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Waiting Time for Prescription Services on Social-Health-Insurance Patients at X Kendal Hospitals: Why Takes Too Long?

Eka Kristia Ayu Astuti[1]*, Ayun Sriatmi[2], Farid Agushybana[3]

1. Department of Master of Public Health, Faculty of Public Health, Diponegoro University, Semarang, Central Java, Indonesia
2. Department of Health Policy and Administration, Faculty of Public Health, Diponegoro University, Semarang, Central Java, Indonesia
3. Department of Biostatistics and Demography, Faculty of Public Health, Diponegoro University, Semarang, Central Java, Indonesia

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Corresponding Author:
Eka Kristia Ayu Astuti

Corresponding Author Email:
ekakristiaayu@gmail.com

ABSTRACT

Background: Excessive waiting time for prescription services at the pharmacy can negatively impact a hospital's reputation. Exceeding the minimum service standard for prescription service waiting time may indicate bottlenecks in the process, leading to inefficient service delivery.

Objectives: This research aimed to determine the average waiting time for the prescription services for social health insurance patients and identify external and internal factors that prolong the prescription process.

Methods: The research employed a mixed-method approach using an explanatory sequential design. Quantitative data was collected by measuring prescription waiting times from the submission of the prescription sheet by the patient to dispensing medicine to the patients. Qualitative data was gathered through in-depth interviews.

Results: The results of the analysis of 100 prescriptions (38 compound and 62 non-compound) showed that the average waiting time for compound prescriptions was 50.42 minutes and 41.03 minutes for non-compound prescriptions. The longest stage in compound and non-compound prescription processes was prescription review, averaging 19 minutes from all outpatient clinic prescriptions sampels. Results of in-depth interviews revealed that incomplete prescription information by doctors, the total number of medicine items, distraction from patients, inadequate staff skills, and a shortage of prescription pharmacists contributed to delays in prescription services.

Conclusion: Duration of prescription services for social health insurance that exceeded the standard time was observed in non-compound prescriptions, with bottlenecks occurring during the prescription review. Therefore, pharmacy management should evaluate and improve prescription services to enhance the efficiency of service time.

Keywords: Hospital-Pharmacy; Prescription Services; Waiting Time

INTRODUCTION

Hospitals are facing increasingly intense competition, not only in terms of examination technology but also quality services.[1] Hospitals compete with one another to gain public trust by offering efficient and high-quality services, as this will determine the hospital's reputation. Building a hospital's initial reputation is important for hospital managers because people's perceptions of service quality will determine their decision to use healthcare services.[2,3,4] One crucial aspect determining a hospital's initial reputation is the patient's

waiting time to receive services because patient waiting time is a potential component that can cause patient dissatisfaction. Patients often spend more time waiting for services than they do receiving services. It can have a negative impact on the hospital's service quality reputation, which could be perceived as poor.[3,5] Patients may perceive a hospital's service negatively if their pain levels do not improve, the queues are long, and they experience unfriendly behavior from the staff.[6] The length of patient waiting time can also have a negative impact on patient health, causing anxiety, service inefficiencies, and a loss of valuable time for patients or their families. Therefore, hospitals should prioritize addressing the issue of waiting time.[7]

Prescription waiting time is a crucial indicator of hospital service quality, as mandated by the Indonesian Ministry of Health's Decree No. 129/Menkes/SK/II/2008. This indicator stipulates patients' time to receive their medications from the pharmacy. The standard waiting times for non-compound and compound prescriptions are 30 minutes and 60 minutes, respectively.[8] According to the 2019 Technical Guidelines for Pharmaceutical Services in Hospitals, the medication prescription process comprises six key steps: prescription acceptance, prescription review, medication availability check, medication preparation, medication review, and medication dispensing.[9] Existing research suggests that not all hospitals effectively manage prescription waiting times. A 2017 study at RSUD Bhakti Dharma Husada revealed that the average waiting times for non-compound and compound prescriptions were 86 minutes and 62 minutes, respectively, exceeding the stipulated standards.[10] Another study at Atma Jaya Hospital in 2018 attributed prolonged waiting times to factors such as prescription backlogs, underdeveloped hospital information systems, and ineffective communication between pharmacy staff and other hospital personnel.[11] Factors influencing prescription waiting times include medication unavailability, inadequate patient categorization, handling prescriptions from all departments, unclaimed prescriptions, and limited pharmacy space.[12]

X Hospital in Kendal Regency is a private general hospital that accepts social health insurance patients. A single outpatient pharmacy installation serves all prescriptions from outpatient clinics. The pharmacy installation operates 24 hours a day, with the critical service period being in the afternoon from 2:00 PM to 8:00 PM. The number of outpatient prescriptions the pharmacy installation receives is significantly higher for social health insurance patients than general patients. In 2021, there were 22,895 (79.7%) social health insurance patient prescriptions and 5,827 (20.3%) general patient prescriptions. This indicates that the proportion of social health insurance outpatient prescriptions is approximately four times higher than that of general patient prescriptions at this hospital. Therefore, this study focused on social health insurance outpatient prescriptions.

The minimum service standard for prescription waiting time in X Hospital Kendal is based on Ministerial Decree No. 129/Menkes/SK/II/2008. The standard for non-compound prescription waiting time is ≤30 minutes, and compound prescription waiting time is ≤60 minutes, with a hospital quality achievement target of 95% each month. Based on the data on the achievement of the minimum service standard (MMS) indicator for prescription waiting time from January 2020 to March 2022, there was a consistent fluctuation in the results. The findings demonstrate that a considerable number of outpatient prescription services did not meet the MMS target each month, both for compound and non-compound prescriptions. The highest point of MMS achievement for compound prescriptions was in March 2020 (99.62%) and non-compound prescriptions in June 2020 (97.20%), while the lowest point of MMS achievement for compound prescriptions was in April 2021 (71.58%) and non-compound prescriptions in March 2021 (58.40%). The fluctuating MMS waiting time achievement indicates that pharmacy management has not been able to manage the timeliness of drug services according to hospital standards. In addition, based on a direct observation, the prescriptions submitted by the patients were not immediately followed up by the officers. The prescriptions took about 10-16 minutes, and then the officers followed up individually. This certainly was lengthy, resulting in a significant delay for patients to receive their medication. Based on the survey results, 5 out of 6 patients stated that the outpatient social health insurance prescription service was slow. The amount of time they spent waiting for medication was around 41 to 69 minutes.

Considering the fluctuating achievement of the minimum service standard (MMS) for prescription waiting times, patient complaints, and delayed prescription processing by staff, the authors were motivated to conduct further research on the waiting time for outpatient social health insurance patient prescription services at the hospital pharmacy of X Hospital in Kendal Regency. The objectives of this study were to determine the average waiting time for outpatient social health insurance patient prescription services, identify the bottleneck process in the prescription services that might contribute to the longest waiting time, and identify the obstacles that might lead to prolonged waiting time for outpatient social health insurance patient prescription services. A key strength of this study is in the identification of external and internal obstacles through in-depth interviews.

These obstacles might potentially contribute to prolonged prescription service time at the identified bottleneck stage and may impact patient's waiting time for medication.

METHODS

Study design

This descriptive study combined quantitative and qualitative approaches using an explanatory sequential model. The model began with quantitative research to provide initial evidence, followed by qualitative research for deeper exploration. This study was conducted at X Hospital in Kendal Regency from August to September 2022. The research variables comprised six components of the hospital's prescription service process: prescription acceptance, prescription review, medication availability check, medication preparation, medication review, and medication dispensing.

Population and samples

A total of 100 prescription records were analyzed for this study, and they were selected using accidental sampling. The inclusion criteria were prescriptions received and medication dispensed on the same day between 2:00 PM and 8:00 PM Western Indonesian time (WIB). The sample size was determined using Slovin's formula with an error tolerance of 10% from the average monthly prescription population of 6,490 prescriptions. A 10% error tolerance is acknowledged as a limitation of this study. For the qualitative component of the study, purposive sampling was employed to select research subjects/informants based on the following criteria. For pharmacy personnel, they had to have a minimum of 1 year of experience and direct involvement in the prescription service process at the outpatient pharmacy. Meanwhile, for patients, they had to be able to communicate verbally and willing to participate as research informants. These criteria were established to ensure the adequacy of the information obtained, ensuring that informants could provide information relevant to the research questions based on the researchers' interview guide. Using these criteria, eight informants were selected, comprising four main and four triangulation informants. The role of the triangulation informants was to compare and cross-check information obtained from the main informants. The main informants of this study consisted of 2 outpatient pharmacists and 2 outpatient pharmaceutical technicians. The triangulation informants included 1 head of the hospital pharmacy, 1 head of the outpatient pharmacy, and 2 social health insurance patients at the outpatient pharmacy of X Hospital in Kendal Regency. The addition of patient triangulation informants in this study aimed as a complement to enrich the research findings from the patient's perspective.

Study instrument and data collection

Quantitative data was collected by measuring waiting times using a stopwatch as a measuring tool. The collected data on waiting time for medication prescriptions were recorded on an observation sheet. The purpose was to record the waiting time for pharmaceutical services for social health insurance patients. In the qualitative study, the instrument used was the researchers themselves (human instrument) guided by interview guidelines that had been prepared based on the modified framework method of the theory of constraints and the outpatient prescription service process. Qualitative data was collected using an in-depth interview. The researcher was assisted by a voice recorder, writing utensils, and a camera. The purpose of collecting qualitative data in this study was to delve deeper into the issue and obtain information on the obstacles that caused prolonged waiting time for prescription services. This involved interviewing informants/research subjects.

To collect data on patient prescription service waiting time, the researchers employed a stopwatch and a prescription service waiting time observation sheet to collect quantitative data on patient prescription service waiting time. The research focused on social health insurance outpatient prescriptions. Each prescription was marked with a sticky note to track its movement through the various stages of the prescription service process. Prescriptions were randomly selected due to the single-handed nature of the data collection. The researchers initiated the observation and recorded the total waiting time for each prescription using a stopwatch, starting from the submission of prescription to the pharmacy staff by the patient to dispensing the medication to the patient. The researchers further divided the waiting time into two categories: prescription delay time (the period during which the prescription awaited processing by the staff) and prescription processing time (the time spent by the staff on processing the prescription). The aim was to identify the stages in the prescription service process that consumed the most time and hindered workflow. The researcher recorded the time readings from the stopwatch onto the observation sheet for prescription service waiting time. Data collection for prescription

service waiting time spanned 14 days (started from Agust 16, 2022 to September 5, 2022). The quantitative data was analyzed, the research continued with qualitative research through in-depth interviews. The researcher employed a semi-structured interview approach, utilizing a predetermined guide that could be adapted and developed during the interviews to elicit more comprehensive information. The interview guide was tailored to pharmacy staff and patients to ensure consistency in data collection across informants. In-depth interviews focused on exploring external and internal constraints at the stage that took the longest time in prescription service process. The guidelines for the main interview questions that were used to delve deeper into the research on the process stages that prolong prescription waiting times can be seen in Table I.

Data Analysis

Collected data on waiting time was analyzed descriptively using Excel tools to determine the duration of prescription services with average, minimum, and maximum values. Qualitative data obtained from in-depth interviews was analyzed using content analysis with the following stages: data reduction, data presentation, and conclusion drawing. The qualitative data processing involved the manual transcription of audio recordings from the interviews into written format and Word tools. The transcribed data was simplified and categorized according to themes into a research matrix, then presented in interview boxes and concluded with conclusions from the presented data.

RESULTS AND DISCUSSION

The study sample consisted of the prescriptions of social health insurance patients, comprising non-compound and compound prescriptions. The non-compound prescriptions accounted for 62 of the total prescriptions analyzed, and the compound prescriptions made up 38. Compound prescriptions require the mixing or compounding medications, while non-compound prescriptions do not. The higher percentage of non-compound prescriptions compared to compound prescriptions indicates that the most prevalent type of prescription received at the outpatient pharmacy of X Hospital in Kendal Regency was the non-compound prescription.

A Description of Waiting Times for Prescription Services for Social Health Insurance Outpatient Patients

Patient prescription service waiting time is defined as the time interval starting from the patient's submission of a prescription to a pharmacist until the patient receives the medication. The Ministry of Health has established Minimum Service Standards (MMS) for waiting times, categorized into non-compound medication prescription of service waiting time with a standard of ≤30 minutes and compound medication prescription service waiting time of ≤60 minutes.[8] The waiting time for compound and non-compound medication prescription services is calculated starting from the submission of the prescription by the patient until the pharmacist dispenses the medication to the patient. It involves calculating the time at each stage of the process and distinguishing between action time and delay time components to identify the stages of the process that cause the prescription service process to be lengthy. The prescription delay time is defined as the amount of time a prescription awaits to be processed by the pharmacist, while prescription action time is the amount of time it takes for the pharmacist to process the prescription.[13] Hospital prescription services consist of six processes: prescription acceptance, prescription review, medication availability check, medication preparation, medication review, and medication dispensing to the patient.[9] Table II shows the overall waiting time for prescription services and the percentage of compliance with the Minimum Service Standards (MMS) for prescription service waiting times at the outpatient pharmacy of X Hospital in Kendal Regency.

As shown in Table II, the percentage of non-compound prescriptions that did not meet the standards was higher than that of compound prescriptions. The percentage of non-compound prescriptions with an average waiting time of less than or equal to 30 minutes that did not meet the standards was 77.4% or 48 out of 62 prescriptions processed. Meanwhile, the percentage of compound prescriptions with an average waiting time of less than or equal to 60 minutes that did not meet the standards was 50%, or 19 out of 38 prescriptions processed. The average waiting time for compound prescriptions was 50.42 minutes with standard deviation of 24.55, while the average for non-compound prescriptions was 41.03 minutes with standard deviation of 23.03 . On average, the time required to complete compound prescriptions from the moment they were received until the medication was dispensed to the patient was longer than that of non-compound prescriptions. However, the average waiting time for compound prescriptions met the standard waiting time set by the Ministry of Health. In contrast, the average waiting time for non-compound prescriptions was 11.03 minutes longer than

Tabel I. The Interview Questions Guide

Variable	Question Theme	Question
Prescription Review (Based on the results of waiting time data analysis, the prescription review variable had become the stage that had taken the longest time)	Implementation process	1. How has the process of reviewing compounded prescriptions for social health insurance patients? 2. How has the process of reviewing non-compounded prescriptions for social health insurance patients? 3. Who has been involved in the process? 4. Has a checklist been utilized during the prescription review process?
	Prescription Review Requirements	1. What requirements have a prescription (compounded and non-compounded) had to meet to be processed? 2. What procedure has been followed if a prescription has not met the requirements? Has it taken a long time?
	Obstacles in the Prescription Review Process	1. Why have the prescription review delay time prolonged? 2. What internal constraints have prolonged the prescription review process? 3. What external constraints have prolonged the prescription review process? 4. Why could these obstacles occurred?

Table II. Adherence of Compound and Non-Compound Prescriptions to Minimum Service Standards (MMS) for Prescription Service Waiting Time

Prescription Type	Prescription Waiting Time				Adherence to Standards				Frequency (f)
	Mean (Minutes)	Min (Minutes)	Max (Minutes)	Standard Deviation	Yes		No		
					f	%	f	%	
Compound Medication	50.42	12.50	130.26	24.55	19	50	19	50	38
Non-compound Medication	41.03	06.36	116.22	23.03	14	22,6	48	77.4	62
			TOTAL						100

the set standards. This indicates that the speed of completing compound prescriptions surpassed that of non-compound prescriptions when referred to the standards. The failure to meet the standard waiting time for non-compound prescriptions might be because most prescriptions received at the outpatient pharmacy of X Hospital in Kendal Regency were of the non-compound type.

Sari's study found that the waiting time for compound prescriptions was longer than that for non-compound prescriptions due to the compounding process. The average waiting time for compound prescriptions was 30.9 minutes, while for non-compound prescriptions, it was only 18.7 minutes. Waiting times may vary depending on the time of day and the number of prescriptions received. The longest waiting times were observed between 09:00 and 11:00 WIB, coinciding with the peak hours of clinic operations.[14] Karuniawati's study suggests that waiting times for prescription services can be significantly reduced with proper management. It is supported by the average time to complete compound and non-compound prescriptions, which was less than 10 minutes, at 9.18 minutes and 5.70 minutes, respectively.[15]

Nurjanah's study found that waiting times for non-compound prescriptions were shorter than those for compound prescriptions due to the absence of compounding process.[16] However, waiting times for non-compound prescriptions can be prolonged due to the large number of prescribed items and the simultaneous arrival of multiple prescriptions.[17] The waiting time for medication services in the pharmacy installation can vary depending on the type of prescriptions received, with the most being either non-compound or compound

prescriptions.[18] Nevertheless, waiting times for non-compound prescriptions should not be lengthy, as the prescribed medications are already in their final form. Other studies have shown that the average waiting time for non-compound prescriptions is only 2.65 minutes. Prolonged waiting times for prescription services can lead to decreased patient satisfaction as time is valuable for patients.[19]

As shown in Table III, the stage in the prescription service process that was lengthy was the prescription review process. The average prescription review time for compound prescriptions was 19.31 minutes, and for compund prescriptions, it was 19.45 minutes. The prescription review time was longer than the other stages of the process because the process had the highest average delay time. The average delay time for compound prescriptions was 17.24 minutes, while for non-compund prescriptions, it was 17.50 minutes. This indicates that the waiting time for prescriptions is spent waiting for staff to review prescriptions, even though the average review time was only 1.54 minutes for non compund prescriptions and 2.07 minutes for compound prescriptions. Compared to the time required for staff to process prescriptions, the long delay in the prescription review process indicates that the prescription service process for social health insurance patients in the outpatient pharmacy of Hospital X in Kendal Regency has not been managed optimally.

A study conducted by Miftahudin found that if the delay time component is greater than the action time component, the management of the prescription service process is ineffective. The results of this study showed that the longest stage of the process was the preparation and dispensing of medication to patients, with an average of 33.36 minutes and 14.06 minutes, respectively. This is because the prescription time is spent waiting for staff to work on the prescriptions.[18] A delay time factor in the process will prolong the process. The causes of the delay include staff are working on other tasks or processing previous prescriptions.[20]

Based on our observations of the pharmacy staff, the causes of the long delay in the prescription review process for compound and non-compound prescriptions were the backlog of prescriptions waiting to be processed by the prescription review staff. The increase in prescriptions was a consequence of the heavy workload between 2:00 PM and 8:00 PM in the outpatient pharmacy and the inconsistency in doctors' practice times with the established practice schedule. This is in line with the results of Fitriah's research which showed that the accumulation of prescriptions at the screening officer station is due to doctors running behind schedule for their appointments, leading to a backlog of patients waiting at once, which ultimately causes a backlog of prescriptions at the pharmacy. Doctors are late due to technical constraints such as surgical activities, doctors attending to inpatients, and others.[20] Late arrival of doctors is one of the obstacles leading to the suboptimal performance of the pharmacy service.[21] The influx of prescriptions during the hospital's busy service hours will simultaneously have a direct impact on the backlog of prescriptions after the staff receives the prescriptions.[22]

Internal and External Barriers Hindering the Prescription Review Process at X Hospital in Kendal Regency

The results of the quantitative analysis of prescription service waiting times at the outpatient pharmacy of X Hospital in Kendal revealed that the prescription review was the stage that became a bottleneck that prolonged the process of preparing compound and non-compound medicines for social health insurance patients. The prescription review is a crucial step following prescription acceptance. It is conducted by a pharmacist to verify the conformity of the received prescription. It involves assessing three aspects: administrative, pharmaceutical, and clinical criteria.[23] Prescription review, or screening, aims to analyze prescribed medications to prevent errors.[24]

The time required for pharmacists to review a prescription is prolonged due to various obstacles that hinder their efficiency and prevent them from meeting established time standards. Barriers are defined as factors that restrict the performance of an organizational or corporate system in achieving its predetermined goals.[25] Hansen's constraint theory categorizes barriers into two types based on their origin: external and internal barriers. External barriers stem from outside the organization and limit its operations, while internal barriers arise from within.[26] Therefore, this study delves into the internal and external barriers contributing to the lengthy prescription review process for compound and non-compound medications at the outpatient pharmacy of X Hospital in Kendal. The characteristics of the informants are summarized in Table IV.

Based on the in-depth interviews with the research informants, the following external and internal barriers may have contributed to the prolonged prescription review process for compound and non-compound medications at the outpatient pharmacy of X Hospital in Kendal:

Incomplete Prescription Information

Incomplete prescription written by doctors was the source of external obstacles that greatly hindered the prescription review process at the outpatient pharmacy of X Hospital in Kendal Regency. All informants in

Table III. Time Required for Each Stage of Compound and Non-Compound Prescription Service

No	Process	Average Time (Minutes)					
		Compound			Non-compound		
		Delay	Action	Total	Delay	Action	Total
1	Prescription Acceptance	00.00	00.06	00.06	00.00	00.05	00.05
2	Prescription Review	17.24	02.07	19.31	17.50	01.54	19.45
3	Medication Availability Check	00.23	00.47	01.11	00.07	00.42	00.49
4	Medication Preparation	07.16	08.50	16.06	04.50	03.13	08.04
5	Medication Review	11.37	00.57	12.34	10.20	00.47	11.07
6	Medication Dispensing	00.06	01.09	01.15	00.09	01.04	01.13
	TOTAL	36.46	13.56	50.42	33.16	07.45	41.03

Table IV. Characteristics of Research Informants

No	Research Informant	Age	Position	Years of Work Experience
1	Main Informant 1	29	Functional Pharmacist	3
2	Main Informant 2	40	Functional Pharmacist	13
3	Main Informant 3	23	Pharmaceutical Technician	1
4	Main Informant 4	38	Pharmaceutical Technician	12
5	Triangulation Informant 1	28	Head of Outpatient Pharmacy	4
6	Triangulation Informant 2	43	Head of Outpatient Pharmacy	21
7	Triangulation Informant 3	44	Outpatient Patient	-
8	Triangulation Informant 4	61	Outpatient Patient	-

this study stated that the pharmacist in the prescription review section was hampered from working when the prescription written by the doctor was incomplete. Many doctors fail to provide a complete prescription, especially regarding the amount of medicine, dose, rules for taking, and the frequency of medicine use. Moreover, doctors sometimes inaccurately inputted the patient's name on the prescription, prescribed the wrong dosage form, and the medication did not match the patient's needs. As a consequence, the pharmacy staff had to re-edit the prescription and re-confirm it to the doctor who prescribed the medicine, which prolonged the process to review a prescription.

"Incomplete prescriptions require confirmation, which is time-consuming. The dosage is sometimes incorrect, and the quantity, instructions, and frequency are not fully specified. Sometimes the medication is inappropriate for the patient's symptoms, or the name is incorrect." (Main informant 2)

"Incomplete prescription filled by doctors is a problem for us, and there are also instances of double prescriptions, with the dosage being written down two or three times for the same medication. We then have to confirm with the doctor. Some doctors copy and paste their previous prescriptions." (Triangulation informant 2)

This is in line with previous studies that found that non-compliant prescription writing requires pharmacists to reconfirm. The time required cannot be determined because it all depends on the doctor's cooperation in responding to the pharmacist's confirmation. Prescription service waiting times may become longer due to delayed confirmation processes because the doctor is unavailable or does not respond to the pharmacist.[27] Unclear prescriptions, such as dosage, writing, and others, require pharmacists to reconfirm them with the doctor.[19] Concerns have been raised that incomplete prescriptions may lead to medication errors.[28]

Incomplete prescriptions at X Hospital in Kendal Regency was often found in patients with regular check-ups or chronic diseases. Because there were no new complaints reported by the patient, the doctor prescribed the same medication as in the previous visit without verifying the completeness of the previous prescription. According to a study conducted at Ahmad Yani Surabaya Islamic Hospital, doctors often overlook or fail to verify the details in a patient's prescription due to their lack of focus on the patients' past medication history.[29] Doctors

should provide prescriptions that contain sufficient and clear information to avoid misunderstanding from pharmacists or pharmaceutical technicians when examining and dispensing drugs to patients.[24]

Number of Prescribed Medication Items

The number of medication items physicians prescribe was another external factor that caused pharmacist to spend an excessive amount of time to review a patient's prescription at the outpatient pharmacy of X Hospital in Kendal Regency. According to the study informants, the number of prescribed medications may vary depending on the doctor's diagnosis of the patient's complaints. Nonetheless, this posed a challenge when the number of prescribed medications exceeded five items, as pharmacists had to meticulously review each item, considering both pharmaceutical and clinical aspects. The underlying causes of excessive medication prescriptions are multifaceted, including patient's complaints and the prescribing habits of individual physicians. It is noteworthy that a single medication can often address multiple patient's complaints. It highlights the potential divergence in perspectives between physicians and pharmacists regarding the appropriate medication selection and dosage for patients.

"The number of prescribed medications is often high, and we also have to double-check everything, so this automatically slows down the process. It depends on the doctor's diagnosis and the patient's complaints, but usually, it is more than 5 items, sometimes even 11 items." (Main Informant 1)

"There are many medications, which is unavoidable, but it slows down the process. The more medications there are, the longer it takes us to process them, as we have to check each medication carefully." (Triangulation Informant 1)

The findings of this study are consistent with research conducted at Dr. Zainoel Abidin General Hospital, which demonstrated that the number of medication items can significantly impact the amount of time pharmacists require to process prescriptions. After implementing an intervention, the study found a four-minute difference in prescription review time between prescriptions with less than six items and those with more than six items.[27] Another study also highlighted that the type and quantity of compound medications significantly impact prescription service wait times, primarily due to the lack of consensus between doctors and pharmacists regarding effective patient therapies.[20]

While doctors have the ultimate authority to determine the number of medications prescribed to patients, effective communication and shared understanding between doctors and pharmacists are crucial to promoting rational medication use.[30] Careful consideration should be given to the number of medications prescribed to patients to avoid irrational medication use or polypharmacy, which refers to the prescription of more than two medications for a single diagnosis. The more medication items a doctor prescribes on a prescription sheet, the higher the likelihood of drug interactions.[31] Polypharmacy can put patients at risk even though the intention of prescribing multiple medications is to alleviate patient symptoms. However, not all patient complaints require medication.[32] The more medications prescribed, the longer it takes to enter medication usage into the system. Therefore, physicians should be encouraged to prescribe rationally to minimize polypharmacy.[33]

Distraction from patients

According to research informants, patient inquiries posed an external obstacle at the outpatient pharmacy of X Hospital in Kendal Regency due to the unavailability of reception counters which provided information to patients. The informants considered this as a hindrance as they had to spare time to address inquiries from patients while reviewing prescriptions. It divided their focus and extended the time required to process a single prescription. Common patient inquiries revolved around the placement of prescriptions and their queue numbers. This indicates that the availability of essential information resources is crucial for patients to easily navigate the prescription service flow at the outpatient pharmacy of X Hospital in Kendal Regency, ultimately reducing the likelihood of patients approaching busy staff with inquiries.

