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Mapping of Pharmacies in Bandar Lampung Municipality: Nearest Neighbor Analysis and Overlay Approach

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ABSTRACT

Background: Pharmacies should improve people's quality of life by providing pharmaceutical services. In this case, the distribution and accessibility of pharmacy facilities play an essential role.

Objectives: This research aims to provide an overview of the distribution of pharmacies in Bandar Lampung municipality and analyze their distribution and accessibility.

Methods: Non-experimental research with descriptive methods was conducted using spatial analysis. All population pharmacies in Bandar Lampung were selected as a sample, and their location was pointed using the Garmin Global Positioning System (GPS). Arc-Gis software was used for data analysis. A nearest-neighbor analysis was conducted to get a distribution pattern, and the pharmacies' density was calculated to obtain accessibility data. The overlapping approach was carried out to determine factors related to pharmacy distribution patterns.

Results: Bandar Lampung municipality has 268 pharmacies spread across 20 districts. This research shows that the average density of pharmacies per 10,000 residents is 2.26. The highest pharmacy accessibility is in Sukarame, with a ratio of 4.07, and the lowest is in Bumi Waras, with a ratio of 0.62. The distribution of pharmacies is a clustered pattern (T value 0.55) and centralizes on collector roads, residential urban land use, and health facilities.

Conclusion: The distribution of pharmacies is odd. They are distributed in a cluster pattern.

Keywords: Global Positioning System; Nearest Neighbor Analysis; Pharmacy; Spatial Analysis

INTRODUCTION

Universal health coverage, particularly access to essential medicines and vaccines that are safe, effective, quality, and affordable for everyone, is a vital component of the Sustainable Development Goals (SDGs).[1,2] Pharmacies have a vital role in the health system, especially for pharmaceutical services that improve patients' quality of life.[3,4] However, the number of pharmacies is not proportional to the population. The pharmacies cluster into health service centers, shopping centers, transportation centers, and main roads.[5–8] The inequality of pharmacies will influence the SDGs goal.[1] Moreover, inequality creates a gap in the accessibility of pharmaceutical services.

Some studies showed a correlation between the distance of a pharmacy, the number of consumer visits, and the number of prescriptions.[8,9] The low accessibility of pharmacies causes additional expenses in the form of transportation costs for the community. Thus, the farther the pharmacy is, the smaller the number of visits and the number of prescriptions, and pharmacy's turnover will dwindle.[8,9] Furthermore, the uneven distribution of pharmacies influences business competition and the quality of pharmaceutical services.[10] In terms of service quality, additional competition pressures pharmacies to create innovation. On the other hand, greater competition interconnects with the violations of regulations existing.[10]

Pharmacy regulations in pharmacy distribution are needed to protect people in obtaining pharmaceutical services. Regulating the distribution of pharmacies is the authority of regional governments. Regional government must focus on public access and community needs. Those correlate with pharmacies' location[11,12]. Geographical location is key to excellent service and customer satisfaction.[7,13] Globally, several countries have implemented regulations regarding pharmacy distance, such as Portugal, England, Finland, and France. This regulation aimed at equalizing and improving health services.[6,14] This policy has been effect as well in various areas of Indonesia, such as Bogor and Bantul.[15,16]

Meanwhile, according to the Indonesian Food and Drug Authority report, the number of pharmacies in Lampung Province increases yearly. In 2018, this number reached 625 pharmacies; by 2020, it went up to 726 pharmacies or increased to around 16.16%.[17] With this trend, the number of pharmacies in Lampung province will continue to rise. The same situation occurs in Bandar Lampung, the number of pharmacies was 241 in 2018 and jumped to 253 pharmacies in 2020.[18,19] Unfortunately, no policy has been concerned about location requirements for pharmacy permits in Lampung Province, and lack of comprehensive data on pharmacy communities.

The density of pharmacies is a standard indicator in assessing pharmacy accessibility. A Geographic Information System (GIS) is computer-based information that can visualize pharmacy locations in the form of mapping, making it easier to analyze pharmacy distribution and public accessibility.[2,4,20] The nearest neighbor on the GIS can analyze the pattern of distribution. Several studies reported that the pharmacies tend to be concentrated on main roads, residential areas, and health/public services.[5–8] There are several supporting factors to consider when distributing pharmacies establishment. Overlay is a method for combining one map on top of another map.[21–23] Mapping analysis using an overlapping approach can explore supporting factors influencing the distribution pattern. Using spatial analysis with an overlapping approach can gather comprehensive factors in pharmacies distribution. Furthermore, this result is a reference for planning regulations in pharmacy permits.[24,25]

This research proposes an overview of the distribution of pharmacies in Bandar Lampung municipality and an analysis of public accessibility to pharmaceutical services. The description of pharmacy distribution can help regional governments make decisions regarding regulatory arrangements for granting new pharmacy permits.

METHODS

Study design

This study was non-experimental research with analytical descriptive methods using nearest neighbor analysis and overlay approach. The location of the research was in Bandar Lampung municipality and was conducted from July to December 2022.

Population and samples

The population consisted of active pharmacies in Bandar Lampung municipality. According to the Bandar Lampung health service report, there were 268 active pharmacies in August-September 2022. The samples determined by total sampling method. As a result of that, the entire population of existing pharmacies, 268 pharmacies, was a sample in this current study.

Study instruments

The pharmacy location was plotted to collect coordinates using the Garmin Global Positioning System (GPS) and analysis using Arc Gis software.

Collected Data

Bandar Lampung Health Service was the primary data source for pharmacies' names and locations. The Central Statistics Agency gathered the population of each district. A digital map representing Bandar Lampung Municipality was obtained from the Institut Teknologi Sumatera (ITERA) database.

Data Analysis

Accessibility calculated the ratio between the number of pharmacies and the population in each district. The distribution of pharmacies was carried out using the Nearest Neighbor Analysis. The nearest neighbor value

index (T) ranges from 0 to 2.15. Analysis of pharmacy distribution patterns using nearest-neighbor analysis produces three possible distribution patterns. First, the T value is 0 – 0.7, and then the distribution pattern is clustered. The second is the T value is 0.7 – 1.4, and then the distribution pattern is random (random pattern). Lastly, the T value is 1.4 – 2.15, and then the distribution pattern is uniform (dispersed pattern). Further analysis is done through an overlapping approach, with the map overlayed on maps of population per district, road class, land use, and community health center facilities.

RESULTS AND DISCUSSION

The Bandar Lampung Municipality covers an area of 197.22 km^2 and consists of 20 districts. It has a population of 1,184,949, with 50.93% male and 49.07% female. The population density is 6,008.26 people/Km^2. The highest population density is in Tanjung Karang Timur (21,563.57 people per km^2), and the lowest is in Sukabumi (3,266.91 people per km^2) (Table I).

The pharmacy density in Bandar Lampung is 2.26. This number means that every 10,000 residents in Bandar Lampung are served by 2 to 3 pharmacies. The International Pharmaceutical Federation (FIP) represents parameters for pharmaceutical workforce density of 1:10,000 population. This parameter is the most common for the description and planning of pharmaceutical services because this accounts for population growth as a measure of need and demand.[26,27] This parameter is in line with Indonesian regulation, SNI No. 03-1733-1989. This regulation regulates one pharmacy to serve 10,000 residents.[28] Based on these parameters, the ratio of pharmacies in Bandar Lampung has met the existing need. However, accessibility varies across 20 districts, ranging from 0.62-4.07 pharmacies per 10,000 residents (Figure I).

The largest distribution pharmacies are concentrated in the Sukarame and Way Halim districts, with 28 pharmacies for each district. The most minor pharmacies are Teluk Betung Timur, Bumi Waras, and Langkapura, with four pharmacies in each district. Compared to the ratio of pharmacies per 10,000 residents, Bumi Waras has the lowest ratio (0.62), and the most significant ratio is in Sukarame (4.07). Some districts, such as Bumi waras, Langkapura, and Teluk Betung Timur, do not meet the ideal ratio of 1 pharmacy per 10,000 residents. This ratio indicates unequal access to pharmaceutical service in each district. This situation will influence the access to pharmaceutical and the rational use of medicines.[29]

Pharmacy density varies globally, being seven times higher in Europe than in Africa, and three times higher in high-income countries compared to low-income countries.[1,4,26,29,30] In Indonesia, West Java, East Java, and Central Java are the provinces with the most significant number of pharmacies[31], correlating with their larger populations.[32] Compared to other regions, Bandar Lampung's pharmacy density is lower than Yogyakarta's (2.52 per 10,000), and Malang's (9.90 per 10,000)[9,25] but higher than Banyumas (0.74 per 10,000), Pekalongan (0.77 per 10,000), and Kebumen (1.8 per 10,000).[7,9,24] Pharmacy density across regions generally correlates with the population size and economic indicators.[2,27,33] Regions with lower economic levels often have fewer pharmacies due to lower population income and fewer pharmaceutical workers.[2,26,27,34]

The Nearest Neighbor analysis shows a clustering pattern in pharmacy locations, with an index distribution value of 0.55 (Figure II.a). Pharmacies are closely spaced in some areas like Tanjung Karang Pusat, Tanjung Karang Timur, Tanjung Karang Barat, Way Halim, and Kedaton, while more spread out in districts like Teluk Betung Timur, Teluk Betung Barat, Teluk Betung Selatan, Sukabumi, and Rajabasa (figure II.b).

The study also reveals that geographic regions are the principal factor related to the density of pharmacies. Figure III.a illustrates that the number of pharmacies in each district sometimes does not align with population size. For instance, Sukarame and Way Halim, with medium populations (58,277 - 87,340 people), each have 28 pharmacies, while similarly populated Bumi Waras and Panjang have only 4 and 9 pharmacies, respectively. Kemiling, with the highest population (>87,340 people), has 22 pharmacies, while Enggal, with the lowest population (<58,277 people), has 6 pharmacies. Pharmacies tend to be located near collector roads, residential and urban land use areas, and close to health facilities. Specifically, 52.27% of pharmacies are near collector roads, 62.04% are in residential and urban areas, and 59,90% are in health facilities (Figures III.b, III.c, and III.d). The diverse topography of Bandar Lampung, ranging from coastal plains to hilly and mountainous areas, influences residential areas and, consequently, pharmacy distribution.

The pharmacy's location must be accessible to provide good services. They commonly will seek the nearest health services. The overlay analysis results in this study were in line with several previous studies.[7–9,24,25] Several factors, such as residential areas, allocation of health facilities, road networks, and topographic

Table I. Distribution of Population Density in Bandar Lampung Municipality in 2022

District	Population	Area (km^2)	Population Density Per km^2
Teluk Betung Barat	41761	11.02	3789.56
Teluk Betung Timur	54746	14.83	3691.57
Teluk Betung Selatan	43564	3.79	11494.46
Bumi Waras	64189	3.75	17117.07
Panjang	82120	15.75	5213.97
Tanjung Karang Timur	43774	2.03	21563.57
Kedamaian	58843	8.21	7167.23
Teluk Betung Utara	54419	4.33	12567.90
Tanjung Karang Pusat	56831	4.05	14032.34
Enggal	29113	3.49	8341.83
Tanjung Karang Barat	66616	14.99	4444.03
Kemiling	90007	24.24	3713.16
Langkapura	44275	6.12	7234.48
Kedaton	58264	4.79	12163.67
Rajabasa	58522	13.53	4325.35
Tanjung Seneng	63175	10.63	5943.08
Labuhan Ratu	53241	7.97	6680.17
Sukarame	68822	14.75	4665.90
Sukabumi	77099	23.6	3266.91
Way Halim	75568	5.35	14124.86
Bandar Lampung Municipality	1,184,949	197.22	6008.26

Source: Statistic Lampung Province accessed on 6 September 2022

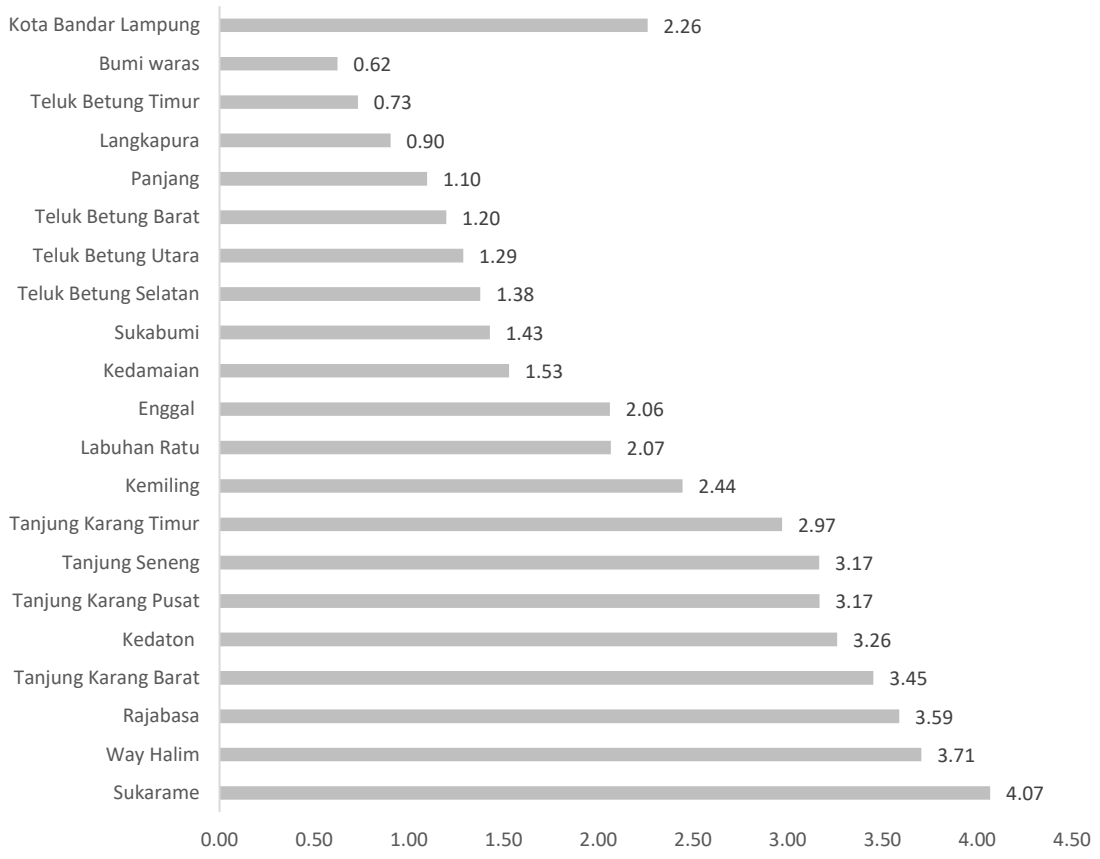
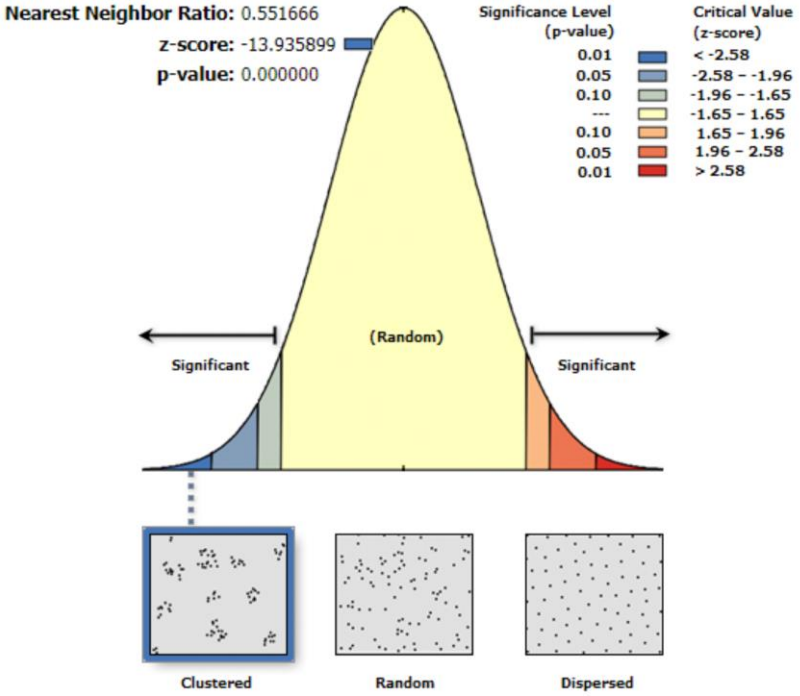


