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IMPLEMENTATION OF MONITORING SIDE EFFECTS OF DRUGS IN DRUG-RESISTANT TUBERCULOSIS PATIENTS IN REFERRAL HOSPITALS: A QUALITATIVE STUDY

Elmiawati Latifah[1], **Endang Yuniarti**[2*], **Rinto Susilo**[3], **Hidayah Karuniawati**[4], **Nur Azizah**[5], **Dyah Aryani Perwitasari**[6], **Syifa Imelda**[7]

[1]*Department of Pharmacy, Faculty of Health Science, Universitas Muhammadiyah Magelang, Magelang, Indonesia*

[2] *Department of Pharmacy, Faculty of Health Science, Universitas Muhammadiyah Gombong, Kebumen, Indonesia*

[3] *Department of Pharmacy, Faculty of Pharmacy, Universitas Muhammadiyah Ahmad Dahlan, Cirebon, Indonesia*

[4]*Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Universitas Muhammadiyah Surakarta, Surakarta, Indonesia*

[5]*Department of Pharmacy, Faculty of Pharmacy, Health and Science, Universitas Muhammadiyah Kuningan, Indonesia*

[6]*Faculty of Pharmacy, Universitas Ahmad Dahlan, Yogyakarta, Indonesia*

[7]*Gunung Jati Regional Hospital, Cirebon, Indonesia*

**Email Corresponding: endangyuniarti@unimogo.ac.id*

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ABSTRACT

Drug-resistant Tuberculosis (TB) is a public health problem that poses major challenges to patients, health workers, society, and the healthcare system. This qualitative study explored the implementation of drug side-effect monitoring and the role of health workers in handling side-effect monitoring medication for patients with TB. We collected data through focus group discussions and conducted in-depth interviews. The informants in this study were doctors, pharmacists, and nurses who were directly involved in treating patients with drug-resistant TB. Two drug-resistant TB referral hospitals in the Cirebon area hosted this study. INVIVO 12 was used for the qualitative analysis. Both hospitals still need to optimize the mechanism for tracking drug side effects in drug-resistant TB patients in accordance with technical guidelines. Doctors at both hospitals played a significant role in implementation compared to other health workers. Doctors in both hospitals play a similar role in implementation, including initial examination and history taking, determining causality, managing medication side effects, and providing education on these effects. Pharmacists have a similar role in managing drug side effects and documenting "unwanted events." In both hospitals, nurses played a similar role in educating patients about drug side effects. We need to increase the implementation of drug side effect monitoring by conducting assessments of their causality, documenting them using specific instruments in accordance with standards, ensuring the completeness of manual monitoring forms, and providing continuous drug side effect monitoring training for health workers.

Keywords: Implementation, monitoring side effects of drugs, drug-resistant tuberculosis, hospital

INTRODUCTION

Tuberculosis is an infectious disease that is a major cause of poor health, is one of the top 10 causes of death worldwide, and is the main cause of death from a single infectious agent (ranked above HIV/AIDS). Indonesia ranks among the three countries with high burdens of TB, TB, HIV, and drug-resistant TB (WHO, 2020; Bagcchi, 2023). When a

person who might have TB becomes resistant to at least isoniazid and rifampicin, along with or without other first-line drugs such as isoniazid, rifampicin, ethambutol, and streptomycin, it is called drug-resistant TB (Kemenkes, 2022; WHO, 2020; Perhimpunan Dokter Paru, 2006). In Indonesia, the estimated number of resistant TB patients is 2.40% of all new TB patients and 13% of previously treated TB patients, with a total incidence of 24,000.

Drug side effects of drug-resistant TB present a significant challenge in the treatment process, particularly because these drugs often include new drugs and regimens that contain more types of drugs than those used in drug-sensitive TB. Over the last decade, some studies have shown that morbidity and mortality related to drug use are two of the main health problems. The United States estimates drug side effects to be the fourth- to sixth-largest cause of death. Adverse drug reactions result in the death of several thousand patients annually. For example, in several countries, the percentage of patients treated in hospitals for side effects is more than 10% (Norway, 11.5%; France, 13.0%; England, 16.0%) (BPOM, 2019). According to one study, TB drugs cause side effects that force patients into hospitals (Sahilu *et al.*, 2020). According to a study that looked at many studies, the most common side effects of drugs, especially pyrazinamide, in people with drug-resistant TB were gastrointestinal (23%), hepatotoxicity (20%), rash (13%), and hyperuricemia (6%) (Lan *et al*., 2020).

A total of 176 patients experienced side effects from long-term treatment for drug-resistant TB, primarily in the digestive tract (52.8%) and with electrolyte disorders, such as hypokalemia (15.3%) and hyponatremia (8.5%), but most of these patients recovered. In 37 patients, the outcomes included treatment failure (5.1%), treatment dropout (31.8%), and death (21.1%). High side effects affect the success of drug-resistant TB treatment (Iswa, 2019). It is impossible to separate successful drug-resistant TB treatment from drug side effect management. Health workers, including doctors, pharmacists, and nurses who directly serve patients, play an important role in monitoring the side effects of drugs. Pharmacovigilance activities and monitoring of drug side effects are important for postmarketing drugs, considering the variability of individuals using different drugs compared to the time of study (Iswa, 2019).