"The patients ask many questions, like where to put the prescription and their queue number, and we have to answer them while trying to focus on reviewing other prescriptions. Sometimes patients have left and come back to ask us for their queue number, and we have to look for their name again." (Main Informant 3)

"Patients ask many questions, and instead of being able to focus, our attention is divided. Some patients have never been to the pharmacy before, and there is no information on the counter above." (Triangulation Informant 1)

"I was unsure of where to go when I first came here, and the sign that read 'Place prescriptions here' was small and placed low down." (Triangulation Informant 3)

Consistent with previous research, patient behavior can also contribute to extended prescription service wait times. This includes factors such as patient knowledge of the prescription service flow and non-cooperative patient behavior. These actions by patients can impact the performance of pharmacy staff and lead to poor service quality. Hospitals must provide information resources in the prescription service flow and the estimated time required for each stage of the prescription service process.[27] The behavior of patients who lack discipline affects the prescription service wait time.[15]

Lack of Staff Skills in Utilizing the System

The internal obstacle that hindered the prescription review process at the outpatient pharmacy at X Hospital in Kendal Regency was the lack of staff skills in using the system. The time required to review prescriptions is also influenced by the speed at which pharmacy staff can review prescriptions using the system. Based on the in-depth interviews with research informants, it was found that the pharmacy service had begun implementing electronic prescriptions. However, not all pharmacy staff were skilled in using the hospital's pharmacy information system, notably in operating the system quickly during the prescription review process. This was because not all pharmacy staff were accustomed to reviewing prescriptions using the system, especially pharmacy technicians. Therefore, as explained by the research informants, the lack of staff skills was an obstacle that prolonged the prescription review process due to its impact on the speed of staff in processing prescriptions. In line with previous research, differences in work speed among staff will lead to increased patient waiting times.[27] Prescription service waiting times are also influenced by the speed of staff in operating computers.[15] The speed of staff in working is greatly influenced by the knowledge and skills possessed by the pharmacy staff.[34]

"The speed of each staff is different. All can get e-prescription training. The level of understanding of the technicians is the same, but in terms of the restriction of chronic drugs, not all of them know." (Main informant 4)

"Not all of them are skilled in using e-prescriptions, so some are fast, and some are slow. I am not used to e-prescriptions, but training has been given. Although not all of them, I see some of them self-study with other staff. Training also requires funds. And the average staff here is already old, the young ones are agile." **(**Triangulation informant 2)

The research informants also stated that the cause of the insufficient staff skills in operating the system was that not all pharmacy technicians received training on the use of the pharmacy information system in the application of electronic prescriptions, with age-related factors also contributing to this issue. All pharmacists had received pharmaceutical system training, but only a few pharmacy technicians had attended the training as representatives of pharmacy technicians. The lack of training for pharmacy technicians was because not all pharmacy technicians were willing to spare time to attend training outside their work shifts. In addition, almost all informants stated that pharmacy staff under 30 were more proficient in using the system than those over 30. However, regular training for pharmacy staff is important to ensure the continuous improvement of their knowledge and skills, which significantly impact the quality of pharmacy services.[14]

Insufficient Number of Pharmacists Reviewing Prescriptions

A further internal obstacle hindering the prescription review process at the outpatient pharmacy of X Hospital in Kendal Regency was the shortage of prescription review personnel. The hospital’s pharmacy had two pharmacists and one pharmacy technician assigned to the prescription review section. According to the research informant, the prescription review should have been carried out by a pharmacist. However, due to the work system being divided into several shifts, the number of pharmacists was divided evenly across each shift. As a result, there were only three pharmacists per shift. Only one pharmacist and one pharmacy technician were available during the prescription review process because the other two pharmacists dispensed medication. Research informants believed that the number of prescription review personnel during peak pharmacy service hours was insufficient if only two personnel were available. Outpatient pharmacy prescription services saw a surge in prescriptions during the evenings, making it a critical period at the pharmacy. Therefore, at least three to four prescription review personnel were needed. The shortage of personnel also led to delays in prescription review. The head of the outpatient pharmacy justified the allocation of pharmacists during peak service hours (day to evening shift) by pointing out that the presence of more pharmacists assigned to a single shift resulted in pharmacy technicians relied more on pharmacists for assistance. Consequently, the allocation of prescription review personnel was not proportional to the number of prescriptions received, leading to a backlog of prescriptions for review and ultimately extending prescription wait times.

"*There are not enough personnel. It could be faster if we added about four more. It is lacking because during peak hours in the afternoon, when all the doctors are practicing, the data entry is experiencing the most crowded point*." (Main Informant 4)

"There are not enough pharmacists, so one pharmacy technician assists them. Actually, according to our standards, the number of pharmacists is adequate. However, three pharmacists are insufficient during peak hours because they are divided into morning and afternoon shifts. With only three pharmacists, the pharmacy technicians become complacent and rely too much on the pharmacists. So, the pharmacists prepare them, and then hand them out." (Triangulation Informant 1)

The number of available pharmacy human resources was found to affect the speed of prescription services in the outpatient pharmacy. Only one or two personnel on duty can lead to a backlog of prescriptions when the personnel calculate dosages, prepare medications, and compound medications.[19] Only 3-4 pharmacists per shift can significantly impact the speed of the prescription service process due to the high volume of prescriptions received due to insufficient personnel.[14] According to the Regulation of the Minister of Health Number 72 of 2016 concerning Pharmacy Standards in Hospitals, the prescription review process must be conducted by a pharmacist. The number of pharmacists needed in outpatient pharmacies must be adjusted to the workload, including managerial and clinical pharmacy services such as prescription review, medication dispensing, medication use recording, and counseling. It also states that the ideal pharmacist-to-patient ratio is 1:50.[23] Pharmacist-filled prescriptions are faster than pharmacy technician-filled prescriptions, with a wait time reduction of 3.1 minutes if a pharmacist fills the prescription items because they are more knowledgeable about medications.[35]

Study informants also revealed that there are several obstacles beyond prescription review that hinder the prescription service process. These include delays in some doctor' practices, causing simultaneous prescription backlogs at the pharmacy; drug stock system errors, requiring staff to wait for system restoration; limited outpatient pharmacy drug availability, necessitating retrieval from the main pharmacy warehouse; inefficient patient administrative files hindering final review; and patients requesting repeated education, requiring additional time. Although this study focuses on exploring the constraints in the prescription review process, which that stage consumes the most time. The aforementioned issues cannot be ignored. These contribute to patient complaints too, due to the long medication wait times. One patient (triangulation informant 4) stated, "*Waiting for a long time, only starting practice at 9 o'clock. Still having to wait again at the pharmacy. It feels long, boring*". Long waits cause complaints and stress in patients with weak physical conditions, particularly when collecting prescriptions. Lengthy wait times also create patient discomfort, resulting in negative perceptions of hospital service quality, decreased patient satisfaction, and potentially affecting future trust.[36] Patient complaints are an indication of problems in healthcare services, often related to safety and quality of care issues.[37]

The findings of this study have implications for practical implications in hospital prescription services. Prompt delivery of prescription services is undoubtedly a common expectation among patients. However, various service bottlenecks in practice can delay the process of providing medications to patients. Consequently, the results of this study can serve as valuable input for hospitals, particularly for pharmacy management, pharmacists, and pharmacy technicians. These stakeholders should pay closer attention to patient waiting times for medications to ensure adherence to service standards and evaluate all factors that hinder the service process. It is crucial to recognize that prolonged waiting times can negatively impact a hospital's reputation among patients.

CONCLUSION

Prolonged waiting times for social health insurance patients prescription services at X Hospital in Kendal Regency posed a significant challenge to patient access to timely medications. The identified obstacles can serve as a consideration for the pharmacy management in evaluating prescription services to improve the time efficiency in delivering services. Further research should quantify the impact of these obstacles on the overall waiting times and patient satisfaction.

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STATEMENT OF ETHICS

Ethical approval for this research was granted by the Health Research Ethics Committee of the Faculty of Public Health at Diponegoro University (reference number 319/EA/KEPK-FKM/2022).

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Cost-Effectiveness Analysis of ERACS Compared to Non-ERACS at Hospital

Balqis Hisyam Saleh Basleman[1], Didik Setiawan[1,2]*, Susiyadi[3]

1. Departemen Farmasi Sosial dan Administratif, Fakultas Farmasi, Universitas Muhammadiyah Purwokerto, Jl. KH. Ahmad Dahlan PO BOX 202, Kembaran, Banyumas, Indonesia
2. Pusat Studi Ekonomi Kesehatan, Universitas Muhammadiyah Purwokerto, Jl. KH. Ahmad Dahlan PO BOX 202, Kembaran, Banyumas, Indonesia
3. Fakultas Kedokteran, Universitas Muhammadiyah Purwokerto, Jl. KH. Ahmad Dahlan PO BOX 202, Kembaran, Banyumas, Indonesia

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Corresponding Author:
Didik Setiawan

Corresponding Author Email:
d.didiksetiawan@gmail.com

ABSTRACT

Background: Cesarean section has a 5 to 7 times greater risk of maternal and child mortality than prevaginal delivery. Several other complications, namely reduced mobility, prolonged pain in the surgical wound, and longer hospital stays affect the patient's quality of life. The ERACS protocol, which is a multidisciplinary approach, is a good strategy to reduce the negative effects of cesarean section.

Objectives: To find out whether the ERACS protocol is more cost-effective than the non-ERACS protocol from a patient's perspective.

Methods: Researchers took data on costs and quality of life (using EQ-5D-5L) prospectively at private hospitals in Wonosobo which then calculated the value of the ICER. The cost components measured include direct medical and non-medical costs as well as indirect costs. The effectiveness of the measures in this study was reported in terms of reducing the LOS to 1 day, which represents a faster recovery and reduced costs. In this study, there were 2 sample groups, namely the ERACS protocol group with 24 respondents and the non-ERACS protocol group with 75 respondents.

Results: Based on the research, the effectiveness of the protocol in the form of improving the quality of life of patients was seen from the utility value and higher costs in the ERACS group compared to the non-ERCAS group (utility 0.771 vs 0.715; cost IDR.16,127,183 ± 5,023,356 vs IDR. 10,459,562 ± 3,826 .424) and obtained an ICER of 94,311,767 which means that the patient needs to add IDR.94,311,767 to improve the quality of life of post-cesarean section patients, which value is higher than Indonesia's 2022 GDP.

Conclusion: ERACS measures are more cost-effective when compared to non-ERACS measures because the ICER value is below three times Indonesia's 2022 GDP according to the perspective of patients at private hospitals in Wonosobo.

Keywords: ERACS; Incremental Cost Effectiveness Ratio (ICER); non-ERACS

INTRODUCTION

The maternal mortality rate (MMR) in Indonesia is still very high, where MMR is an indicator to see the quality of life index and women's health status and this has a very high social influence.[1] By 2020, MMR in Indonesia had reached 189 per 100,000 live births.[2] This figure is very high when compared to Indonesia's MMR target in 2015, which is 102 per 100,000 live births. The high MMR in Indonesia is caused by several factors related to pregnancy and childbirth, including the mother's readiness to become pregnant and the mother's

health, regular pregnancy checks, birth assistance, and care provided immediately after delivery, and socio-cultural factors of Indonesian society.[3]

Cesarean section not only causes several major complications but can also result in permanent complications. Complications can include disability or even death, resulting in an increased risk of maternal and infant death up to 5-7 times greater than vaginal delivery.[4] Some complications that often occur include reduced mobilization which affects the quality of recovery, prolonged pain in the surgical wound which affects the mother's quality of life after surgery and the patient's length of stay in hospital becomes longer.[5] ERAS (Enhanced Recovery After Surgery) was first introduced in 1997 by Kehlet for colorectal surgery to reduce the length of hospital stay.[6] In 2018 the ERACS (Enhanced Recovery After Caesarian Surgery) surgical delivery method was developed from the ERAS surgical method and was proven to reduce the length of stay in hospital (LOS) as well as indirect costs due to reduced adverse events (morbidity and mortality) in mother and baby) for 30 days after the protocol was carried out9. Apart from reducing LOS and costs, ERACS also has significant benefits that can be felt by mothers, in the form of significantly increased mobilization, reduced surgical wound pain, increased bonding between mother and baby, and decreased use of intravenous opioids. [7–9]

Implementation of the ERACS delivery protocol has consequences in the form of changes in cost and clinical aspects experienced by patients. Therefore, it is necessary to carry out a Cost-Effectiveness Analysis (CEA) to determine the economic influence on the effectiveness of treatment or a protocol implemented for patients. [10,11] Selfie research at Krakatau Medika IHC Cilegon Hospital concluded that cesarean section using the ERACS method is more cost-effective compared to non-ERACS for Social Security Agency on Health patients. [12]

METHODS

Study design

The research design used was observational analytic with a prospective cohort study type cohort design.

Population and samples

The sampling technique in this study was a quota sampling technique carried out on women who underwent cesarean section in the period January to March 2023 at a private hospital in Wonosobo Regency. The samples were ERACS and non-ERACS surgery patients who met the inclusion criteria, including pregnant women aged 18-40 years, gestational age 38-42 weeks, ASA (American Society of Anesthesiology) level II, and willing to be respondents in the research. The exclusion criteria in this research were having a history of accompanying or comorbid diseases, complications during and/or after surgery, the additional length of stay in the hospital without medical indications, and patients not filling incomplete data.

Study instruments

The ERACS method used in this study is a method with low-dose anesthesia using hyperbaric bupivacaine 0.5% 5 mg and fentanyl 25 mcg which is added with additional regional anesthesia in the form of a transversus abdominis plane (TAP) block with bupivacaine 0.25%. The non-ERACS method used is the conventional cesarean method (2.5 mg bupivacaine plus 0.1 mg moIDRhine adjuvant, 25 mcg fentanyl). [13]

This research assesses the quality of life of respondents using the EQ-5D-5L questionnaire which is in Indonesian. Before use, the validity and reliability of the questionnaire were tested on 100 patients after cesarean section at another private hospital in Wonosobo Regency. Then the results were tested for validity using the Pearson Product Moment correlation test and also tested for reliability using the Cronbach Alpha coefficient formula where when the calculated r value of the questions in the questionnaire gives a value of ≥ 0.60, then the measuring instrument is considered reliable and vice versa.[14–16] After the questionnaire was declared valid and reliable, utility data was collected from the test subjects using direct interviews. This interview also aims to obtain cost information (direct non-medical and indirect). In this research, the values obtained from respondents' answers to the 5 (five) questions provided in the EQ-5D questionnaire were then converted into utility values using the Indonesia value set.[17] Apart from utility, the effectiveness of the ERACS protocol can also be seen from the reduction in respondents' length of stay after surgery (LOS) obtained from respondent billing data. Acceleration of clinical significance and faster recovery were concluded if patients had an LOS ≤ 1 day.[12]

Data collection

The pharmacoeconomic perspective in this study uses the patient's perspective, so the cost components in this study are direct medical costs (operation/action costs, drugs & medical consumables during surgery,

inpatient drugs & medical consumables, room facilities, administration, laboratory, medical professionals and inpatient support) obtained from billing data from the hospital's financial system, direct non-medical costs (waiter's meals, transportation, baby sanitary napkins, vehicle parking, etc.), as well as indirect costs in the form of loss of patient productivity during 1 month obtained through interviews to the patient.

Data Analysis

In this research, the effectiveness of actions is calculated using the following formula:

$$Effectiveness = \frac{total\ patients\ with\ LOS\ 1\ day}{total\ patients} \text{ x } 100\%$$

After the cost, effectiveness, and utility data are collected, the Incremental Cost Effectiveness Ratio (ICER) value is calculated and compared with the willingness to pay (WTP) in Indonesia, which is 3x the value of Gross Domestic Product (GDP) per capita in 2022, where this GDP value is equal to IDR. 71.0 million.[18] Looking at the value of Indonesia's GDP in 2022, the WTP value in this research is IDR. 213 million.

From the resulting data, it is necessary to carry out a sensitivity analysis to take into account aspects of uncertainty.[19] One-way sensitivity analysis was carried out on variables that were predicted to influence the ICER value, namely costs of surgery or procedures, drugs and MEDICAL CONSUMABLES during surgery, drugs and MEDICAL CONSUMABLES for inpatient care, administration, inpatient support, ERACS patient utility value, utility value non-ERACS patients and presented in the form of a tornado diagram.

RESULTS AND DISCUSSION

Respondent characteristics

From the total population of patients undergoing cesarean section, totaling 146 patients, selection based on inclusion and exclusion criteria resulted in a sample of 99 people (figure 1). The largest number of excluded samples in the non-ERACS group was gestational age < 38 weeks, namely 16, and ERACS was the addition of LOS without indication is 5.

Based on Table I, it can be seen that the largest number of respondents in this study were in the age range of 26-30 years (38.38%), where this age range is the ideal condition of biological and psychological maturity for receiving conception.[20] In the gestational age range category, the largest number of respondents was with a gestational age range of 38-39 weeks (70.83%) in the ERACS group and 54 respondents (72%) in the non-ERACS group. A gestational age of 38-39 weeks is the gestational age range that is months enough for delivery.[21] The educational levels in the ERACS group were evenly distributed between SMA and D1-S2 (50%). Meanwhile, in the non-ERACS group, the highest level of education was at the high school level (49.33%). The most common occupation in both groups is housewife. Where in the ERACS group there were 14 respondents (58.33%) and in the non-ERACS group there were 40 respondents (53.33%). This is related to the level of education where the highest level of education was obtained, namely at the high school level which was the highest education for the housewife occupational group in this study.

Effectiveness of actions

The effectiveness parameters of the action are seen from the LOS and utility values. The results of this study show that the ERACS action has a higher presentation of success in reducing the LOS value, but this difference is not statistically significant (12.5% vs 8.0%, p-value 0.173 (Table II). This research is in line with Selfie's research (2023) where the difference in average length of stay between ERACS and non-ERACS was found (2.96 ± 0.2 vs 3.96 ± 0.2).[12]

The EQ-5D value for ERACS measures was higher when compared with non-ERACS measures (0.771 ± 0.124 vs 0.715 ± 0.117), and was directly proportional to the EQ-5D VAS scores for ERACS and non-ERACS measures (81.458 ± 10.052 vs 78 ± 10.591). Looking at the results in Table III, most of the ERACS group did not show problems in the five dimensions of quality of life assessed. This is different from the non-ERACS group where all dimensions of quality of life assessed by respondents indicate problems. These results are in line with other research related to quality of life using the EQ-5D questionnaire conducted by Suwendar where the VAS and utility values are directly proportional.[11] Similar results were also reported in the research of Setiawan and Yuswar.[22,23]

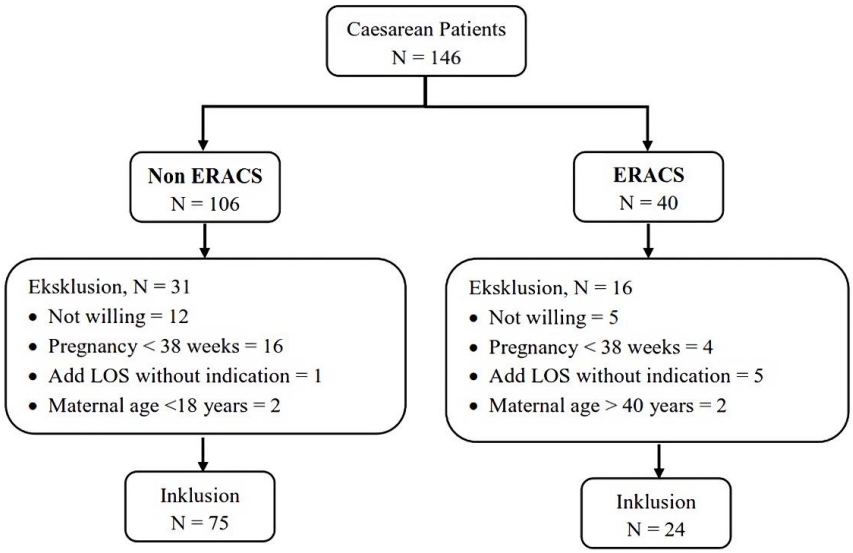

Figure 1. Inclusion of research respondents

Table I. Distribution of respondent characteristics

Characteristics	ERACS (N=24)		Non-ERACS (N=75)		Total	
	n	%	n	%	n	%
Mother's Age						
18-25	9	37.50	21	28.00	30	30.30
26-30	8	33.33	30	40.00	38	38.38
31-35	5	20.83	19	25.33	24	24.24
36-40	2	8.33	5	6.67	7	7.08
Gestational Age						
<38	0	0.00	0	0.00	0	0.00
38-39	17	70.83	54	72.00	71	71.71
40-41	5	20.83	17	22.67	22	22.22
>42	2	8.33	4	5.33	6	6.06
Education						
Elementary – Middle School	0	0.00	18	24.00	18	18,19
Senior High School	12	50.00	37	49.33	49	49.49
Diploma 1 – Postgraduate	12	50.00	20	26.67	32	32.32
Work						
Employee	4	16.67	20	26.67	24	24.24
Trader	6	25.00	15	20.00	21	21.21
Housewife	14	58.33	40	53.33	54	54.54

Cost Components

Based on this research (Table IV), several costs differ statistically significantly (p-value < 0.05), namely surgery or procedure costs, drug & and medical consumables costs during surgery, inpatient drug & and medical consumables costs, room facilities, administration costs, medical professionals, inpatient support and waiting meal costs. This difference in costs is due to differences in rates for types of costs that are directly related to the class of inpatient room. The average total cost for delivery using ERACS is IDR. 16,127,183 and non-ERACS IDR. 10,459,562, so the total difference between the average ERACS and non-ERACS costs is IDR. 5,667,621. This is not in line with Selfie's (2023) research, where there was a significant difference in average costs between the two cesarean methods, namely IDR. 5,342,990 for ERACS actions and IDR. 6,266,168 for non-ERACS actions. In

Table II. Effectiveness of ERACS and non-ERACS measures

Action Type	Total LOS 1 day (N)	Total patient procedures (N)	Effectiveness (%)	p-value
ERACS	3	24	12.5	0.173*
Non-ERACS	6	75	8.0	

Note = *: difference is not significant (P>0.05)

Table III. The frequency and proportion of EQ-5D-5L were reported based on dimensions and levels of ERACS and non-ERACS delivery methods

Dimensions	Levels	ERACS (N=24)		Non-ERACS (N=75)	
		n	%	n	%
Mobility	No problem	24	100.00	72	96.00
	There is a problem	0	0.00	3	4.00
Self-care	No problem	24	100.00	68	90.67
	There is a problem	0	0.00	7	9.33
Daily activities	No problem	21	87.50	52	69.33
	There is a problem	3	12.50	23	30.67
Pain/Discomfort	No problem	24	100.00	66	88.00
	There is a problem	0	0.00	9	12.00
Anxiety/Depression	No problem	24	100.00	74	98.67
	There is a problem	0	0.00	1	1.33
EQ-5D Index, mean ± SD		0.771±0.124*		0.715±0.117*	
EQ-5D VAS, mean ± SD		81,458±10,052*		78±10,591*	

Note: *difference is not significant (P>0.05)

Table IV. Cost components in rupiah

Fee Type	ERACS (N=24) LOS 1,875 days ± 0.338		Non-ERACS (N=75) LOS 2 days ±0.403		P- value
	Mean	SD	Mean	SD	
Direct Medical Costs					
Operation or action	6,497,917	1,271,466	4,451,409	1,020,679	0,000
Medication & medical consumables during surgery	2,578,970	344,009	1,140,650	246,631	0,000
Inpatient medication & and medical consumables	2,010,929	613,184	469,725	280.113	0,000
Room facilities	521,875	153,918	439,067	98,130	0.003
Administration	139,167	24,480	94,067	14,789	0,000
Laboratory	394,667	51,808	370,733	60,737	0.086*
Medical professional	207,292	42,375	173,933	23,196	0,000
Inpatient support	773,771	241,997	391,673	158,007	0,000
Non-Medical Direct Costs					
Eat the waiter	270,833	120.611	197,000	76,996	0.001
Transportation	145,833	79,286	141,667	89,982	0.840*
Baby sanitary napkins/pampers	97.917	39,643	101,533	41,435	0.708*
Vehicle parking	13,013	5,632	14,206	5,328	0.824*
Etc	275,000	146,385	473,899	212.116	0.012*
Indirect Costs					
Loss of productivity	2,200,000	1,888,562	2,000,000	1,498,285	0.726*
Total	16,127,183	5,023,356	10,459,562	3,826,424	0,000

Table V. ICER ERACS compared with non-ERACS

Procedure Type	Average cost	Outcome	Cost difference	External Difference	ICER
		Effectiveness			
Non-ERACS	10,459,562	8.0%	-	-	-
ERACS	16,127,183	12.5%	5,667,621	4.5%	1,259,471
		Utility			
Non-ERACS	10,459,562	0.715	-	-	-
ERACS	16,127,183	0.771	5,667,621	0.056	101.207.517

Table VI. ICER ERACS compared with non-ERACS (provider perspective)

Procedure Type	Average cost	Utility	Cost difference	Difference in effectiveness	ICER
Non-ERACS	7,531,257	0.715	-	-	-
ERACS	13,124,588	0.771	5,593,331	0.056	99,880,910

the Selfie study, it was found that the costs of non-ERACS procedures were higher than ERACS due to the additional length of hospital stay.[12]

Cost-effectiveness analysis

Cost-effectiveness analysis shows that to get 1 additional patient who successfully reduces LOS in the ERACS procedure, an additional cost of IDR. 1,259,471 and to improve the quality of life for the ERACS procedure an additional fee of IDR. 101.207.517. So, it can be inteIDRreted that in this study, cesarean delivery using the ERACS method was cost-effective when compared with the non-ERACS method because the resulting ICER value was below the WTP value, namely 213 million rupiah. These results are in line with research by Selfie, which states that decreasing LOS will have a direct impact on returning patients from the ward more quickly so it will imply reducing costs.[12]

Apart from looking at it from the patient's perspective, this research also produces ICER values based on the provider's (hospital) perspective. For the amount of costs in these two perspectives, only direct medical costs were used, where the average costs for ERACS and non-ERACS procedures were IDR. 13,124,588 and IDR. 7,531,257. With the ICER value obtained in Table VI, namely IDR. 99,880,910, it can be stated that the ERACS action is cost-effective according to the provider's perspective when compared with 3 times the value of Indonesia's GDP in 2022. Meanwhile, if seen from the INA-CBG Regional 1 tariff for houses private class C hospitals, the average claim made for cesarean section services for the three classes of inpatient care and degree of operation is IDR. 6,877,200 lower than the direct medical costs spent by hospitals to provide cesarean section services.[24]

Sensitivity analysis

The sensitivity analysis in this study is shown in the toIDRedo diagram (figure 2) which shows that there are no variables that influence changes in the ICER value. So, the ICER value remains below the WTP value used.