Figure I. The Density of Pharmacies Per 10,000 Population Per District in Bandar Lampung Municipality

conditions, lead to the uneven distribution of health services. The topographic conditions, such as relatively hilly and steep slopes, relate to the limited road network.[30] The distribution of pharmacies in the Banyumas Regency was dominant in urban areas and especially in districts around the capital of regency.[9] In Kebumen and Pekalongan, most pharmacies were in urban areas, located on the side of the arterial, collector, and local



(a) The map of pharmacies distribution; (b) Analysis of Nearest Neighbor Spatial Distribution Patterns

Figure II. The Pharmacies Distribution in Bandar Lampung Municipality in 2022

highways, and tend to be near health service facilities and markets.[7,24] In Malang and Yogyakarta, pharmacies showed uniform results, but this distribution looks uneven and appears clustered in the border district areas.[8,9]

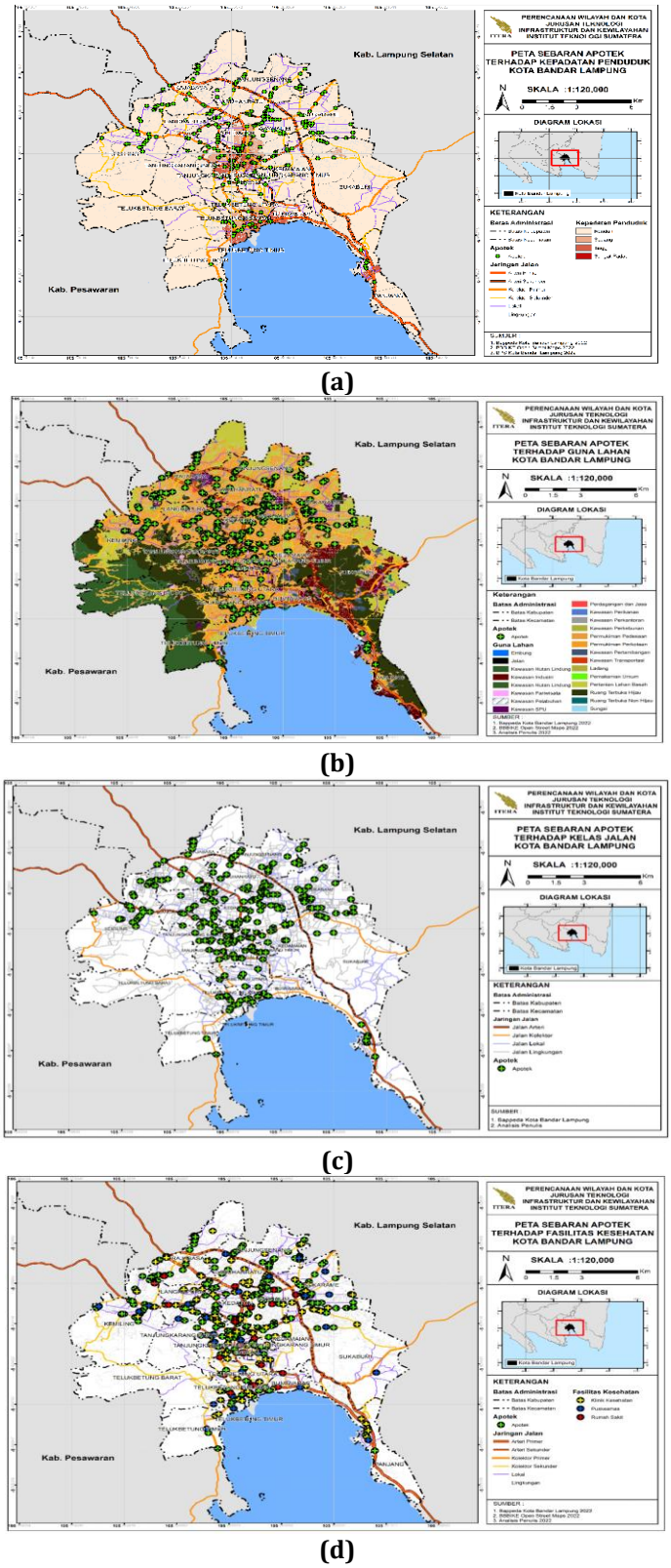


Figure III. Map of Pharmacy Distribution in Bandar Lampung Regency in 2022

(a) Map of the distribution of pharmacies against the population; (b) Map of the distribution of pharmacies by road class; (c) Map of pharmacy distribution relative to land use; (d) Map of the distribution of pharmacies to health facilities

Ensuring equal access to health services, including pharmacies, is essential for reducing morbidity rates and ensuring proper medication use. The regional government of Bandar Lampung needs to improve public accessibility to pharmaceutical services. Regulations should consider pharmacy density to maintain business viability and service accessibility. Establishing pharmacies involves considering the pharmacist's role, which has expanded beyond managing supplies to providing comprehensive pharmaceutical care.[12]

Establishing a pharmacy is related to the pharmacist's location and role in pharmaceutical care.[35] The role of pharmacists has overgrown in recent years, with broader boundaries, not only managing pharmaceutical supplies but also emphasizing providing pharmaceutical care.[26,36] This research focuses on spatial data, highlighting the need for further studies on the role of pharmacists and other factors affecting pharmacy distribution inequality. Additionally, pharmaceutical services are provided not only by pharmacies but also by public and private health centers and hospitals, which were not considered in this study, representing another limitation.

CONCLUSION

The accessibility to pharmacy service is 2.52 per 10,000 residents, which means this is in accordance with existing regulation. However, the distribution of pharmacies is uneven. Pharmacies distribute following a cluster pattern and concentrate on collector roads, residential and urban land uses, and health facilities. The role of the Bandar Lampung government is key in regulating the distribution of pharmacies.

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STATEMENT OF ETHICS

This research obtained ethical permission from the Malahayati University Health Research Ethics Commission with No. 3005/EC/KEP-UNMAL/XII/2022

REFERENCE

1. World Health Organization. SDG Target 3.8. *Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all*. Accessed January 30, 2023. https://www.who.int/data/gho/data/themes/topics/indicator-groups/indicator-group-details/GHO/sdg-target-3.8-achieve-universal-health-coverage-(uhc)-including-financial-risk-protection
2. Tharumia Jagadeesan C, Wirtz VJ. *Geographical accessibility of medicines: a systematic literature review of pharmacy mapping*. *J Pharm Policy Pract*. 2021;14(1). doi:10.1186/s40545-020-00291-7
3. Peraturan Pemerintah Republik Indonesia No 51 Tahun 2019 Tentang Pekerjaan Kefarmasian.
4. Zomrawi N, Eisa E, Elhaj A, Nagi D, Mohammed Z. Assesment of Pharmaceutical Service Ditribution Using GIS. *International Research Journal of Engineering and Technology*. Published online 2020. https://www.researchgate.net/publication/341979877
5. Zaini M, Lazuardi L. Analisis Pola Distribusi Apotek di Kota Banjarbaru Berdasarkan Nearest Neighbor Statistics dan Sistem Informasi Geografis. *Jurnal Pharmascience*. 2016;03(02):1-8. http://jps.unlam.ac.id/
6. Muhammadi Z, Lazuardi L. Analisis Niat Konsumen Dalam Pemanfaatan Pelayanan Apotek. *Jurnal Manajemen dan Pelayanan Farmasi*. 2014;4(1):17-24. doi:10.22146/jmpf.252
7. Dahbul NA, Yasin NM, Lazuardi L. Analisis Distribusi Apotek Berdasar Standar Pelayanan Kefarmasian Melalui Sistem Informasi Geografis. *Majalah Farmaseutik*. 2021;17(1):82. doi:10.22146/farmaseutik.v17i1.52846
8. Sukamdi DP, Lazuardi L, Sumarni. Analisis Distribusi Apotek dengan Sistem Informasi Geografis. *Jurnal of Management and Pharmacy Practice*. 2015;5(1):56-60.
9. Manan A, Iswati Utami P, Siswanto A, et al. Profil Distribusi Apotek di Kabupaten Banyumas berdasarkan Sistem Informasi Geografi dan Korelasinya dengan Jumlah Kunjungan dan Resep Tahun 2019. *Jurnal Kefarmasian Indonesia*. 2021;11(2):142-155. doi:10.22 435/jki.v11i2.3961

10. Jannah MM, Rokhman MR, Saitibi. *Pemetaan Apotek Dengan Geographical Information System Serta Hubungan Kompetisi Terhadap Omset Dan Inovasi Apotek Di Kabupaten Sleman*. Universitas Gajah Mada; 2018.
11. Peraturan Menteri Kesehatan No 9 Tahun 2017 Tentang Apotek.
12. Peraturan Menteri Kesehatan No 14 Tahun 2021 Tentang Standar Kegiatan Usaha Dan Produk Pada Penyelenggaraan Perizinan Berusaha Berbasis Risiko Sektor Kesehatan.
13. Kompil M, Jacobs-Crisioni C, Dijkstra L, Lavalle C. *Mapping accessibility to generic services in Europe: A market-potential based approach. Sustain Cities Soc*. 2019;47. doi:10.1016/j.scs.2018.11.047
14. Fernandes BD, Lírio AF, Freitas RR de, Melchiors AC. *Use of Spatial Analysis to Assess Geographic Accessibility of Community Pharmacies in Sao Mateus. Pharmacology & Pharmacy*. 2013;04(05):438-442. doi:10.4236/pp.2013.45062
15. Peraturan Walikota Bogor No 19 Tahun 2006 Tentang Penyelenggaraan Apotek Dan Pedagang Ecerean Obat.
16. Peraturan Bupati Bantul No 25 Tahun 2012 Tentang Penyelenggaraan Apotek Di Kabupaten Bantul.
17. Badan POM. *Laporan BPPOM Lampung 2018*. 2019.
18. Badan POM. *Laporan Tahunan 2020 Loka POM Di Kabupaten Tulang Bawang*. 2021.
19. Badan POM. *Laporan Tahunan 2020 Balai Besar POM Di Bandar Lampung*. 2021.
20. Monica E, Rega Prilianti K, Lestar I, Caesarika E. Pemanfaatan Sistem Informasi Geografis untuk Analisa Pola Distribusi Apotek di Kota dan Kabupaten Malang. *JMPF*. 2022;12(3):137-152. doi:10.22146/jmpf.67445
21. Tew MM, Hatah E, Arif F, Abdul Wahid MA, Makmor-Bakry M, Abdul Maulad KN. *Geospatial analysis of distribution of community pharmacies and other health care facilities providing minor ailments services in Malaysia. J Pharm Policy Pract*. 2021;14(1). doi:10.1186/s40545-021-00308-9
22. Rafols I, Porter AL, Leydesdorff L. *Science overlay maps: A new tool for research policy and library management. Journal of the American Society for Information Science and Technology.* 2010;61(9):1871-1887. doi:10.1002/asi.21368
23. Deti Marlena HA. Sistem Informasi Geografis Letak Lokasi Rumah Sakit dan Apotek Kota Bengkulu Berbasis Android. *Jurnal Media Infotama*. Published online 2014.
24. Rahayu F, Kristina SA, Lazuardi L. *Analisis Spasial Dan Profil Pelayanan Kefarmasian Apotek Di Kabupaten Kebumen*. 2023. http://etd.repository.ugm.ac.id/
25. Monica E, Prilianti KR, Lestari I, Caesarika E. Pemanfaatan Sistem Informasi Geografis untuk Analisa Pola Distribusi Apotek di Kota dan Kabupaten Malang. *Journal of Management and Pharmacy Practice*. 2022;12(3):137. doi:10.22146/jmpf.67445
26. Bates I, John C, Seegobin P, Bruno A. *An analysis of the global pharmacy workforce capacity trends from 2006 to 2012. Hum Resour Health*. 2018;16(1). doi:10.1186/s12960-018-0267-y
27. Bates I, John C, Bruno A, Fu P, Aliabadi S. *An analysis of the global pharmacy workforce capacity. Hum Resour Health*. 2016;14(1). doi:10.1186/s12960-016-0158-z
28. Standar Nasional Indonesia Tata Cara Perencanaan Lingkungan Perumahan di Perkotaan. Badan Standardisasi Nasional.
29. International Phramaceutical Federation. *Community Pharmacy at a Glance 2021*.; 2021. Accessed May 29, 2024. www.fip.org
30. Geofana A. GIS Application for Health Facility Coverage Mapping in Temanggung Regency, Central Java Province. *Journal of Regional and Rural Development Planning*. 2021;5(3):160-173. doi:10.29244/jp2wd.2021.5.3.160-173
31. Kementrian Kesehatan Republik Indonesia. Profil Kesehatan Indonesia 2020. 2021.
32. Badan Pusat Statistik. *Hasil Sensus Penduduk 2020*. 2021.
33. Faraco EB, Guimarães L, Anderson C, Leite SN. *The Pharmacy Workforce in Public Primary Healthcare Centers: Promoting Access And InformationoOn Medicines*. *Pharm Pract (Granada)*. 2020;18(4):1-7. doi:10.18549/PharmPract.2020.4.2048
34. Bates Ian, Meilianti Sherly, John Christopher, Bader LR, *Fédération internationale pharmaceutique. Pharmacy Workforce Intelligence : Global Trends Report. International Pharmaceutical Federation*; 2018.