According to one study, health workers' roles, drug side effects, and knowledge all have an impact on TB patients' non-compliance with medication (Yeti and Usman, 2021). Indonesia has had a pharmacovigilance system called Cohort Event Monitoring (CEM) since 2015 for drug-resistant TB patients who were part of the first bedaquiline trial. Since mid-2017, all patients with drug-resistant TB receiving treatment have also undergone basic-level active drug side-effect monitoring. Implementation of effect monitoring: The Food and Drug Supervisory Agency (BPOM) and the Directorate of Prevention and Control of Infectious Diseases (P2PM) collaborate to provide active drugs for drug-resistant TB in Indonesia. This collaboration involves various parties, such as the Provincial, Regional, and City Health Service, the National Pharmacovigilance Committee, and TB health service facilities. The P2PM Directorate of the Indonesian Ministry of Health aims to monitor drug side effects daily in 80% of drug-resistant TB patients by sharing technical instructions with the TB information system (Kemenkes, 2022).

Researchers use bibliometric analysis to map the relationships between concepts, identify trends or research directions, assess the state of the art (novelty of research results), and generate new knowledge about topics, fields, and research problems for future work. This study employed VOSviewer application version 1.6.19 for bibliometric mapping. VOSviewer has a text-mining function that is useful for building and displaying visualizations of relationships or networks (correlations) in citations or articles. This program allows for a more detailed map of publications. VOSviewer specifically presents bibliometric geographic maps, simplifying the analysis of the existing relationships. This bibliometric analysis stage used data sourced from the Scopus database with search keywords related to monitoring drug side effects and drug-resistant TB patients. Data collection was conducted from 2013 to 2023 using the Publish or Perish data application, followed by selecting scientific articles from the data and storing them in the RIS form.

Furthermore, we used the VOSViewer application to analyze the relationship between research topics, research trends, and the most frequently researched topics.

The novelty mapping representation in this study consists of three parts: network visualization, overlay visualization, and density visualization. The clusters in **Figure 1** illustrate the six areas of this research: pharmacies, multidrug-resistant TB, patients, drugs, pharmacovigilance, and pharmacists. All these areas had almost the same average number of links. Each cluster illustrates the relationship between one term and another. The colored circles contain the marks for each term. The size of the circle has a positive correlation with the appearance of the term in the title and abstract. The more frequently a term appears, the larger is the sign. **Figure 2** shows the significant research on multidrug resistance and pharmacovigilance from 2018 to 2019. Research in 2019 has also examined TB infections, antibiotics, and adverse drug reactions. **Figure 3** shows the density visualization. This representation shows that the brighter the yellow color and the larger the diameter of the term label circle, the more often the term appears. This means that much research has been conducted on this term. Conversely, when the color of a term approaches the background color, it signifies a reduced level of research on the term. Research on multidrug resistance, pharmacovigilance, and tuberculosis (TB) has garnered significant attention in density visualization. However, the absence of monitoring keywords or qualitative approaches contributed to the novelty of this study. This study aimed to determine the implementation of drug side effect monitoring in referral hospitals for drug-resistant TB patients based on the formulated background.