The limitation of researchers in this study is that they have not measured the quality of life of patients 2 hours after surgery, which has an impact on the lack of accuracy in measuring the quality of life of respondents after surgery which is directly related to the effectiveness of the surgery performed, so it is hoped that in future research they can add measurements of patient quality of life 2 hours after the procedure other than 7 days after the procedure. Apart from that, because there is no clinical pathway (CP) for ERACS procedures at the hospital where this research was carried out, this has led to the lack of limits on the therapy given to ERACS patients so the costs incurred by patients are uncontrolled.

At the hospital where the research was conducted, the ERACS method used was low-dose anesthesia plus TAB block pain management, where ideally ERACS should be replaced using low-dose anesthesia alone. With the addition of pain management, it is hoped that patients will immediately show improvement in clinical conditions, thereby reducing direct medical costs and increasing the cost-effectiveness of ERACS procedures.

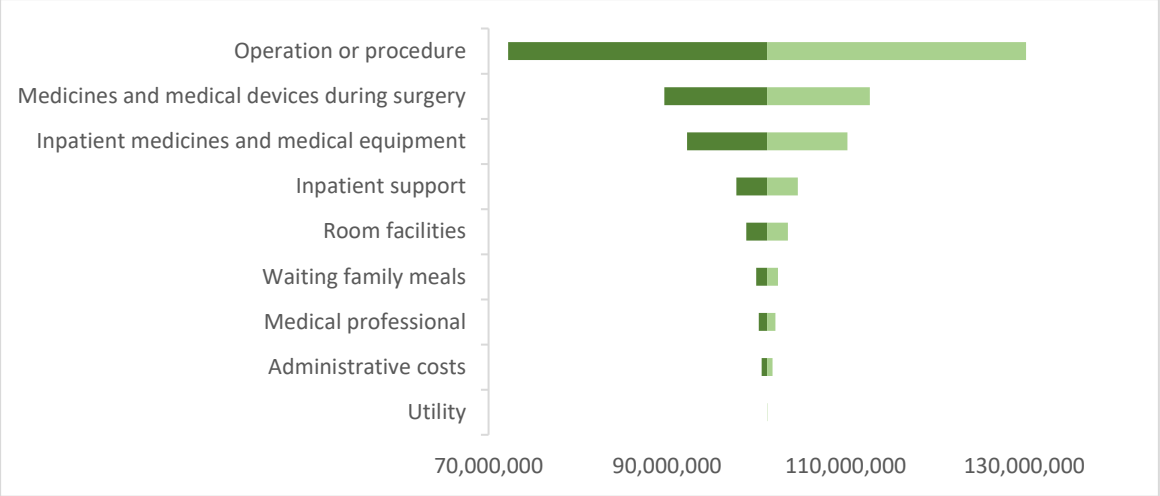

Figure 2. Univariate sensitivity analysis of parameters that influence ICER

CONCLUSION

ERACS measures are more cost-effective when compared to non-ERACS measures because the ICER value is below three times Indonesia's 2022 GDP according to the perspective of patients at private hospitals in Wonosobo.

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STATEMENT OF ETHICS

This research received ethical feasibility from the Muhammadiyah University of Purwokerto Health Research Ethics Committee in October 2022 with Registration Number: KEPK/UMP/11/X/2022.

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Traditional Medicinal Plants for the Prevention and Treatment of Hypertension: A Literature Review

Athika Reza Febyanesti[1]*, Bagoes Widjanarko[2], Zahroh Shaluhiyah[2]
1. Master of Health Promotion, Faculty of Public Health, Diponegoro University, Semarang, Indonesia
2. Faculty of Public Health, Diponegoro University, Semarang, Indonesia

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Corresponding Author:
Athika Reza Febyanesti

Corresponding Author Email:

ABSTRACT

Background: Hypertension is described as a disease that has a high prevalence in Indonesia. If it is not appropriately treated, it will cause advanced diseases such as stroke, heart failure, and kidney damage. Therefore, it is necessary to prevent and give early treatment, one of which is through alternative routine consumption of herbal medicines.
Objectives: This study aims to find out the benefits of herbal medicine for people with hypertension.
Methods: The method used in this research is a literature review. It is carried out in several stages by analyzing relevant previous pieces of literature using the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) flowchart that illustrates the flow of information through the different phases of a systematic review.
Results: A total of 11 reviewed articles show that various herbal plants were obtained with multiple uses to reduce hypertension, and these plants were easy to get and use. It shows that the boiled leaves were the most frequently used part of the plant. Herbal treatment for hypertension aims to enrich antioxidants, block calcium channels, strengthen the endothelium, inhibit ACE, increase without production, and release and decrease biogenic amines. Herbal plants like lemongrass leaves, ginger, gotu kola leaves, and cat's whiskers are useful for lowering blood pressure levels in routine and intensive use without any side effect intervention by boiling.
Conclusion: Education regarding herbal plants for hypertension is also beneficial because the increased insight and knowledge they have reduced the possibility of hypertension occurring in the community
Keywords: Herbal plants; Hypertension; Prevention; Treatment

INTRODUCTION

Hypertension is described as a disease that is highly prevalent in Indonesia. Hypertension is a disease that causes a person to experience increased blood pressure in the arteries. In general, hypertension is described as an asymptomatic condition in which the pressure is abnormally high in the arteries, which, if it continues to increase, will cause further diseases such as stroke, heart failure, and kidney damage.[1] The World Health Organization (WHO) also explains hypertension as an increase in systolic blood pressure higher than 140 mmHg and/or diastolic blood pressure higher than 90 mmHg.[2] Apart from that, the World Health Organization (WHO) data in 2015 showed that around 1.13 billion people were affected by hypertension. It is estimated that there will be 1.5 billion people in the world affected by hypertension in 2025.[3] Based on the statement provided by Riskedas 2018, it was explained that the rate of hypertension in the population over the age of 18 was 31.4%, with an estimated number of cases of 63,309,620 people and the number of deaths of 427,218. It proves that there was an increase in the number of patients with hypertension in 2013, which was only 25.8%.[4]

The increase in the number of people affected by hypertension occurs because many people do not realize that they have hypertension. In addition, some people believe that routine check and ordering medicines at the nearest health care center require quite a large amount of money, and there are even side effects of antihypertensive drugs, such as amlodipine, diltiazem, and felodipine. These include constipation, dizziness,

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weakness, nausea, and swelling.[5] These side effects occur due to chemical-based drugs. Based on this, an effective option for treating hypertension is to use herbal medicines. Medicinal herbal treatment is an essential and cost-effective form of treatment with fewer side effects compared to allopathic treatment.[6] The use of herbal medicine to treat hypertension is supported by the tradition of Indonesian people, who often use traditional medicine to treat various diseases. These plants can be considered part of the cultural heritage and traditional medicine that the community has used.

Plants are common industrial units for the invention of chemical components. These are used to strengthen the immune system and improve the body's natural ability to fight various health problems.[1] Therefore, herbal medicines have several active substances with pharmacological and prophylactic properties that can be used in the treatment of hypertension.[7] An example is cucumber juice, which has been proven to be effective in reducing systolic and diastolic blood pressure in people with hypertension.[8] However, the use of this herbal medicine still needs to be clearly researched regarding the appropriate type of plant and also the appropriate method of processing herbal plants to treat hypertension. Therefore, the novelty of this study is the comprehensive systematic observation methodology using the PRISMA flowchart to launch a rigorous literature on traditional medicinal plants for the treatment of hypertension. This study highlights the importance of education and support to increase public knowledge and reduce the incidence of hypertension. The thematic analysis of traditional medicinal plants provides deeper insight and demonstrates a holistic approach to hypertension treatment.

METHODS

Study Design

The method used in this research is a literature review. It is carried out in several stages by analyzing relevant previous pieces of literature using the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) flowchart that illustrates the flow of information through the different phases of a systematic review. The PRISMA flow diagram visually represents the study selection process in a systematic observation or meta-analysis. The process begins by identifying the dataset through databases and other sources searching, and removing the duplicate records. The remaining records were screened based on title and abstract, and records that did not meet inclusion criteria were excluded. Following this initial review, the full texts of potentially relevant studies were checked for eligibility. Further delivery can be carried out at this stage based on predetermined criteria such as research design, population, intervention, and results. Studies that meet the eligibility criteria will be included in the qualitative synthesis. Some of this research will also be included in a quantitative synthesis (meta-analysis). Throughout this process, the reasons for recording research will be documented at each stage to ensure transparency and reproducibility of visibility.

Search Strategy

Research team members, including the researcher, were involved in the initial search strategy planning. The search was conducted online via journal publication platforms such as Garuda, Pub Med, and ScienceDirect. The article search used English and Indonesian with the keywords.

Eligibility criteria

The inclusion criteria were: (1) articles published in the last five years (from 2019-2023); (2) open access; (3) have full text and explain the plant parts used for the utilization of hypertension treatment as well as an explanation of medicinal plant education to the community; (4) written in English or Indonesian. Exclusion criteria were: (1) absence of the word ‘Hypertension’ in the title in order to target studies with a clear focus on methodological development or use in qualitative research; (2) Mismatch between article title and abstract; (3) studies reported in grey literature; and (4) No full text available.

Data Extraction

In the first stage, articles were searched using the keywords "Herbal plants" AND "Hypertension" AND "Prevention" AND "Treatment." A total of 9,943 articles were obtained without considering other factors, including year of publication and year of research. After that, identification was carried out by filtering articles that were not older than 2019 with no duplicate publications to avoid publication bias. In the duplication identification stage, researchers used the publish or perish tool and Ms. Excel to help speed up the duplication

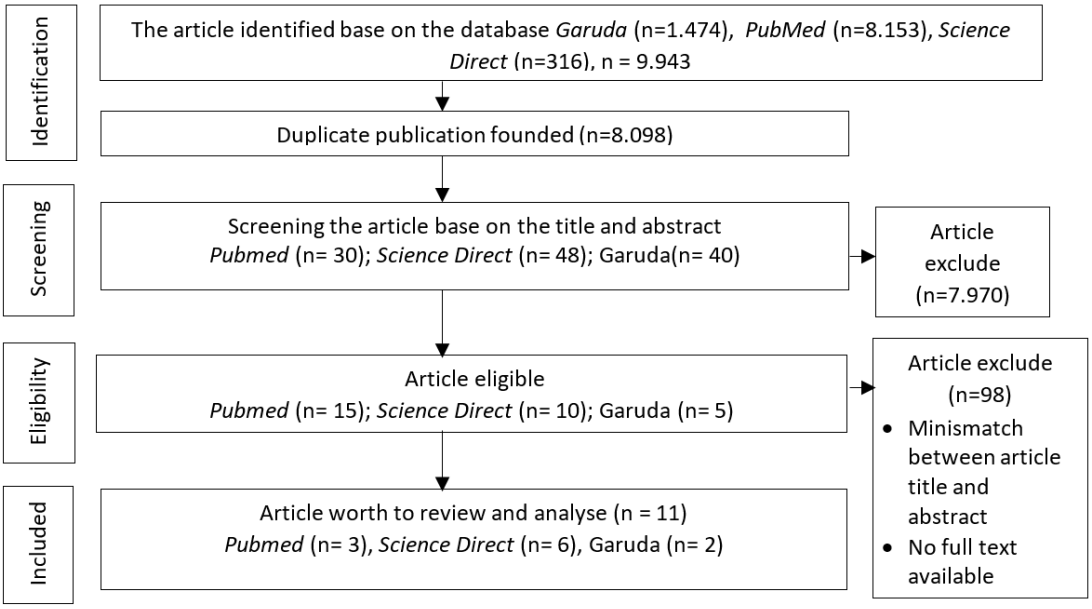

Figure 1 . PRISMA Flow Diagram

identification process. It resulted in 8,089 articles that did not meet the criteria because articles and research were published before 2019, or there was publication bias or both.

At the screening stage, an in-depth analysis was carried out regarding the suitability of the article title and the variables to be studied in this review, and 118 articles were obtained. The 118 articles were analyzed regarding the suitability of the title with the abstract and identifying whether or not a full-text version of the article title was obtained, so the final results in searching for articles that were eligible for analysis according to the criteria were 11 articles.

Analysis

The data were analyzed thematically on traditional medicinal plants for hypertension. Several research team meetings were held during the iterative data extraction and analysis process. Data matrices were used to display the findings according to the scoping review questions.

RESULTS AND DISCUSSION

Based on the results, the identification article was an appropriate scientific knowledge study, which made the recapitulation article scientific.

Table I. shows that public knowledge regarding the growth of herbal plants used as antihypertensives is still general. After counseling and education were held, public knowledge and insight increased. Some people who have used herbal plants as antihypertensives generally use boiled plant leaves. This is supported by previous research, which states that herbal medicine as an antihypertensive can be used by boiling, brewing, grating, and grinding, as has been done by the community in Simbang District.[18] People or respondents consume ½ to 1 glass of boiled plant water every day. Regular consumption results are shown to reduce high blood pressure and make it more stable. The side effects given were relatively mild, so treatment focused on reducing the respondent's blood pressure levels. Several studies have used more than 30 plants to treat hypertension because they contain flavonoids and other supporting compounds. These plants are predominantly in the Composite and Lamiaceae families. The following sub-chapter will provide a more in-depth discussion of this matter.

Traditional herbal medicine is a form of active community participation in solving health problems and has been recognized by many countries for its role in improving public health conditions. In previous journals, it was explained that the Chinese had used herbal medicine as an antihypertensive.[19] The World Health Organization (WHO) recommends the use of traditional medicines, especially herbal medicines, to maintain public health, prevent and treat diseases, especially chronic diseases, degenerative diseases and cancer.[20]

Table I. Study Characteristic

No	Title, Author, Year	Method	Results
1	Phytochemical study, antioxidant, and vasodilation activities of leafy stem extracts of *Flemingia Faginiea* Guill & Perr (Barker), a medicinal plant used for the traditional treatment of hypertension Ouedraogo, Beleemnaba, Nitema, Kabore, Koaala, Ouedraogo, Semde, Ouedraogo 2023[2]	Phytochemical studies were carried out using high performance thin layer chromatography and high performance liquid chromatography techniques coupled with mass spectrometry. The analysis was carried out using the aluminum trichloride colorimetric method to calculate total polyphenols and flavonoids.	The results show that phytochemical studies revealed the presence of flavonoids, tannins, coumarins, sterols and triterpenes, alkaloids and saponins in leafy stem extracts of *Flemingia Faginiea* Guill & Perr can be used for the treatment of hypertension.
2	BMI in the Associations of Plant-Based Diets with Type 2 Diabetes and Hypertension Risks in Women: The E3N prospective cohort study Laouali N, Shah S, Macdonald C, Saleh Y, Fatouhi, Mancini F, Fagherazzi G, Ruault M 2021[9]	A type of statistical quantitative research was used using the FFQ analysis method, namely the Cox regression model.	There were 4.64% cases of T2D (type 2 DM) and 27.14% cases of hypertension. The different relationship between plant-based diets on T2D and hypertension among women has a significant influence. The results show that only plant foods were healthier and partially low-risk.
3	Plants Used as Antihypertensive Verma, Sinha, Bansal, Yadav, Shah, Singh Chauhan 2020[1]	Literature-based qualitative research review of plants that are useful as antihypertensives.	The results show that various plants for the treatment of hypertension were used for the mechanism of action of hypertension. Pharmacological activity influences the pathogenesis of hypertension by modulating several parameters, namely endothelial function, ROS production, pro-inflammatory signals, platelet activation, opening and closing of ion channels, and ACE inhibition.
4	*Pemanfaatan Tanaman Obat sebagai Pengobatan Hipertensi dan Diabetes Melitus* Faoziyah, Rahma dan Febriani 2019[10]	This type of research uses quantitative statistics by conducting pre and post-tests on educational knowledge about medicinal plants in respondents.	The screening results at the Bahagia V Elderly Posyandu had the highest number of sufferers, namely hypertension and diabetes. Providing education increases insight to 30%, from 57.5% to 87.5%, regarding the use of herbal medicines for hypertension and diabetes.
5	Ficus Plants in the Management of Hypertension and Erectile Dysfunction Ajeigebe, Oboh, dan Adomasun 2021[11]	This descriptive qualitative type of research describes how plant Ficus regulates hypertension and erectile dysfunction in a person's body.	The results show that therapeutic drugs offer ED, HBP, and antihypertensive medications for reduction interventions by targeting active enzymes and proteins. The Ficus plant has a function in managing hypertension and erectile disease because it has aphrodisiac properties and has high heart protective power because it contains residual polyphenols.

Table I. (Continued)

No	Title, Author, Year	Method	Results
6	Traditional Herbal Therapies for Hypertension: A Systematic Review of Global Ethnobotanical Field Studies Aumeruddy, Mahonodally 2020[12]	This qualitative type of research is a systematic review within the scope of ethnobotanical studies.	The results show that Compositae and Lamiaceae are the most widely used plant families. In the plant body, 35% of people use leaves for healing, 12% fruit, and 1% roots. The method used is 50% decoction and 22% infusion. The results show that it has been scientifically validated in vitro, in vivo, and in clinical studies before the plant can be considered as an alternative or complementary antihypertensive therapy.
7	*Sosialisasi Ramuan Tanaman Herbal untuk Pengobatan Hipertensi di Desa Blubuk* Nurhidayati, Rejeki, Pramiastuti, Murti 2023[13]	This research uses a quantitative methodology with pre- and post-methods tests on residents in Blubuk village.	From the results of outreach conducted to Blubuk village residents regarding the treatment of hypertension, there was an increase in knowledge of the use of herbal plants in the treatment of hypertension by 10.2%.
8	Traditional Medicinal PlantsUsed by Hypertensive Patients in Belize: A Qualitative Evaluation of Beliefs and Practices Mputhi dan Husaini 2022[14]	This research uses testing methods on 15 plant families which are generally used to control hypertension.	The results show that of the 15 families of plants used, the leaves are the most frequently used part. The boiling method is the most frequently used method, with a recommended daily consumption of ½ to 1 glass. Mild side effects were detected when antioxidants reacted, which were felt to be more efficient in terms of healing.
9	*Pemanfaatan Terapi Herbal dan Pijat Akupresur dalam Terapi Terapi Lanjut Usia* Septianingrum, Nurpalupi, Astuti, Hanafi, dan Setiawan 2020[15]	This research uses a field survey method in Kembangan Hamlet through counseling and field practice.	The results show that elderly residents are not well monitored in terms of their health. After training and counseling, the knowledge and health behavior of residents with hypertension were improved.
10	*Hibiscus Sabdariff*, Treatment for Hypertension Anbaki, Cavin, Nogueira, Tasimi, Ali, Najem, Mahmood, Khaleel, MOHAMMED, Hasan, Marcourt, Felix, Der's, Queiroz, Wolfender, Watissee, Graz 2021[16]	This type of research uses quantitative research with a multicentric comparative method.	The results show that after six weeks, 61.8% of respondents in the intervention group had blood pressure <140/90 mmHg, compared to 6.7% of the control group. The intervention group had a mean reduction of 23.1 mmHg and 12 for systolic diastolic high pressure. In the control group, the reduction was 4.4/3.6. Based on this, the use of anthocyanins and hibiscus acid is effective.

Antihypertensive Herbal Plants

Several studies have shown that several plants are used as antihypertensives, some of which can be seen in the following table.[14,16,17]

Table II. shows that many plants have their leaves taken to be brewed/boiled with water in a consumption capacity of ½ to 1 glass to lower blood pressure levels. From the table of plants that reduce hypertension, many plants are very easy to find in the kitchen and are also used as spices/food ingredients such as onions, lime,

Table I. (Continued)

No	Title, Author, Year	Method	Results
11	Ethnobotanical and Ethnopharmacological Study of Medicinal Plants Used By A Traditional Community in Brazil's Northeastern Magalhaes, Araujo, Santos, Vanderlei, Souza 2020[17]	This research used an interview type of research on 24 interviewees who were residents of Quilombola, Alagoas.	use as plants and the use to fight arterial hypertension, diabetes mellitus, and inflammation. Its general use is boiled as tea. It is commonly used in quilomba groups because people usually plant these plants in their backyards.

Table II. Antihypertensive Herbal Plants

Plant Name	Family	Species	Parts used	How to use
Andu nuts	Fabaceae	*C. cajan*	Leaves and seeds	Brewed and Filtered like Tea
Chinese Senna	Fabaceae	*S. Macranthera*	Seed	Brewed like Coffee
Noni	Rubiaceae	*M. Citrifolia*	Fruit	Juice
Rosemary	Rubiaceae	*S. Rosmarinus*	Leaf	Brewed like Tea
Alecrim				
Asparagus	Asparagaceae	*A. Densiflorus*	Leaf	Brewed like tea
Juntai				
Roselle	Malvaceae	*H. Sabdariffa*	Fruit	Brewed like tea
Soursop	Annonaceae	*Annona muricata*	Leaves and Fruit	The fruit is consumed directly and the leaves can be brewed/boiled
Moringa leaves	Moringaceae	*Moringa oleifera*	Leaf	Brewed
Garlic	Amaryllidaceae	*Alliums sativum*	Bulbs	Raw garlic is consumed directly
Lime	Rutaceae	*Citrus Aurantilofolia*	Leaves and Fruit	Lime juice mixed with water / boiled leaves
Ginger	Zingiberaceae	*Zingiber Officinale*	Ginger/dry root	Boiled
Lemongrass	Poaceae	*Cymbopogon Andripoganeae*	Leaf	Boiled
Breadfruit	Moraceae	*Artocarpus altilis*	Leaf	Eat it straight away
Cat whiskers	Rubiaceae	*Uncaria tomentosa*	Leaf	Boiled
Pineapple	Broromaliaceae	*Ananas comosus*	Fruit	Eat it straight away
Anato	Bixaceae	*Bixa orellana*	Leaf	Boiled
Bukut	Leguminosae	*Cassia grandis*	Bulbs	Consumed directly
Serosion	Cucurbitaceae	*Momordica charantia*	Leaf	Boiled
Trumpet plant	Cecrapiaceae	*Cecropia peltata*	Leaf	Boiled
Cinnamon	Lauraceae	*Cinnamon verum*	Powder	Boiled

lemongrass, and cinnamon. A previous study explained that as many as 1,329 species in 823 genera with 176 families were detected as traditional medicine. The most common families that can be used for hypertension treatment are Compositae, Lamiaceae, Leguminosae, Rosaceae, Apocynaceae, Malvaceae, and Rubiaceae. The use of herbal plants to cure hypertension has been used for a long time. Apart from Indonesia, there are 90 countries that use herbal plants as a cure for hypertension such as 24 countries in Africa, 26 countries in Asia, 20 countries in Europe, 7 countries in North America, 10 countries in South America, 2 countries in Oceania, and

1 country in Marquesas.[12] It shows that herbal plants are used massively in various countries because of their efficacy and effectiveness as a medicine.