35. Peraturan Menteri Kesehatan No 73 Tahun 2016 Tentang Standar Pelayanan Kefarmasian Di Apotek. 2016.
36. Todd A, Copeland A, Husband A, Kasim A, Bambra C. *The Positive Pharmacy Care Law: An Area-Level Analysis of The Relationship Between Community Pharmacy Distribution, Urbanity and Social Deprivation in England. BMJ Open*. 2014;4(11). doi:10.1136/bmjopen-2014

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Perceptions, Expectations, Reality, and Public Confidence Regarding the Role of Pharmacists in Pharmacy Services in Bandung

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ABSTRACT

Background: The shifting from the old paradigm to the new paradigm with the philosophy of pharmaceutical care demands pharmacists to enhance the quality of pharmaceutical services. However, this role has not been optimally fulfilled, especially in the community setting.

Objectives: This study aimed to identify the perceptions and expectations, the gap between expectations and reality, and public confidence as well as to analyze the relationship between sociodemographic factors and the perceptions, expectations, and public confidence in Bandung City regarding the role of pharmacists in pharmaceutical services.

Methods: A cross-sectional study was conducted using a validated survey instrument with 440 respondents in Bandung, West Java, from March to April 2023. The survey data were analyzed descriptively and through inferential statistics.

Results: The analysis showed that 58.41% of the community had a positive perception, 56.82% had high expectations, the average gap between expectations and reality was 14.04%, and more than 51.36% had a high level of public confidence in pharmacists. Sociodemographic factors influencing perceptions were age and the highest level of education ($p = 0.005$; $p = 0.003$), factors influencing public confidence were age, the highest level of education, residence address according to ID card (KTP), and occupation ($p < 0.001$; $p = 0.034$; $p = 0.001$; $p = 0.001$), and the factor influencing expectations was the residence address according to ID card (KTP) ($p = 0.043$). A correlation was found between the dimensions of perceptions, expectations, and public confidence.

Conclusion: Most participants held a positive perception, had high expectations, and shown high confidence in the pharmacist's position, despite the existence of a disparity between expectations and the actual provision of pharmacy services. The elements of perception, expectations, and confidence are interrelated.

Keywords: expectations; perceptions; pharmacists; public confidence; reality

INTRODUCTION

A pharmacist is a healthcare professional who specializes in the field of medicine and is committed to serving humanity. Every pharmacist must prioritize the well-being of the patient or the broader public as their main focus. As per the Law of the Republic of Indonesia (Undang-Undang Republik Indonesia) No. 36 of 2009, specifically section 108 on Health and Government Regulations of the Republic of Indonesia (Peraturan Pemerintah Republik Indonesia) No. 51 of 2009, pertaining to Pharmaceutical Work, the provision of pharmaceutical practice or services must be conducted by qualified health personnel, specifically pharmacists, who possess the necessary competence and authority as outlined in the relevant laws and regulations.[1,2] Nevertheless, in Indonesia, not all pharmacists exhibit or deliver pharmaceutical services at their highest level of

effectiveness.[3,4] Pharmacy services play a significant role in enhancing public health.[3] Indonesia has implemented standardization measures on pharmaceutical services in Hospitals, Puskesmas, and Pharmacies to ensure and uphold the quality of pharmacy service. These measures involve the pharmacist as a central character, as outlined in Permenkes No. 72 Year 2016, No. 26 Year 2020, and No. 73 Year 2016. Regarding the level of pharmaceutical services, it encompasses two aspects: the management of pharmacy supplies, medical equipment, and utilized medicinal materials, as well as clinical pharmacy services. The primary objective of pharmaceutical services is to detect, prevent, and address drug-related issues (DRPs), while also ensuring that patients derive maximum benefit from their medication.[5]

In recent years, there has been a rise in public health demands, particularly with the emergence of the Covid-19 pandemic, which necessitates pharmacists to enhance the standard of pharmaceutical services.[6] These events are providing more evidence for the necessity of broadening the traditional drug-focused paradigm to incorporate a new patient-centered paradigm that aligns with the principles of pharmaceutical care.[7] An essential prerequisite for achieving successful Pharmaceutical care is the establishment of a strong rapport among the pharmacist, the patient, and the community.[8] Pharmacists and patients or communities have a mutually dependent relationship, relying on each other for their respective needs. The patient's outcome or appearance will be contingent upon the conduct or deeds of the pharmacist as a healthcare practitioner, and vice versa. To cultivate a favorable image, it is essential for the pharmacist to establish emotional connections, foster trust, facilitate communication, encourage motivation, and engage in social engagement with patients and society. An additional crucial element that contributes to the effectiveness of pharmaceutical services is the comprehension of the needs, perceptions, and expectations of the general public.[8]

The description indicates the necessity of conducting research on understanding public attitudes and expectations regarding the role of the pharmacist in pharmaceutical services. Having a favorable public perception is crucial for establishing a positive image of the pharmacist's profession. Consequently, pharmacists are anticipated to have the opportunity to uphold and enhance the quality of pharmaceutical services. Pharmacists might acquire the unfavorable opinion of society by examining and reassessing their position in the provision of pharmacy services. A survey conducted in Saudi Arabia revealed that 72.8% of the participants acknowledged that pharmacists had supplied them with unambiguous instructions on drug information. Additionally, 70.2% of the respondents expressed trust in the pharmacist's professional opinion about drugs, while 64.8% reported being content with the services rendered by the pharmacist.[5] A further survey revealed that 52.9% of favorable opinions and 47.1% of unfavorable opinions were created among the populace of Dusun Bandung Hilir about the pharmacy's function in providing pharmaceutical services.[9] Differences in the distribution of sociodemographics and cultural backgrounds will give rise to varying attitudes and expectations within societies. This research aims to ascertain the public's perceptions, expectations, and confidence regarding the role of pharmacists in pharmaceutical services in the City of Bandung. It also seeks to determine if there is a disparity between societal expectations and reality. Additionally, the study will analyze the relationship between sociodemographic characteristics and the population's perception, expectation, and confidence in this regard.

METHODS

Study design

This study is a cross-sectional analytical survey that combines inferential and descriptive-observational methods.

Population and samples

The research participants were selected from the population residing in Bandung City, with the inclusion criteria being those aged 17 years or older living in Bandung city. The study excludes individuals who are professionals in the field of pharmacy (such as pharmacists or pharmaceutical technical staff), individuals who are currently pursuing an education in pharmacy or are licensed pharmacists, individuals who do not fully complete the questionnaire, and individuals who choose to withdraw their participation in this research. The sample size, calculated using the Slovin formula and accounting for a 10% margin of error, is 400 respondents. Additionally, 10% of this number, which is 40 respondents, is added as a precautionary measure to account for any potential exclusions. Therefore, the total number of respondents is 440. The sample technique employed in this work was non-probability sampling where the researcher deliberately picks individuals for the sample by sharing the questionnaire link via various online platforms and visiting public spaces across Bandung.

Study instruments

The study utilizes primary data sources acquired through the distribution and completion of questionnaires to the community in Bandung. The questionnaires are disseminated via diverse online platforms like Instagram, Line, Whatsapp, Gojek, Grab, Shopee, and Indriver. The questionnaire is disseminated to the general public through both Google Forms and printed copies. Researchers distribute a paper-based questionnaire to target individuals who lack access to Google Form and are challenging to contact through digital forms in public spaces.

We used the following operational definitions (perceptions, expectations, reality, public confidence) to develop this instrument. Perceptions are individualized interpretations of the existence and role of pharmacists in pharmacy services, shaped by personal experiences, knowledge, and beliefs including both positive and negative perceptions. Expectations are defined as anticipations of what pharmacists ought to be able to do and how they should contribute to pharmacy services derived from the national regulation. Reality is the actual state of pharmacist roles and contributions within pharmacy services in Bandung, Indonesia. Public confidence is the level of trust and faith that the public has in the ability of pharmacists to fulfill their roles and meet expectations within pharmacy services.

The initial section of the questionnaire comprises information pertaining to the respondents' identity and sociodemographic characteristics. The second component consists of a questionnaire aimed at determining the public's perceptions (regarding the existence and competence of pharmacists), expectations, and confidence regarding the function of the pharmacist in the pharmaceutical service. This questionnaire is divided into four sections: Existence of pharmacist, competence of pharmacist, expectations towards pharmacist, and public confidence toward pharmacist.

Public's perceptions were measured by perception towards existence and competence of pharmacist. Questions on existence were divided into two categories: the presence of a pharmacist at a hospital or community health center, and the presence of a pharmacist in a pharmacy. This section includes four questions in a Yes/No format, identified by the question codes S1-S4. There is no definitive correctness or incorrectness in this part, allowing respondents to provide replies based on their personal feelings or experiences. Respondents who provided an affirmative response were assigned a rating of 1, while those who responded negatively were given a score of 0. The competence section consisted of 14 questions in the Yes/No format, identified by the question codes K1-K14. The questionnaire in this part is derived from the Decree No. 058/SK/PP.IAI/IV/2011 issued by the Central Committee of the Indonesia Pharmacist Association (IAI), outlines the standards for competence expected of Indonesian pharmacists.[10] Respondents who provided right answers were assigned a rating of 1, while those who gave erroneous responses were assigned a score of 0.

The Expectations and Realities part consists of eight questions, each labeled with question codes E1-E8 and R1-R8. Questions pertaining to expectations and reality are aligned in order for respondents to compare their expectations of the pharmacist's role with the actual experience they perceive when getting pharmacy services. Participants have the option to provide the responses they consider most suitable. The assessment of high and low expectations is based on the mean value of the overall scale selected by the participants when responding to eight questions regarding the public's expectations for the pharmacist's role. The maximum achievable score is thirty-two points. Respondents whose scores are at or above the category average have high expectations, whereas respondents with scores below the category average have low expectations.

The public confidence was assessed by four questions labeled with the P1-P4 question code. Participants have the option to provide the answer they deem most suitable. The answers to expectations, realities, and public confidence are measured on an objective scale ranging from 1 to 4. The scale values are as follows: 1 represents "Very Disagree," 2 represents "Disagree," 3 represents "Agree," and 4 represents "Very Agree."

Positive public perceptions, high expectations and high public confidence can be inferred when over 50% of the respondents exhibit an average score greater than 2.

The validity and reliability of the questionnaire questions have been assessed on a sample of 39 randomly selected respondents, in accordance with the specified inclusion and exclusion criteria. As part of the validation process, we calculated Pearson's correlation coefficient between the score of each question and the total score of questions within the same section. We retained only items with an absolute correlation coefficient greater than 0.304 ($r > 0.304$). The reliability test utilizes Cronbach's Alpha coefficient ($\alpha = 0.6665$ for ability, 0.8288 for expectation, 0.8098 for reality, and 0.4975 for confidence).

Data Analysis

The questionnaire data is examined using univariate and bivariate methods to determine the correlation between two variables in the questionnaire. Univariate analysis results were reported as total numbers and percentages while bivariate analysis was applied through correlation analysis (Cramer's V correlation). The independent variable in this study is a sociodemographic component. The related variable pertains to the opinion and expectations of the residents of Bandung City regarding the role of pharmacists in providing pharmacy services. The Chi-Square and Cramer's V[11] tests are conducted using Minitab v21.1 software.

RESULTS AND DISCUSSION

Participant characteristics

A total of 440 individuals from the Bandung community participated in this study, with demographic characteristics as outlined in Table I.

The majority of respondents were young individuals, specifically between the ages of 17 and 24, accounting for 72.27% of the total. Furthermore, 63.86% of the respondents identified themselves as students. According to a survey conducted by BPS Kota Bandung[12], the population in Bandung City is predominantly youth, with the lowest proportion being senior individuals. The survey found that the majority of respondents were female, as determined by their gender. The majority of respondents have earned a high school education or a similar level of education, with the last level of education being primary school or an equivalent level. This data aligns with the BPS Kota Bandung[12] statistics, which indicates that the majority of people in Bandung have completed high school or an equivalent degree, while the lowest percentage is comprised of individuals who have not graduated from primary school (5.08%). When examining the respondents of this study from the perspective of their place of residence, it is evident that the majority of them are residents of Bandung City who possess a KTP (identity card) issued by the city. The respondents with income ranging from Rp. 1,000.001 to Rp. 5,000,000 were the highest followed by those with income ranging from Rp. 500.001 to Rp. 1,000,000. The least number of respondents had an income ranging from Rs 10,000.001 to Rp. 15,000,000. This is feasible due to the prevalence of student dependency, whereby the money is derived from a third party (such as a parent or grandfather) and is presumed to be derived from non-permanent employment.

Each data presented is discussed comprehensively in one flow: presenting the data, comparing it with other similar research, and putting forward relevant theories related to the existing data.

Discussion must explore the significance of the results of the study. Adequate discussion or comparison of the current results to the previous similar published articles should be provided to show the positioning of the present research (if available).

Perception of pharmacists' existence as viewed by the residents of Bandung

Perception is contingent upon the attributes of the surrounding environment and the objects inside it, as such, existence serves as a means to discern and comprehend perception.[13] The majority of respondents, over 85%, indicated that they could differentiate a pharmacist from other pharmaceutical technicians and believed that pharmacists should utilize identity signs (Table II). Curiously, only approximately 70% of individuals are capable of perceiving the existence of a pharmacist. One potential explanation is that most participants perceive that they are not attended to by a pharmacist, but rather by another healthcare professional, such as a pharmacy technician. Aside from the physical presence of pharmacists in healthcare facilities and their readiness to directly serve patients, it is necessary for pharmacies to consistently utilize a unique identification symbol, such as professional attire with the pharmacist's name, to enable the public to easily identify and perceive their presence within the healthcare facility. The findings of this study were lower than two previous studies conducted in Saudi Arabia, which indicated that 70-80% of participants perceived the presence of a pharmacist in the pharmacy.[14,15]

Perception of pharmacists' competency by the general public

There are a total of fourteen binary questions for the purpose of analyzing perception. The respondents provided responses regarding the pharmacist's competency based on their knowledge, personal experiences, and feelings. The assessment of positive and negative views is derived from the mean sum of accurate scores. The maximum cumulative score is fourteen points. Respondents with scores equal to or above the average are classified as having positive perceptions, whilst respondents with scores below the average are labeled as having

negative perceptions. Figure 1 displays a chart illustrating the replies of the participants to the fourteen questions in the pharmacist's competency section.