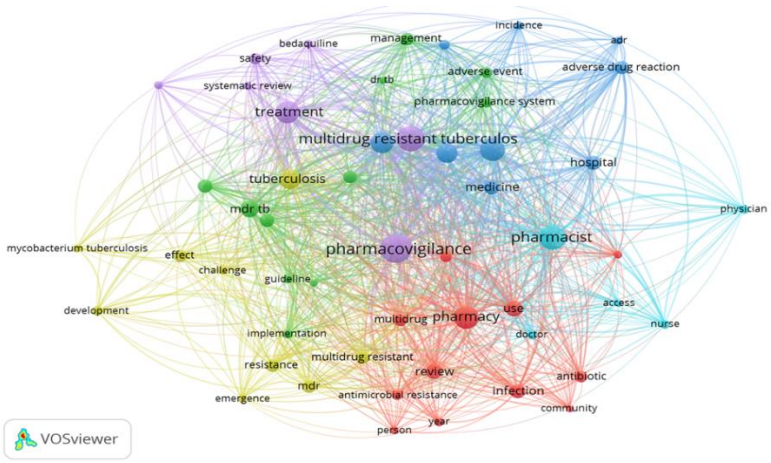

Figure 1. Network visualization

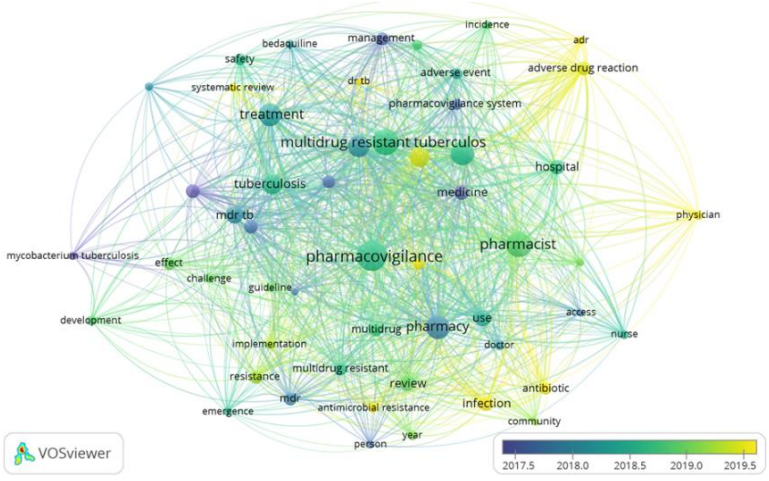

Figure 2. Overlay visualization

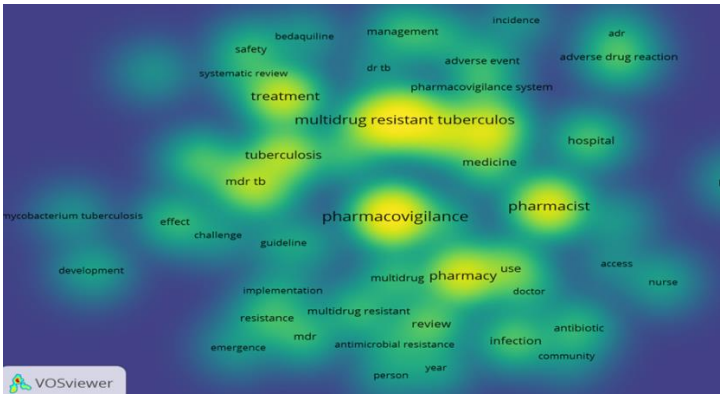

Figure 3. Density visualization

RESEARCH METHODS

Research Design

This qualitative study aimed to determine the application and implementation of drug side effect monitoring, the challenges faced, and the role of health workers in managing this monitoring in drug-resistant TB patients. This study was a multiple-case study of two drug-resistant TB referral hospitals. The process included identification, assessment, treatment, monitoring, and reporting of drug side effects in these patients.

Research Setting

The study was conducted at two drug-resistant TB referral hospitals in Cirebon over three months, from August to October 2023.

Informant Criteria

The primary data used in this study originated from informants. The informants in this study were doctors, pharmacists, and nurses who were directly involved in treating drug-resistant TB patients, namely, programmer nurses, doctors who discovered and reported drug side effects, and pharmacists who provided drugs used to treat drug side effects.

Data collection

Data were collected through FGD and face-to-face in-depth interviews with informants if additional information was needed. We conducted in-depth face-to-face interviews to delve deeper into the data and uncover unreported information from the FGDs. The researchers recorded the process during the in-depth interviews.

DATA TRIANGULATION

Data triangulation was performed by reviewing and assessing documents for monitoring and reporting drug side effects in drug-resistant TB patients on the Indonesian Ministry of Health's TB information system website, minutes of meetings discussing the case, and monitoring and reporting activities for drug side effects in resistant TB patients.

DATA ANALYSIS

During FGD, discussions and in-depth face-to-face interviews were conducted using audio. Researchers who participated in the FGD activities transcribed the recorded results verbatim and checked them for accuracy. We used INVIVO 12 software to carry out descriptive content analysis of the transcripts. Two independent researchers coded the translated transcript data by using inductive methods. We used standard procedures to make decisions regarding coding rules and theme generation, relying on consensus. We sought agreement for codes and resolved disagreements among the researchers through discussion. We used the identified codes to determine themes and subthemes. Two other researchers will assess, review, or modify the formed themes and subthemes, and the entire team will discuss them jointly. The final report summarizes the coded text, reflecting the researchers'

collective understanding of the text data. The text in italics is a direct quote from an informant.

ETHICAL CLEARANCE

Before conducting the research, the Health Research Ethics Committee approved the ethical clearance process. All informant data were anonymized and kept confidential. Before data collection, informants were given information and explanations related to the research (purpose, benefits, research process or procedures, rights and obligations of informants, etc.) and were asked to sign a consent form to become informants as proof of their willingness to be involved in the research. The ethical permit number was No.058/LAIKETIK/KEPPKRSGJ/IX/2023.

RESULTS AND DISCUSSION

All health worker informants provided informed consent to participate in this study. The informants included three doctors, two pharmacists, and one nurse. The research setting used two government referral hospitals for drug-resistant TB in Cirebon City. Both hospitals had the same characteristics as type B hospitals and were teaching hospitals. We mapped the codes and categories to themes from the existing framework. These themes are: (1) mechanisms for tracking, identifying, and reporting drug side effects in drug-resistant TB patients; and (2) the implementation and role of health workers in monitoring drug side effects in drug-resistant TB patients. There are three barriers to the implementation of drug side effect monitoring and reporting, and there are four supporting factors and implementation strategies for monitoring and reporting drug side effects.

Theme 1: Mechanisms for tracking, identifying, and reporting drug side effects in drug-resistant TB patients.

Figure 4 and **Figure** 5 illustrate the tracking of adverse drug events in patients at both hospitals. Health workers conduct observations at both hospitals to establish a baseline, coordinate with the “Mortality Reduction Team," and take action if they find and report adverse events to the TB information system. Every time a patient complains at Hospital ‘X,’ the patient documents the adverse drug event in a logbook, which serves as a valuable data source for health workers at the hospital to monitor and identify adverse drug events. At Hospital ‘Y,’ adverse drug event tracking relies on patient reports to hospital staff via WhatsApp.