Hypertension Treatment

Treatment of hypertension includes non-pharmacological and pharmacological approaches. Treatment decisions depend on whether cardiovascular disease, diabetes, or CKD are already present. The 2017 AHA/ACC guidelines recommend considering the 10-year risk of cardiovascular disease for patients without stage 1 hypertension. If the risk is less than 10%, lifestyle modifications for only 3-6 months are reasonable. For pre-existing stage 2 hypertension, such as diabetes or CKD, and a 10-year risk of cardiovascular events of 10% or more, lifestyle modifications and treatment are recommended.[21]

Consume antioxidant-rich foods and drinks

Based on the results of the study, it was found that antioxidants have a relationship with hypertensive patients. For example, plasma Vit. C levels are inversely proportional to blood pressure. The presence of antioxidants in the body helps circulation and reduces hypertension. One can consume *Camellia sinensis, Zingiber officinale*, and *Terminalia arjuna* to enrich antioxidants.[12] Based on the literature, other studies have shown the benefit of *Camellia sinensis* and *Zingiber officinale* as cardioprotective and antioxidant-rich.[22] The benefits of *Camellia sinensis* (Green Tea) in reducing blood pressure as a tea derived from the *Camellia sinensis* plant which is generally known for its high polyphenol content, particularly compounds like Epigallocatechin gallate (EGCG). The polyphenols present in green tea possess antioxidative and vasodilatory properties. These characteristics can help relax blood vessels, enhance endothelial function, and mitigate oxidative stress, potentially leading to decreased blood pressure. Green tea can be consumed as a beverage, either hot or cold, and is also available in supplement form. Moreover, *Zingiber officinale* (Ginger) is renowned for its anti-inflammatory and antioxidative attributes and has been investigated for its potential to lower blood pressure. Ginger may reduce blood pressure by promoting blood vessel relaxation, improving blood circulation, and inhibiting angiotensin II, a hormone that can cause blood vessel constriction and heightened blood pressure. Ginger can be integrated into your diet by adding it to your meals, brewing ginger tea, or taking ginger supplements.[23] Then, the benefit of *Terminalia arjuna,* an herb utilized in traditional Ayurvedic medicine, has been explored for its cardiovascular advantages, including the possibility of lowering blood pressure. *Terminalia arjuna* may aid in reducing blood pressure by easing the tension in blood vessel walls, enhancing endothelial function, and lessening the workload on the heart. Additionally, it is believed to possess antioxidant and anti-inflammatory properties. *Terminalia arjuna* is accessible in various forms, such as capsules, powders, and extracts, and is commonly used as a dietary supplement.[24]

Inhibiting ACE

ACE inhibition functions to inhibit hypertension levels in patients who also experience diabetes on insulin with nephropathy. The ACE inhibitor plants are *Nigella sativa* and *Tribulus terrestris.*[1]

Pathway dependent/independent endothelium

The endothelium functions as a vasoconstrictor and vasodilation agent, which functions to regulate blood vessel tone and a substance that influences the interaction of blood platelet walls and the growth of vascular smooth muscle cells. The endothelium plays an important role in the distribution of blood in blood vessels. Based on this, a person can consume *Hibiscus sabdariffa* and *Crataegus spp* to facilitate vasoconstrictor substances.[1] In other research explained in the context of searching for natural vasodilators that function in the endothelium pathway, plants are used that are rich in ascorbic acid and phenol compounds. It aims to ensure that these herbal medicines can be used as a stepping stone to overcome endothelial dysfunction. Such plants are *Flemingia faginea* (Guil. and Perr.).[2]

Calcium Channel Blockers

These are drugs that function to limit the body's use of calcium. This drug functions to treat diseases, one of which is high blood pressure. Plants that have calcium ion channel blocker capabilities among them are *Coriandrum sativum, Salvia miltiorrhiza, Crocus sativus, Bidens pilosa, Apium graveolens, Cymbopogon citratus, Coptis chinensis, and Andrographis paniculata.*[1]

PGI2/KATP Channel Opener

KATP channels constitute the trigeminovascular system and are essential in regulating tone in the cerebral and meningeal arteries. Clinical trials also stated that opening KATP had side effects, namely headaches, due to the impact of vascular mechanisms. KATP has an essential role in reducing blood pressure levels in hypertension. PGI2 and KATP are found in plants *Coptis chinensis.*[1]

Improvement without production and release

In this case, the herbal plants that reduce blood pressure and help spread it are *Alliums sativum, Tribulus terrestris, Andrographis, paniculata, Camellia sinensis, and Panax ginseng*.[1]

Biogenic amines depletion

Several plants must be consumed to reduce the depletion of biogenic amines, including *Rauwolfia serpentina*. Biogenic amine is a component that functions as a nitrogen base, formed through the decarboxylation of amino acids.[1]

Herbal Plants and Society

Counseling was conducted at posyandu in Cilacap Regency, consisting of 14 respondents who were diagnosed with hypertension. Testing was carried out through general insight regarding herbal plants and their relationship to hypertension in pre-tests carried out together.[10] After the pre-test, training, and education were carried out regarding herbal plants for hypertension, and an increase in insight occurred by 30%. Another research carried out a pre-test and post-test for making a tensiherb concoction using turmeric, *alang-alang*, celery leaves, gotu kola leaves, palm sugar, and water, then boiled and filtered the juice.[11] Pre-test shows that the initial average result was 54; in the post-test, the final average result was 71.2, with an average percentage value of 31.8%.

Good knowledge about medicinal plants in the community can also be a significant opportunity for the local population. Traditional medicinal plants have great potential as a new commodity that can improve the economic and health status of the community. With a deeper understanding of herbal preparations, the community can produce high-quality herbal products and market them effectively. Herbal preparations made from simplisia (natural materials such as whole plants or plant parts) are essential to traditional medicine in many cultures. Their use can provide a more natural and safe alternative for health. Therefore, education and training in herbal preparation can help the community develop their potential in this field. Furthermore, knowledge of the correct and safe use of medicinal plants is also crucial to prevent negative impacts on public health. This can include understanding the appropriate dosage, potential side effects, and proper storage methods. With the development of education and understanding of medicinal plants and herbal preparations, it is hoped that the community can experience positive changes in economic and health aspects, providing new opportunities for the younger generation to pursue higher education and reduce unemployment rates.[25]

Apart from that, education on the benefits of herbal plants is now increasingly made easier by the existence of social media and electronic tools, which help reach the public more widely and efficiently. The use of social media to promote herbal plants has been carried out,[26] and the educational service on the benefits of herbal plants and juices carried out through social media can be easily accepted by various age groups.

Uses of Herbal Plants

There are several uses for herbaceous plants, some of which are as follows that may be easy to find in society:[13]

Reed plants

The roots contain 1.07% flavonoids, which facilitate diuretic and blood-stopping, cool the blood, reduce glucose, and strengthen the heart.

Turmeric

Turmeric contains curcumin and essential oils, which have a smoothing function of blood and energy in vital organs.

Celery leaves

Leaves function to improve digestion, fever, and flu, increase appetite, and reduce hypertension.

Gotu Kola

Horse's foot leaves reduce hypertension because they contain flavonoids, tannins, steroids, glilpsoda, and folia compounds—hydroceles, which clean the blood, and diuretics.

F. Faginea

In Ouedraogo's research, it was explained that the leaves of this endemic plant can be used to regulate blood pressure and other traditional treatments. In addition, it can be useful as a vaccinator to anticipate endothelium dysfunction.[2]

Ficus

Ficus is a plant that protects the body from high blood pressure. Ficus is an herbal medicine with many phytochemical compounds, namely alkaloids, tannins, triterpenes, and quinones, which ward off oxygen radicals and manage comorbidities from high blood pressure.[8]

A total of 11 articles were successfully processed that show herbal plants are helpful. In addition, these natural substances exhibit the potential to reduce blood pressure. It is essential to bear in mind that individual responses can vary. Moreover, their efficacy may not match that of prescription medications. Therefore, it is crucial to consult a healthcare professional before incorporating these natural remedies into your hypertension management strategy. The healthcare provider can offer tailored advice, monitor blood pressure, and ensure the safety and suitability of these natural remedies, especially in the context of specific health conditions and medications.[24]

CONCLUSION

This research concludes the review of 11 articles. It shows that herbal plants are useful for lowering blood pressure levels. Even though they require a long period of time, regular, and intensive use, they will reduce blood pressure levels without any side effects. In addition, herbal plants are easy to find, and the manufacturing process is easy. Some examples are lemongrass leaves, ginger, gotu kola leaves, and cat's whiskers, which can be boiled in water, and the juice can be drunk. Education and counseling in the community regarding herbal plants for hypertension is also beneficial because increasing the insight and knowledge they have reduces the possibility of hypertension in the community.

STUDY LIMITATIONS

Our study presented some limitations. First, this research focuses on hypertension in general. It does not discuss the use of herbal medicine for certain types of hypertension. Second, the literature is open access. Third, the article must be in full text with an appropriate title and abstract.

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CONFLICT OF INTEREST

None declared.

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Marketing Strategy of "AL" Traditional Medicine Products: Case Study in "SP" Company in Yogyakarta

Felicita Eka Putri[1], Bondan Ardiningtyas[2*], Dwi Endarti[2]
1. Magister Management of Pharmacy, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia
2. Department of Pharmaceutics, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia

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Corresponding Author:
Bondan Ardiningtyas

Corresponding Author Email:
bondan_ard@ugm.ac.id

ABSTRACT

Background: Exclusive breastfeeding is an effort to avoid cases of stunting in children. However, the breastmilk produced by the mother is not always enough to meet the needs of the baby. PT. SP is one of the companies that manufacture "AL" as a traditional herbal medication (a combination of *katuk* and moringa leaves) that can boost milk production. However, the sales of this product are not optimal yet, meaning competent marketing strategies are needed.

Objective: This study aimed to identify and analyze the internal and external factors of PT. SP to gain an understanding of the company's position so that the best marketing strategy can be determined.

Methods: This study was carried out using an analytical descriptive method involving key informants including the supervisor of production, Quality Control, Quality Assurance, and the marketing division. Data analysis utilized the Internal Factor Evaluation (IFE), External Factor Evaluation (EFE) Matrix, and Internal-External (IE) Matrix.

Results: Based on the analysis PT. SP had significant internal factors for capturing opportunities and facing threats, as shown in cell IV. It indicated that PT. SP is a growing and developing company. The most suitable marketing strategy needed is an intensive strategy, such as market penetration, market expansion, and product development. An integration strategy is carried out, which is forward integration.

Conclusion:
The company was positioned in cell IV in the IE matrix, namely growing and developing. It is suggested that the strategies that can be used to improve marketing are intensive and integration strategies.

Keywords: Breastmilk booster; IE matrix; IFE-EFE; marketing strategy; traditional medicine

INTRODUCTION

Stunting refers to a condition of malnutrition which is shown by the height of the person is shorter than the height of other people of the same age. The stunting rate in Indonesia in 2022 was 21.6%. This rate has decreased by approximately 3% from the year 2021.[1] Stunting can occur when a person suffers from malnutrition during the First 1000 Days of Life (*HPK*) which is permanent and difficult to recover from (Kemenkes, 2018). Stunting can be prevented by breastfeeding the babies from birth to two years old. Breastfeeding rates for babies under two years old (Baduta) have been consistently above 90% from 2017 to 2021. It is claimed that 90% of *Baduta* in Indonesia were given exclusive breast milk. However, there were still 10% of *Baduta* who had never been given breast milk. Some factors that influence breastfeeding toward *Baduta.* Fikawati and Syafiq discovered that the most common reason for the mother to quit exclusively breast-feeding her baby was that the production the breast milk was unable to meet the needs of the baby.[2] According to the Report on Result of National Basic Health Research (Riskesdas) in 2018, the main reason babies are not/ did not give breast milk was because the milk does not come out or there is not enough(65,7%).[3]

Many factors can affect the increase of breast milk production, one of which is the use of Breast Milk Booster (*ASI* Booster). Breast milk booster that contains lactagogue is thought to stimulate breast milk production.[3] One of some natural ingredients that have been widely researched and confirmed to help boost breast milk is moringa leaf.[4] This opportunity was well captured by PT. SP is one of the business units of a large corporation in Indonesia. PT. SP produces a breast milk booster named AL that is made from moringa leaf extract, *katuk* leaf, and ginger. This product was developed based on the hereditary habits of Indonesian people in consuming these natural ingredients to increase breast milk production. Moreover, this result was supported by scientific research by Mustofa et al which developed the polyherbal formulation of the extract of *katuk* and moringa leaf and obtained the result that this combination was able to significantly increase breast milk production.[4]

The AL product was launched by the company at the end of 2021. Sales tend to be stuck from the beginning of the launch until 2022. Inventory related to the product stock became the company's primary concern which needed to be addressed immediately. Currently, the marketing team has not promoted the product optimally. The strategy employed by the company is to maximize visits and approaches to pharmacies, which was established based on the experiences of the marketing team. This strategy is not enough to introduce the product to the market. To be able to market the products optimally, an appropriate marketing strategy is required based on the company's conditions. As a result, it is critical to undertake an analysis regarding the environmental factors as well as internal and external factors of the company. Thus, identification of the company's internal factors (strengths and weaknesses), and external factors (opportunities and threats) is necessary to obtain a big picture of the company's position and determine the most appropriate marketing strategy.

METHODS

Study Design

This study utilized a descriptive methodology. Descriptive research involves more than just gathering and compiling data because it also analyzes and interprets the significance of the data.[5] This method is also known as an analytical descriptive method, and it focuses on solving existing actual problems. This study was conducted at PT. SP Yogyakarta manufactures herbal medicines that are used as breast milk boosters. This research has received ethical approval from the Ethics Commissions of FK-KMK UGM Yogyakarta with the number KE/FK/0212/EC/2024

Population and Samples

Population

The population in this study are all employees involved in the company's business processes, especially for AL products.

Sample

The inclusion criteria in this study were coordinators from the production, Quality Control, Quality Assurance, and marketing divisions with a minimum work period of 1 year. The coordinator was chosen because they are a leader on their team and has more knowledge about the company's business process. Then, the exclusion criteria were personnel who were unwilling to be involved in the research.

Data Collection

Formulating a strategy begins with identifying factors that can positively or negatively influence the company. The analyses of the internal environment included marketing mix, human resources, management, and operations. Then, the external environment was analyzed, including demographics, economics, socio-cultural, law and politics, marketing, and competitors. Internal analyses were conducted to find out the company's strengths and weaknesses, while external analyses were used to identify factors that constitute the opportunities and threats to the company. In this research, the identification of internal and external factors was carried out and involved several key informants in the business process of this product. The data collection technique in this study is observation and interviews to find out the company's SWOT. Data collection began with observation through a presentation and explanation about the company by one of the company directors. Next, interviews were conducted with informants who met the criteria to confirm and complete the observation results.

Study Instruments

Instruments are arranged based on SWOT observation. Instruments use a scale of 1 to 4. The scale shows the influences of these factors on the company's condition. Scale of 1 (least influences) and 4 (most influences). The instrument's content validity asses by the research supervisor.

Data Analysis

The analytical method employed in this study was the analysis of internal and external factors using the IFE and EFE matrix Then, the company's position and marketing strategy were further determined by using the IE matrix. The data analysis process is in the below figure. Figure 1.

IFE and EFE Matrix

The IFE and EFE matrix is used to determine the influences of internal and external factors on the company's business processes. Matrix IFE and EFE are represented in Figures 2 and 3.

The stages for using the matrix are:

1. Write the internal factor in the IFE matrix and the external factor in the EFE matrix.
2. Value (a), the value indicates the relative importance of a factor to a company's success in the industry. The responses from all informants are summed (m). The responses from all informants for each indicator are summed (n). The value (a) is (n) divided by (m), so the scale is 0 to 1.
3. Rate (b), the rate is based on the effectiveness of the company. The average of the informant's response for each indicator is the rate.
4. The IFE and EFE score is obtained by multiplying value (a) and rate (b). The summed of the IFE score (A) and EFE score (B) will be used in the IE matrix.

IE Matrix

The combination of the IFE and EFE produces an IE matrix which contains nine types of cells. Figure 3. This matrix is used to determine a more detailed business strategy at the business unit level. In this matrix, IFE score (A) is the x-axis and EFE score (B) is the y-axis.

RESULTS AND DISCUSSION

Research Respondents/Participants

This research involved company employees who are responsible for the product production and marketing process. The research involved 5 people consisting of 1 pharmacist in charge of production, 1 person from the Quality Control division, 1 person from the Quality Assurance division, and 2 people from the marketing division.

Internal and External Factors Analyses

Here is the list of strengths and weaknesses (Table I) and the list of opportunities and threats (Table II). This result was obtained from the informant's answers through interviews.

Assessment of Internal and External Factors

Based on the internal and external factor analysis, each factor was assessed using the IFE matrix (Table III) and EFE matrix (Table IV).

Based on the two tables above, it was reported that the total score of each matrix was 3.67 for the internal factor matrix and 2.98 for the external factor matrix. This score would be used to determine the position of the company. A similar analysis was done for the marketing of Bidara herbal home products in Palopo. The results showed an internal matrix value of 3.00 and an external matrix of 2.46.[6] Moreover, a study by Rimba Raya Mushrooms obtained an internal matrix value of 2.81 and an external matrix of 3.10.[7]

Determining the Company's Position

To determine the company's position, the researcher used an internal-external matrix. Rangkuti mentioned that the goal of employing an internal-external matrix is to capture the company's position and progress through detailed analysis. The Internal-External Matrix was built around two key points, namely the total score of internal factors in the X axis and the total score of external factors in the Y axis, which would eventually result in 9 cells.

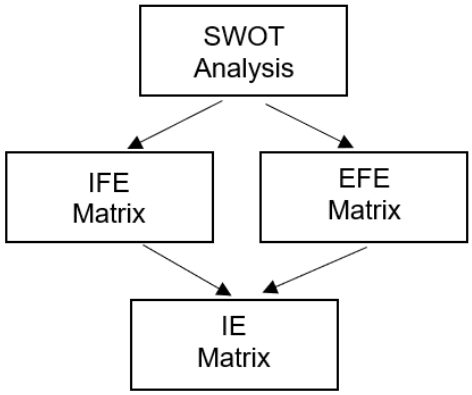

Figure 1. Flow of Data Analysis

No	Factor	Value (a)	Rate (b)	Score (a x b)
Strengths				
1	……	…	…	…
2	……	…	…	…
3	……	…	…	…
4	Etc.	…	…	…
Weaknesses				
1	……	…	…	…
2	……	…	…	…
3	……	…	…	…
4	Etc.	…	…	…
Total		**1**		**A**

Figure 2. Matrix IFE

No	Factor	Value (a)	Rate (b)	Score (a x b)
Opportunities				
1	……	…	…	…
2	……	…	…	…
3	……	…	…	…
4	Etc.	…	…	…
Threats				
1	……	…	…	…
2	……	…	…	…
3	……	…	…	…
4	Etc.	…	…	…
Total		**1**		**B**

Figure 3. Matrix EFE

Based on the calculation in the previous stage, it is known that the value of the internal factor is 3.67 and the external factor is 2.98. In the Internal-External Matrix, PT. SP was placed in the cell IV (Figure 4). Bidara Herbal Home in Palopo also placed in the same position with the value of internal and external factors was 3.00 and 2.46.[6] On the other hand, the product from Rimba Raya Mushroom was placed in cell II in which internal and external factors were valued at 2.81 and 3.10[7] respectively.

Therefore, according to the results of the company position analysis, PT. SP can use intensive and integration strategies to maximize product marketing.[9 10]

Several ways might be used to apply intensive and integration strategies.[11] In intensive strategy, there are 3 applicable approaches, such as market penetration, market development, and product development. Meanwhile, the integration strategy can be done by arranging backward, forward, and horizontal integration.[11]

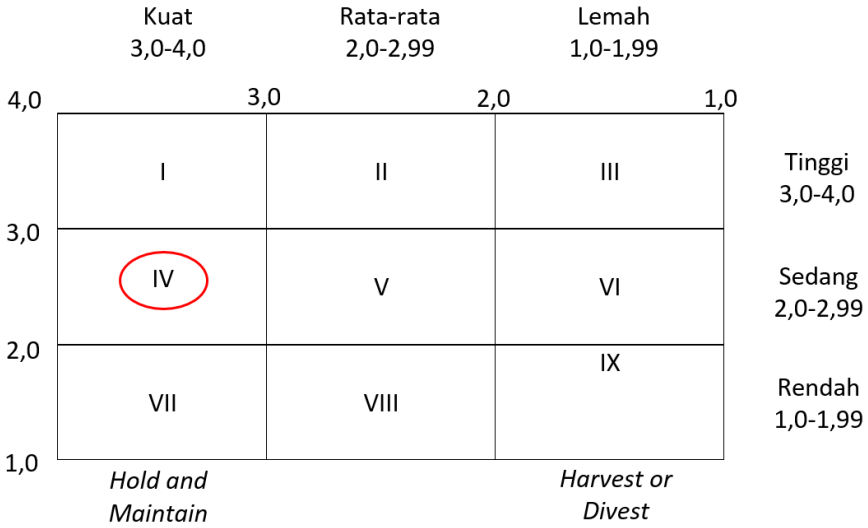

Figure 4. Internal-External Matrix (Rangkuti, 2015)

Of the nine existing cells, they are divided into 3 different strategies, namely:[8]

a. Cell I, II, and IV are growth and development positions where intensive and integration strategies can be used.
b. Cell III, V, and VII are the positions where guarding and defending strategies are the most suitable to be used.
c. Cell VI, VIII, and IX are the positions for using harvest and divestment strategies

Table I. List of Company Marketing Strengths and Weaknesses

Strengths	1.	The product has a good quality.
	2.	It has its own production facilities.
	3.	CPOTB certified.
	4.	The product has a BPOM distribution permit.
	5.	Products produced are based on integrated research
	6.	It has attractive product packaging
	7.	Branding the corporate name attached to the product.
	8.	It has many raw material supplier relationships
Weaknesses	1.	Insufficient number of marketing human resources.
	2.	The promotions carried out are not optimal.
	3.	Promotional facilities are not optimal.
	4.	The use of social media/online is not optimal.
	5.	The product prices are higher compared to competitors.

Table II. List of Company's Opportunities and Threats

Opportunities	1.	Back to nature lifestyle trend
	2.	The growth of online marketing trend
	3.	Movement for the First 1000 Days of a Child's Life
	4.	Clear market segmentation (pregnant and breastfeeding women)
	5.	Limitations for pregnant and breastfeeding mothers to consume chemical drugs
	6.	Sales relations from the corporate scope
Threats	1.	Development of the herbal medicine industry on a national scale.
	2.	Economic issues that cause changes in the prices of raw materials.
	3.	Price competition with competitors.
	4.	The existence of new competitors.

Intensive Strategy

Market Penetration

Market penetration is an effort to increase the product's market share in the current market with greater marketing efforts. Market penetration by a corporation is a key factor in achieving optimal marketing

Table III. Marketing Internal Factor Evaluation (IFE) Matrix

No	Factor	Value	Rate	Score
Strengths				
1	The product has a good quality	0,08	4	0,34
2	It has its production facilities	0,08	4	0,34
3	The production facilities are CPOTB-certified	0,07	3	0,23
4	The product has a BPOM distribution permit	0,08	4	0,34
5	Products produced are based on integrated research	0,08	4	0,28
6	It has attractive product packaging	0,08	4	0,34
7	The name of the brand is under a big corporation and attached to the product	0,06	3	0,19
8	It builds many relations with raw material suppliers.	0,08	4	0,28
Weaknesses				
1	Insufficient number of marketing human resources	0,07	3	0,23
2	Promotions are not yet optimal	0,08	4	0,28
3	Promotional facilities are not optimal	0,08	4	0,28
4	Lack of using social media or online promotions	0,07	3	0,23
5	The product has a higher price compared to competitors	0,08	4	0,28
Total		**1**		**3,67**

Tablet IV. Marketing External Factor Evaluation (IFE) Matrix

No	Factor	Value	Rate	Score
Opportunities				
1	Back to nature lifestyle trend	0,12	3	0,40
2	The growth of online marketing trend	0,12	3	0,40
3	Movement for the First 1000 Days of a Child's Life	0,10	3	0,26
4	Clear market segmentation (pregnant and breastfeeding women)	0,12	3	0,40
5	Limitations for pregnant and breastfeeding mothers to consume chemical drugs	0,14	4	0,58
6	Saler relations from the corporate scope	0,11	3	0,33
Threats				
1	Development of the herbal medicine industry on a national scale.	0,07	2	0,14
2	Economic issues that affect the changes in the prices of raw materials	0,05	1	0,06
3	Price competition with competitors	0,07	2	0,14
4	The existence of new competitors	0,10	3	0,26
Total		**1**		**2,98**

performance.[12] This is in line with other research which states that market penetration is proven to influence marketing performance.[13] To attain this goal, several steps can be taken, including strengthening marketing human resources, and more intensive promotional operations both offline and online.[11] Promotion is important because it informs buyers about the product and its presence. Promotion is a method of transmitting product information and boosting communication with customers.[12]

Offline promotions can be done by setting up exhibition booths and creating gimmicks and promotional materials that can be distributed to consumers. In the modern era, the use of digital has a significant impact on marketing activities. Utilizing social media as a marketing communication tool is the best way to expand the market and reach out to the young generation. Apart from that, the use of social media also accelerates the possibility of sharing information and testimonials, as well as gathering customers' feedback.[14] Therefore, the company can build a digital marketing team that will focus on managing everything related to digital, including activities on social media and e-commerce.

Market Expansion

Market expansion or market development is a medium-risk strategy, selling the product to the new customers.[15] The aim is to introduce products into new areas or segments. Currently, the company focuses solely on pharmacy customers in Yogyakarta only. Opening new shops specializing in mother and infant equipment can help to jumpstart market expansion. This can also be seen as an opportunity as it is known that traditional medicine products can be bought and sold with looser regulations compared to chemical medicines.

Product Development

Product development is a medium-risk strategy that improves or modifies existing products for existing customers.[15] Recently, the trend for breast milk boosters is towards products in the form of snacks or drinks. Therefore, the next step that can be taken is to consider producing the AL breast milk booster with a cookie variant.

Integration Strategy

Forward integration is a strategy that can be implemented by PT. SP to provide distributors and retailers more control over product distribution.[7] What the company can do is to collaborate with Pharmacy X which is still within the same company. Pharmacy X will be the main retailer for AL products so that consumers will easily get the products offline at the pharmacy.

CONCLUSION

Based on the analysis of the company's internal and external factors, it is recognized that the company was positioned in cell IV in the IE matrix, namely growing and developing. It is suggested that the strategies that can be used to improve marketing are intensive and integration strategies.

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STATEMENT OF ETHICS

This article was written under the code of ethics and not published or under review in other journals.

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Factors Related to Herbal Medicine Use in Breastfeeding Mothers in Klaten Regency, Indonesia

Nutrisia Aquariushinta Sayuti[1]*, Nur Atikah[1]
1. Department of Pharmacy, Ministry of Health, Health Polytechnic of Surakarta, Central Java, Indonesia

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Corresponding Author:
Nutrisia Aquariushinta Sayuti

Corresponding Author Email:
nutrisayuti@gmail.com

ABSTRACT

Background: The diverse plant diversity promotes herbal medicine use for breastfeeding mothers in Klaten to promote postpartum health and breast milk production. However, factors related to herbal medicine use have not yet been studied.

Objectives: The study aimed to identify factors related to herbal medicine use among breastfeeding mothers in the Klaten Regency.

Methods: The study used a structured survey questionnaire in a cross-sectional approach. Survey participants were recruited from community health centers in Klaten. The survey instrument was validated questionnaires that consisted of predisposing, supporting, and need factors. Logistic regression analyzed factors related to herbal medicine used in breastfeeding mothers.

Results: The survey of 111 breastfeeding mothers in Klaten Regency found that 78.40% of respondents used herbal medicine, with most aged 20-35. The most perceived health status of the mother and breastfed child was healthy. Most respondents agreed that herbal medicine was safer and more effective than conventional medicine. The logistical regression revealed that breast milk flow issues (p-value = 0.000) and the belief that herbs are more effective than chemical medications (p-value = 0.008) significantly influence the use of herbal medicine.

Conclusion: The study concluded that the significant factors related to herbal medication use were breast milk's smoothness and the belief that herbal medicine is more efficacious than conventional medicine. The belief is often shaped by social culture and family experiences, leading to the possibility of incorrect information. Health professionals are crucial in providing information about herbal medicine and recommending its use to promote health and prevent health problems.