Table I. Respondent Demographic Data

Characteristics (n = 440)	N	%
Age (years)		
17 – 24	318	72,27
25 – 34	46	10,45
35 – 44	25	5,68
45 – 54	27	6,14
55 – 64	21	4,77
≥ 65	3	0,68
Sex		
Male	202	45,91
Female	238	54,09
Education		
Elementray school	9	2,05
Junior high school	11	2,50
Senior high school	265	60,23
Diploma (D1/D2/D3/D4)	23	5,23
Bachelor (S1)	121	27,50
Masters (S2)	11	2,50
Domicile based on KTP		
Bandung City	251	57,05
Other than Bandung City	189	42,95
Profession		
Students	281	63,86
Working	130	29,55
Not working	29	6,59
Income (per month)		
Rp0 – Rp500.000	109	24,77
Rp500.001 – Rp1.000.000	75	17,05
Rp1.000.001 – Rp5.000.000	177	40,23
Rp5.000.001 – Rp10.000.000	49	11,14
Rp10.000.001 – Rp15.000.000	13	2,95
> Rp15.000.000	17	3,86

Table II. Respondents' Responses to Questions Related to the Existence of Pharmacists

Questions Related to Existence	n (%)
Able to Distinguish Pharmacists from Pharmacy Technicians	187 (85)
Pharmacists Should Use Identification Marks	418 (95)
Can Feel the Presence of Pharmacists	304 (69,09)

Figure 1 displays two questions with a correct response percentage below 50%. These questions pertain to the right to suggest alternative medication (K8) and the pharmacist's duty to oversee the effectiveness of patient treatment (K6). This occurrence can be attributed to a significant likelihood that the respondents have misconstrued the responsibilities and duties of the pharmacist. Pharmacists have a crucial role in ensuring patient safety, particularly through their prescription review activities.[16] Pharmacists may have the power to suggest other options when there is a shortage of medications, discrepancies in dosage, potential drug and allergy interactions, severe side effects for the patient, and other factors that could affect the patient. Prior confirmation of drug replacement will be provided to the doctor. When a patient desires to purchase a drug that is either free or available at a reduced cost, the authorized pharmacist provides education and guidance to assist the patient in selecting the appropriate medication, ensuring its efficacy and safety. In addition, the pharmaceutical services standard states that pharmacists are responsible for overseeing the effectiveness of patient therapy through

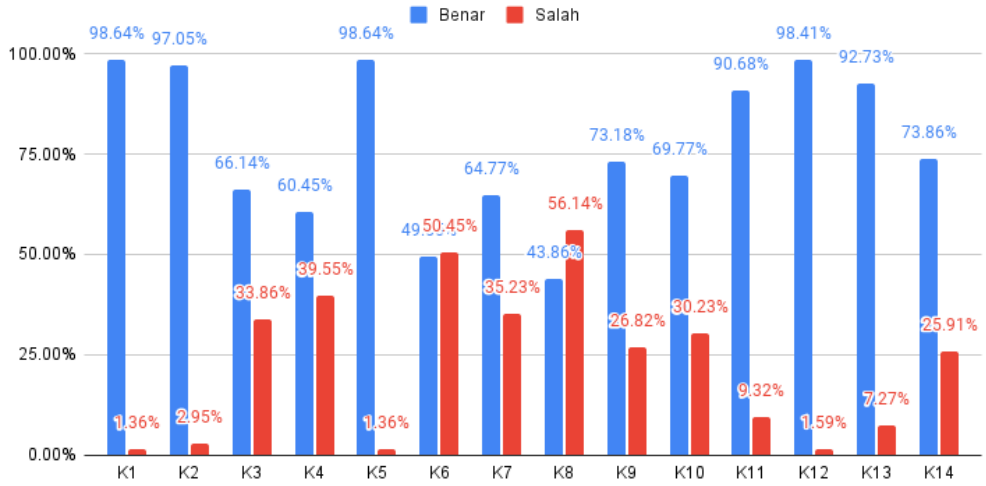

Figure 1. Distribution Chart of Responses to the Pharmacist Competency Section. Details of the questions are provided in the appendix. Blue: Correct; Red: Incorrect.

Drug Therapy Monitoring (PTO), monitoring drug side effects (MESO), providing home pharmacy care, conducting Drug Use Evaluation (EPO), offering counseling, and fostering positive interpersonal relationships with patients.

Correlation between sociodemographic characteristics and perception

The research in Table III revealed a significant correlation between age and perception of the population in Bandung (p = 0.005). According to Stephen P. Robins and David Krech in Prasilika, Tiara (2007)[17] study, one of the aspects that affects how we perceive things is our frame of experience, which is shaped by our past experiences. However, the study found that respondents aged 17-24, who were in their younger years, had a stronger inclination towards positive impression compared to older individuals. The influence of reading on an individual's frame of reference, which is a knowledge framework that determines perception, may be a contributing component to this phenomenon.[17] Adolescents and young professionals often possess idealistic and generative qualities that are influenced by their reading materials and surroundings, resulting in a utopian perspective. The results of this study are in direct opposition to earlier research which claimed that age (p = 0.69; p = 0.29) had no association with society's perceptions.[8,9]

The educational level significantly affects public perception in Bandung (p = 0.003). In summary, Table III demonstrates a direct correlation between a person's level of education and the formation of more favorable opinions. According to Haloho, et.al., perception is influenced by the frame of experience, which is determined by education, in accordance with the theory proposed by Stephen P. Robins and David Krech[17] An individual with a high level of education is more likely to have a broad perspective and a positive outlook. Nevertheless, the findings contradict the study conducted by Jose et al.[8], which suggests that there is no significant difference in the amount of education in relation to the perceptions established by society (p = 0.774).

The statistical analysis indicates that gender does not have a significant impact on public perception in Bandung (p = 0.121). This aligns with the previous reports indicating that gender does not exhibit any link with the perception created in society (p= 0.752; p= 0.982).[8,9] The KTP location (p= 0.785), employment (p= 0.083), and average monthly income (p= 0.696) do not have any discernible impact on public preception. According to Suprayogi's research,[9] there is no significant relationship between employment, average monthly income, and public impression (p = 0.148; p = 0.278).

The public's expectations towards pharmacists and the actual reality

Surprisingly, the respondents' perception of reality did not align with the high expectations (58.62%). This was evident when comparing the scores of the reality-related questions (R1 to R8) in Figure 2, which were lower than the scores of the expectation-related questions. (E1 to E8). The highest disparity (-21.95%) between expectations and reality is observed in situations where the patient needs to communicate with the pharmacist. The subsequent largest disparity is observed in inquiries pertaining to the requirement of self-introduction (-21.38%), the willingness of the Pharmacist to engage in treatment discussions (-14.42%), the necessity of

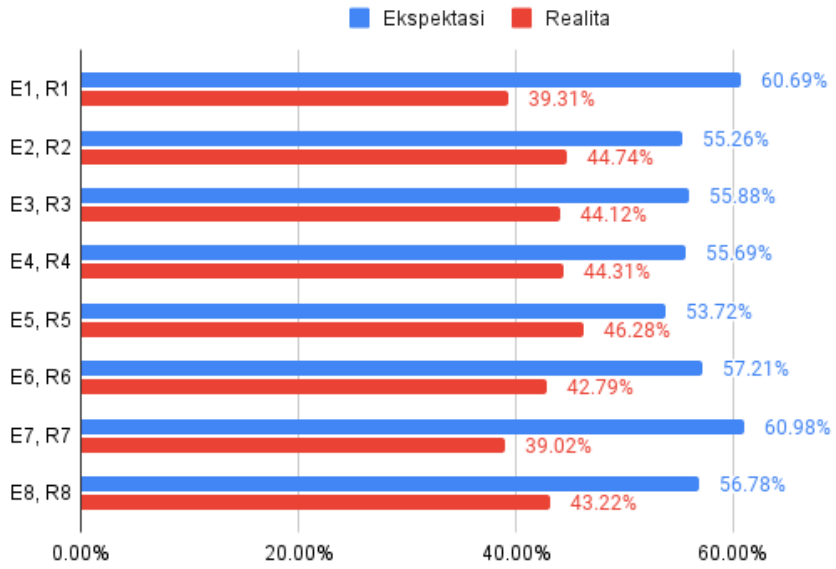

Figure 2. Distribution Chart of Responses to the Expectations and Reality Section Regarding Pharmacists. The detailed codes and questions can be found at the Supplementary. Blue: Expectation; Red: Reality.

Table III. Correlation of Sociodemographic Factors with Public Perception

Characteristics	Cramer's V Correlation	p value	Interpretation
Age	0,195	0,005*	Strong
Sex	0,074	0,121	Weak
Education	0,202	0,003*	Strong
Domicile (KTP)	0,013	0,785	Moderate
Occupation	0,106	0,083	Moderate
Average monthly income	0,083	0,696	Weak

Note: (*) = significant difference (*p value* < 0,05)

empathy and establishing a positive emotional rapport with the patient (-13.55%), the entitlement to substitute the prescribed treatment (11.76%), the duration of waiting for the preparation of medications and non-medicinal items (-11.37%), the duty to provide thorough and accurate responses to inquiries (-10.52%), and ultimately, the responsibility to ensure the comprehensiveness and clarity of the drug label (-7.43%).

Correlation between socio-demographic factors and expectations

The analysis results (Table IV) demonstrated the impact of KTP location on the population's expectations in Bandung on the role of pharmacists in pharmaceutical services (p = 0.043). Bandung's reputation as a patient referral health center in West Java may explain the expectation for a more robust healthcare infrastructure. Individuals with a positive history of getting pharmaceutical services are more likely to hold elevated expectations for future experiences.[18] Public expectations are shaped not only by personal experience but also by other sources of information. The Internet provides convenient access to urban sources of information. According to the data from BPS Kota Bandung[12], 69.22% of Internet users obtain information.

Furthermore, age, gender, last education, employment, and average monthly income elements do not exert any influence on people's expectations. Contrary to Johnson and Lewis's assertion in Kriskovich, Tanner (2012)[19], which asserts that the demography, gender, culture, and hierarchy present in social societies impact one's expectations, there is a contradiction. In the realm of healthcare, patient expectations can be shaped by various factors such as the patient's comprehension of the disease, cultural heritage, health belief, attitudes, and knowledge levels, as well as other demographic characteristics.[20] Regarding the educational aspect, the p-value exceeds 0.05, indicating a lack of statistical significance. However, there is a robust link with expectations. If the distribution of respondents is uniform or the sample size is increased, there is a potential for the analysis results to demonstrate the impact of education on public expectations.

Table IV. Correlation of Sociodemographic Factors with Public Expectations

Characteristics	Cramer's V Correlation	p value	Interpretation
Age	0,1038	0,448	Moderate
Sex	0,0255	0,592	No/Very weak
Education	0,1543	0,063	Strong
Domicile (KTP)	0,0963	0,043*	Weak
Occupation	0,0957	0,133	Weak
Average monthly income	0,0998	0,495	Weak

Note: (*) = significant difference (*p value* < 0,05)

Table V. Percentage of Scores for Each Aspect of Public Confidence Compared to the Total Score

Public confidence aspects	Percentage of Total Score (%)
P1 = Confidence in the information provided by pharmacists about drugs	27.5
P2 = Confidence in the expertise of pharmacists as healthcare professionals	24.8
P3 = Confidence in the responsibility of pharmacists in patient treatment	24.1
P4 = Confidence in the importance of the role of pharmacists	23.6

Public confidence in pharmacists

According to Ni Luh Putu et al.[21] trust that can influence public perception. Table V displays the mean aggregation of responses from participants for four questions related to their level of confidence in the pharmacist. This image illustrates that inquiries pertaining to the trustworthiness of drug information provided by pharmacists had the highest mean percentage of cumulative responses (27.5%). This parallels a study conducted by Tjong[22], which demonstrated that the highest level of confidence is associated with the provision of information pertaining to medications. The questions pertaining to the pharmacist's secondary duty had the lowest average accumulation percentages of replies, specifically at 23.6%.

While there may not be any notable disparities among aspects, a majority of over 50% of the people in Bandung possesses a strong level of trust in pharmacists. It is desirable for pharmacists to persist in upholding and improving their role in pharmaceutical services. (Table VII).

The correlation between sociodemographic characteristics and public confidence

Table VI demonstrates significant associations between age, level of education, place of residence, profession, and the public's confidence of the pharmacist's position in the pharmaceutical service ($p < 0.001$; $p = 0.034$; $p = 0.001$; $p = 0.001$). The findings are consistent with other research that shown the impact of age-related factors on the level of trust the public has in the information provided by pharmacists.[23] Elena's study (2021) found that the educational criteria did not have any impact on public trust, contradicting previous research. Communities outside of Bandung (based on KTP) generally exhibit a greater average level of confidence than those within Bandung. In the future, researchers should include inquiries regarding the frequency of pharmacy visits at a specific healthcare facility to enhance the conclusiveness of the analysis findings. Additional research indicates that one's employment status does not serve as a distinguishing feature that influences public confidence.[23]

Public confidence is unaffected by gender variables and average monthly income. Women exhibit the highest average level of confidence in relation to the gender factor. Communities with an income range of Rp. 10,000.001 – Rp. 15,000,000 exhibit the highest average confidence level in terms of monthly income. The study's findings align with the research conducted by Elena Druica et al.[23], which asserts that public trust is unaffected by an individual's gender and average wealth.