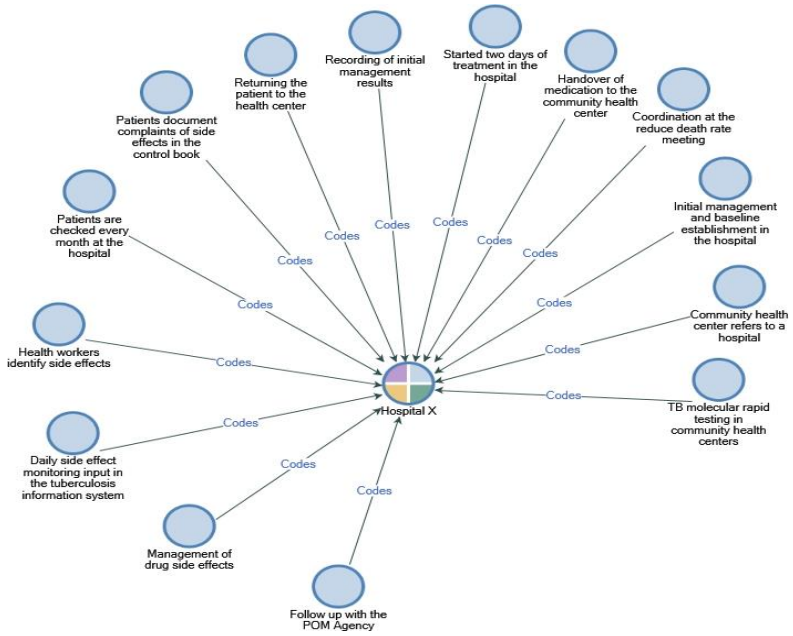

Figure 4. Mechanism for tracking, identifying and reporting drug side effects in drug-resistant TB patients at 'X' Hospital

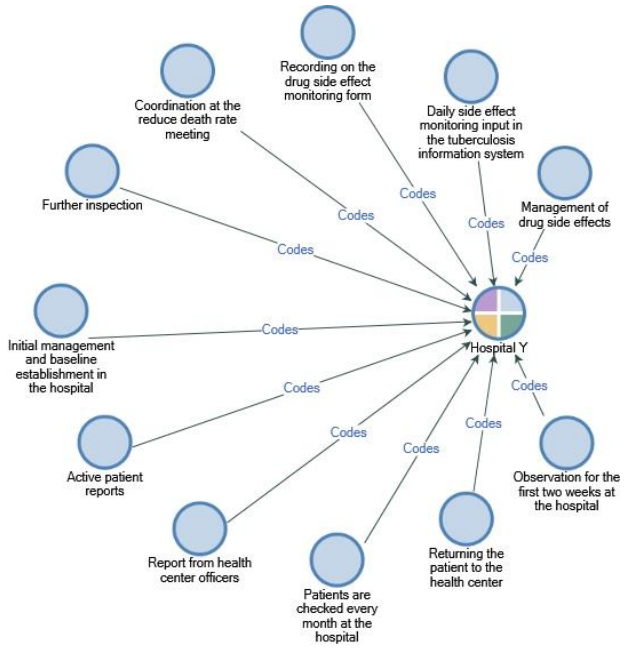

Figure 5. Mechanism for tracking, identifying and reporting drug side effects in drug-resistant TB patients at 'Y' Hospital

*"Doctor S also gave the patient a small notebook. The book records any side effects that may occur at home. Officers at the community health center will later review this book to identify any side effects and record them in the special application information system for TB, which monitors drug side effects on a daily basis. According to the schedule, Hospital 'X' will check the patient every month, and a doctor will see him there (**Pharmacist K, Hospital 'X'**)*

*"We provide a small notebook for the patient or the patient's family to fill in daily. We hope that you will promptly record any complaints in this notebook. Staff at both the health center and hospital should be able to use the book (**Doctor S, Hospital 'X'**).*

Every undesirable event and drug side effect experienced by the patient must be recorded, both as serious and non-serious. The recording form for patients who experience unwanted events or serious drug side effects uses the serious adverse event reporting form and TB information system. Patients who experienced drug side effects but were not included in the unwanted events or serious drug side effects were then recorded, and reporting was carried out in the drug-resistant TB patient treatment book and TB information system in the daily drug side effect monitoring section. Pharmacists, nurses, and data officers, in coordination with the 'Suppress Mortality Rate' team, can record and report manual side effect monitoring of patients' medication.

At Hospital X, the agreement was to exclusively use the TB information system for reporting, whereas Hospital Y continued to use manual forms in addition to the TB information system. The Pati district health service facility also found that manual forms for recording and reporting TB remained incomplete during the implementation of MDR-TB discovery and treatment (Rachmawati, Widjanarko and Sriatmi, 2023). Previous research has also revealed that the lack of standard recording and reporting contributed to the failure of the TB program (Inayah and Wahyono, 2019). The Ministry of Health's (2022) Technical Guidelines for monitoring side effects of active drugs in the treatment of drug-resistant TB mandate manual recording and reporting of every patient for side effects, either manually or through the TB information system. **Figure 6** lists the recording and reporting documents for the two hospitals along with their implementing officers.