Keywords: Breastfeeding Mothers; Factors; Herbal medicine; Klaten Regency

INTRODUCTION

Postnatal care is critical because it can prevent maternal and infant deaths. Difficulty in breastfeeding is one of the postnatal problems.[1] This difficulty is also caused by the mother's perception that their milk is not enough for the growth and development of the breastfed baby.[2] The use of herbal medicine during breastfeeding is gaining international attention. Breastfeeding mothers use herbal medicine because of the health benefits for them and their babies. The health literacy of breastfeeding mothers influences the choice of herbal medicines used during breastfeeding. The country's culture also influences health literacy.[3]

The use of herbal medicine during breastfeeding is part of the cultural tradition.[3] Cultural influences have also led to the widespread use of herbal medicine for breastfeeding mothers in Indonesia. Single or polyherbal plants are used in many communities in Indonesia; for example, *papeja* is used in Madura, breastfeeding mother uses uyup-uyup in Jogjakarta, *gepyok* is used in Banjarnegara, and West Nusa Tenggara.[4–7] Herbal medicine uses

during breastfeeding also applies in Klaten Regency. The health profile of Klaten Regency showed that population visits to traditional practices have increased by 77.97% in 2020.[8]

Breastfeeding mothers in Klaten, Indonesia, use herbal medicine for health promotion.[9] Health promotion as referred to the guidebook for the integration of health promotion in health programs in districts/cities, is defined as an effort to increase community capacity through learning from, by and for the community so that community can help themselves and develop community-based activities that are socially appropriate. local culture and supported by health-oriented public policies. This effort includes community empowerment in the household setting, especially community empowerment in caring for pregnant, maternity and postpartum women. Through the activity, it is hoped that mothers and families can provide care for the postpartum period, newborn babies and carry out family planning. Activities included in this community empowerment are socialization of the use of medicinal plants to families and breastfeeding mothers. Empowerment is carried out among health cadres, cross-sector health workers, Family Empowerment and Welfare (PKK), community leaders, mass organizations and professional organizations.[10,11] Conversely, the Klaten Regency government aggressively promotes herbal medicine to maintain the heritage and ancestral culture. All Community Health Centers in Klaten District have implemented several programs. These programs include drinking herbal medicine together, training health cadres in producing and monitoring herbal consumption, and cultivating medicinal plants for self-medication.[12]

Improving the quality of traditional health programs is urgently needed. Improvement is also required to maintain the effectiveness and safety of herbal medicine use, especially its use in breastfeeding mothers. The explanation above describes the benefits of herbal medicine in breastfeeding mothers in the Klaten Regency. However, the factors associated with using herbal medicine have never been studied. James et al. [13] found that 378 of 20-29-year-old women in Sierra Leone, Africa, were most likely to use herbal medicine during breastfeeding. The other significant factors that influenced the decision to use herbal medicine were the breastfed child's age, health state, and herbal medicine's efficacy. The study was cross-sectional, with respondents' self-reporting to assess herbal medicine use. It caused under-reporting or over-reporting, and it's challenging to establish an apparent causal effect. The study also needed to explore reasons women use herbal medicine despite receiving free conventional healthcare.[13]

The study of Millinga et al.[14] showed that herbal medicine use in breastfeeding mothers was linked to education level and low breast milk production. The survey by Millinga et al.[14] was conducted at a single health center, and it may not fully represent the views of other breastfeeding women because of participant bias and recall bias. However, it is the first study documenting the significant factor and the pattern of herbal medicine use among breastfeeding mothers in Tanzania. [14]

The two studies were conducted in different countries with different histories and cultures. It makes different results of the predictor factors of herbal medicine use. The various health developments of both countries also cause different results of predictor factors for herbal medicine use. Both studies also mention limitations regarding the area of sampling locations. Hence, the results were only valid for the research locations. The results can only be generated in the same regions or countries. Therefore, studying factors related to herbal medicine use in breastfeeding mothers in Klaten Regency is essential. Another reason for the importance of researching factors related to the use of herbal medicines in breastfeeding mothers is that the research results can describe health problems and health needs in breastfeeding mothers. Therefore, research on factors related to the use of herbal medicine in breastfeeding mothers in Klaten is essential. The research results can be used as material and a reference for adding new programs in traditional health services carried out by community health centers in Klaten. The research results can also be used as a reference for other countries because it provides an overview of the characteristics of breastfeeding mothers who encourage behavior to maintain health through herbal medicine. The research can also be helpful as a reference source for policymakers in forming guidelines for using herbal medicines during breastfeeding. Thus, this study aimed to determine the factors associated with the action/behavior of using herbal medicine in breastfeeding mothers in the Klaten Regency.

METHODS

Study design

The study was conducted on breastfeeding mothers under the guidance of four (4) community health centers (*Pusat Kesehatan Masyarakat (Puskesmas)*) in Klaten District. The study period was from February to November 2022, starting from preparing proposals, arranging permits, validating questionnaires, recruiting respondents, collecting data, analyzing data and preparing reports. The study was a non-intervention type study with a cross-sectional research design. Validated questioner was used to find data about factor related to herbal medicine use in breastfeeding mothers.

Population and samples

The study was conducted on breastfeeding mothers who breastfed their children up to a maximum of one (1) year old who visited integrated service posts, toddler classes, and the village poly, which are under the working area of four (4) community health centers in Klaten District. Breastfeeding mothers who refused to participate in the study was excluded. The sample size was calculated using the sample size calculation formula for a cross-sectional study, based on formula 1.

$$n = Z^2 . \frac{p.q}{d^2} \quad \ldots\ldots(1)$$

In this calculation, Z is 1.96 with a 95% confidence interval. d is the margin of error of 0.10, and p is the expected proportion based on the average prevalence of herbal use in breastfeeding mothers. The proportion is 20.99% based on the results of a survey on the percentage of traditional medicine users in Indonesia in 2014 because there is no proportion of the use of herbal medicines among breastfeeding mothers in Klaten. q is the proportion of breastfeeding mothers who do not use herbal medicine (1-p). The results of the sample calculation were 64 respondents, which is the minimum sample size for the study.

Recruitment of respondents carried out in April 2022 after an ethical permit has been issued. The respondent recruitment process was carried out as follows: Midwives, who play a pivotal role in the maternal and child health program at the *Puskesmas*, coordinate integrated service posts (*Posyandu*), toddler classes, and the village poly, which is under the work area of the *Puskesmas*. The work area has a growth and development assessment program for babies and toddlers, which involves breastfeeding mothers as program participants. The midwives provided recommendations to breastfeeding mothers who were program participants and met the inclusion criteria as potential survey respondents. The research team screened breastfeeding mothers as potential respondents when they visited posyandu, village polyclinics, and toddler classes. The screening was done by explaining the research, objectives, benefits, and technicalities of the research, as well as their willingness to participate.

Respondents willing to participate were explained further information about the survey activities, volunteering to participate in the study, procedures, obligations as a respondent, benefits of the study, and confidentiality of the research. Further explanation about the study was as follows: 1) The explanation regarding volunteering to be a respondent is the freedom of potential respondents to participate in the survey. If the respondent decides to participate, they are free to withdraw or change their mind at any time without being subject to fines or sanctions. 2) Explanation of research procedures is an explanation of filling out the questionnaire or interview according to the questionnaire if the respondent wishes, filling in identity, signing the consent form, and answering questions according to the questionnaire. 3) The obligation as a respondent is to answer the questionnaire. If anything needs to be clarified, respondents can ask the research team. 4) The benefit of the study is to increase public understanding of factors related to the use of herbal medicine, which helps provide an overview of the health problems and needs of breastfeeding mothers and adds references in realizing new health programs in Klaten Regency. 5) The explanation regarding research confidentiality is that all information relating to the respondent's identity will be kept confidential and only known by the researcher.

Prospective respondents who agreed to become respondents filled out and signed a 'written consent form after explanation'. It showed the respondent's agreement to participate in the survey. Survey data was collected through face-to-face interviews between the research team and respondents or by completing questionnaires. Respondents were guaranteed confidentiality and could opt out at any time when answering questions.

Study instruments

The instrument in this study was a questionnaire that had been tested for validity. The questions in the questionnaire contain several factors that are thought to be related to a person's behavior, namely predisposing factors, supporting factors, and need factors. Predisposing factors consist of age, education level, employment status, parturition status, gender of breastfed child, problems with fluency of breastmilk (low breastmilk supply), mother's perceived health status, perceived health status of the current child, the status of living with parent or parents in law, experience side effect after using herbal medicine and have a special diet during breastfeeding. Supporting factors consist of the husband's support, family support, and health professional support (health profesionals have explained about herbal medicine). The need factor is the respondent's opinion that herbal medicines are more effective and safer than chemical or conventional medicines.[11-12]

Respondents' ages were divided into three categories: less than 20, 20 to 35, and more than 35. Respondents' education was categorized into three levels, namely primary, secondary, and higher education. Higher education is academy education or more than an academy; the secondary level of education is senior high school, while the primary education level is junior high school and elementary school.

The questionnaire was validated using the Lawshe content validation method. Content validity is based on the resulting Content Validity Ratio (CVR). A data analysis method called CVR, created by Lawshe in 1975, is often used to assess content validity. By using CVR to identify the validation of each question item, a Content Validity Index (CVI) can then be calculated.[15]

Eight (8) panelists who were not part of the research team validated the questionnaire. The panelists consisted of two (2) public health experts, two (2) herbalists, two (2) midwives, and two (2) pharmacists. The questionnaire used to collect content validity data was structured with answer categories: 'important' with a score of 3, 'valuable but not important' with a score of 2, and not important with a score of 1. The answer given by the panelists was converted with a score of 1 if the answer was 'important ' and 'valuable but not important' and a value of 0 if the answer was 'Not important.' After conversion, the panelists' assessments for each question item in the questionnaire were analyzed for content validity using CVR calculations based on formula 2. CVR is the Content Validity Ratio. ne is the number of experts or panelists who answered important/valuable but not important, and n is the number of experts who carried out validation.

$$CVR = \frac{2ne}{n} - 1 \quad \text{.....(2)}$$

Question items in the questionnaire are declared acceptable if the CVR value is equal to or more significant than the critical value. The critical value is based on the number of panelists, as shown in Table I. The Content Validity Index (CVI) value is calculated using formula 3. CVI is the average CVR value for valid question items. The CVI value illustrated that all items on the questionnaire had good content validity.

$$\text{CVi} = \frac{\Sigma\, Valid\ CVR}{number\ of\ valid\ items} \quad \text{.....(3)}$$

Data collection

Face-to-face interviews using validated questionnaires or filling out the questionnaire independently by the respondent were conducted from April 2022 to July 2022. The research team surveyed respondents who were willing to participate in this research and had signed informed consent. A total of 111 questionnaires were distributed to respondents and immediately checked for completeness. If the respondent's answer was incomplete, a re-interview was carried out to the respondents at that time so that there were no incomplete questionnaires, therefore data from 111 respondents was included in the analysis.

Data Analysis

Data was analyzed by researcher after data collection stage. Data was calculated using univariate analysis to describe variables and see their distribution. Bivariate analysis was carried out using the chi-square test with a confidence interval value of 95%, Fisher's exact or Kolmogrov-Smirnov. Bivariate analysis was used to determine the relationship between predisposing factors, support factors, and need factors using herbal

Table I. CVR critical value based on the number of panelists (one-tailed, α = 0.5)[15]

Number of Panelist	CVR Critical Value
5	0.736
6	0.672
7	0.622
8	0.582

medicines. Logistic regression was carried out to determine the factors associated with using herbal medicines. Independent variables in the bivariate analysis with p-values ≤ 0.2 were entered into the initial univariate analysis (model 1) to calculate the raw ORs with 95% confidence intervals. Independent variables with a p-value less than 0.05 in multivariate analysis (model 2) to determine the adjusted odds ratio.

RESULTS AND DISCUSSION

The CVR results for each factor range from 0.750 to 1.000 as can be seen in table II. Each factor was considered valid because the CVR was more than 0.582.[15] The CVI for all factors was 0.986. The questionnaire was valid because the CVI was more than 0.582. As a result, the validated questionnaire has 17 questions about predictor factors for the use of herbal medicine in breastfeeding mothers consisting of age, education level, employment status, parturition status, gender of breastfed child, the problem with the fluency of breastmilk, mother perceived health status, the perceived health status of breastfed child, living with parents or parents-in-law, experienced side effects after using herbal medicine, special diet during breastfeeding, husband's support for herbal medicine, family's support for herbal medicine, health professional's support for herbal medicine, get explanations from health professionals about herbal medicine, agreement that herbal medicine is more effective than conventional medicine, an agreement that herbal medicine is safer than conventional medicine.

The actual total number of participants in the study was 111 respondents. Participants who used herbal medicine were more than non-users (78.4% versus 21.6%). Details of the factors related to the use of herbal medicine are listed in Table I. In terms of predisposing factors, most participants were aged 20-35 years (76.6%), had secondary education (60.4%), and unemployed (87.4%). Multiparous outnumbered primiparous (63.3% versus 36.9%). The gender of breastfed children was predominantly male (52.3%). Herbal medicine users were more multiparous (66.7%), while primiparous and multiparous status were balanced among nonusers of herbal medicine. Herbal medicine users experienced more problems with breastfeeding (64.0%) than nonusers. Most participants perceived health status was healthy (95.5%). The most participants' current child perceived health was healthy (94.6%). Most participants lived with parents or parents-in-law (88.3%) and had no experienced side effects after using herbal medicine (92.8%).

Support factors consist of the husband's support, family's support, and health professional's support in the form of mere support or explanation about herbal medicine. Most participants had husband's support (90.1%) and family's support (91.0%). Most participants had no support from health professionals (63.1%) and no information or explanations regarding herbal medicine (76.6%). The need factor was seen from participants' agreement to the statement that herbal medicine is more effective and safer than conventional medicine. Most participants agreed that herbal medicine is more effective (75.7%) and safer (80.2%) than conventional medicine.

Table III showed that the factors with significant differences between herbal medicine users and nonusers were age (p-value = 0.146), education level (p-value = 0.003), parturition status (p-value = 0.134), problem with fluency of breastmilk (p-value = 0.000), husband's support to herbal medicine (p-value = 0.058), health professional's support to herbal medicine (p-value = 0.171) and agreement that herbal medicine is more effective than conventional medicine (p-value = 0.025). Table IV showed the results of the multivariate logistic regression analysis to determine the predictive factors for using herbal medicine. Participants who experienced problems with fluency breastmilk were more likely to use herbs than participants who did not experience issues with fluency breastmilk (OR: 0.21, 95% CI: 0.000 – 0.111, p-value = 0.000). Participants who agree that herbal medicine is more efficacious than conventional medicine were more likely to use herbal medicine than participants who disagree (OR: 8.886, 95% CI: 1.767 – 44.691, p-value = 0.008). The following discussion is carried out on each factor studied using herbal medicine.

The age of 20 – 35 years old is the reproductive age category. The reproductive organs of women between the ages of 20 and 35 are physically developed. It's ready to carry out the reproductive process, which includes

Table II. Validation Results of Questioner

No	Variables	CVR	Validation criteria	CVI of valid CVR	Validation criteria
1.	age	1.000	Valid	0.986	Valid
2.	Education level	1.000	Valid		
3.	Employment status	1.000	Valid		
4.	Parturition status	1.000	Valid		
5.	Gender of breastfed child	1.000	Valid		
6.	Problem with the fluency of Breastmilk	1.000	Valid		
7.	Mother perceived health status.	1.000	Valid		
8.	Perceived health status of breastfed child	1.000	Valid		
9.	Living with parents or parents in-law	0.750	Valid		
10.	Experienced side effects after using herbal medicine	1.000	Valid		
11.	Special diet during breastfeeding	1.000	Valid		
12.	Husband's support for herbal medicine	1.000	Valid		
13.	Family support for herbal medicine	1.000	Valid		
14.	Health professionals' support for herbal medicine use	1.000	Valid		
15.	Get explanations from health professionals about herbal medicine	1.000	Valid		
16.	Herbal medicine is more efficacious than conventional medicine.	1.000	Valid		
17.	Herbal medicine is safer than conventional medicine.	1.000	Valid		

Table III. Factors Associated with the Use of Herbal Medicines

No	Variables	Total n=111(100%)	Herbal medicine users n=87(78.4%)	Nonusers n-24(21.6%)	p-values
1.	**age**				0.146*
	<20	3 (2.7)	1 (1.2))	2(8.3)	
	20-35	85(76.6)	67(77.0)	18(75.0)	
	>35	23(20.7)	19(21.8)	4(16.7)	
2.	**Education level**				0.003*
	higher	12(10.8)	5(5.7)	7(29.2)	
	Secondary	67(60.4)	57(65.5)	10(41.7)	
	primary	32(28.8)	25(28.7)	7(29.2)	
3.	**Employment status**				1,000
	employed	14(12.6)	11(12.6)	3(12.5)	
	Unemployed	76(87.4)	21(87.5)	97(87.4)	
4.	**Parturition status**				0.134*
	Primiparous	41(36.9)	29(33.3)	12(50.0)	
	Multiparous	70(63.3)	58(66.7)	12(50.0)	
5.	**Gender of breastfed child**				0.256
	Male	58(52.3)	43(49.4)	15(62.5)	
	Female	53(47.7)	44(50.6)	9(37.5)	
6.	**Problem with the fluency of Breastmilk**				0.000*
	Yes	71(64.0)	68(78.2)	3(12.5)	
	No	40(36.0)	19(21.8)	21(87.5)	
7.	**Mother perceived health status**				1,000
	Healthy	106(95.5)	83(95.4)	23(95.8)	
	sick	5(4.5)	4(4.6)	1(4.2)	
8.	**Perceived health status of breastfed child**				1,000
	Healthy	105(94.6)	82(94.3)	23(95.8)	
	sick	6(5.4)	5(5.7)	1(4.2)	

Table III. (Continued)

No	Variables	Total n=111(100%)	Herbal medicine users n=87(78.4%)	Nonusers n-24(21.6%)	p-values
9.	**Living with parents or parents in-law**				0.473
	Yes	98(88.3)	78(89.7)	20(83.3)	
	No	13(11.7)	9(10.3)	4(16.7)	
10.	**Experienced side effects after using herbal medicine**				0.367
	Yes	8(7.2)	5(5.7)	3(12.5)	
	No	103(92.8)	82(2.6)	21(87.5)	
11.	**Special diet during breastfeeding**				1,000
	Yes	4(3.6)	4(4.6)	0(0.0)	
	No	107(96.4)	83(95.4)	24(100)	
12.	**Husband's support for herbal medicine**				0.058*
	Yes	100(90.1)	81(93.1)	19(79.2)	
	No	11(9.9)	6(6.9)	5(20.8)	
13.	**Family support for herbal medicine**				0.219
	Yes	101(91.0)	81(93.1)	20(83.3)	
	No	10(9.0)	6(6.9)	4(16.7)	
14.	**Health professionals' support for herbal medicine use**				0.171*
	Yes	41(36.9)	35(40.2)	6(25.0)	
	No	70(63.1)	52(59.8)	18(75.0)	
15.	**Get explanations from health professionals about herbal medicin**				0837
	Yes	26(23.4)	20(23.0)	6(25.0)	
	No	85(76.6)	67(77.0)	18(75.0)	
16.	**Herbal medicine is more efficacious than conventional medicine**				0.025*
	Agree	84(75.7)	70(80.5)	14(58.3)	
	Disagree	27(24.3)	17(19.5)	10(41.7)	
17.	**Herbal medicine is safer than conventional medicine.**				0.247
	Agree	89(80.2)	72(82.8)	17(70.8)	
	Disagree	22(19.8)	15(17.2)	7(29.2)	

exclusive nursing or lactation—women at 20 – 35 years old experience psychological and mental stability. In general, age can affect comprehension, understanding, mindset, knowledge, and ability to make decisions or actions.[16,17]

Most of the participants in the study had secondary education. The level of education is directly proportional to the quality of life. Someone with a higher level of education is expected to have the ability to think logically and understand health information. Women with moderate to high education levels can accept new information and change to maintain health, especially regarding breastfeeding. There is motivation to find information and experience. The information obtained can be used as knowledge and applied to maintain health.[18]

The majority of participants were housewives. Housewives usually have more time to care for their children and to provide exclusive breastfeeding.[17] However, working women can gain experience, add insight, and create a mindset that plays a role in decision-making, including breastfeeding the baby.[19]

Multiparous dominated the characteristics of the paticipants. The result did not follow the research result of Vardanjani et al[19] on breastfeeding mothers in Shiraz, Iran, which showed that primiparous was the most prevalent among breastfeeding mothers (64.4%). The highest proportion of primiparous is mainly due to the high number of health referrals in this group because of the less experience with breastfeeding.[19] The level of anxiety at breastfeeding is different betweeen primiparous and multiparous. Primiparous women feel more anxious than multiparous womwn. Most primiparous worry about the future while breastfeeding and caring for babies. Women with primiparous must adapt to the afterbirth situation, while women with multiparous get used to the presence of new family members.[18] Therefore, primiparous women can overcome the fear of breastfeeding

Table IV. Potential predictors of herbal use in breastfeeding mothers using multivariate analysis

Variables	Crude			Adjusted		
	OR	95% CI	p-values	OR	95% CI	p-values
age						
<20	0.102	0.000 – 26.534	0.422			
20-35	0.747	0.087 – 6.442	0.791			
>35	NA	NA	NA			
Education Level						
Higher Education	7.003	0.686 – 71.510	0.101			
Secondary Education	0.340	0.060 – 1.919	0.222			
Primary Education	NA	NA	NA			
Parturition status	0.316	0.067 – 1.486	0.145			
Problem on Fluency of Breastmilk	0.011	0.001 – 0.083	0.000*	0.021	0.004 – 0.111	0.000**
Husband's support for herbal medicine	1,719	0.155 – 19.037	0.659			
Health professionals' support for herbal medicine	2,898	0.498 – 16.865	0.236			
Agreement that herbal medicine is more efficacious than conventional medicine	7,740	1,254–47,786	0.028*	8,886	1,767 – 44,692	0.008**

problem by consuming herbal medicine. Vardanjani et al[19] reported that most primiparous consumed herbal medication (97.1%), and 65.8% did not experience breastfeeding problems.

The most gender of the babies was male (52.3%). The research conducted by Habtewold[20] stated that breastfeeding mothers with male children had a 31% higher chance of exclusive breastfeeding for the first six (6) months than mothers with female children. Mothers with male newborns had a 2% higher chance of breastfeeding within 1 hour after birth than female newborns, although not significantly. Meta-analysis stated that newborn gender was related substantially to exclusively breastfeeding. Early initiation of breastfeeding was significantly associated with antenatal care but not with the gender of the breastfed baby.[20]

Most participants had problems with breastfeeding (64.0%). Kent et al.[21] stated that postpartum women with an average age of 32.6 ± 4.4 years old experienced difficulties in breastfeeding. It is due to the perception of insufficient milk (PIMS), which is indicated by the mother's feeling that the breastfed baby look dissatisfied after breastfeeding. PIMS requires infant formula or the role of a lactation consultant to resolve the problem. Poor breast milk production is the most common cause of breastfeeding failure, and the use of herbal medicine (galactagogues) is often used to increase breast milk production.[22]

Most mothers' perceived health status was healthy (95.5%). Scime et al[23] investigated the relationship between illness perception and exclusive breastfeeding in pregnant women with chronic conditions. The results stated that 61.8% of pregnant women with chronic conditions planned to breastfeed exclusively for six months. Perceptions of worsening disease and disease symptoms and the impact of disease on physiological functions of the body are associated with a low intention to breastfeed for up to six months exclusively. The research by Zubaran and Foresti[24] on breastfeeding mothers in southern Brazil stated that success in breastfeeding is significant to the health and the mother's well-being. Health status is a critical factor in diagnosing depression postnatally. Evaluation of the health of mothers can help measure the effectiveness of breastfeeding and remind health professionals to estimate the complexity of breastfeeding problems in breastfeeding mothers.[24]

Postpartum and breastfeeding mothers often face health issues like coughs, infections, and mastitis, which require medication. Most medicines are safe and have rare side effects, but some may be contraindicated. The use of drugs must be monitored by health professionals.[23] The lack of research regarding the use of herbal medicines during breastfeeding has led to a lack of evidence regarding the safety of using herbs for breastfeeding mothers. Many sources contain conflicting findings and safety recommendations for lactation, confusing breastfeeding mothers and health professionals.[22]

Breastfed children's most perceived health state was healthy (94.6%). The result followed the research of James et al.[27] at healthcare facilities in Sierra Leon, which stated that most breastfed children were in good health (63.0%). Breastfeeding mothers maybe not use herbal medicines when their breastfed child has health problems. It is cause the reliability of drug safety information is only sometimes accurate. Although breastfeeding is actively promoted, the issue of medicines use during breastfeeding has received little attention. In addition, studies on breastfeeding women and their babies are rare, and clinical risk assessment for many of the medications required by breastfeeding women is often hampered by a lack of data.[25]

Several health problems in infants make breastfeeding unsuitable. An example is babies with galactosemia, who cannot digest or tolerate breast milk because their bodies are unable to break down the sugar galactose. Infants with classic galactosemia should be given special foods free of lactose and galactose.[26]

Most respondents lived with parents or in-laws, and the role of parents may be influential in medicine selection decisions. Herbal medicine, as a culture inherent in Java, cannot be separated from the role of parents or parents-in-law who suggest its use. This is why information regarding the use of herbal medicine is mainly obtained from parents rather than health professionals.[27]

Eight percent (8%) of respondents had experienced the side effects of herbal medicine. Herbal medicine is considered to have minimum side effects because it is made from natural ingredients and is free from synthetic chemicals.[28] However, debate about the evidence for the safety of using herbal medicine still exists. The experience of side effects from herbal medicine may influence their decision to use it during breastfeeding.[14]

Most respondents did not undergo a special diet during breastfeeding. A special diet is included as a factor that may be related to the use of herbal medicine during breastfeeding because some breastfeeding mothers prefer a special diet to increase breast milk and maintain health compared to using herbal medicine. The special diet is the addition of ingredients believed to increase milk production in daily food, such as cassava leaves or peanuts. It may also be due to the limited supply of herbal medicine, which functions as a galactagogue in specific regions or areas.[13]

Most respondents received their husband's support in using herbal medicine. The husband's support is vital to the well-being of breastfeeding mothers. The husband's support gives encouragement or guidance if the mother experiences problems from pregnancy to postpartum. A husband is a family member who is very close to the mother. All actions taken or decided by the husband related to smooth breastfeeding will impact the wife's psychological state and the smooth running through the puerperium and breastfeeding.[29]