Interdimensional correlation analysis

Table VII indicates that around 58% of participants had a positive preception regarding the role of pharmacists in pharmacy services. Nevertheless, there are still some who maintain a pessimistic viewpoint. The previous study found that 52.9% of the community in Dusun Banung Hilir had a positive perception of the role of the pharmacist.[9] A study conducted in Sokaraja district revealed that 63.64% of the society held positive

Table VI. Correlation of Sociodemographic Factors with Public Confidence

Characteristics	Cramer's V Correlation	p value	Interpretation
Age	0,2518	0,000*	Very strong
Sex	0,0752	0,115	Weak
Education	0,1657	0,034*	Strong
Domicile (KTP)	0,1646	0,001*	Strong
Occupation	0,1769	0,001*	Strong
Average monthly income	0,0756	0,774	Weak

Note: (*) = significant difference (*p value* < 0,05)

Table VII. Categories of Public Perceptions, Expectations, and Trust Towards Pharmacists

Aspects	n	%
Positive Perceptions	257	58,41
High Expectations	250	56,82
High confidencei	226	51,36

Table VIII. Correlation Analysis Among Dimensions using Cramer's V Test

Dimension	Perceptions		Expectations		Confidence	
	Cramer's V	p-value	*Cramer's V*	p-value	*Cramer's V*	p-value
Perceptions	-	-	0,1394	0,003*	0,2398	<0,001*
Expectations	0,1394	0,003*	-	-	0,1614	0,001*
Confidence	0,2398	<0,001*	0,1614	0,001*	-	-

Note: (*) = significant difference (*p value* < 0,05)

attitudes regarding the functions of pharmacists.[24] Several research have indicated that, on the whole, individuals residing in urban areas tend to possess a more prevalent inclination towards negative perceptions rather than positive ones. A comprehensive analysis revealed that 10 out of the 11 studies examined consistently demonstrated that the general public held a favorable assessment of community pharmacists' endeavors in mitigating and managing cardiovascular diseases[25]. Additional systematic research have similarly indicated favorable perceptions and attitudes towards community pharmacists [26]. More than 50% of the respondents exhibited elevated expectations and confidence in the pharmacist.

Third-dimension correlations are established to facilitate the tracking of misunderstandings and discrepancies between community expectations and actual conditions, as experienced by the residents of Bandung, by pharmacists and local government authorities. (Table VIII).

The dimensions of perception and expectation exhibit statistically significant connections with average categories. To our knowledge, limited studies have endeavored to explore the correlation among perceptions, expectations, and public confidence regarding services provided by pharmacists. We have encountered only one study from Saudi Arabia which reported a strong and positive correlation between public perception and attitude ($r = 0.71$, $p < 0.01$).[27] These findings align with our own study, which underscores a moderate to strong and statistically significant correlation among these dimensions. Other studies by Miftah Toha[28] asserted that an individual's expectations are the erroneous component that influences perception. Furthermore, there exists a robust and statistically significant association between perception and public confidence. This correlation suggests that the higher the public perception of the pharmacist, the greater the public confidence in their abilities.[29] This aligns with Tang and Sporrong's assertion that hope influences an individual's confidence in the pharmacy profession.[30] By examining the three outcomes of the analysis, the pharmacist can comprehend the importance of trust in addressing misconception.

The strengths and limitations

The research is limited by its failure to address the frequency of visits to healthcare facilities, the geographical distribution of health facilities, and the role of healthcare providers in analyzing public views and expectations.

However, this study is notable for its substantial sample size and unique focus on Bandung City as the primary demographic, which sets it apart from previous studies. Bandung City was selected due to its status as the capital of Java Bawat, the hub for patients in West Java. Furthermore, in contrast to prior research that solely examined perception and satisfaction, this study specifically examines the dimensions of perceptions and expectations. This is because public satisfaction with pharmaceutical services cannot be attained without analyzing the disparity between expectations and actuality. To the best of the researchers' knowledge, this study is unique in its integration of elements such as existence, competence, and public confidence to examine society's perceptions.

CONCLUSION

Most participants held a positive perception, had high expectations, and shown high confidence in the pharmacist's position, despite the existence of a disparity between expectations and the actual provision of pharmacy services. The sociodemographic elements that impact perception include age and education level. The factors that affect confidence are age, education level, KTP domicile, and occupation. The characteristics that influence expectations is KTP domicile. The elements of perception, expectations, and confidence are interrelated.

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STATEMENT OF ETHICS

The research has received ethical approval from the Ethics Commission of Bandung Health Polytechnic, Ministry of Health, with the reference number 122/KEPK/EC/II/2023, on 24 February 2023.

REFERENCES

1. Undang-undang (UU) Nomor 36 Tahun 2009 tentang Kesehatan. In. Jakarta2009.
2. Peraturan Pemerintah (PP) Nomor 51 Tahun 2009 tentang Pekerjaan Kefarmasian. In. Jakarta2009.
3. Peran Apoteker Komunitas Dalam Peningkatan Derajat Kesehatan Indonesia. Fakultas Kedokteran dan Ilmu Kesehatan UIN Syarif Hidayatullah; 2015. https://repository.uinjkt.ac.id/dspace/handle/123456789/52330.
4. Parera MMW, Kristina SA, Yasin NM. Implementasi Standar Pelayanan Kefarmasian di Apotek Kupang. *JURNAL MANAJEMEN DAN PELAYANAN FARMASI (Journal of Management and Pharmacy Practice).* 2021;11(3).
5. El-Kholy AA, Abdelaal K, Alqhtani H, Abdel-Wahab BA, Abdel-Latif MMM. Publics' Perceptions of Community Pharmacists and Satisfaction with Pharmacy Services in Al-Madinah City, Saudi Arabia: A Cross Sectional Study. *Medicina.* 2022;58(3).
6. PERAN APOTEKER DALAM PELAYANAN KEFARMASIAN DI MASA PANDEMI COVID-19 [press release]. 2020.
7. Peraturan Menteri Kesehatan Nomor 72 Tahun 2016 tentang Standar Pelayanan Kefarmasian Di Rumah Sakit. In. Jakarta2016.
8. Jose J, Al Shukili MN, Jimmy B. Public's perception and satisfaction on the roles and services provided by pharmacists – Cross sectional survey in Sultanate of Oman. *Saudi Pharmaceutical Journal.* 2015;23(6):635-641.
9. Suprayogi H. *Persepsi Masyarakat Dusun Baning Hilir terhadap Peran Apoteker dalam Pelayanan Kefarmasian*. Yogyakarta: Pharmacy, Universitas Islam Indonesia; 2020.
10. PP-IAI. Surat Keputusan Pengurus Pusat Ikatan Apoteker Indonesia No. 058/SK/PP.IAI/IV/2011 tentang Standar Kompetensi Apoteker Indonesia. In:2011.
11. Akoglu H. User's guide to correlation coefficients. *Turk J Emerg Med.* 2018;18(3):91-93.
12. Data Sensus Kota Bandung. 2023. https://bandungkota.bps.go.id/subject/12/kependudukan.html#subjekViewTab3.
13. Ismayanti, Siswoyo M, Wulandari S. PERSEPSI TOKOH MASYARAKAT TERHADAP EKSISTENSI LEMBAGA KEMASYARAKATAN DESA (Studi Kasus di Desa Curug Kecamatan Kandanghaur Kabupaten Indramayu). *Jurnal Ilmiah Publika.* 2017;5(1).

14. Alghurair SA, Simpson SH, Guirguis LM. What elements of the patient-pharmacist relationship are associated with patient satisfaction? *Patient Prefer Adherence.* 2012;6:663-676.
15. Al-Arifi MN. Patients' perception, views and satisfaction with pharmacists' role as health care provider in community pharmacy setting at Riyadh, Saudi Arabia. *Saudi Pharm J.* 2012;20(4):323-330.
16. Peraturan Menteri Kesehatan Republik Indonesia Nomor 35 Tahun 2014 Tentang Standar Pelayanan Kefarmasian Di Apotek. In: Kesehatan K, ed. Jakarta2014.
17. Haloho TP. *Studi Persepsi Risiko Keselamatan Berkendara serta Hubungannya dengan Konsep Locus of Control pada Mahasiswa FKM UI yang Mengendarai Motor, Tahun 2007* [Baschelor thesis]. Depok: FKM-UI, Universitas Indonesia; 2007.
18. Zeithaml VA, Berry LL, Parasuraman A. The Behavioral Consequences of Service Quality. *Journal of Marketing.* 1996;60(2).
19. Kriskovich T. How Culture Influences Our Expectations of Others. 2012.
20. Lateef F. Patient expectations and the paradigm shift of care in emergency medicine. *J Emerg Trauma Shock.* 2011;4(2):163-167.
21. Ni Luh Putu Sari W, Ni Wayan E. Peran Kepercayaan dalam Memediasi Persepsi Nilai terhadap Niat Beli Produk Ramah Lingkungan. *E-Jurnal Manajemen Universitas Udayana.* 2015;4(8).
22. Tjong JA. Harapan Dan Kepercayaan Konsumen Apotek Terhadap Peran Apoteker Yang Berada Di Wilayah Surabaya Timur. *Calyptra : Jurnal Ilmiah Mahasiswa Universitas Surabaya.* 2014;2(2).
23. Druică E, Ianole-Călin R, Băicuș C, Dinescu R. Determinants of Satisfaction with Services, and Trust in the Information Received in Community Pharmacies: A Comparative Analysis to Foster Pharmaceutical Care Adoption. *Healthcare.* 2021;9(5).
24. Pratiwi H, Mustikaningtias I, Widyartika FR, Setiawan D, Nasrudin K, Julietta L. Analisis Persepsi Masyarakat Terhadap Peran Apoteker Pada Layanan Kefarmasian Di Apotek Kecamatan Sokaraja, Baturraden, Sumbang, Dan Kedungbanteng. *JPSCR: Journal of Pharmaceutical Science and Clinical Research.* 2020;5(1).
25. Motlohi NF, Wiafe E, Mensah KB, Padayachee N, Petrus R, Bangalee V. A systematic review of the role of community pharmacists in the prevention and control of cardiovascular diseases: the perceptions of patients. *Syst Rev.* 2023;12(1):160.
26. Ababneh BF, Ong SC, Mahmoud F, Alsaloumi L, Hussain R. Attitudes, awareness, and perceptions of general public and pharmacists toward the extended community pharmacy services and drive-thru pharmacy services: a systematic review. *J Pharm Policy Pract.* 2023;16(1):37.
27. Almohammed OA, Alsanea S. Public Perception and Attitude toward Community Pharmacists in Saudi Arabia. *Saudi Journal of Health Systems Research.* 2021;1(2):67-74.
28. Thoha M. *Kepemimpinan Dalam Manajemen.* Jakarta: Raja Grafindo Persada; 2003.
29. Aryani R. Persepsi Pasien tentang Peran Apoteker pada Layanan Kefarmasian di Pusat Kesehatan Masyarakat. *Jurnal Penelitian Kesehatan Suara Forikes.* 2022;13(1):92-97.
30. Tang JTC SS. *The Role of Pharmacists in Asia and Africa - A Comparative Study to the UK and Sweden*: Inst. F. Farmaci, Uppsala Universitet; 2008.

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Analysis of Beer's Criteria 2019 and Patient Characteristics of Potentially Inappropriate Medication in Elderly Patients with Diabetes Mellitus

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ABSTRACT

Background: Elderly patients with type 2 diabetes mellitus with polypharmacy and various comorbidities often have problems with Potentially Inappropriate Medications (PIMs). One of the methods commonly used to detect this event is Beer's Criteria 2019.

Objectives: This study aims to: (1) identify the characteristics of elderly hospitalized patients with type 2 DM; (2) analyze the incidence of PIM in patients; and (3) analyze the relationship between characteristics (age, gender, comorbidities, length of stay, and number of drugs given) with the incidence of PIMs.

Methods: The research was conducted at two type C hospitals in the city of Bengkulu, with a total of 105 patients using the purposive sampling method. This research is a cross-sectional study with data collection techniques in the form of medical record data from patients for the period January – December 2022 who received drug therapy. Data analysis consists of comparing data with Beer''s Criteria, quantitative descriptive and Fisher''s test.

Results: The research results showed that: (1) the largest age group in Hospitals) had comorbidities, the highest number of drugs given was more than 10 types of drugs, and the majority of patients were hospitalized for less than five days; (2) There was an incidence of PIMs of 98.65% (73 patients) in Hospital (3) Statistical tests show that there is no relationship between age, gender, comorbidities, number of medications and length of stay with the incidence of PIMs.

Conclusion: There is still inappropriate use of drugs given to elderly DM patients. It is hoped that further researchers will be able to find out the reasons for giving these drugs to elderly patients.

Keywords: Beer's Criteria 2019; DM Type 2; elderly; PIM; Polypharmacy

INTRODUCTION

Based on data from the World Health Organization (WHO), the population of elderly people is estimated to reach 2.1 billion in 2050 1; where in almost five decades, the number of elderly people in Indonesia has increasingly doubled (1971-2020), namely 9.92% or as many as 26 million people. The population in Bengkulu province is 2 million people; the percentage of older adults is dominated by the 60-69 year age group at 5.60%, older adults in the 70-79 year age group are 1.91%, and elderly people in the age group over 80 years are 0 .55% 2.

Elderly or geriatric patients are people who have more than one disease, so they are often vulnerable to inappropriate medication administration, which can lead to the risk of side effects from the medication 3. One thing that must be considered is the inappropriateness of administering medication to geriatric patients with chronic diseases, such as diabetes mellitus. Diabetes mellitus is a metabolic disease that is often found in elderly patients. This disease is a chronic disease caused by the pancreas not being able to produce enough insulin 4. Elderly diabetes sufferers, who are often accompanied by other comorbidities, certainly pose a challenge for health workers regarding disease management patterns at this age due to varied pathological conditions,

polypharmacy, decreased organ function, and atypical disease manifestations. This certainly encourages Potentially Inappropriate Medication (PIM) or potentially inappropriate medication. 5

PIM is an important clinical problem because patients with polypharmacy are less likely to benefit from treatment compared with patients who receive fewer medications. With metabolic conditions that cannot work optimally and several comorbidities that elderly people have, this results in them consuming a lot of medication during treatment. In general, inpatients receive a greater number of drug prescriptions while in Hospital, thereby increasing the risk of drug side effects. Therefore, avoiding drugs that are considered inappropriate is one of the interventions for treatment options in elderly patients 6.

Beer's Criteria is one of the most frequently used methods to identify PIM use in the elderly 7. Beer's Criteria aims to reduce drug-related problems in older adults consisting of potentially inappropriate drug exposure, drug-drug interactions, drug-disease interactions, and drugs that should be used with caution in older adults age 7. Comorbidities of diabetes were selected because they are the most common group of diseases and impose a higher burden on patients, payers, and the health care system. Beer's Criteria is a tool that can be used to evaluate potential incidents of inappropriate drug use in geriatrics. Since 2012, Beer's Criteria have been updated every three years. Beer's Criteria 2019 is an update of Beer's Criteria 2015, so this research will be one of the latest studies using Beer's Criteria 2019 to analyze PIM.