*"...Whatever the patient's complaint is, we first include it in monitoring the side effects of the drug, whether it will include mild, moderate, or severe side effects, up to unwanted events. Therefore, we initially record the complaint in the following format" (**Doctor D, Hospital 'Y'**).*

*".... In the TB information system application, we report the daily monitoring of the side effects of medicines at community health centers. When a patient is admitted to the hospital, we monitor the daily side effects of their medication and report any adverse events that may occur during treatment, death, or medication changes. We agree with the pharmacy for the yellow form because we reported it through the TB information system application, which finally reached the form. The yellow form also arrived and I reported it twice. Therefore, we agreed with the pharmacy team that I would report it via the application, only the amount to the pharmacy team' (**Pharmacist K, Hospital 'X'**).*

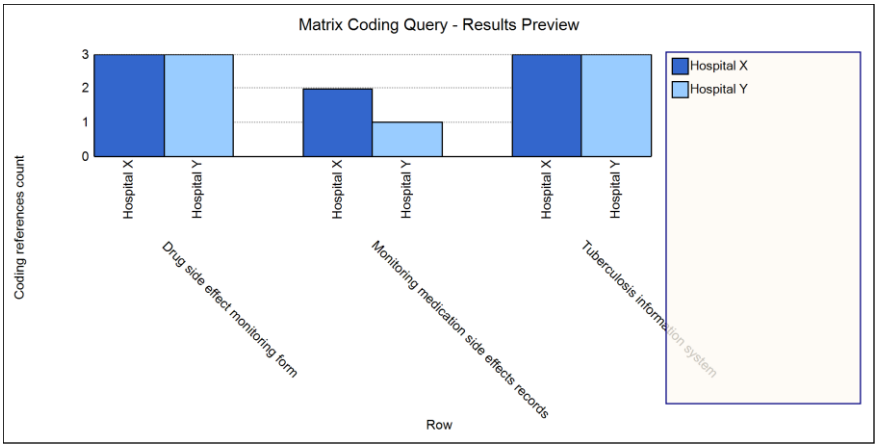

Figure 6. Recording and monitoring of drug side effects

The next step involves managing drug side effects after establishing a baseline and coordinating with the "Death Rate Reduction Team." **Figure 7** outlines a mechanism that adheres to the technical guidelines for tracking the side effects of active drugs in drug-resistant TB treatment. When a patient encounters a complaint or side effect, they report it to the "Death Rate Reduction Team," and if hospitalization is necessary, they collaborate with the doctor and nurse. The "Death Rate Reduction Team" specialists, including those in heart disease and internal medicine, carry out further examinations if necessary. Both hospitals mostly implemented procedures for handling drug side effects by adjusting the dose because the side effects of anti-TB drugs are related to the dose administered. Hospital "Y" manages drug side effects based on the patient's severity, identifying the degree of severity in accordance with the Ministry of Health's guidance instruments (Kemenkes, 2022). The routine examination of drug-resistant TB patients at both hospitals was in accordance with national guidelines, namely, a clinical examination consisting of physical examination, body weight, visual function screening, and psychiatric screening. Bacteriological examination included the analysis of acid-fast bacteria and sputum culture, laboratory tests, radiography, and electrocardiography.

"*We don't use that scale. From my perspective, this closely resembles the Ministry of Health's grading system. You can take a closer look at the grade, which ranges from 1 to 4, representing mild to severe, and potentially life-threatening conditions. We evaluate the severity of the medication's side effects, determine if the patient requires treatment, observation, or replacement, and determine if the medication should continue or cease*" ***(Doctor D, Hospital 'Y')***.

Health facilities must optimally handle drug side effects, as other studies indicate a correlation between drug side effects and treatment success in MDR TB patients. The results of the study were p = 0.001 for severe and moderate side effects (OR = 0.04; 95% CI = 0.01 to 0.24; p<0.001) (Widyasrini and Probandari, 2017). Other studies have shown a link between the side effects of anti-TB drugs and the number of people who stopped taking their treatment for TB. Side effects were categorized as severe (p = 0.01) or mild (p = 0.04). The respondents decided to stop treatment because of the effects they received (Merzistya and Rahayu, 2019).

Figure 7 illustrates the use of cluster analysis—a technique that groups similar or related sources or words using automated coding from NVivo 12 software—to explore and visualize the initial management and baseline determination of adverse drug reactions in hospitals. In general, four main clusters were used to group words and their relationships: coordination with the team, identification of the cause of drug side effects, identification of severity levels and interventions, and documentation of drug side effect monitoring conducted in both hospitals.