The data shows that 91% of participants get family support in using herbal medicine in user and nonuser groups. Mothers' attitudes towards breastfeeding are influenced by various factors, including their own experiences or other people's experiences with breastfeeding in the family or relatives, customs (habits), and breastfeeding beliefs in their respective regions.[30] Confidence can grow due to receiving sociocultural influences from someone or family who has the same interest or goal to get cheap and effective treatment by using herbal medicines. The possibility of choosing herbal medicines is becoming more significant because of the habits passed down and supported by family. [25]

The data showed that few respondents received support from health professionals to use herbal medicine (41%). The number of respondents who received explanations about herbal medicines during breastfeeding was also low (23.4%). James et al.[11] stated that the lack of support and information about herbal medicine from health professionals was caused by a pessimistic perception of the safety of herbal medicine, so they considered herbal medicine not very relevant for medical discussion. Breastfeeding mothers may not tell health professionals who care for them about herbal medicines. They fear health professionals' reactions and potential damage to the relationship and trust between patients and health professionals because health professionals consider that herbal medicines are not always safe.[13]

The data showed that most respondents agreed that herbal medicines are more efficacious and safer than chemical or conventional drugs. The dissatisfaction with the conventional health care system, low cost, accessibility, perceived efficacy, safety, and cultural acceptance of herbal medicine may explain the high use of herbal drugs in breastfeeding mothers.[13] The agreement was because of the effectiveness and safety of the herbal medicines used among breastfeeding mothers, which were based more on experience evidence than clinical evidence. It raises the need to evaluate the safety and efficacy of herbal medicine through pharmacological studies for scientific evidence.[14]

This study showed that the factors related to herbal medicine use were the problem of smooth breastfeeding and the perception or attitude of agreeing with the statement that herbal medicines are more efficacious than chemical drugs. Respondents who had issues with the smoothness of breastfeeding used herbal medicines more than respondents who had no problems with the smoothness of breastfeeding. These results followed a study conducted by Millinga et al[14]., which stated that mothers with low milk supply tend to choose herbal medicines over conventional ones (OR = 15.526 (95% CI = 5.564–43.327), p-value < 0.001). Herbal medicine was used because it modulated milk production and managed breast and nipple pain.[14]

Respondents who agreed that herbal is more effective than conventional medicine were more inclined to utilize herbal medicine than respondents who disagreed. Research by Jamet et al.[13] also found that the perception of herbal medicine's efficacy is a significant factor in its use. James et al.'s study showed that mothers who agree with the belief that herbal medicine is more effective than conventional drugs during breastfeeding are more likely to use it. However, this difference is not statistically significant.[13]

As mentioned above, the result depends on social culture. Herbal medicine has been used for many years based on experience, so the belief in its efficacy has developed in society.[27] Most of the information and recommendations regarding herbal medicine use in breastfeeding mothers were also obtained from the family. The information obtained should be reviewed again to prevent misinformation and achieve the expected results, especially regarding the benefits of traditional medicine as an alternative to family medicine.[19]

The family is responsible for the correct information, so the family must update their knowledge about herbal medicines used by breastfeeding mothers. The role of health professionals needs to be increased to provide information on efficacious and safe herbal medicines used during breastfeeding. Pharmacological studies evaluating the safety and efficacy of herbal medicine in breastfeeding mothers also need improvement for scientific evidence. In addition, although the use of herbal medicine among breastfeeding mothers is widespread, no clinical guidelines have been established to promote dialogue between healthcare professionals and breastfeeding mothers to ensure the safe use of herbal medicine, so these clinical guidelines need to be prepared based on scientific evidence. Therefore, health professionals must recommend and supervise herbal medicine to promote health and prevent health problems. The involvement of health professionals can also help prove the efficacy and safety of herbal medicine for scientific use and under stricter supervision use.[31]

The limitation of the study was that the healthcare setting made the views and opinions of respondents not fully representative of other breastfeeding women. In addition, recall bias may arise because of the retrospective study design. Further research is needed to increase effective communication between health professionals and breastfeeding mothers regarding herbal medicine's efficacious and safe use. Additional research is required to increase breastfeeding mothers' knowledge of herbal medicine. The research about the development of effective and safe herbal concoctions for breastfeeding mothers also needs to be increase.

CONCLUSION

Factors related to and contributing to the use of herbs in breastfeeding mothers were the problem of smooth breastfeeding (p = 0.000) and the attitude of agreeing or the belief that herbal medicine is more efficacious than conventional medicine (p = 0.008). Social culture and familial experiences frequently shape the beliefs, which can lead to the transmission of inaccurate knowledge. Health professionals are essential in delivering information about herbal medicine and advising its use to promote and avoid health concerns.

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STATEMENT OF ETHICS

The study has been authorized by the Surakarta Health Polytechnic's Health Research Ethics Commission, with a letter of ethical suitability dated April 4 2022, research number : LB.02.02/ 1.1/ 693.6/ 2022.

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Evaluation of Antibiotic Use in the Internal Medicine Ward and ICU at Universitas Tanjungpura Hospital Pontianak with ATC/DDD

Dzuria Adhana Rifdah[1], Hariyanto IH[1], Delima Fajar Liana[2,3]*, Mardhia Mardhia[2], Mahyarudin Mahyarudin[2]

1. Pharmacy Study Program, Faculty of Medicine, Universitas Tanjungpura, Pontianak, West Kalimantan, Indonesia
2. Department of Microbiology, Faculty of Medicine, Universitas Tanjungpura, Pontianak, West Kalimantan, Indonesia
3. Universitas Tanjungpura Hospital, Pontianak, West Kalimantan, Indonesia

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Corresponding Author:
Delima Fajar Liana

Corresponding Author Email:
delimafajar@medical.untan.ac.id

ABSTRACT

Background: Evaluating the wise use of antibiotics is needed to control antibiotic resistance in hospitals.

Objectives: This study aimed to analyze patient characteristics, antibiotic profiles, and quantitative use of antibiotics in inpatients prescribed by internal medicine specialists in the internal medicine ward and Intensive Care Unit (ICU) at Universitas Tanjungpura Hospital Pontianak from August to October 2022.

Methods: This study method is descriptive observational, and data collection was done retrospectively using a purposive sampling technique. There were 143 samples that met the inclusion criteria, and then using the Anatomical Therapeutic Chemical (ATC)/Defined Daily Dose (DDD) method, the samples were analyzed quantitatively.

Results: Most patient characteristics were female patients (60.14%), patients aged 56-65 (26.57%), and the most common diagnosis was typhoid fever (32.74%). Of the 13 types of antibiotics used, cephalosporin was the most commonly prescribed antibiotic group to patients (58.48%), with the most types of antibiotics in ceftriaxone (42,69%) and intravenous administration of antibiotics was the standard route given to patients. The results of the quantitative analysis of all antibiotic prescriptions obtained a total value of 88.55 DDD/100 patient-days. Antibiotics with the most considerable DDD/100 patient-days value were ceftriaxone (44.71), followed by meropenem (10.46) and levofloxacin (9.28). Furthermore, the value of DDD/100 patient-days is not an indicator in determining the rational use of antibiotics, so further study must be done using the Gyssens method.

Conclusion: The value of DDD/100 patient-days is not an indicator in determining the rational use of antibiotics, so further study must be done using the Gyssens method as qualitative evaluation to obtain information regarding the rationality of prescribing antibiotics.

Keywords: Anatomical Therapeutic Chemical; Ceftriaxone; Cephalosporin; Defined Daily Dose; RS UNTAN

INTRODUCTION

Resistance is the absence of inhibition of bacterial growth by systemic administration of antibiotics at appropriate therapeutic doses. Antibiotic resistance can be caused by irrational use of antibiotics.[1] Data from the Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report 2021 shows an increase in the number of countries reporting Antimicrobial Resistance (AMR) data from 22 countries in 2017 to 70 countries in 2020.[2] Antimicrobial Resistant in Indonesia (AMRIN) data states that 700,000 people died from Antimicrobial

Resistance in 2018. Estimates suggest that by 2050, as many as 10 million people each year will die from Antimicrobial Resistance.[1]

Bacterial resistance leads to high rates of death, pain, and hospitalization, threatening a return to the pre-antibiotic era. If this trend continues without intervention, antibiotics that are useful as a treatment for various bacterial infections may become unavailable.[1] Hospital efforts are needed to control the incidence of antibiotic resistance, such as wise use and evaluation of the antibiotics used.[3] Evaluation of antibiotic use is one of the hospital quality indicators from the PPRA (Antimicrobial Resistance Control Program) team, which aims to inform the pattern of antibiotic use quantitatively and qualitatively.[4] Quantitatively evaluated antibiotic use can be calculated using the Anatomical Therapeutic Chemical (ATC)/Defined Daily Dose (DDD) method, which is a specific and standardized assessment method by the World Health Organization (WHO).[5] Anatomical Therapeutic Chemical (ATC) classifies drugs based on pharmacological classification, chemical compounds, and therapeutic functions, then interprets them into Defined Daily Dose (DDD) units, the average daily dose of antibiotics for adults with specific indications.[6] The evaluation of antibiotic use using the ATC/DDD method was developed as a drug utilization study tool to facilitate the review and evaluation of prescribing, dispensing, and use of medicines so that it is hoped that improvements in antibiotic use and a decrease in the incidence of infections caused by multiresistant bacteria can be obtained in the hospital.[4,7]

Based on the results of the preliminary study, which was conducted directly at Universitas Tanjungpura Hospital, showed that the internal medicine ward and ICU were recommendations for evaluating antibiotic use due to the high occurrence of infectious diseases and antibiotic use in these rooms compared to other rooms in the hospital. Amrin's research at Dr. Soetomo Hospital and Dr. Kariadi Hospital showed high antibiotic use in the internal medicine department, reaching 67%.[8] Patients admitted to Internal Medicine wards are usually elderly, affected by chronic poly pathology, undergoing poly pharmacotherapy, often showing cognitive and functional impairment, and staying in long-term facilities, so they are at high risk of infection.[9] In addition, it is also known that WHO and other studies show that the highest prevalence of nosocomial infections occurs in the ICU, which is more than 30%.[10] ICU has a higher potential for infection due to the use of invasive devices, frequent contact between hospital staff and patients, high intensity of antibiotic use, and excessive use of empirical antibiotics. This occurs because patients admitted to the ICU generally suffer from severe illness and are immunocompromised.[11]

A study on the quantity of antibiotic use has been conducted by Dirga et al., in the internal medicine ward at Dr. H. Abdul Moeloek Lampung Province Hospital, showing that ceftriaxone is the most commonly prescribed antibiotic with a DDD/100 patient-days value reaching 62.31.[12] In addition, a study by Woro et al., in the ICU at West Nusa Tenggara Province Hospital also showed that ceftriaxone was the most common antibiotic given to patients and had a DDD/100 patient-days value of 60.71.[13] However, few studies have focused on this field in Pontianak. To our knowledge, only two studies related to the quantitative evaluation of antibiotic use have been published, including a study by Inez et al., that evaluated the antibiotic rationality for pediatric inpatients at Universitas Tanjungpura Hospital and a study by Putri et al., determined the antibiotic use in the ICU patients at Dr.Soedarso Pontianak Hospital. Both studies showed that ceftriaxone was the antibiotic with the highest DDD/100 patient-days value, reaching 27.18 and 76.15.[14,15] Based on this, the researcher is interested in analyzing the quantity of antibiotic use prescribed by internal medicine specialists to patients at Universitas Tanjungpura Hospital Pontianak, especially in the scope of the internal medicine ward and ICU using the ATC/DDD method because this is the first study in the evaluation of antibiotic use has conducted in these two wards of our hospital, especially in Pontianak.

METHODS

Study design

This study design is descriptive observational with a quantitative approach. It was conducted in the internal medicine ward and ICU of Universitas Tanjungpura Hospital Pontianak from April to May 2023.

Population and samples

The population of this study is all patients who were hospitalized and received antibiotic treatment in the period August - October 2022 in the internal medicine ward and ICU of Universitas Tanjungpura Hospital Pontianak. The sample for this study was patients who met the predetermined inclusion and exclusion criteria. In this study, the inclusion criteria were patients who were in the internal medicine inpatient ward and ICU of Universitas Tanjungpura Hospital who received antibiotic treatment by an internal medicine specialist in the

period August - October 2022, while patients with incomplete or inaccessible medical record data, included as exclusion criteria.

Study instruments

The sample calculation used in this study was the Slovin formula. This formula is considered to be used if the population size is known. In this study, the Slovin formula uses a sampling error component of 5%, and we obtained the minimum number of samples required, which was 124 patients. Based on the results of data collection, 143 samples that met the inclusion criteria were accepted. Furthermore, the samples were then used to evaluate the use of antibiotics quantitatively.

Data collection

Data were collected retrospectively using the purposive sampling technique. They were first compiled into primary data and processed using Microsoft Excel software.

Data Analysis

The data was then analyzed based on patient characteristics, antibiotic profiles, and quantity of antibiotic use. Descriptive analysis was performed on patient characteristics in the form of data on gender, age, and disease diagnosis, which will be calculated by percentage. The analysis results were continued by determining the profile of antibiotic use in the form of data on the number of classes, types, and routes of administration of drugs classified based on ATC. The quantitative value of antibiotic use was then calculated using the DDD unit. On the official WHO website (http://www.whocc.no/atc-ddd-in-dex/), the ATC code is obtained along with the standard DDD value of each type of antibiotic.[16] Antibiotics that have been classified based on the ATC code can then be calculated using the DDD/100 patient-days formula as follows[4] :

$$\text{DDD/100 patient-days} = \frac{\text{The number of grams of antibiotics used by the patient}}{\text{WHO DDD standard in grams}} \times \frac{100}{\text{Total LOS}}$$

Description: The number of grams of antibiotics used by the patient = the use of antibiotics in grams, multiplied by the daily dose with the frequency of use and duration of antibiotic administration; WHO DDD standard in grams = DDD value for each antibiotic determined by WHO in grams; Total Length of Stay (LOS) = the total length of time of all hospitalized patients.

RESULTS AND DISCUSSION

Overview of Study Results

Number of Hospitalized Patients

The number of patients in the internal medicine ward and ICU of Universitas Tanjungpura Hospital for August - October 2022 was 314 (Table I).

Antibiotics prescribed to inpatients by internal medicine specialists in August - October 2022 in the internal medicine ward and ICU of Universitas Tanjungpura Hospital reached 45.54%, namely 143 patients, 134 from the internal medicine ward and nine from the ICU. The results showed that in August - October 2022, the number of patients in the internal medicine ward and ICU of Universitas Tanjungpura Hospital who were prescribed antibiotics by doctors was more than those who were not named antibiotics. High antibiotic prescribing, if given irrationally, can lead to a significant increase in bacterial resistance, pain, and death.[12] A total of 143 patients who received antibiotics from internal medicine specialists will be sampled in this study.

Patient Characteristics

The characteristics of patients in this study are based on the division of gender, age, and disease diagnosis (Table II).

Patient characteristics of gender are divided into two groups: women and men. Most patients who received antibiotic therapy from internal medicine specialists in the period August - October 2022 in the internal medicine ward and ICU of Universitas Tanjungpura Hospital were female patients, reaching 60.14%, namely 86 female patients out of a total of 143 patients, while male patients amounted to 57 patients (39.86%). These results are not significantly different from similar previous studies, stating that patients who received more antibiotic prescriptions in internal medicine wards and ICU in several Indonesian hospitals were female patients with 50.77% - 60.58%.[6,12,18,19] However, several other studies showed that male patients were the most likely to receive antibiotic prescriptions, reaching 50.65% - 58%.[13,15,20] Based on this, the incidence of infections that occur in women and men has a chance of occurrence that is not much different. This statement may happen due to differences in the immune system, biology, and behavior showing different prevalence.[21]

Table I. Percentage of antibiotic prescriptions and without antibiotics in the internal medicine ward and ICU of Universitas Tanjungpura Hospital Pontianak for the period August - October 2022

Recipe		Number of Patients	Percentage (%)
Prescription with antibiotics	Prescribed by a doctor internal medicine specialist	143	45.54
	Prescribed by a doctor internal medicine non-specialist	36	11.47
Prescription without antibiotics		135	42.99
Total		**314**	**100.00**

Table II. Characteristics of patients based on gender and age in the internal medicine ward and ICU of Universitas Tanjungpura Hospital Pontianak for the period August - October 2022

Patient Characteristics	Number	Percentage (%)
Gender		
Female	86	60.14
Male	57	39.86
Total	**143**	**100.00**
Age Range[17]		
≤25 years	28	19.58
26 - 35 years	11	7.69
36 - 45 years	17	11.89
46 - 55 years	27	18.88
56 - 65 years	38	26.57
>65 years	22	15.39
Total	**143**	**100.00**
Infectious Disease Diagnosis		
Typhoid fever	37	32.74
Sepsis	19	16.81
Pneumonia	14	12.39
Gastroenteritis (GEA)	9	7.96
Abscess	6	5.31
Bilateral pneumonia	5	4.42
Cystitis	4	3.54
Acute pharyngitis	4	3.54
Others	11	9,73
Total	**113**	**100.00**

Patient characteristics based on age are divided into six groups, namely early and late adolescence (≤25 years), early adulthood (26-35 years), late adulthood (36-45 years), early elderly (46-55 years), late elderly (56-65 years), and elderly (>65 years).[17] The age category that received the most antibiotic therapy from internal medicine specialists in the period August - October 2022 in the internal medicine ward and ICU of Universitas Tanjungpura Hospital was patients aged 56-65 years who were included in the late elderly group, reaching 26.57% or 38 patients out of a total of 143 patients. The results of this study are not significantly different from the study of Dirga et al., in which patients in the internal medicine ward of Lampung Provincial Hospital who received more antibiotic prescriptions were late elderly patients aged 56-65 years, reaching 25.60%.[12] However, the results of this study also have differences from several other studies in that most patients who received antibiotic prescriptions were early and late elderly patients with an age range of 46-65 years, as much as 47%, and in the elderly age group (>65 years) as much as 40%.[19,20] The high proportion of elderly patients can be caused by being more susceptible to infection due to decreased immune and physiological functions, less than optimal nutrition, having more than one comorbidity, and less supportive social environmental factors.[19] However, most patients who are over 65 years old cannot go to the hospital alone for treatment and have complications that cause high mortality rates. It can be the cause of the small number of patients of this age compared to elderly patients aged 46-65.[12,22]

The last patient characteristics are based on disease diagnosis. Diagnosis of the disease was taken from the discharge diagnosis data of patients who received antibiotics from internal medicine specialists from August - October 2022 in the internal medicine ward and ICU of Universitas Tanjungpura Hospital. The data were grouped into 20 groups based on the diagnosis of diseases suffered by patients with infectious causes. There were three groups of infectious disease diagnoses most commonly suffered by patients who received antibiotics in the internal medicine ward and ICU of Universitas Tanjungpura Hospital Pontianak, including typhoid fever (32.74%), sepsis (16.81%), and pneumonia (12.39%). In addition, 12 other groups of infectious disease diagnoses had a percentage of less than 2%, namely septic shock (1.77%), dysentery (1.77%), cellulitis pedis (1.77%), bronchopneumonia (0.88%), osteomyelitis (0.88%), stomatitis (0.88%), pulmonary tuberculosis (0.88%), peritoneal tuberculosis (0.88%), peritonitis (0.88%), acute otitis media (0.88%), sinusitis (0.88%), and chronic diarrhea (0.88%). The most common infectious disease diagnosis experienced by patients was typhoid fever, which amounted to 32.74%. In addition to typhoid fever, two other infectious disease diagnoses had a significant incidence rate, including sepsis (16.81%) and pneumonia (12.39%). The results of this study indicate no significant difference from the study of Dirga et al., that in the internal medicine ward at the Lampung Provincial Hospital, the diagnosis of typhoid fever, sepsis, and pneumonia was included in the seven most common disease diagnoses suffered by patients, with percentages of 23.2%; 19.0%; and 6.5%.[12]

The diagnosis of diseases suffered by patients in the internal medicine ward and ICU of Universitas Tanjungpura Hospital (Table IIb) is a type of infectious disease generally caused by bacterial infections requiring antibiotic therapy.[23] Antibiotics are the most widely used drugs globally related to many bacterial infectious diseases.[24] Antibiotics selected must consider several things, such as patient-specific factors (age, organ function, site of infection, and degree of sepsis), causative organism factors (germ map/antibiotic pattern, pharmacokinetics and pharmacodynamics, tolerability and safety profile, penetration into tissues and principles, costs and benefits).[26] The selection and use of appropriate and rational antibiotic therapy will determine the therapy's success and avoid bacterial resistance.[27,28] Antibiotic rationality criteria are assessed based on the accuracy of indications in the selection of antibiotics, including effectiveness, toxicity, price, spectrum, dose, duration of administration, interval, route, and time of administration.[4]

Antibiotic Use Profile Based on ATC Classification

Patient antibiotic data collected is then classified based on Anatomical Therapeutic Chemical (ATC) to facilitate the identification of antibiotics used so that the DDD value of antibiotics can be calculated.

Eight groups of antibiotics with 13 types that internal medicine specialists prescribed to patients in the internal medicine ward and ICU of Universitas Tanjungpura Hospital from August to October 2022 (Table III). The most commonly prescribed antibiotics by doctors, namely the cephalosporin group (58.48%) with the type of antibiotic ceftriaxone, reached 42.69%. The second most common antibiotic was beta-lactam carbapenems (12.87%) with meropenem (12.87%). The third most common antibiotic was fluoroquinolone (10.52%) with levofloxacin (8.77%). The results obtained are directly proportional to several studies that the cephalosporin group is among the most commonly used antibiotic groups with a percentage range reaching 51.41% to 79.25%, and the most common type of antibiotic given to patients, namely ceftriaxone which comes to 25.86% - 52.59%.[6,12,20] This is due to the broad spectrum of cephalosporin antibiotics as empirical treatment and ceftriaxone as a third-generation cephalosporin can be more effectively used than the second-generation in inhibiting the process of bacterial growth, especially in gram-negative bacteria.[20]

The most commonly used route for administering antibiotics to patients in the period August - October 2022 in the internal medicine ward and ICU of Universitas Tanjungpura Hospital is intravenous because, in general, the treatment of moderate to severe infections uses the intravenous route, with the resulting onset faster and the amount of bioavailability is higher. This route will result in the maximum effectiveness of antibiotics that suppress or kill bacteria that cause infection.[6,20] Identifying the route of antibiotic administration is an essential stage because the determination of the standard value of DDD by WHO for each antibiotic can vary, readjusted to the route of administration. This identification will significantly determine whether the antibiotic has a high or low DDD value.[30]

Quantity of Antibiotic Use in Units DDD/100 patient-days

Data on antibiotics used by patients included the name of the antibiotic, the dose of antibiotics given, the frequency of use, the duration of administration, and the route of antibiotics used for therapy, then used to calculate the quantitative value of antibiotic use with the calculation method established by WHO, namely the

Table III. Classification of antibiotics using the ATC classification in the internal medicine ward and ICU of Universitas Tanjungpura Hospital Pontianak for the period August - October 2022

Class of Antibiotics	Antibiotic Name	ATC Code	Route	Number of Uses	Percentage (%)	Cumulative Percentage (%)
Cephalosporins	Cefotaxime	J01DD01	iv	2	1.17	58.48
	Ceftriaxone	J01DD04	iv	73	42.69	
	Cefixime	J01DD08	po	2	1.17	
	Cefoperazone	J01DD12	iv	23	13.45	
Nitroimidazoles	Metronidazole	J01XD01	iv	8	4.68	4.68
Fluoroquinolones	Ciprofloxacin	J01MA02	iv	3	1.75	10.52
	Levofloxacin	J01MA12	iv	15	8.77	
Carbapenems beta-lactams	Meropenem	J01DH02	iv	22	12.87	12.87
Macrolides	Azithromycin	J01FA10	iv	8	4.68	4.68
Combined penicillins beta-lactams	Ampicillin-sulbactam	J01CR01	iv	1	0.58	8.18
	Amoxicillin and beta-lactamase inhibitors	J01CR02	iv	13	7.60	
Lincosamide	Clindamycin	J01FF01	iv	1	0.58	0.58
Sulfonamides	Sulfamethoxazole and trimethoprim	J01EE01	po	1	0.58	0.58
	Total			**172**	**100.00**	**100.00**

Description: ATC Code[16,29]; iv = intravena; po = per oral

Defined Daily Dose (DDD).[6] This quantitative antibiotic use information can be used in providing predictions regarding rationality or irrationality in antibiotic use.[12,31]

The total DDD value in this study reached 88.55 DDD/100 patient-days (Table IV). This result means that out of 100 patients, the total antibiotic consumption given to patients every day is 88.55. The study results were lower when compared to the results of Dirga et al., who had a total value of DDD/100 patient-days in the internal medicine ward of Lampung Provincial Hospital, reaching 118.57.[12] The results of the quantitative analysis showed that in the internal medicine ward and ICU of Universitas Tanjungpura Hospital Pontianak for the period August - October 2022, ceftriaxone, meropenem, and levofloxacin antibiotics became the three types of antibiotics with the most dominant use, respectively having a DDD/100 patient-days value of 44.71; 10.46; and 9.28. These results show that ceftriaxone antibiotics have the highest DDD/100 patient-days value, reaching 44.71, which shows that the total ceftriaxone antibiotics daily amounted to 44.71 per 100 patients. In other words, 44.71% of patients admitted to the internal medicine inpatient ward and ICU of Universitas Tanjungpura Hospital in August - October 2022 received ceftriaxone antibiotic prescriptions daily from internal medicine specialists. The results obtained are not significantly different from several previous studies, which state that in several Indonesian hospitals, especially in the scope of internal medicine wards and in the ICU, ceftriaxone is an antibiotic that has the highest DDD/100 patient-days value ranging from 27.79 to 76.15.[6,12,15,19,20]

Ceftriaxone is a third-generation antibiotic of the cephalosporin class intended for empirical treatment because it has broader activity than the second generation.[12] This antibiotic can kill bacteria by inhibiting bacterial cell wall synthesis.[32] Ceftriaxone is a suitable alternative to fight *Salmonella typhi* bacterial infection that causes typhoid fever, which is the most common disease diagnosis in patients who get antibiotics from internal medicine specialists in the period August - October 2022 in the internal medicine ward and ICU of Universitas Tanjungpura Hospital Pontianak.[33] Ceftriaxone is often prescribed to patients because of its higher potency, broader spectrum of action, and low risk of toxicity. Other advantages of ceftriaxone antibiotics include an easy administration route, no restriction on breastfeeding time, and lower cost than other antibiotics.[34] Ceftriaxone is still highly active against many susceptible pathogens and is often recommended as a first-line treatment option in many infectious disease guidelines.[35]