I have studied several times. Previous research reported that the incidence of Potentially Inappropriate Medication (PIM) was found to be 62.5% in geriatric patients, where female gender and polypharmacy were risk factors for PIM 8. Other studies also reported that the prevalence of patients who received PIM was 23.5% based on the 2012 Beer's Criteria 9 and around 55.6% of identified patients (PIM) based on the 2015 Beer's Criteria 10. Previous research in 2020 reported that PIM was found in geriatric patients with type 2 diabetes mellitus during hospitalization, p polypharmacy, decreased kidney function, and female gender are associated with a higher incidence of PIM 10.

Other research shows a significant relationship between the incidence of PIM, the number of medications four, and the patient's length of stay 11. Meanwhile, the relationship with age, gender, and comorbidities was previously studied in 2018; although the results did not show a relationship, these characteristics can still be studied further 12. The use of drugs in elderly patients requires consideration to avoid potentially inappropriate use of type 2 DM drugs. Avoiding prescribing potentially inappropriate medications (PIMs) to patients can improve health care. Therefore, this study aims to identify the prevalence of PIM in elderly patients with Type 2 DM hospitalized at a Hospital for long hospitalization. It is hoped that the research results can be used as a reference in evaluating hospital services so that the safety of using type 2 DM drugs will increase and reduce the risk of morbidity and mortality in elderly patients in the city of Bengkulu.

METHODS

Research design

This research is a cross-sectional and prospective study during the period January 2022 – December 2022 at two type C hospitals in the city of Bengkulu, which will here inafter be referred to as Hospital X and Hospital Y. The PIM identification process was carried out by comparing treatment records with the 2019 Beer's Criteria list. Meanwhile, the relationship between PIM incidence and characteristics will be tested statistically.

Population and Sample

The sample in this study was selected using a purposive sampling method with inclusion criteria: (a) type 2 DM patients who underwent examinations in the period January 2022 – December 2022 at 2 predetermined hospitals; (b) Elderly patients aged >60 years; (c) type 2 DM patients without comorbidities or with comorbidities; (d) complete patient medical record data including age, gender, diagnosis, drug name, dosage form, dose, route of use, total use and frequency of use. Apart from that, there are also exclusion criteria, namely: (a) the patient's medical record data is incomplete; (b) the patient was forced to return home/died/was referred to another location. Based on the criteria above, a total of 105 patients were obtained who met the inclusion criteria, with details of 74 patients at Hospital X and 31 patients at Hospital Y.

Data collection

The data collected is data from type 2 DM patients who underwent treatment in June 2022 - December 2022 at Hospital X and Hospital Y, Bengkulu City. Data was collected manually by filtering data that matched the research sample criteria and transferring it to a data collection sheet which included medical record number,

age, gender, comorbidities, number of drugs given and length of stay. The data source comes from patient medical records obtained from data reports in the medical records unit and hospital laboratory unit.

Data analysis

Data were analyzed using: (1) quantitative descriptive analysis comparing characteristics between Hospitals X and Y; (2) univariate analysis used to determine the incidence of PIM in elderly patients who were identified using the 2019 Beer's criteria by looking at the patient's medical record data for their treatment, then recording the treatment data of all patients who met the inclusion criteria one by one, then comparing them using the Beer's method. 2019 criteria to find out which drugs fall into the PIM category. In the 2019 Beer's Criteria analysis , these criteria are divided into 5 categories, namely category 1 "drugs that should be avoided in general in elderly patients", category 2 "drugs that should be avoided if suffering from history of certain diseases", category 3 "drugs that can still be given to the elderly but with special attention or caution", category 4 "interactions between drugs that have the potential to be clinically important because they can worsen the condition of the elderly if given which must be avoided" , and category 5 “drugs that should be avoided or reduced in dose with varying levels of kidney function in the elderly”. and (3) bivariate analysis to determine the relationship between demographic data and the incidence of PIM in hospitals using Fisher's statistical test.

RESULTS AND DISCUSSION

Characteristics of Type 2 Elderly Patients

Based on table I, information is obtained that the elderly age group that has been categorized according to the Ministry of Health, is mostly in the 60-69 year old, both at Hospital X and Hospital Y with each receiving 55 patients (74.32%) at Hospital and 25 patients (80.64%) at Hospital Y. This data shows that the higher the age group, the fewer the number of patients hospitalized. The 60-69 year old group is the age most vulnerable to diabetes, because at this age, especially 65 years and above, a person's risk of developing diabetes will also increase. This is caused by glucose intolerance and a decrease in the function of the pancreas in producing insulin. [13]

Based on gender differences, women are generally more susceptible to diabetes than men. [8] However, the research results show that in terms of percentage and number, the number of women and men is almost the same. At Hospital Meanwhile, at Hospital Y, the number of elderly male patients with type 2 DM was slightly higher than female patients (51.61% > 48.39%). This proves that diabetes is often accompanied by other chronic diseases such as hypertension, high cholesterol, cardiovascular disease, insomnia and anxiety. [14]

The number of drug administrations of more than 10 types of drugs also still occurred at Hospital X as much as 48.64% and Hospital Y as much as 70.93%. In the medical record data that researchers obtained, although the level of drug administration was less than 10 types, it was still quite a large amount, such as 8-9 types of drugs given. This is polypharmacy and is something that is dangerous for elderly patients with Type 2 DM. However, according to previous research, the causes of polypharmacy in these elderly patients are the chronic multipathological disease they suffer from, drugs prescribed by more than one doctor, the symptoms felt by the patient are often unclear, the patient often asking for prescription drugs, and administering new drugs to eliminate the side effects of drugs that have been consumed previously. [15] Meanwhile, regarding the length of stay variable for elderly patients with type 2 DM in both hospitals, it was recorded that more patients were hospitalized for less than five days, recorded at Hospital X at 92.86% and at Hospital Y at 77.42%. This indicates that many patients were sent home when the symptoms had improved and treatment continued on an outpatient basis.

Analysis of *Potentially Inappropriate Medications* (PIMs)

Assessment PIMs in this research use Beer's Criteria 2019, which is one of the method for measure nonconformity treatment that includes the best medicines avoided or can be used with attention especially for patients elderly 60 years old and above. [16] Assessment done with method view recorded data medical Type 2 DM patients at Hospitals X and Y, then seen treatment existing patients given during take care stay. Medications are recorded and compared with the 2019 Beer's criteria method and observed to find out what medications are inappropriately given to patients.

From the two hospitals in Bengkulu City which were the research conducted, the incidence of PIMs in Hospital X was 98.65% (n=73) and Hospital Y was 96.77% (n=30). This indicates that many PIM incidents occurred in these two hospitals .

According to the 2019 Beer's Criteria, there were 15 patients in Hospital X and 15 patients in Hospital Y who received at least one PIMs who were hospitalized with Type 2 DM . In this study, the use of diabetes drugs

Table I. Description of characteristics of elderly Type 2 DM patients treated at Hospitals X and Y for the period January 2022 - December 2022

Characteristics	N=74		N=31	
	Hospital X		Hospital Y	
	n	%	n	%
Age				
60-69 years old	55	74.32%	25	80.64%
70-79 years old	15	20.27%	5	16.13%
>80 years	4	5.41%	1	3.23%
Gender				
Man	33	44.59%	16	51.61%
Woman	41	55.41%	15	48.39%
Concomitant Diseases				
There is	65	87.84%	25	80.65%
There isn't any	9	12.16%	6	19.35%
Number of Drugs				
< 10 types	38	51.35%	9	29.03%
≥ 10 types	36	48.65%	22	70.93%
Length of Hospitalization				
<5 days	60	81.08%	24	77.42%
≥5 days	14	18.92%	7	22.58%

Table II. Prevalence of Concomitant Disease Conditions in Elderly Patients with Type 2 DM

Diagnosis	n (%)	
	Hospital X	Hospital Y
DM Type 2	29.73	51.60
Type 2 DM Type 2, Hypertension	25.68	16.30
Type 2 DM, Kidney Disease	17.57	-
Type 2 DM, Congestive Heart Failure (CHF)	1.35	6.44
Type 2 DM, Anemia	4.05	3.23
Type 2 DM, Respiratory Disease	8,11	6.44
DM Type 2, UTI	4.05	3.23
DM Type 2, OA	1.35	-
Type 2 DM, Coronary Heart Disease (CAD)	-	6.44
Type 2 DM, UAP, CAD & Hypertension	1.35	3.23
Type 2 DM, Hypertension, Anemia	-	3.23
Type 2 DM, CKD & Hypertension	2.70	-
Type 2 DM, CKD & Anemia	1.35	-
Type 2 DM, Hypertension & UTI	2.70	-
Total	74	31

included in the Beer's Criteria was still quite high. The insulin sliding scale group is seen in the administration of insulin to Type 2 DM patients, when only one is given (basal/ long acting), then the occurrence of PIM is calculated. Table IV is obtained from the results of examining medical record data which has been compared with the Beer's criteria method to determine the incidence of PIM in Type 2 DM patients at Hospitals .67% at Hospital Y. Apart from clear guidelines, the use of a sliding insulin scale is also common. Insulin therapy in the elderly with poor glycemic control, HbA1c levels > 9% (74.9 mmol/mol), FPG levels > 250 mg/dL (13.9 mmol/L), random glucose values > 300 mg/dL or patients with ketonuria, insulin should be administered and is chosen as initial therapy. When initiating insulin therapy in elderly patients, it is important to have general health status, ability to make insulin, measure blood sugar, understanding of hypoglycemia, and capacity to treat it. [17]

Among antidiabetic drugs, the most frequently prescribed PIMs are sliding scale insulin, glimepiride and glibenclamide, because these drugs can cause severe prolonged hypoglycemia in the elderly, whereas sliding

Table III. PIM incident at Hospital X and Hospital Y, Bengkulu City

PIMs	N=74		N=31	
	RS		Y Hospital	
	n	%	n	%
PIMs occurrence				
There is	73	98.65%	30	96.77%
There isn't any	1	1.35%	1	3.23%

Table IV. Type 2 DM medication prescribed for hospitalized elderly Type 2 DM patients

Drug Class	RS _		Y Hospital	
	n	%	n	%
Insulin, *sliding scale* (Insulin regimen containing only short-acting or rapid-acting insulin dosed according to current blood glucose levels without concomitant use of basal or long-acting insulin).	8	53.33	4	26.67
Sulfonylureas				
Glimepiride	5	33.33	11	73.33
Glibenclamide	2	13.33	-	-
Total	**15**	**100**	**15**	**100**

scale insulin (short or rapid acting) is an approved agent for these patients. Diabetes. [19] However, older patients may be at higher risk of hypoglycemia without improving hyperglycemia management. [15] Use of insulin based on random blood glucose should be avoided (insulin regimens containing only short-acting or rapid-acting insulin dosed according to current blood glucose levels without concomitant use of basal or long-acting insulin). The findings of this study are in line with a 2020 study which stated that 19.7% of PIMs were related to sliding scale insulin based on the 2015 and 2019 Beer's Criteria. [10]

The overall incidence of PIMs based on Beer's Criteria 2019 in this study was 98.65% (73/74) in Hospital *X* and 96.77% (30/31) in Hospital Y. Inpatient elderly patients also receive treatment apart from providing therapy for Type 2 DM due to congenital diseases suffered by the elderly patient himself. So a large number of drugs can be given because the patient may have one or more comorbidities. In the analysis Beer's Criteria 2019 , these criteria are divided into 5 categories, namely category 1 "drugs that should be avoided in general in elderly patients" , category 2 "drugs that should be avoided if you suffer from a history of certain diseases" , category 3 "drugs that can still be given to the elderly but with special attention or caution" , category 4 "interactions of drugs that are potentially clinically important because they can worsen the condition of the elderly if given and should be avoided" , and category 5 "drugs that should be avoided or reduced in dose by various levels of kidney function in the elderly " . Obtaining drugs given based on categories included in the Beer's Criteria at Hospitals X and Y can be seen in table V.

The incidence of drug incompatibility (PIM) in this study, when viewed from categories 1 to 5, shows that category 1 is the category that occurs most frequently. Meanwhile, the most widely used drug is omeprazole. The reason the possibility of using omeprazole is greater than ranitidine which has the same function is Ranitidine has been proven to be safer to administer compared to omeprazole. This is likely because when elderly patients develop gastric ulcers, they are more likely to heal when the patient receives concurrent treatment with a PPI rather than ranitidine. [20]

The use of furosemide in this study was also quite high, especially at Hospital However, The American College of Cardiology/American Heart Association (ACC/AHA) does not recommend use loop diuretic as drug line First For treating hypertension [21] . So on research At this point, furosemide was given as treatment line second in patients, although furosemide was included in Beer's Criteria category 3 which is treatment given must in a way be careful.

Based on the results obtained, the use of PIMs in patients elderly with Type 2 DM care stay in study This different One each other, on some patient only use one PIMs, whereas a number of patient other use more from one PIMs. The number of PIMs used per patient can be seen in table VI below.