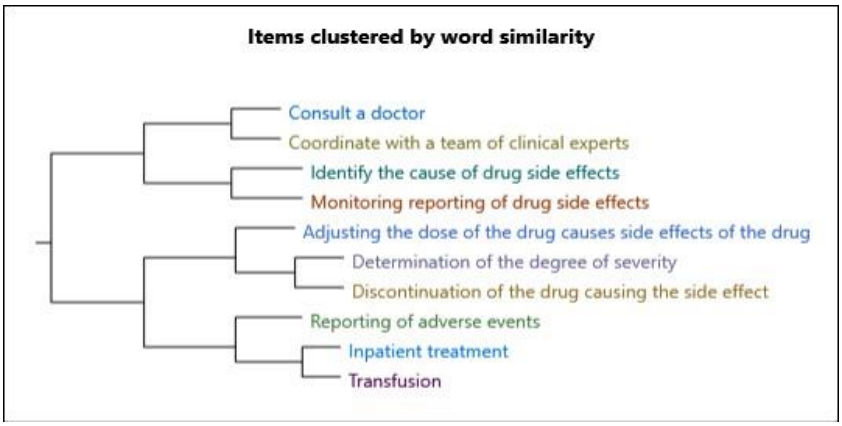

Figure 7. Initial management and baseline establishment of in-hospital drug side effects

Theme 2: Implementation and role of health workers in monitoring drug side effects in drug-resistant TB patient

According to **Figure 8** and **Figure** 9, the role of doctors in both hospitals in implementing drug side effects monitoring is significant compared to that of other health workers. The roles of doctors in both hospitals in implementing drug side effect monitoring for patients with TB are similar. These roles include initial examination and history-taking, determining the causality of drug side effects, managing drug side effects, identifying drug side effects, and providing education on drug side effects. At Hospital 'Y, doctors also play a crucial role in documenting drug side effect monitoring forms and maintaining the TB information system. Apart from that, for the first two weeks at 'Y' Hospital, doctors monitor drug side effects before moving on to the next stage of treatment and decentralization back to the community health center. The role of doctors at both hospitals in determining the causality of drug side effects is not to use the Naranjo instrument, but to determine the specific type of causal relationship in accordance with the Ministry of Health's technical instructions.

*"During the course of treatment, we usually evaluate it first in two weeks. During those two weeks, we directly observed the patients, meaning that for the first two weeks, we (the hospital) were conducting direct observations. However, we returned it to the community health center for monitoring after two weeks' (**Doctor AL, Hospital Y**).*

*" .. The Ministry of Health has provided technical guidelines that outline what should be done when patients experience adverse effects. For instance, there are specific guidelines to follow if a patient suffers from conditions such as anemia. Some patients experience a slight decrease in their hemoglobin levels, whereas others experience a significant decrease; for instance, their hemoglobin levels may drop to 4, 7, 8, or even lower. According to the technical guidelines, there are specific guidelines regarding when the patient should cease taking their medication. When should we receive treatment? Will supplementing drugs, such as folic acid or fe suffice, and when should we receive a transfusion? Such technical guidelines exist" (**Doctor SI, Hospital X**)*

Generally, doctors follow the Technical Guidelines for monitoring the side effects of active drugs in treating drug-resistant TB in Indonesia. They work in collaboration with the Mortality Reduction Team to diagnose and treat drug-resistant TB, educate patients about drug side effects, and provide TB treatment services. During each visit, they gather all patient or family complaints about drug resistance; manage any adverse events or side effects from mild, moderate, and severe drugs; and direct patients to internal and external specialists for patient care (Kemenkes, 2022). Previous studies have indicated the need for repeated patient counseling and education, increased coordination between the various levels of service providers involved in the care of drug-resistant TB patients, including collaboration between general practitioners and private and traditional health practitioners, and the promotion of social and economic support to help patients comply. To treat MDR-TB and prevent Lost-To-Follow-Up (LFU) (Shringarpure *et al.*, 2016).

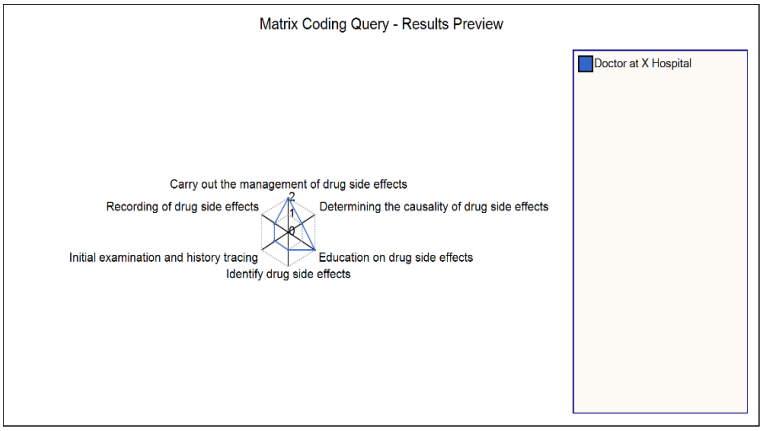

Figure 8. Hospital X doctors play a crucial role in monitoring the side effects of drugs.