Table IV. Quantitative use of antibiotics based on DDD calculations in patients receiving antibiotics from internal medicine specialists in the internal medicine ward and ICU of Universitas Tanjungpura Hospital Pontianak for the period August - October 2022

Class of Antibiotics	Antibiotic Name	ATC Code	Route	Number of Doses (grams)	WHO DDD (grams)	DDD Value	Total LOS (days)	DDD/100 *patient-days*	
								Per Antibiotic Name	Per Antibiotic Class
Cephalosporins	Cefotaxime	J01DD01	iv	18	4	4.5	765	0.59	53.66
	Ceftriaxone	J01DD04	iv	684	2	342		44.71	
	Cefixime	J01DD08	po	6	0.4	15		1.96	
	Cefoperazone	J01DD12	iv	196	4	49		6.41	
Nitroimidazoles	Metronidazole	J01XD01	iv	43.5	1,5	29		3.79	3.79
Fluoroquinolones	Ciprofloxacin	J01MA02	iv	7.2	0.8	9		1.18	10.46
	Levofloxacin	J01MA12	iv	35.5	0.5	71		9.28	
Carbapenems beta-lactams	Meropenem	J01DH02	iv	240	3	80		10.46	10.46
Macrolides	Azithromycin	J01FA10	iv	7.75	0.5	15.5		2.03	2.03
Combined penicillins beta-lactams	Ampicillin-sulbactam	J01CR01	iv	30	6	5		0.65	7.37
	Amoxicillin and beta-lactamase inhibitors	J01CR02	iv	154.13	3	51.38		6.72	
Lincosamide	Clindamycin	J01FF01	iv	6.6	1.8	3.67		0.48	0.48
Sulfonamides	Sulfamethoxazole and trimethoprim	J01EE01	po	9.6	4	2.4		0.31	0.31
			Total					**88.55**	**88.55**

Description: ATC Code and WHO standard DDD value[16,29]; iv = intravena; po = per oral

Meropenem is a beta-lactam carbapenem antibiotic, and in this study, the DDD value reached 10.46 DDD/100 patient-days, the second largest value after ceftriaxone. Meropenem works by blocking the bacterial cell wall synthesis process, quickly penetrating the bacterial cell wall and forming high-affinity bonds to penicillin-binding proteins to inactivate bacteria.[36] Meropenem has a broad spectrum of action, so gram-positive or gram-negative bacteria can be combated.[37] In addition, in this study, levofloxacin is a fluoroquinolone class antibiotic with the third largest DDD/100 patient-days value of 9.28. Levofloxacin is an antibiotic with broad-spectrum activity so that gram-positive bacteria and gram-negative bacteria can be fought.[38] Fluoroquinolone antibiotics have a mechanism of action that blocks bacteria from synthesizing nucleic acids and proteins.[39] The use of levofloxacin as a treatment for upper and lower respiratory tract contaminations is considered efficient because it has high activity in attacking gram-positive bacteria and atypical bacteria that cause pneumonia.[38]

Other antibiotics used at Universitas Tanjungpura Hospital Pontianak, especially in the internal medicine ward and ICU for the period August – October 2022, are cefotaxime, ceftriaxone, cefixime, cefoperazone, metronidazole, ciprofloxacin, levofloxacin, meropenem, azithromycin, ampicillin-sulbactam, amoxicillin, and beta-inhibitors lactamase, as well as sulfamethoxazole and trimethoprim. These antibiotics have a DDD value smaller than 7.00 DDD/100 patient-days, of which sulfamethoxazole and trimethoprim are the antibiotics with the lowest DDD value, 0.31 DDD/100 patient-days. The significant variation in antibiotic use can result in irrational use and the emergence of an increase in the incidence of antibiotic resistance. The types and DDD values obtained can vary in several studies on the quantitative use of antibiotics in hospitals. Various factors, including differences in characteristics and infection status of each patient, can cause this.[18]

The significant value of DDD/100 patient-days shows that the greater the number of antibiotics used quantitatively.[12,19] The large quantity of antibiotic use can be used as an initial estimate of the possibility of antibiotic use approaching the principle of irrationality due to inappropriate administration or use of antibiotics.[12] However, the increase in antibiotic use does not necessarily indicate irrational use of antibiotics.[38] This study uses the ATC/DDD classification and calculation method recommended by the World Health Organization and the Ministry of Health in Indonesia to calculate the antibiotics used. The ATC/DDD method is specifically intended to present quantitative data on antibiotic use by patients, so the ATC/DDD method cannot be used to give qualitative data. Therefore, this is a limitation of this study. Thus, a qualitative evaluation of antibiotic use can be carried out further using the Gyssens method to obtain information regarding the rationality of prescribing antibiotics by internal medicine specialist doctors at Universitas Tanjungpura Hospital Pontianak.

CONCLUSION

The cephalosporin group is the most frequent class of antibiotic prescribed in the internal medicine ward and ICU at Universitas Tanjungpura Hospital, Pontianak, in the period August – October 2022, namely 58.48% and ceftriaxone being the most antibiotics was prescribed, 42.69%. The total value obtained for the quantity of antibiotic use reached 88.55 DDD/100 patient-days. The three antibiotics that had the most significant DDD/100 patient-days values were ceftriaxone (44.71), followed by meropenem (10.46), and levofloxacin (9.28). The most the DDD/100 patient-days value, showed the most quantity of antibiotics used. Furthermore, the value of DDD/100 patient-days is not an indicator in determining the rational use of antibiotics, so further study must be done using the Gyssens method.

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STATEMENT OF ETHIC

This study was approved by the Committee on Ethical Clearance Faculty of Medicine, Universitas Tanjungpura, with ethical clearance no. 7353/UN22.9/PG/2022, published on November 14, 2022.

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Cost-effectiveness Study in Type 2 Diabetes Mellitus in Asia: A Review

I Made Wiracana[1], Nunung Priyatni[2], Dita Maria Virginia[2]*

1. Student of Master Degree Program, Universitas Sanata Dharma, Yogyakarta, Indonesia
2. Department of Pharmacy, Universitas Sanata Dharma, Yogyakarta, Indonesia

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Corresponding Author:
Dita Maria Virginia

Corresponding Author Email:
virginia@usd.ac.id

ABSTRACT

Background: Type 2 Diabetes Mellitus (DM) requires intensive treatment to prevent progression and complications. One of the intensive treatments is insulin therapy. The increase in insulin price and variation in insulin therapy results in differences in treatment costs. In Asia, commonly used types of insulin therapy are NPH insulin and glargine insulin. It is urgent to define the most cost-effective insulin therapy among type 2 DM patients because of the economic burden.

Objectives: This study aims to assess the cost-effectiveness of these insulin types. We did a narrative review using literature discussing the cost-effectiveness of insulin for type 2 DM patients.

Methods: This study employs a narrative review approach using the PRISMA-P 2015 structured approach to examine studies. This article's methodological quality was evaluated using the Drummond checklist. The terms "cost-effectiveness analysis," "diabetes mellitus type 2," and "insulin" were used in the literature search for this study.

Results: We obtained five pieces of literature fulfilling inclusion and exclusion criteria. The results indicated that the age range of type 2 DM patients in this study is 57-62 years, with a majority being women. The most frequently occurring complication is cardiovascular complications. NPH insulin and glargine insulin were the most extensively studied insulins in the literature review.

Conclusion: Based on the cost-effectiveness analysis, glargine insulin is more cost-effective than NPH insulin in Asia due to the rare occurrence of hypoglycemia which is a common side effect as a treatment outcomes.

Keywords: Asia; cost-effectiveness; DM type 2; Insulin NPH; Insulin glargine

INTRODUCTION

Diabetes Mellitus (DM) is a common term for a group of metabolic disorders characterized by hyperglycemia resulting from impaired insulin secretion, insulin effectiveness, or both.[1] Chronic hyperglycemia associated with diabetes is linked to long-term organ damage, dysfunction, and failure, particularly in the eyes, kidneys, nerves, heart, and blood vessels. Among diagnosed cases of DM, 5.8% are classified as type 1 diabetes, while 90.9% are classified as type 2 diabetes.[2]

According to the latest data from the International Diabetes Federation (IDF), the global prevalence of type 2 diabetes mellitus in adults is 536.6 million people (10.5%) in 2021.[3] In 2019, 10.7 million people in Indonesia had diabetes, making it one of the countries with the highest absolute prevalences globally. Approximately 812.204 people were identified with a diagnosis of type 2 diabetes mellitus based on National Health Insurance (JKN) data.[4]

Type 2 DM requires intensive therapeutic management to prevent disease progression and complications. The principles of managing type 2 DM include non-pharmacological interventions such as adopting a healthy lifestyle and pharmacological interventions such as oral antidiabetic (OAD) therapy, either alone or in

combination with insulin.[5] Insulin is an essential medication in the management of type 1 DM and is also used in certain cases of type 2 diabetes.[6]

The variation in insulin therapy utilization results in differences in treatment costs.[7] Specifically in India, the latest expensive insulin promoted and frequently prescribed costs INR 1800 (30 USD) per vial, making insulin degludec more expensive in India compared to Europe, and 50% more expensive than human insulin compared to NPH, sold at INR 133 (2.2 USD). Additionally, the average price list of insulin has nearly tripled from 2002 to 2013. Between 2001 and 2015, lispro and human insulin became expensive by 585% (from 35 to 234 USD per vial) and 555% (from 20 to 131 USD per vial), respectively.[8] The economic burden associated with DM treatment necessitates a cost-effectiveness analysis to aid decision-making in selecting more cost-effective treatment options.[9]

Pharmacoeconomics is the foundation of Health Technology Assessment (HTA), but its uptake in Asia has historically been sluggish. The lack of awareness and the lack of country-specific epidemiological, clinical, and health economics data, together with fragmented research efforts, are some of the factors that have contributed to the sluggish adoption of HTA across Asia.[10] Pharmacoeconomic studies will help determine treatment choices for DM by considering the cost-effectiveness of the therapies provided.[11] Cost-effectiveness analysis aids in determining the value of money or efficiency, which enables decision-makers to deploy resources effectively.[12] The study aims to investigate the cost-effectiveness of insulin utilization among type 2 diabetes patients.

METHODS

Inclusion and Exclusion Criteria

The literature utilized in this study must meet the following criteria: (1) written in both English and Indonesian languages, (2) published between 2013 to 2023, (3) accessible through electronic databases such as PubMed and Google Scholar, (4) focus on the cost analysis of treatment for patients diagnosed with Type 2 Diabetes Mellitus who use insulin, (5) provide patient profile information, including gender, age, blood glucose levels, Body Mass Index (BMI), complications or comorbidities, and conducted in Asian regions. Exclusion criteria include studies involving therapies other than insulin, lack of initial patient profile description (baseline), and articles that do not discuss the influence of costs on patient treatment.

Method

This study employs a narrative review approach using the PRISMA-P 2015 structured approach to examine studies. The methodological quality of this article was appraised using Drummond checklist.[13]

Literature Search Strategy

Literature search in this study utilized the keywords "cost-effectiveness analysis," "diabetes mellitus type 2," and "insulin." The literature publications were restricted to the period from 2013 to 2023. Subsequently, the literature search was conducted based on title, author names, contextual references, and library variables.

Data Extraction

Data extraction was performed by reviewing the population, intervention, outcome, and results, which were then recorded in a table based on an extraction form containing the following information: (1) author(s), (2) year of publication, (3) population criteria, (4) intervention, (5) comparator, (6) outcome.

Data Synthesis

Data synthesis was conducted by analyzing the effectiveness of single or combination insulin therapy in patients with type 2 diabetes mellitus using a narrative approach. The obtained literature was subjected to critical appraisal by two researchers and discussed until conclusions were reached.

RESULTS AND DISCUSSION

Data from the literature studies indicate that the age range of patients with type 2 diabetes mellitus receiving insulin therapy varies from 57 years to 62 years. According to the CDC, the majority of type 2 diabetes patients fall within the age range of 45-64 years, where there is an increased insulin resistance and pancreatic cell dysfunction among individuals above 45 years of age. In this literature study, the majority of individuals with type 2 diabetes were women.[14] The higher prevalence of type 2 diabetes among women is associated with lower physical activity levels and a higher prevalence of obesity among women.[5] The HbA1c levels in the literature

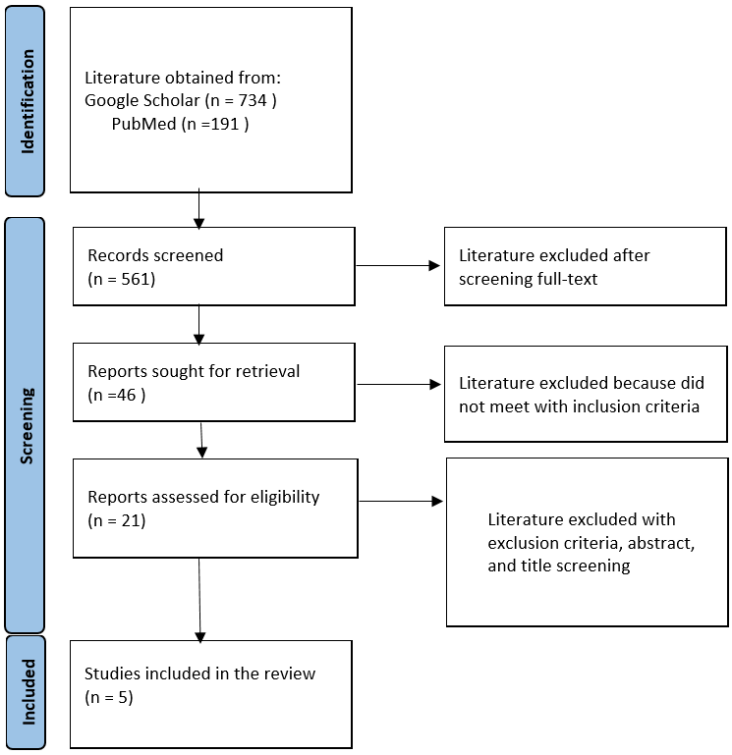

Figure 1. Diagram of articles included in the analysis

studies ranged from 8.1% to 9.55%. According to the recommended insulin therapy guidelines in Indonesia, basal insulin can be initiated in combination with dual/triple oral antidiabetic drugs (OAD) if the HbA1c levels range from 7.5% to 9% and the diabetes has been present for a long duration.[15] Body Mass Index (BMI) values are divided into five categories based on WHO criteria: underweight (<17.0 kg/m2), mild underweight (17.0-18.4 kg/m2), normal weight (18.5-25.0 kg/m2), mild overweight (25.1-27.0 kg/m2), and overweight (≥27.0 kg/m2).[16]

The sample size in this literature study varies from 174 patients to 9,419 patients. The variation in patient sample sizes is attributed to differences in methods and modeling used. The lowest sample size is from the study by Farschi et al (2016) because the research employed a pharmacoeconomic study method simultaneously with clinical trials, while other studies in this literature review used pharmacoeconomic study methods with modeling. Despite several proposed methods as a basis for calculating sample size for pharmacoeconomic studies conducted alongside clinical trials, a standardized formula that can be practically and universally accepted is not yet available.[17] On the other hand, studies utilizing modeling methods yield larger sample sizes, as exemplified by the research conducted by Permsuwan et al (2017) with 9,419 patients. This increase is attributed to the utilization of the Thai Database Registry (TDR) database, allowing for simulation modeling.[18] Based on this literature study, most individuals with type 2 diabetes were classified as mildly overweight or overweight. The risk of developing type 2 diabetes increases proportionally with the incidence of diabetes, with a 23% increased risk for every unit increase in BMI (kg/m2).[19]

The most commonly occurring complications from the literature studies are cardiovascular complications (myocardial infarction, angina pectoris, stroke, peripheral vascular disease, congestive heart failure), microalbuminuria, and neuropathy. Type 2 diabetes mellitus is often associated with an increased risk of cardiovascular complications. One mechanism linking type 2 diabetes to cardiovascular complications is the occurrence of low-grade inflammation. Type 2 diabetes and insulin resistance are associated with excessive expression of several cytokines by adipose tissue, including tumor necrosis factor-alpha, interleukin-1, interleukin-6, leptin, resistin, monocyte chemoattractant protein-1, plasminogen activator inhibitor-1, fibrinogen, and angiotensin. The excessive expression of these cytokines contributes to increased inflammation and lipid accumulation, which have detrimental effects on blood vessels and can lead to endothelial dysfunction, myocardial infarction, and cardiomyopathy.[20]

Shaffie and Ng (2020) examined insulin glargine and NPH, as well as insulin detemir and NPH, in a Malaysian study. The study utilized the UKPDS OM 2.0 modeling. This modeling is a computerized simulation tool

Table I. Characteristics of the Literature Reviewed

No	Country, Author	Characteristics of the Patients	Intervention and Comparator	Clinical Outcome, QALY	Cost	ICER
1	Malaysia Shafie and Ng, 2020	Age: Average 62 Hba1C: Average 8.2 Time Horizon: 40 years Sample size: 2000 patients	NPH insulin insulin glargine insulin detemir	improvement in QALY (between +0.1317 (insulin Glargine) and +0.8567 (insulin Detemir)) in patients with LAIA compared with NPH insulin.	insulin glargine: 4,867 MYR per 0.1317 per QALY gained insulin detemir: 6,026 MYR per 0.8567 per QALY gained	insulin detemir is dominant
2	Iran, Farschi et al, 2016	age: 57.24 – 58.5 HbA1c: 9.55-9.75% BMI: 29.57 – 31.78 kg/m2 observation period: 48 weeks Sample size: 174 patients	Biphasic Aspart 30 NPH regular	Biasp 30: HbA1c decrease to 7.15% QALY increase to 0.73 NPH reg: HbA1c decrease to 7.62% QALY increase to 0.66	930.5 ± 81.4 for BiAsp 30, 1101.3 ± 165.5 for NPH reguler	ICER was approximately 20000 $ per QALY. Regarding major clinical outcomes (i.e. hypoglycemia events and QALY) BIAsp 30 showed lower ICER as a dominant alternative
3	Thailand, Permsuwan et al, 2016	Average age: 60.9 years HbA1c 8.1 % BMI 25.7 Sample size: 751 patients	Insulin glargine Neutral Protamin Hagedorn	QALY for Biasp 30 is 8.838, and for NPH is 8.350	US$2,977.90 (glargine) vs. US$228.31 (NPH)	ICER value is 244.915 US/QALY
4	Hongkong, Lau et al, 2019	mean age 57.28 years, mean BMI 25.36 kg/m2, HbA1C 8,98 %, Sample size: 2344 adults	Insulin glargine Insulin NPH	Insulin glargine QALY vs Insulin NPH (7,842 vs 7,625)	insulin glargine cost 762,136 HKD and insulin NPH cost 740,776 HKD	ICER value is 98,663 HKD/QALY
5	Thailand, Permsuwan et al, 2017	mean age 60,9 years, mean BMI 25.7 kg/m2, HbA1C 8.1 % Sample size: 9,419 patients	insulin glargine Insulin detemir	Insulin glargine QALY vs Insulin detemir (8.908 vs 8.921)	Insulin glargine cost 2,405,599 THB and insulin detemir cost 3,262,268 THB	ICER value is 285,556,370 for insuline glargine vs insuline detemir

BMI: body mass index; HKD: Hongkong Dolar; THB: Thailand Bath; HbA1c: Hemoglobin A1c; NPH: Neutral protamine hagedorn; US$: US Dolar; BiAsp: Biphasic Aspart; QALY: Quality Adjusted Life Years

designed to estimate Life Expectancy, Quality Adjusted Life Years, Quality, and cumulative costs of complications in patients with type 2 diabetes mellitus (T2DM). It applied equations and peer-reviewed algorithms published in the UK Prospective Diabetes Study (UKPDS).[21] Insulin detemir and glargine have higher costs compared to NPH insulin but have higher QALY values due to lower complication rates and hypoglycemic events. Although insulin glargine and detemir are more cost-effective compared to NPH, the obtained ICER values are higher than the accepted willingness-to-pay threshold set by the Malaysian government (RM 29,080/QALY).[22]

Insulin BiAsp 30 and insulin NPH were examined in an Iranian study by Farschi et al. (2016). The study was conducted over 48 weeks. The QALY value was obtained using the EQ-5D-3L questionnaire and the Visual Analogue Scale (VAS). The European Quality of Life-5 Dimensions 3 Level version (EQ-5D-3L) was used, which was developed by EuroQol from the UK. This questionnaire consists of 5 dimensions: 1) mobility/walking, 2) self-care, 3) usual activities, 4) pain/discomfort, and 5) anxiety/depression. Each dimension has 3 levels of response: 1) no problems, 2) moderate problems, and 3) severe problems. Each level in the dimension has different coefficients. A value of 100% or 1000 indicates perfect health.[23] The study calculated the costs of each intervention (direct and indirect) as well as the side effects (hypoglycemia and weight gain). The conclusion obtained was that insulin BiAsp 30 is more cost-effective in terms of dominance (higher effectiveness and lower cost) compared to insulin NPH.[24]

A Hong Kong study by Lau et al. (2019) contrasted insulin NPH with insulin glargine. The QVIA™ Core Diabetes Model (CDM) v9.0 was used to assess the costs incurred during treatment and the outcomes achieved. CDM is often used as a policy analysis tool because it is a non-product-specific model. It consists of a set of 15 sub-models, where each sub-model is a combination of a semi-Markov model structure and Monte Carlo simulation, which simulate major diabetes complications including, but not limited to, congestive heart failure, myocardial infarction, stroke, end-stage renal disease, lower extremity amputation, foot ulcers, and hypoglycemia. This model uses time-dependent probabilities, states, and diabetes types derived from published sources. CDM projects outcomes for the population based on the following lists: initial cohort characteristics, history of past complications, concomitant treatments, and changes in physiological variables over time. From these, the model can calculate complication events, life expectancy, quality-adjusted life expectancy, and total costs in the population. The calculated costs include direct and indirect costs. The results obtained indicate that insulin glargine was more cost-effective than insulin NPH with an ICER value of 98.663.[25]

A 2016 study by Permsuwan et al. in Thailand comparing NPH therapy with insulin glargine. The study utilized the IMS CORE Diabetes Model version 8.5 (CDM), a computer simulation model. The research perspective was from the national insurance, so only direct costs of medication, therapy management, diabetes-related complications, and associated side effects were considered. The results showed that insulin glargine therapy was more cost-effective compared to NPH insulin due to the higher QALY value obtained with insulin glargine. The ICER value obtained was 244,915 THB/QALY. However, the ICER value obtained was still above the willingness-to-pay threshold set by the Thai government, which is THB 160,000/QALY.[14]

A study conducted by Permsuwan et al. (2017) in Thailand compared insulin glargine vs detemir therapy. The study utilized the IMS CORE Diabetes Model version 8.5 (CDM), a computer simulation model. The IMS CORE Diabetes Model (CDM) is a simulation model that predicts long-term health outcomes and costs associated with the management of T1DM and T2DM. The CDM has been extensively used to evaluate the cost-effectiveness of new therapy options for diabetes treatment. The model is also routinely used to inform reimbursement decisions, public health issues, resource planning, clinical trial designs, and optimal patient management strategies.[26] The results showed that insulin detemir had higher total costs compared to insulin glargine. However, when measuring insulin detemir as a single dose, it was dominant (lower cost and higher effectiveness) compared to insulin glargine. The ICER value obtained was 856,899.[18]

Based on Table II, the costs incurred for each therapy in various countries in Asia are described. There are differences in costs even for the same type of therapy. This is due to the different perspectives used in each pharmacoeconomic study. Malaysia and Thailand adopt a payer perspective, Iran uses a patient perspective, and Hong Kong applies a social perspective. The difference in perspectives significantly influences the total costs incurred in a therapy. From the payer perspective, it usually includes only medical costs. This perspective is commonly used by state-owned insurance providers. The patient perspective includes medical costs, direct non-medical costs (such as transportation expenses), and productivity loss costs. On the other hand, the social perspective encompasses medical costs, direct non-medical costs (such as transportation and informal expenses), and productivity loss costs.[27] Insulin NPH and insulin glargine are the most extensively researched insulins in this literature study. Insulin NPH is widely studied due to its more economical price compared to analog insulins.[28] On the other hand, insulin glargine is frequently prescribed and considered the gold standard in basal

Table II. The Costs Associated with Each Literature

	Malaysia	Iran	Hongkong	Thailand (1)	Thailand (2)
NPH	33,182 RM (7,503.84 USD)	1,101.24 USD	740,776 HKD (94,367.87 USD)	541,806 THB (15,790.11 USD)	
Glargine	38,151 RM (8,627.54 USD)		762,136 HKD (97,088.93 USD)	661,344 THB (19,273.86 USD)	2,405,599 THB (70,107.51 USD)
Detemir	39,209 RM (8,866.80 USD)				3,262,268 THB (95,073.82 USD)
BiAsp 30		930.55 USD			

NPH: Neutral Protamine Hagedorn, BiAsp: Biphasic Aspart, RM: Ringgit Malaysia, HKD: Hongkong Dolar, THB: Thailand Bath, USD: US Dolar; Perspective: Malaysia: Payer, Iran: Patient, Hongkong: Social, Thailand: Payer

insulin therapy. Additionally, insulin glargine can be safely and effectively used in various stages of injection therapy, ranging from initial basal insulin therapy combined with oral antidiabetic medicines to different combination therapies.[29]

Compared to NPH insulin, basal insulin analogs have demonstrated several benefits, such as reduced pharmacological fluctuations, a decreased likelihood of hypoglycemia, and a more significant influence on overall quality of life. The clinically significant reduction in the risk of hypoglycemia by insulin glargine compared to NPH in patients with T2DM is expected to be a major contributor to the cost-effectiveness of insulin glargine, as significant savings can be achieved with lower hypoglycemia treatment costs.[30,31] Regarding cardiovascular complications, insulin glargine reduces triglyceride levels, causes a low increase in body weight, decreases hypoglycemia compared to NPH, and has a neutral effect on blood pressure. The ORIGIN trial, a specific cardiovascular outcome trial of glargine, did not show an increased risk of cardiovascular events.[32] According to the study by Wolnik et al. (2020), insulin glargine achieved a reduction in HbA1c of ≥0.5% from baseline to 6 months after switching from NPH insulin in 71.7% of participants. At 3 and 6 months, there was a significant average reduction in HbA1c of 0.77% and 1.01%, respectively.[33] In addition, insulin glargine is also effective with a good safety profile in both younger and older patients with uncontrolled T2DM, indicating that insulin glargine can be a suitable treatment option for elderly patients representing a vulnerable population susceptible to hypoglycemia.[34]

CONCLUSION

Insulin NPH and insulin glargine have been extensively studied in the literature due to the cost-effectiveness of NPH insulin, which is cheaper than analog insulins, and the widespread prescription of insulin glargine for basal insulin therapy in Asia. In the studies included in the literature, insulin glargine is found to be more cost-effective than NPH insulin in Asia because it has a lower occurrence of side effects, particularly hypoglycemia, which is a common concern in diabetes treatment.