Table V. Medicines categorized into the 2019 Beer's Criteria given to elderly patients with Type 2 DM with comorbidities

Medicine name	RS _		Y Hospital	
	n	%	n	%
Category 1				
Omeprazole	59	39.86	21	30
Lansoprazole	10	6.76	8	11.43
Ketorolac	7	4.73	7	10
Clonidine	1	0.68	-	-
Na. Diclofenac	2	1.35	1	1.43
Nifedipine	1	0.68	1	1.43
Meloxicam	-	-	2	2.86
Metoclopramide	1	0.68	1	1.43
Diazepam	-	-	2	2.86
Alprazolam	10	6.76	2	2.86
Digoxin	-	-	1	1.43
Category 2				
Mefenamic acid	7	4.73	1	1.43
Cilostazol	-	-	2	2.86
Category 3				
Furosemide	20	13.51	4	5.71
Aspirin	4	2.70	2	2.86
Spironolactone	1	0.68	-	-
Diphenhydramine	1	0.68	1	1.43
Haloperidol	-	-	-	-
Category 4				
Corticosteroids + Oral or Parenteral NSAIDs	6	4.05	1	1.43
Category 5				
Ranitidine	4	2.70	3	4.29
Tramadol	-	-	1	1.43
Gabapentin	5	3.38	8	11.43
Ciprofloxacin	9	6.08	1	1.43
Total	**148**	**100**	**70**	**100**

Table VI. Use of PIMs in hospitalized elderly patients with Type 2 DM

Use of PIMs per patient	Number of Patients	Percentage (%)	Y Hospital	
			Number of Patients	Percentage (%)
0	1	1.35	1	3.26
1	18	24.32	8	25.81
2	28	37.84	6	19.34
3	15	20.27	3	9.68
4	10	13.51	8	25.81
5	2	2.70	5	16,13

The number of PIMs that occur in elderly patients with Type 2 DM ranges from 1-5. This indicates that medications listed in the 2019 Beer's Criteria should be administered with caution, if not avoided, because the risk of side effects outweighs the benefits when used in elderly patients. [20]

Association Between Patient Characteristics and PIMs

The results of statistical tests showed that patient characteristics or risk factors studied did not have a significant relationship with the incidence of PIMs in Hospital X and Hospital Y in Bengkulu City ($p>0.05$). This is in line with previous research which states that factors such as age, gender, [5] comorbidities, [22] number of drugs

Table VII. Results Analysis of the characteristics of risk factors that influence the use of *PIMs* in the entire study sample

Variable	PIMs		*p*
	N	%	
Age			
60-69 years old	80	76.19%	0.430
70-79 years old	20	19.04%	
≥80 years old	5	4.76%	
Gender			
Man	49	46.66%	0.497
Woman	56	53.33%	
Concomitant Diseases			
There is	90	85.71 %	0.266
There isn't any	15	14.28 %	
Number of Drugs (type)			
< 10	47	44.76%	0.198
≥ 10	58	55.23%	
Length of Hospitalization			
<5 days	84	80.00%	1,000
≥5 days	21	20.00%	

Table VIII. Table Example (Without vertical lines)

Characteristic	N (%)
Gender	
Male	6 (15.4)
Female	33 (84.6)

given and length of stay [12] are not related to the incidence of PIMs. Thus, it is possible that the occurrence of PIMs in the two Bengkulu City hospitals is influenced by other factors not examined in this study.

Results should be clear and concise. Show only the most significant or main findings of the research. Describe the outcome of the study. Describe Tables as “Table” and Figures as “Figure” (not “Fig.”). Every figure should have a title or caption, which should be concise but clear enough to explain its main components independently from the text.

Each data presented is discussed comprehensively in one flow: presenting the data, comparing it with other similar research, and putting forward relevant theories related to the existing data.

Discussion must explore the significance of the results of the study. Adequate discussion or comparison of the current results to the previous similar published articles should be provided to show the positioning of the present research (if available).

CONCLUSION

Based on the research results obtained, there was an incidence of PIMs in elderly patients with type 2 DM who were hospitalized, amounting to 73 patients (98.65%) in Hospital aged 60-69 years . Meanwhile, the antidiabetic drug classes included in the 2019 *Beer's criteria category are sliding scale* insulin , glimepride, and glibenclamide. Of the several risk factors or patient characteristics studied, there was no relationship between age, gender, length of stay, number of medications and comorbidities on the incidence of PIMs (p>0.05).

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STATEMENT OF ETHICS

Ethical Clearance was submitted to the Medical/Health Research Bioethics Commission, Faculty of Medicine, Sultan Agung Islamic University, Semarang, and a recommendation for implementation at Bengkulu City Hospital was issued in March 2023 with number 127/III/2023/Bioethics Commission.

REFERENCES

1. Liu J, Yu Y, Yan S, et al. Risk factors for self-reported medication adherence in community-dwelling older patients with multimorbidity and polypharmacy: a multicenter cross-sectional study. *BMC Geriatr*. 2023;23(75):1-10. doi:https://doi.org/10.1186/s12877-023-03768-7
2. CPM. *Older Population Statistics* . Central Bureau of Statistics; 2020.
3. Rumi A, Tahir MT, Ilham M. Identification of Potentially Inappropriate Medication (PIM) Using Beers Criteria in Inpatient Geriatric Patients in the Seroja and Flamboyan Rooms at Undata Hospital, Central Sulawesi Province. *Public Media Promotion of Indonesian Health. 2023;6(1):51-58. doi:10.56338/mppki.v6i1.2531*
4. *Wahyuni KSPD, Widyaningrum EA, Sari EA, Noerhalizah D. Relationship between the number of drug prescriptions and potential inappropriate medication based on the 2019 Beers Criteria for Diabetes Mellitus Patients. 2023;3(2):195-202. doi:10.37311/ijpe.v3i2.19752*
5. *Rahmawati R, Harianti Putri Y, Handayani D, et al. Potential for Inappropriate Medication Use in Geriatric Outpatients Based on the Beers Criteria 2019. J Kefarasian Akfarindo. 2022;7(2):9-14. doi:10.37089/jofar.vi0.125*
6. *Corsonello A, Pranno L, Garasto S, Fabietti P, Bustacchini S. Potentially Inappropriate Medication in Elderly Hospitalized Patients. Drugs Aging . 2009;1(26):31-39. doi:10.2165/11534640-000000000-00000*
7. *Díez R, Cadenas R, Susperregui J, et al. Potentially Inappropriate Medication and Polypharmacy in Nursing Home Residents: A Cross-Sectional Study. J Clin Med . 2022;11(13). doi:10.3390/jcm11133808*
8. *Al-Azayzih A, Alamoori R, Altawalbeh SM. Potentially inappropriate medications prescribing according to beer criteria among elderly outpatients in Jordan: A cross sectional study. Pharm Pract (Granada). 2019;17(2):1-7. doi:10.18549/PharmPract.2019.2.1439*
9. *Pasina L, Djade CD, Tettamanti M, et al. Prevalence of potentially inappropriate medications and risk of adverse clinical outcomes in a cohort of hospitalized elderly patients: Results from the REPOSI Study. J Clin Pharm Ther . 2014;39(5):511-515. doi:10.1111/jcpt.12178*
10. *Sharma R, Chhabra M, Vidyasagar K, Rashid M, Fialova D, Bhagavathula AS. Potentially Inappropriate Medication Use in Older Hospitalized Patients with Type 2 Diabetes: A Cross-Sectional Study. Pharmacy. 2020;8(4):219. doi:10.3390/pharmacy8040219*
11. *Puspitasari RM. Test the Effectiveness of the "Screening Tool For Older People's Prescription" on Potentially Inappropriate Treatment in Geriatric Patients at Depok City Regional Hospital." Univ Indonesia Published online 2013.*
12. *Juliha S. Identification of Potentially Inappropriate Medications (PIMs) Based on STOPP START Criteria in Inpatient Geriatric Patients at Bandar Lampung Adventist Hospital. J Anal Health . 2018;7(1):657. doi:10.26630/jak.v7i1.912*
13. *Yakaryılmaz FD, Öztürk ZA. Treatment of type 2 diabetes mellitus in the elderly. WorldJ Diabetes. 2017;8(6):278. doi:10.4239/wjd.v8.i6.278*
14. *Lu L, Yao K, Chen J, et al. Prevalence of potentially inappropriate medications and association with comorbidities in older adults with diabetes in an outpatient visitation setting. Front Public Heal. 2022;10(September):1-14. doi:10.3389/fpubh.2022.995948*
15. *Zulkarnaini A, Martini RD. Description of Polypharmacy in Geriatric Patients in Several Polyclinics at RSUP Dr. M. Djamil Padang. J Health Andalas .* 2019;8(15):1-6
16. Sukmawati S, Kosman R, Damayanti I. Identification of Drug Use in Elderly Hypertension Patients Using Beer's Criteria in the Inpatient Installation of Ibnu Sina Hospital Makassar for the 2012 Period. *As-Syifa J Farm* . 2016;8(1):52-58.
17. Isnaini N, Ratnasari R. Risk factors influencing the incidence of type two diabetes mellitus. *J Midwifery and Nursing Aisyiyah* . 2018;14(1):59-68. doi:10.31101/jkk.550
18. Alwhaibi M. Potentially Inappropriate Medications Use among Older Adults with Comorbid Diabetes and Hypertension in an Ambulatory Care Setting. *J Diabetes Res* . 2022;2022. doi:10.1155/2022/1591511

19. Fick DM, Semla TP, Steinman M, et al. American Geriatrics Society 2019 Updated AGS Beers Criteria® for Potentially Inappropriate Medication Use in Older Adults. *J Am Geriatr Soc* . 2019;67(4):674-694. doi:10.1111/jgs.15767
20. Bhavya, Torgal. Potentially inappropriate medications in hospitalized elderly patients: a cross sectional study. *Int J Basic Clin Pharmacol* . 2014;3(1):215. doi:10.5455/2319-2003.ijbcp20140229
21. Bhardwaj A. Prevalence of Polypharmacy and Potentially Inappropriate Medications in Elderly Patients: Cross Sectional Study Based on Updated Beer's Criteria 2019. *J Clin Pharmacol Ther* . 2021;2:2017-2022.
22. Rufaidah A, S. IDPP, Sari IP. Study of Drug Related Problems in the Therapy of Inpatient Heart Failure Patients. *J Management and Farm Services* . 2015;5(2):88-94

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Study of Medicine Dosage Adjustments in Inpatients with Chronic Kidney Disease

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ABSTRACT

Background: Decreased kidney function in patients with Chronic Kidney Disease (CKD) necessitates dose adjustment, especially for medicines that have a narrow therapeutic index to avoid unwanted medicine effects.

Objectives: The purpose of this study was to determine the medicine dosage adjustments in CKD patients and their therapy outcomes.

Methods: This type of research is descriptive with a retrospective approach. The sample in this study is the medical records of inpatient CKD patients at Abdoel Wahab Sjahranie Samarinda Hospital for the period May to November 2022. Calculation of GFR (Glomerular Filtration Rate) uses the MDRD (Modification of Diet in Renal Disease) formula.

Results: The results showed that the sex of most patients was male as many as 56.25%. The age of most patients in the range of 53-59 years old as many as 33.75%. Most CKD severity level is stage 5 as many as 91.25%. The most common comorbidities were hypertension (61 patients), diabetes mellitus (15 patients), and edema or pulmonary edema (11 patients). There were 77 patients requiring dose adjustment out of a total of 80 patients. There were 149 (34.89%) medicines requiring dose adjustment out of a total of 427 medicines, with the 5 most medicines being calcium carbonate (24.16%), furosemide (24.16%), metoclopramide (10.74%), paracetamol (10.74%), and ranitidine (7.39%). There were 128 (85.91%) medicines with doses appropriate to the Lexicomp 2023 or Renal Pharmacotherapy 2013. The therapy outcome improved in patients who required dose adjustments by 90.91%.

Conclusion: It is recommended to calculate GFR using a new formula such as eGFR using CKD-EPI, and collecting data with a larger number of samples.

Keywords: Chronic kidney disease; Dose adjustment; Glomerular filtration rate; Hospital

INTRODUCTION

According to WHO in 2018, 1/10 of the world's population is identified with Chronic Kidney Disease (CKD).[1] The incidence of CKD in Indonesia has increased from 2013 of 0.2% to 2018 of 0.38% of the total population in Indonesia.[2] The prevalence of CKD based on a doctor's diagnosis in residents aged ≥ 15 years in East Kalimantan Province is 0.42%.[3] In general, CKD is an abnormality in the structure or function of the kidneys that lasts for 3 months or more and is irreversible.[4] CKD classification is grouped based on cause, GFR (Glomerular Filtration Rate) category, and albuminuria category.[5] Most water-soluble medicines are excreted in certain amounts in intact form through the kidneys. Therefore, patients with reduced renal function require careful dose adjustment, especially for medicines that have a narrow therapeutic index.[6] Many medicines are largely eliminated by the kidneys, and even medicines with high rates of metabolism will likely require dose adjustments in CKD patients to maximize therapeutic results and minimize side effects. Most medicines that are unchanged in renal elimination can accumulate in CKD patients, which can further increase the risk of side effects.[4]

Research conducted at the Tegal Regency Hospital, Indonesia showed that of the 1,882 medicines prescribed, there were 338 (17.93%) medicines that required dose adjustments in CKD patients. Of these medicines, there were 175 (51.78%) medicines that had dosage adjustments made, and a total of 118 (67.43%) of these medicines resulted in improved therapy outcomes. CKD patients who received medicines with dose adjustments had medicine therapy outcomes achieved 1,992 times higher than CKD patients who received medicines without dose adjustments.[7] These results show a significant relationship between medicine dose adjustments and therapy outcomes in inpatient CKD patients. In another study conducted at Budhi Asih Regional Hospital, from 132 samples, results were obtained from 86 patients who received medication that required dose adjustment. From the 86 patients, there were 29 (33.72%) patients who received dose adjustments to the literature. Some medicines that require dose adjustments include Digoxin and Ranitidine. Digoxin is a medicine that is excreted approximately 50 - 70% in unchanged form through the kidneys and has a narrow therapeutic index with toxic levels > 3 µg/L. Meanwhile, around 30% of ranitidine at oral doses and 70% at intravenous doses is excreted in unchanged form through the kidneys. Both medicines have a prolonged elimination half-life in patients with kidney disease, so the possibility of toxicity increases. Therefore, dosage adjustments are needed to avoid these toxic effects.[8]

Abdoel Wahab Sjahranie Samarinda Regional General Hospital is a class A educational hospital that is one of the referral hospitals for CKD patients in East Kalimantan province and provides hemodialysis services. Based on the results of preliminary tests that have been carried out, there are 380 inpatient CKD patients in the period May to November 27th, 2022 at the hospital, with the most comorbidities in the form of hypertension and diabetes mellitus, the most complications in the form of anemia and pulmonary edema, and the most stages of CKD namely stage 5. Based on this background, researchers are interested in conducting research with the title "Study of Medicine Dosage Adjustments in Inpatients With Chronic Kidney Disease". This study aimed to determine medicine dose adjustments in CKD patients and their therapy outcomes.

METHODS

Study Design

This research is included in the type of descriptive research with a retrospective approach. Data collection in this study was carried out by collecting medical records of inpatient CKD patients at the Abdoel Wahab Sjahranie Samarinda Regional General Hospital for the period May to November 2022, to find out data on the patient's gender, age, comorbidities, laboratory test results in the form of serum creatinine level, type and dose of medication, and hospital discharge conditions. This research was conducted on March 13 until 31, 2023 in the medical records installation of the Abdoel Wahab Sjahranie Samarinda Regional General Hospital.