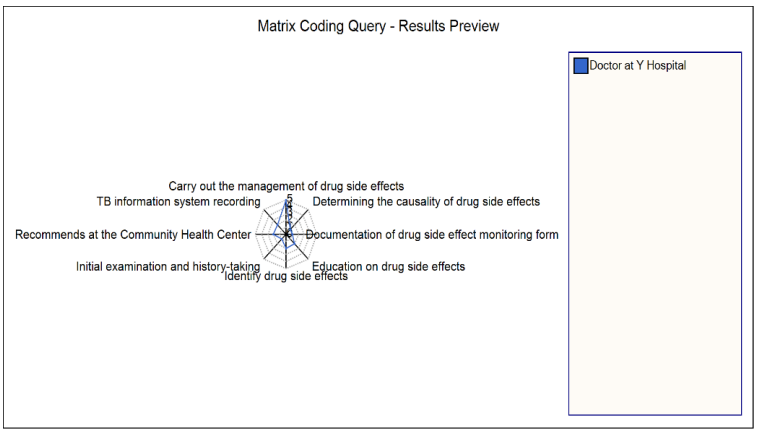

Figure 9. Hospital Y doctors play a crucial role in monitoring the side effects of drugs.

Based on **Figure 10**, the role of pharmacists in both hospitals was similar in managing drug side effects and recording side effect reports. Pharmacists play an important role in managing drug side effects, especially in determining drug regimens in collaboration with doctors and mortality reduction teams. If the drug causes undesirable events or side effects with severity levels 3 and 4, the treatment mix can be modified, the drug and/or regimen can be stopped, and the dose can be adjusted. At Hospital X, pharmacists play an additional role, specifically during the identification stage and in providing education regarding side effects.

A part of a pharmacist's job is to store and distribute drug-resistant TB drugs, find drug-related problems, make management suggestions, work with drug-resistant TB nurses to record and report monitoring of active drug side effects in the TB Information System, and fill out the report form for adverse events or serious drug side effects (Kemenkes, 2022).

"So, we gathered the patients here after the initial management; in other words, we made notes for Thursday to report on the 'Suppress Mortality Rate' team meeting with the 'Suppress Mortality Rate' team at Hospital X, led by a doctor." In 'Reducing the Death Rate,' we discussed the patient's condition, right? The patient's condition, therefore, determines the final regimen used" (**Pharmacist K, Hospital 'X'**).

"There was a case of anemia yesterday, right? The doctor then stated that it was an effect of linezolid. The recommended dosage of linezolid is one tablet once a day, followed by a repeat dose of half a tablet. We reduced the dosage in all cases. If the side effects include nausea or dizziness, additional medications such as paracetamol or antacids such as lansoprazole can be prescribed to alleviate these side effects. If it is serious, reduce the dose or change the medication' (**Pharmacist R, Hospital 'Y'**).

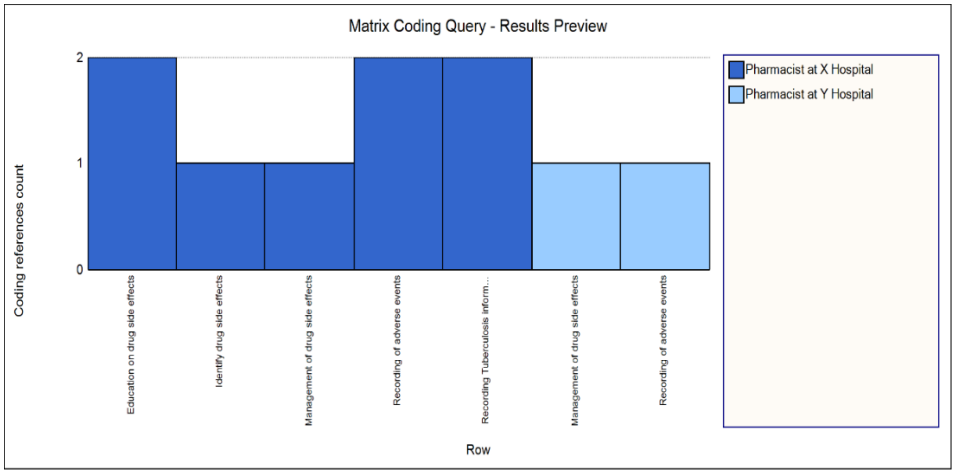

Figure 10. The role of pharmacists at Hospital X and Hospital Y in implementing side effect monitoring

*".. Yes, to identify the side effects of our medicines, patients who have been on treatment for a long time usually have routine control every month. We personally go directly to ask patients about their side effects. Nurses also ask about side effects" (**Pharmacist K, Hospital 'X'**)*

Previous research on the role of pharmacists in the success of intensive treatment for patients with tuberculosis (TB) revealed that pharmacists' education and direct treatment monitoring significantly contributed to the success of TB patients' treatment (Utukaman *et al.*, 2021). Previous studies have also shown that pharmacists play a role in increasing treatment compliance among TB outpatients through patient education. Compared with the control group, the group of respondents who received education exhibited higher compliance. Therefore, education about the factors that lead to therapy failure and the significance of compliance in achieving TB treatment can impact respondent compliance (Hutagaol Restinia and Keban, 2017).

Figure 11 illustrates the similarities between the roles of nurses in monitoring drug side effects in both hospitals and in providing education regarding these effects. Patients with drug-resistant TB have access to direct consultations with nurses regarding drug side effects via WhatsApp. In addition to providing education, nurses also play a role in identifying drug side effects, together with other health workers. This is in line with the duties described in technical guidelines for keeping an eye on the side effects of active drugs. These include nursing actions taken on their own, such as education and other problem-specific interventions, and actions taken together with doctors to deal with unwanted events or drug side effects, such as follow-up interventions (Kemenkes, 2022).