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CONFLICT OF INTEREST

None to declare

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Evaluation of Blood Supplement Tablet Distribution at Community Health Centers (Puskesmas) in Sleman Regency

Veronika Yuni Candra Sari[1], Diah Ayu Puspandari[2]*, Anna Wahyuni Widayati[3]

1. Magister Management Pharmacy, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia
2. Center for Financing and Management of Policy of Health Insurance, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia
3. Department of Pharmaceutics, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia

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Corresponding Author:
Diah Ayu Puspandari

Corresponding Author Email:
diah.ayu.puspandari@mail.ugm.ac.id

ABSTRACT

Background: Anemia is a condition often found in adolescent girls and pregnant women in developing countries. The government has made efforts to reduce cases of anemia through a program that provides blood supplement tablets to teenage girls and pregnant women. However, the distribution coverage in Sleman is still 85%.

Objectives: This study aimed to determine how to distribute blood supplement tablets from the community health center.

Methods: This research used a qualitative approach, data collection techniques with interviews, and observation of the document distribution process in 2022. The study was conducted using purposive sampling, and 35 respondents were health workers, teachers, pregnant women, and female students. The interview results were analyzed using content analysis.

Results: The results of the observation document show that only one of the five indicators is still below standard: TOR, at Puskesmas A is 0,72 times, and at Puskesmas B is 0,44 times. The availability in Puskesmas B is 27 months. The supporting factors in the distribution are regulations, educating pregnant women, and the availability of blood supplement tablets. The inhibiting factors in the distribution process are the need for more budget for distribution to schools, the lack of schedule for distribution and taking blood supplement tablets together in schools, and the lack of education of health workers for teachers and female students.

Conclusion: The process of distributing blood supplement tablets at the community health center in Sleman Regency is efficient and according to the guidelines for administering blood supplement tablets to pregnant women and female students.

Keywords: anemia; blood supplement tablets; community health center; distribution; female student

INTRODUCTION

Anemia is a condition where a person's red blood cell count is insufficient to meet the body's physiological needs, resulting in a reduced capacity to carry oxygen throughout the body. Anemia is mainly caused by iron deficiency but can also be caused by deficiencies in other nutrients such as folic acid, vitamin B12, and vitamin A, acute and chronic inflammation, parasitic infections, and diseases that disrupt hemoglobin synthesis and red blood cell production.[1] Anemia usually occurs in pregnant women because the iron requirement of pregnant women triples due to an increase in the number of red blood cells to meet the needs of placenta formation and fetal growth.[2] Teenager girls have a ten times greater risk of suffering from anemia than young men due to iron loss during menstruation, exacerbated by a lack of iron due to dietary habits. According to WHO, in 2019, 37% of pregnant women experienced anemia globally, and 30% of women of productive age also experienced anemia.[3] Data from Riskesdas in 2018 showed the prevalence of anemia in Indonesia was 23.7%, in adolescent

girls was 32%, and in pregnant women was 37.1%.[4] The prevalence of anemia in pregnant women in D.I.Yogyakarta Province in 2017-2021 continues to increase; in 2021, there were 16.5% cases of anemic pregnant women,[5] while in Sleman Regency, the prevalence of pregnant women in 2019 was 10.46%.[6] Based on WHO recommendations, the Government of Indonesia intensified the prevention and control of anemia in adolescent girls by giving blood supplement tablets through schools[2] and blood supplement tablets at least 90 during pregnancy to pregnant women.[7] During pregnancy, pregnant women should have a minimum of 6 (six) pregnancy checks, namely 1 (one) time in the first trimester, 2 (two) times in the second trimester, and 3 (three) times in the third trimester.[7]

With this commitment, the government has provided a blood supplementation tablet program distributed through community health centers and forwarded to their sub-service units to assist in distributing blood supplementation tablets to reach the target, namely pregnant women and adolescent girls. The results of Riskesdas 2018 also show that not all teenage girls and pregnant women have received blood supplement tablets, where 23.8% of adolescent girls have not received blood supplement tablets and 26.8% of pregnant women have not received blood supplement tablets. The distribution of blood supplement tablets is one of the indicators used to monitor and evaluate the management of blood supplement tablets. The research results at the Puskesmas Pasar Rebo, Puskesmas Air Bangis, and Puskesmas Anak Air in Padang said that the distribution of blood supplement tablets to adolescent girls has not yet been by the guidelines for overcoming anemia in teenage girls.[8–10] Research at the Puskesmas Gedongtengen said that the distribution of blood supplement tablets to pregnant women does not follow the guidelines.[11] Community health centers must have a sound drug management system as a healthcare facility. One of the drug management systems is distribution; distribution at community health centers aims to meet the needs of pharmaceutical preparations in the service sub-unit by type, quality, quantity, and the right time of distribution.[12] The distribution of blood supplement tablets involves sending them from the district to the community health centers and to the other health center facilities, where they are given to the target receiver.[7] This study aims to obtain an overview of the distribution of blood supplement tablets at community health centers in the Sleman Regency area and to determine the supporting and inhibiting factors in distributing blood supplement tablets at community health centers. To the best of the researcher's knowledge, there has been no similar research, so the result of this research can be used as input to improve the process of distributing blood supplement tablets.

METHODS

Study Design

This research uses a qualitative case study approach to describe the process, supporting factors, and inhibiting factors in distributing blood supplement tablets.

Population and Sample

The study was conducted at two community health centers in Sleman Regency in October - November 2023. The subjects in the study were selected as samples by purposive sampling with the criteria of the highest and lowest cases of anemia. The research subjects were divided into two criteria, namely health workers consisting of pharmacists, coordinator midwives, nutrition officers, integrated healthcare center (Posyandu /Pos Pelayanan Terpadu) officers, drug officers at auxiliary health center (Puskesmas Pembantu), drug officers at village health pos (Poskesdes/Pos Kesehatan Desa), and village midwives, and the community consisting of school medical room teachers, pregnant women, and female students. Inclusion criteria for health workers are those who work in public health care, who have anemia prevalence <5% and >15%, health workers who have been involved in the distribution process for at least two years, and who are willing to be respondents. Exclusion criteria are health workers who do not know how to distribute blood supplement tablets properly.

Data Collection Methods

Data was collected for two months for both interviews and document observation. Qualitative data collected by conducting in-depth interviews with respondents about the distribution of blood supplement tablets using interview guidelines and observation of the retrospective data of blood supplement tablet distribution documents, including LPLPO (Lembar Pemakaian dan Pemintaan Obat), stock cards, SBBK (Surat Bukti Barang Keluar), and community health center distribution records. Data analysis of the results of observation of blood supplement tablet management was assessed based on 5 (five) indicators of the drug management system, namely the accuracy of the distribution of blood supplement tablets to the pharmaceutical service sub-unit, the

availability of blood supplement tablets, the percentage of damaged/expired blood supplements tablets, the percentage of conformity of blood supplements tablets with stock cards, turnover ratio of blood supplements tablets.

Data Analysis

The results of in-depth interviews were analyzed using content analysis, which converted them into interview transcripts manually, assigned codes, and presented them narratively.

Interview Guidelines

Interview guidelines for health workers and school medical room teachers were adopted and modified from the research data.[13] The research data were used to determine the distribution process, supporting factors, and inhibiting factors for the distribution of blood supplement tablets. Interview guidelines for pregnant women were adopted from the research data,[14] and for female students were adopted from research data as well.[10] Interviews were conducted with pregnant women and female students to determine their acceptance of and habit of taking blood supplement tablets.

RESULT AND DISCUSSION

Research Respondents

The study results obtained 35 respondents, including health workers and community respondents. The health workers are eleven respondents, and twenty-four community respondents consisting of four school medical room teachers, ten pregnant women, and ten teenage girls taken from female students in high schools (table I). The selection of health worker respondents was based on the selection from community health centers, which had the highest and lowest cases of anemia among pregnant women. Data on pregnant women's anemia cases were obtained from the Maternal and Child Health Program of the Sleman District Health Office. School medical room teacher respondents and female students were based on recommendations from the nutrition officers of the selected community health centers. Interviews with medical room teachers and female students in the medical room school. Pregnant women respondents were obtained using an accidental sampling technique for patients who came to the health center for pregnancy checkups. Interviews with pregnant women were conducted in front of the pharmacy room, while the patient was waiting for medicine.

Analysis of health workers' perceptions

The results of the analysis of interviews with health workers at the Community Health Center, the perception of health workers regarding the distribution of blood supplement tablets is influenced by the management of blood supplement tablets starting from planning, procurement, receipt and storage, availability, stock taking, the absence of damaged or expired blood supplement tablets, and distribution coverage (Table II).

Observation of Blood Supplements Tablet Management

Based on Table III, the results of observations of five indicators of the distribution of blood supplement tablets found that the availability of blood supplement tablets at Puskesmas B does not meet the indicators. The turnover ratio (TOR) indicator is still below standard; It is 0.72 times for Puskesmas A and 0.44 times for Puskesmas B. The availability of blood supplement tablets in Puskesmas B exceeds the standard by 27 months. From the results of interviews with Puskesmas B pharmacists, that situation was caused by distribution to schools that were directly given for two months, usually only one month, and the LPLPO formula, which automatically made the number of requests for the following month significant.

"*If it is excessive, the LPLPO formula is automatic; it multiplies by 2, so, for example, this month, I want to divide it by two months so that I will ask for two months. Next month, I should not ask for it, but the formula is automatic, so there is an excess in the next month, but after that, it will be used again, so it is like piling up for one month's stock, but it would never be expired*." (Pharmacist 2).

The cause of the low TOR value at the community health center is the inaccuracy at the previous stage, which could be in the planning, request, and acceptance stages, which causes excess drug stock at the community health center, this is the same as the research results [15] at Surabaya. In planning at the community health center, the average monthly usage at the community health center is multiplied by 18 months, of which 6 months are used as reserves or buffer stock. The number multiplied by 18 produces a reasonably high planning amount. Then, when receiving medicines at the community health centers, the community health centers often receive

Table I. Characteristics of Research Respondents

No	Respondent	Age	Duration of work at the community health centers
1	Pharmacist 1	37	11 years
2	Pharmacist 2	33	6 years
3	Nutrition Program Officer 1	35	7 years
4	Nutrition Program Officer 2	39	17 years
5	Midwife Coordinator 1	57	13 years
6	Midwife Coordinator 2	50	12 years
7	Health Promotion Program Officer 1	32	5 years
8	Health Promotion Program Officer 2	34	2 years
9	Village Midwife 1	48	16 years
10	Village Midwife 2	57	27 years
11	Pustu Pharmacist 1	33	4 years
		Age	Duration of work as school medical room teacher
1	School medical room teacher 1	55	10 years
2	School medical room teacher 2	30	3 years
3	School medical room teacher 3	35	6 years
4	School medical room teacher 4	25	3 years
		Age	Grade
5	Junior High student 1	13	VIII
6	Junior High student 2	13	IX
7	Junior High student 3	14	IX
8	Junior High student 4	14	VIII
9	Senior High student 1	15	X
10	Senior High student 2	17	XII
11	Senior High student 3	16	XI
12	Senior High student 4	15	X
13	Senior High student 5	17	XI
14	Senior High student 6	16	XI
		Age	Pregnancy's number
15	Pregnant mom 1	23	First
16	Pregnant mom 2	22	First
17	Pregnant mom 3	34	First
18	Pregnant mom 4	27	First
19	Pregnant mom 5	36	Third
20	Pregnant mom 6	40	Second
21	Pregnant mom 7	41	Forth
22	Pregnant mom 8	29	Second
23	Pregnant mom 9	23	First
24	Pregnant mom 10	28	Second

medicines in larger quantities than requested. This can cause medication buildup in the health center's medicine warehouse.

Based on the result of the previous research,[16] the availability of blood supplement tablets in the District Health Office in East Java province has excess stock availability because the blood supplement tablets are delivered based on the calculation of the proportion of drug distribution, which the central government or Provincial Health Office determines.

Overview of the process of distributing Blood supplement tablets in the Community Health Center (Puskesmas) in Sleman Regency

Distribution of blood supplement tablets is the process of sending blood supplement tablets from the state level, province, and district to the health service location where the blood supplement tablets reach the target. Distribution lines are divided into government lines and private/independent lines. The distribution of blood supplement tablets through the government line is from the Health Office to the community health center pharmacy installation and then to the sub-units of health services, which include pharmacies, auxiliary health centers, village health posts, village midwives, and integrated health centers.[17] Schools are distribution channels to reach the target of young women through community health center nutrition program officers.[2] The

Table II. Perception of health workers

No	Perception of health workers
1	**Planning blood supplement tablets** Planning for additional blood tablets at the Community Health Center has involved other health workers and cross-sectors. Quotation example *"Yes, it involves other programs. Before the annual planning, we collected related programs, the prescriber, the prescriber, the doctor, and the midwife, we summarize everything." (Pharmacist 1)* *"Usually, we collaborate with the school medical room. We ask how many female students there are, and then they set a target, so later, we distribute according to the number of female students in each school." (Nutrition 2)*
2	**Procurement, receiving, and storage** The installation pharmacy district procures blood supplement tablets, and the community health center installation receives and stores them. **Quotation example** *"Procurement from the installation pharmacy district, we will receive it monthly by the LPLPO. There are certain months for requests for blood supplement tablets for nutritional activities. "The one gate policy is already in operation here, which receives and stores medicines at the pharmacy." (Pharmacist 1)* *"Yes, pharmacy, when we want to distribute it, ask for the amount that will be distributed and then get it." (Nutrition 2)*
3	**Availability of blood supplement tablets** The availability of blood supplement tablets at the Sleman District Health Center is sufficient. **Quotation example** *"The blood supplement tablets from the government are always sufficient; we never buy them ourselves, just according to our needs. Blood supplement tablets are never slow-moving; in fact, here they are fast-moving because they are also for pregnant women. "There are also quite a lot of pregnant women here, there can be 20-25 pregnant women a day." (Pharmacist 1)* *"In all my time here, there has never been a vacancy." (Nutrition 2)* *"Available, even in excess. (coordinating midwife 1)*
4	**Stock opname** The community health centers routinely check stock at the end of every month and enter it in the monthly report; the stock card does the physical count. **Quotation example** *"Routinely, every month. "Blood supplement tablets are included in the LPLPO, so they are included in the stock-taking report." (Pharmacist 1)*
5	**There are no damaged or expired blood supplement tablets.** The results of observations at the Community Health Center found no damaged or expired blood supplement tablets, and the percentage of expired/damaged blood supplement tablets was 0% **Quotation example** *"There has never been a blood supplement tablet that was damaged or expired." (Pharmacist 2)*

distribution of blood supplement tablets is one of the guidelines for monitoring and evaluating the program and has become an indicator of success in administering blood supplement tablets. The results of interviews with health workers at the community health centers show that blood supplement tablets are distributed only through pharmacies at community health centers, auxiliary health centers, and schools. There is no medical examination for pregnant women at the integrated health posts, so there is no distribution of blood supplement tablets.

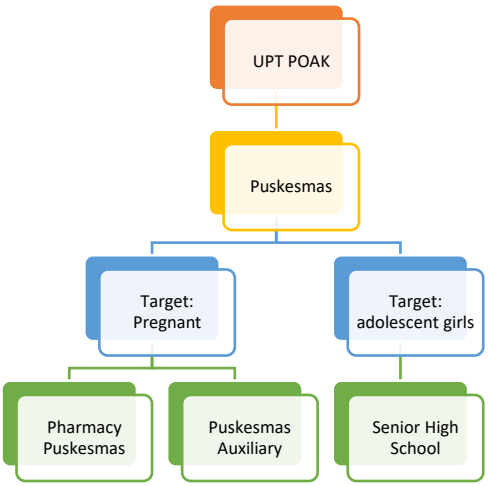

Figure 1. Distribution route for Blood supplements Tablets

Note: UPT POAK is a drug and medical equipment procurement installation at the Sleman district health office.

Table III. (Continued)

No	Perception of health workers
6	**Distribution Coverage**
	Distribution coverage of blood supplement tablets for young women is 100%, and for pregnant women is 70% *"Distribution to young women is 100%." (Nutrition 1)* *"Now it is around 600; the percentage, sis, is already 70% because if you get all that coverage, sis, it is 100%. "The target of achieving 70% is 881; we have reached 700 people, divided by how much, but giving tablets increases the blood volume by 100%." (coordinating midwife 1)*

Table III. Analysis Results of Blood Addition Tablet Distribution Indicators

No	Indicators	Puskesmas A	Puskesmas B
1	Accuracy of blood supplement tablet distribution amount to pharmaceutical service sub-units	100%	100%
2	Blood supplement tablet availability	16.72 Month	27.29 Month
3	Percentage of damaged blood supplement tablets or expired	0%	0%
4	Percentage of blood supplement tablet conformity with stock cards	100%	100%
5	TOR blood supplement tablet	0.72 times	0.44 times

"If for this, pregnant women are more to what, there is no physical examination like that, ANC (antenatal care) does not exist, so they just like maybe measuring what it is like measuring upper arm like that, why seeing this is a bit risky right, then later they can report it to the community health centers.*"(integrated health posts officer 1).*

There were no village health posts in the sampled community health centers. Village health posts in Puskesmas A have become one with the auxiliary health center near the village office. Village midwives are midwives placed in one village within the working area of the community health center as a network of community health center services. The placement of village midwives aims to accelerate the improvement of maternal and Child Health and improve the community's health status. Village midwives have the authority to provide family planning, promotive, preventive, and community blessing services, as well as early detection and treatment related to maternal and child health.[18] Village midwives who are respondents do not carry out their duties as midwives who provide health services.

The study's results showed that the distribution of blood supplement tablets followed guidelines. Community health centers distributed them only through pharmacies and auxiliary health centers to target pregnant women in the Sleman district. Pregnant women who do pregnancy checkups at the community health centers will be given a prescription for blood supplement tablets, and pregnant women who have not been to the community health centers can get blood supplement tablets at the auxiliary health centers until after they do pregnancy checkups at the community health centers. The distribution of blood supplement tablets to students through nutrition programs has been carried out routinely. Puskesmas A did it every three months, and Puskesmas B did it every month. The distribution of blood supplement tablets to schools should be done on a scheduled basis and carried out based on the schedule that has been made, as well as monitored at the school to ensure that the blood supplement tablets given by the community health centers have been given to female students.

Supporting factors for the distribution of tablets added blood in the District Health Center Sleman Regulation

The government has made many regulations regarding giving blood supplement tablets to pregnant women and teenage girls. Minister of Health Regulation No. 51 of 2016 contains standards for nutritional supplementation products; Minister of Health Regulation No. 88 of 2014 contains standards for blood supplement tablets for women of childbearing age and pregnant women, and Minister of Health Regulation No. 21 of 2021 contains health services during pre-pregnancy, pregnancy, childbirth, the postpartum period, contraceptive services, and sexual health services.

The head of the Sleman Regency Health Office supports the blood supplement tablet distribution program by making technical instructions for the implementation of the Stunting Toddler Acceleration Program in Sleman Regency through Instruction Letter Number 183/53/2020 year 2020 by the head of the Sleman Regency Health Office. In the Technical Guidelines, there is an innovation program to prevent the incidence of Stunting babies, namely Getar Thala (movement to overcome juvenile anemia and thalassemia). The technical guidelines include the distribution of blood supplement tablets for young women and the initiative to take blood supplement tablets together at school once a week. The nutrition program manager at community health centers has distributed blood supplement tablets according to the technical guidelines because there are no decrees or technical guidelines on distributing blood supplement tablets from community health centers.

"There is no authorization letter, but the technical guidelines exist from the health office and the ministry. From the health center, there is nothing; follow the technical guidelines of a superior level" (Nutrition 1).

Providing education from health workers to pregnant women

Health workers responsible for maternal and child health programs (KIA/Kesehatan Ibu dan Anak) also provide education on the importance of blood supplement tablets for pregnant women during ANC examinations and in the classes for pregnant women. The Class of Pregnant Women is a group learning about health for pregnant women that aims to improve the knowledge and skills of mothers about pregnancy, childbirth, puerperal care, and newborn care through the practice and use of maternal and child health books facilitated by health care officers.[19] One of the materials presented is a guide on how to take blood supplement tablets.

"Now there are pregnant women classes; the purpose of pregnant women classes is to provide education; in maternal and child health books, there is detailed information about pregnancy, but not everyone reads and understands. So, we will explain the contents of the maternal and child health book."(Auxilliary Health Center 2)

According to the study[20,21] Knowledge affects pregnant women's compliance with taking blood supplement tablets, so the role of health workers in providing education on the benefits of blood supplement tablets for pregnant women is vital.

Availability Of Blood Supplement Tablets

The availability of blood supplement tablets is also a supporting factor in their distribution because the installation pharmacy district always fulfills their availability. Community health centers never purchase blood supplement tablets using their funds. Instead, they request drugs through LPLPO (Lembar Pemakaian dan Lembar Permintaan Obat) every month to installation pharmacy districts to ensure the availability of blood supplement tablets at the community health centers. This is in line with the research results.[22] Drug procurement planning using the Department of Health formulas can improve procurement and ensure drug availability.

"Tablets from the government are always enough, and we never buy them ourselves. According to our needs only. Blood supplement tablets are never slow-moving items, even fast-moving because here, the patient is quite a lot of pregnant women; in one day, it can be 20-25 patients. Because our requests through LPLPO (Lembar Pemakaian dan Lembar Permintaan Obat)are sent to the office every month, it is more regular because it can be evaluated monthly."(Pharmacist 1)

Based on the observation of the management of blood supplement tablets in the community health centers, the availability of blood supplement tablets for more than 12 months is sufficient to meet the needs of blood supplement tablets in the community health centers. Good planning by the target at the beginning of the year is essential to avoid excessive procurement that can cause overstocking and potentially expired tablets.

"So this depends on our coordination and planning at the beginning of that year. The installation pharmacy district will follow our request; how much quantity do we need? We must be clear; for example, the office asked for the high school's target quantity of 1,000 people. Well, it is clear that 1000 a month, they are told to take how many times, and we multiply the number. Later, we also make the buffer stock, for example, about 10% or 20%; it depends on us. So far, that has never been a problem. A pharmacist is committed to ensuring the availability of drugs, so as much as possible to avoid drug shortages"(Pharmacist 2).

Factors inhibiting the distribution of blood supplement tablets in the community health center (Puskesmas) at Sleman Regency

There is no budget for distributing blood supplement tablets

The results of interviews with health workers at the Community Health Center revealed that there was no particular budget for distributing blood supplement tablets to schools and supporting community health centers. At Puskesmas A, blood supplement tablets are distributed by a health center ambulance, and at Puskesmas B, they use their vehicles to distribute blood-added tablets to schools. The results of this research align with the research[8] more funds are needed to distribute blood-added tablets to female students. Meanwhile, research results[9] show a special budget for distributing blood supplement tablets using APBN funds at the Puskesmas Anak Air, APBD, and other sources based on needs. In the Action Plan for the Activities of the Directorate of Management of Public Medicines and Health Supplies for 2020 and 2024, distribution costs are one of the points in assessing the quality management of City Regency pharmaceutical installations.[23]

There is no schedule for distributing and taking blood supplement tablets together at school regularly

The next inhibiting factor in the distribution of blood supplement tablets is the failure to take blood supplement tablets together at school. This is not by the Technical Guidelines from the Head of the Sleman District Health Service. The results of interviews with school medical room teachers showed that only one school routinely took blood supplement tablets every week, and three other schools did not routinely take blood supplement tablets together.

This is also in line with the research[8–10] the distribution of blood supplement tablets to female students has not been effective because there is no schedule for taking blood supplement tablets together at school. There is no monitoring. from the teacher; the female student had already drunk the blood supplement tablets. So, commitment is needed from health workers and *school medical room* teachers to be able to distribute blood supplement tablets on time to female students, accompanied by monitoring whether the female students regularly take the blood supplement tablets that have been given.

There is a lack of outreach from health workers to school medical room teachers and female students, and there is no monitoring of distribution to female students

Another inhibiting factor is the need for more socialization between community health center health workers, school medical room teachers, and female students, causing a lack of knowledge about the benefits of blood supplement tablets for female students. Nutrition officers only distribute blood supplement tablets to schools but do not provide information to school medical room teachers and female students. They do not monitor and evaluate whether school medical room teachers have distributed them to female students.

The results of the research[24–26] show that providing education can increase knowledge and compliance with consuming blood supplement tablets in young women. If female students know the benefits of blood supplement tablets and how to take them correctly, the incidence of anemia in young women can be prevented.

CONCLUSION

The distribution of blood supplement tablets for government programs in Sleman Regency came from district pharmacy installation or what is called UPT POAK (Unit Pelaksana Teknis Pengelolaan Obat dan Alat Kesehatan), distributed to community health centers, then distributed to community health centers pharmacies facility and auxiliary health centers, and high schools for young women as targets and is following government guidelines. The supporting factors in distributing blood supplement tablets in community health centers are regulation, educating pregnant women, and the availability of blood supplement tablets. Inhibiting factors in the distribution of blood supplement tablets were the need for a budget and schedule and the lack of outreach from health workers to school medical room teachers and female students.

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STATEMENT OF ETHICS

This research received ethical clearance from the Faculty of Medicine UGM ethics committee, KE/FK/1502/EC/2023, on September 20, 2023.

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