-NN, and stock reporting.
- 5) System testing is conducted using the Black Box Testing method to verify that all critical system features operate according to the established functional requirements specifications.