*"No, it's the patient who is using WhatsApp." Every patient had a cell phone number. So, consult me; if you already have this, just go straight to it." (**Nurse R, Hospital 'Y'**).*

*"We personally go directly to ask patients about their side effects. The nurse also asked about the side effects. So, we all keep records of patient medication side effects. We as pharmacists, doctor 'S', and doctor 'A' as general practitioners also ask questions, and nurses also ask questions like that (**Pharmacist K, Hospital 'X'**).*

At Hospital 'Y', nurses play a role in recording the side effects of drugs in the TB Information System and documenting causality. This aligns with the responsibilities outlined in the Technical Guidelines for monitoring side effects of active drugs, which include conducting investigations, completing an undesirable event form, and reviewing patient complaints of unwanted events. According to the Technical Guidelines for Monitoring Side Effects of Active Drugs in Drug-Resistant TB Patients, nurses are required to create nursing action plans based on the assessment results, evaluate the outcomes of independent and collaborative nursing actions, and coordinate patient care needs with various related units. The team reduces mortality rates, reports to doctors for management of non-serious and serious adverse events, and coordinates the reporting of the TB Information System to pharmacists (Kemenkes, 2022).

At Dr. H. Abdul Moeloek Hospital in Lampung, previous studies on the role of nurses in caring for TB patients revealed a relationship between their role as educators and motivators and their adherence to swallowing medication (Gunawan and Jaysendira, 2020). Good nurse communication techniques have a relationship with TB patient satisfaction (Fitriani, Veri and Laelah, 2021). Nurses play an important role in supporting patients in the TB treatment process, including educating patients, providing treatment, observing and following up on treatment, and communicating with patients to ensure compliance (Carlsson *et al.*, 2014). Challenges faced by nurses in previous studies include lack of personal protective equipment, lack of isolation rooms, delegation of care for TB patients to young, inexperienced nurses, a long diagnosis process, a lack of policies that protect nurses from exposure to TB, and inadequate training (Fadare *et al.*, 2020).

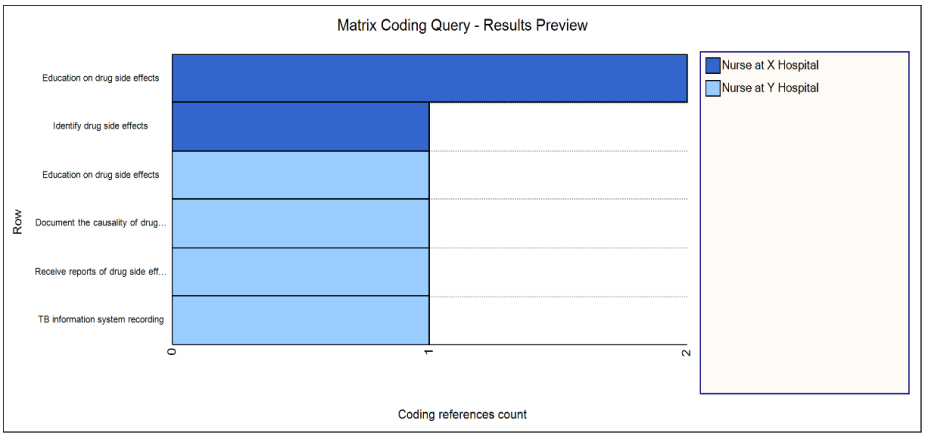

Figure 11. The role of nurses at Hospital 'X' and Hospital 'Y' in implementing monitoring of drug side effects

Overall, health workers in both hospitals conducted observations to establish baselines, coordinated with the "death reduction team," and took action if they found and reported adverse events to the TB information system. Compared to other health workers, doctors played a greater role in both hospitals. Doctors played a role in conducting initial examinations and anamnesis, determining causality, managing, identifying, and educating patients about drug side effects. Hospital X exclusively used the TB information system for reporting, while Hospital Y continued to use manual forms alongside the TB information system. The pharmacists at Hospital X and Hospital Y play a crucial role in executing side effect monitoring. In Hospital X, pharmacists played a crucial role, particularly during the introduction stage and in providing education about side effects. The role of nurses in both hospitals was similar in that they were responsible for educating patients about the side effects of drugs. In Hospital X, in addition to providing education, nurses also played a role in identifying drug side effects, while in Hospital Y, nurses played a role in recording drug side effects in the TB Information System and documenting causality. This research's

limitation lies in the need for quantitative data, such as drug side effect data, to more comprehensively support its results. Future research can develop studies on the incidence, severity, and causality of ADR in drug-resistant TB patients.

CONCLUSION

Based on the Ministry of Health's technical instructions on monitoring the side effects of active drugs for drug-resistant TB treatment, both hospitals still need to optimize their mechanisms for tracking, identifying, and reporting drug side effects in drug-resistant TB patients. We must enhance the execution of drug side effect monitoring by educating people about the causality of drug side effects, documenting them using specialized tools in accordance with standard guidelines, filling out the manual form for drug side effect monitoring, and providing health workers with ongoing training on drug side effect monitoring.

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