Population and Samples

The population in this study were inpatient Chronic Kidney Disease (CKD) patients for the period May to November 2022. The number of samples in this study was calculated using the following Slovin formula :

$$n = \frac{N}{1+Ne^2}$$

In sample calculations, the population of inpatient CKD patients in this study was 380 patients, with a tolerable allowance for inaccuracies due to a sampling error of 10%. The number of sample obtained in this study was 80 inpatient CKD patients in the period May to November 2022. The patients in this study were selected using non-random sampling with a purposive sampling technique. Inclusion criteria in this study included inpatient CKD patients aged ≥ 18 years, inpatient CKD patients with stages 4 and 5, inpatient CKD patients who had complete medical record data (gender, age, comorbidities, laboratory test results in the form of serum creatinine level, history of medicine use, medicine administration data in the form of type and dose of medicine, and therapy outcomes), and medical record data can be read properly. The exclusion criteria in this study was CKD patients who died during the period May to November 2022.

Study Instruments

The instruments used in this research consisted of patient data collection sheets, a laptop, a cell phone, stationery, a scientific calculator, the MDRD eGFR calculator in the Medscape® android application, Lexicomp online literature, and Renal Pharmacotherapy e-book. The sample used was medical records of inpatient CKD patients for the period May to November 2022 which were selected based on the inclusion criteria and exclusion criteria in this study.

Data Collection

Data collection was carried out using a purposive sampling technique. Patient identity data including gender, age, severity of CKD, comorbidities, serum creatinine, drug administration data, and therapy outcomes were taken from the patient's medical record. The data collection was carried out after obtaining a preliminary test permit and a research permit, both obtaining permits from the Program Studi S1 Farmasi Sekolah Tinggi Ilmu Kesehatan Dirgahayu Samarinda, and also obtaining permits at the Abdoel Wahab Sjahranie Samarinda Regional General Hospital.

Data Analysis

The data analysis technique used in this research was the univariate analysis technique. The univariate data consisted of patient gender, age, severity of CKD, comorbidities, number of patients requiring dose adjustments, type and number of medicines requiring dose adjustments, number of medicines with appropriate and inappropriate dose adjustments, and patient's therapy outcomes. Univariate data was presented in tabular form. The patient's GFR was calculated using the MDRD calculator (Modification of Diet in Renal Disease) 4 variables in the Medscape® android application.

RESULTS AND DISCUSSION

Characteristics of Chronic Kidney Disease (CKD) Patients

Gender

The gender characteristics of CKD patients in this study can be seen in Table I which were dominated by male patients as many as 45 (56.25%) patients, while female patients were 35 (43.75%) patients. These results are in line with previous research conducted at Budhi Asih Regional Hospital which stated that men suffer from CKD more often than women because men have different lifestyles from women, including smoking and consuming energy drinks.[8]

Cigarettes contain more than 100 types of cigarettes toxic substances, which have been proven to be carcinogenic, hepatotoxic, immunosuppressive, and nephrotoxic to the body. Nicotine is one of the ingredients in cigarettes that is nephrotoxic. Nicotine increases blood pressure and heart rate. In this case, nicotine also plays an important role as an intermediary for kidney damage, because increasing blood pressure is one of the most important factors in increasing the progression of CKD.[9] Blood pressure will cause the blood vessels in the kidneys to become compressed, causing problems with blood vessels in the kidneys, resulting in decreased kidney function.[10] Another lifestyle is consuming energy drinks, which contain a combination of caffeine and taurine which works as a stimulant. The mechanism of this energy drink is activation of the sympathetic nerves which will result in an acceleration of the heart rate to pump blood and oxygen, as well as vasoconstriction of blood vessels, resulting in an increasing blood pressure (hypertension). Renal function will also decrease and the end products of protein metabolism which are normally excreted in the urine will accumulate in the blood, and the symptoms will become more severe for the patient.[11]

Age

The age characteristics of CKD patients in this study can be seen in Table I which were mostly in the age range of 53 to 59 years old with 27 (33.75%) patients and the age range of 39 to 45 years old with 16 (20%) patients. These results are in line with previous research conducted at Budhi Asih Regional Hospital, where CKD patients were dominated by patients aged 40 years old and over to under 65 years old.[8] This can happen because after the age of 30 years old, every decade (10 years), the kidneys will experience atrophy (tissue damage) and the thickness of the renal cortex will decrease by around 20% of its normal thickness.[12] Physiologically, as age increases, kidney function can also decrease which then increases the risk factors for hypertension or even obesity.[13] In addition, nephron damage to the kidneys also increases with age.[14] These non-functioning nephrons then suppress normally functioning nephrons, which naturally causes a decrease in renal perfusion pressure and a decrease in the Glomerular Filtration Rate (GFR).[4]

CKD Severity Level

The severity characteristics of CKD patients in this study can be seen in Table I which were dominated by CKD stage 5 patients with 73 (91.25%) patients, while stage 4 patients with 7 (8.75%) patients. These results are in line with research conducted at the Tegal Regency Hospital, where the majority of CKD patients were at stage 5 with 166 (83%) patients.[7] The number of hospitalized CKD patients is greater at stage 5 because patients only

Table I. Characteristics of CKD Patients

Characteristics		Number of Patients	Percentage (%)
Gender	Man	45	56.25
	Woman	35	43.75
Total		80	100
Age Range (Years)	18 - 24	1	1.25
	25 - 31	5	6.25
	32 - 38	5	6.25
	39 - 45	16	20
	46 - 52	12	15
	53 - 59	27	33.75
	≥ 60	14	17.5
Total		80	100
Severity Level	4	7	8.75
(Stage) of CKD	5	73	91.25
Total		80	100
Comorbidities	Hypertension	61	76.25
	Diabetes Mellitus	15	18.75
	Edema / Pulmonary Edema	11	13.75
	Gout	4	5
	Atherosclerosis	3	3.75
	Heart Failure	3	3.75
	Cholesterol (Hyperlipidemia)	2	2.5
	Pneumonia	2	2.5
	Coronary Heart	1	1.25

experience symptoms (such as fatigue, nausea, vomiting, loss of appetite, and other symptoms) when the patient is already at stages 4 and 5 of CKD. Meanwhile, at lighter stages, such as in stages 1, 2, and 3, the patient is not yet aware of the condition of decreased kidney function that he is experiencing because he has not felt the symptoms, so, at the same time, the patient has not had an examination or treatment at the hospital.[15] In patients with CKD stage 4, the patient's Glomerular Filtration Rate (GFR) is in the range of 15 - 29 mL/minute/1.73 m^2, while in patients with CKD stage 5, the patient's GFR is < 15 mL/minute/1.73 m^2.[16]

Comorbidities

The characteristics of the comorbidities of CKD patients in this study can be seen in Table I which were dominated by hypertension in 61 (76.25%) patients, diabetes mellitus in 15 (18.75%) patients, and edema or pulmonary edema in 11 (13.75%) patients. These results are in line with research conducted at Budhi Asih Regional Hospital, where there are several comorbidities with the highest number of CKD patients, including diabetes mellitus with 40 (30.30%) patients, and hypertension with 39 (29.54%) patients.[8]

Hypertension and diabetes mellitus can cause or worsen CKD. In patients with hypertension, high blood pressure will cause the blood vessels in the kidneys to become compressed, so that the flow of food substances to the kidneys becomes disrupted, which can cause the blood vessels to become damaged and kidney function to decrease, thus causing kidney function failure. In patients with diabetes mellitus, blood sugar levels that are too high will make the kidneys have to work harder than normal in filtering the blood. This can result in kidney leaks if the kidneys work too hard in filtering the blood continuously.[10]

Comorbidities in the form of edema can also occur in CKD patients. Initially, there is a leak of albumin protein which is excreted in the urine, where protein is one of the components needed by the body, so it should remain stored in the body and not be excreted in large quantities through the urine. This condition then develops and results in a decrease in the filtering function of the kidneys. At the same time, there is a buildup of a lot of waste or waste from waste substances in the body due to a decrease in the filtering function of the kidneys, which is indicated by edema or swelling in the body.[10] CKD patients in this study also experienced pulmonary

edema which was the result of a combination of excess fluid buildup (edema) and abnormal permeability in the pulmonary microcirculation, as well as high intravascular pressure or increased capillary membrane permeability which resulted in rapid fluid extravasation, resulting in impaired air exchange in the alveoli is progressive and results in hypoxia or the absence of enough oxygen in the tissues to maintain body functions.[17]

Number of Inpatients with CKD Requiring Dosage Adjustments

Patients who do or do not require dose adjustments in the medicines used are known by comparing the types of medicines received by the patient with the types of medicines listed in the literature used in this study. The patient is stated to require a dose adjustment if in the literature, the medicine received by the patient has a statement that requires a dose adjustment in patients with CKD, conversely, the patient is stated not to require a dose adjustment, if there is not a single medicine that has a statement that requires a dose adjustment in the patient with CKD in the literature. The literature used in this research consists of 2 pieces of literature, namely Lexicomp online literature used for 327 (76.58%) medicines, and Renal Pharmacotherapy e-book used for 100 (23.42%) medicines. Based on Table II, inpatient CKD patients who required dose adjustments were 77 (96.25%) patients, while there are 3 (3.75%) patients who did not require dose adjustments.

Generally, medicines are excreted in certain amounts in intact form through the kidneys. In CKD patients, there is a decrease in GFR (Glomerular Filtration Rate) which causes a decrease in the ability to excrete medicines through the kidneys, resulting in a longer medicine elimination time. Therefore, it is necessary to adjust the medicine dose, especially for medicines that have a narrow therapeutic window. This is done to prevent the buildup of medicine levels or medicine toxicity in the patient's body.[6]

Types and Number of Medicines Requiring Dosage Adjustments in Inpatient CKD Patients

Based on Table III, of a total of 427 medicines, there are 149 (34.89%) medicines that required dose adjustments in patients with CKD, and 278 (65.11%) medicines that did not require dose adjustments in patients with CKD. Medicines that require or do not require dose adjustments are known by comparing the types of medicines received by the patient with the types of medicines listed in the literature. A medicine is stated to require dose adjustment, if in the literature, the medicine has a statement requiring dose adjustment in patients with CKD, conversely, a medicine is stated to not require dose adjustment, if in the literature, the medicine does not have a statement requiring dose adjustment in patients with CKD. Based on Table IV, of the 149 medicines that require dose adjustments, 5 types of medicines dominate. These five types of medicines include calcium carbonate as many as 36 (24.16%) medicines, furosemide as many as 36 (24.16%) medicines, metoclopramide as many as 16 (10.74%) medicines, paracetamol as many as 16 (10.74%) medicines, and ranitidine as many as 11 (7.39%) medicines.

Calcium carbonate is a phosphate binder that is often given to patients with CKD. In CKD patients, phosphate binders are used to keep phosphate levels normal, to prevent disease progression Chronic Kidney Disease-Mineral and Bone Disorder (CKD-MBD) due to the kidney's inability to filter blood and regulate hormones and minerals.[18] Calcium carbonate needs to be used in the right dose and not excessively in CKD patients because it has the potential to cause hypercalciuria. Hypercalciuria is the cause of the formation of calcium stones in the kidneys. Although most cases of kidney calcium stones are caused by hyperparathyroid disease, in patients who have CKD, calcium supplements must also be given in adequate doses.[19]

Furosemide is a loop diuretic. In CKD patients, furosemide is used to reduce fluid accumulation or edema, as well as a therapy for hypertension, where both diseases are included in the comorbidities commonly experienced by CKD patients. Loop diuretic like furosemide is highly protein-bound to albumin and acidic. Thus, these types of medicines are secreted and not filtered or diffused passively into the proximal tubule by organic acid transporters into the tubular lumen, where they act by blocking the Na/K/2Cl counterporter in the thick ascending loop of Henle, where 20 - 25% Sodium filtered through the glomerulus is reabsorbed.[20] In CKD, organic anions accumulate and compete with diuretics for organic acid transporter receptor sites.[21] Consequently, higher doses are required to overcome competitive inhibition and achieve therapeutic urine concentrations in patients with CKD.[22]

Metoclopramide is a medicine used to relieve several health problems in the stomach and intestines, such as symptoms of nausea and vomiting. In CKD patients, symptoms of nausea and vomiting can be caused by a buildup of waste or metabolic waste that accumulates in the blood, which cannot be removed by the kidneys due to decreased kidney function. Metoclopramide is also one of the medicines that requires dose adjustment in CKD patients. This is because, in patients with impaired kidney function, clearance of metoclopramide is

Table II. Number of Inpatient CKD Patients who Require and Do Not Require Dose Adjustment

Patient Category	Number of Patients	Percentage (%)
Patients who require dose adjustment	77	96.25
Patients who do not require dose adjustment	3	3.75
Total	80	100

Table III. Number of Medicines that Require and Did Not Require Dose Adjustment

Type of Medicine	Number of Medicine	Percentage (%)
Medicines that require dose adjustment	149	34.89
Medicines that do not require dose adjustment	278	65.11
Total	427	100

Table IV. Type and Number of Medicines that Require Dose Adjustment

Type of Medicine Require Dose Adjustment	Number of Medicine	Percentage (%)
Calcium Carbonate	36	24.16
Furosemide	36	24.16
Metoclopramide	16	10.74
Paracetamol	16	10.74
Ranitidine	11	7.39
Allopurinol	6	4.03
Bisoprolol	6	4.03
Cefixime	5	3.36
Potassium Chloride	3	2.01
Ramipril	3	2.01
Cetirizine	2	1.34
Clonidine	2	1.34
Digoxin	2	1.34
Amoxicillin	1	0.67
Tranexamic Acid	1	0.67
Azathioprine	1	0.67
Captopril	1	0.67
Tramadol	1	0.67
Total	149	100

reduced by 70%. In addition, the plasma elimination half-life of this medicine also increases by around 10 - 15 hours in patients with impaired renal function.[23]

Paracetamol is an analgesic that is also used in CKD patients, one of which is to treat low back pain. Low back pain that occurs around the waist and lumbar (lower backbone) can be caused by problems with the kidney itself. Paracetamol is an analgesic that requires dose adjustment for CKD patients. This is because less than 5% paracetamol is excreted in unchanged form. Paracetamol undergoes metabolism which produces a minor metabolite, but it is very active and important at large doses, namely NAPQI which is toxic to the liver and kidneys. At levels that cause toxicity or liver disease, the half-life will double or more. This is what makes use of paracetamol should be considered in CKD patients.[24] The most likely mechanism for the potential risk is increased severity of kidney disorders associated with the use of paracetamol is acute tubular necrosis (a kidney lesion characterized by destruction and necrosis of tubular epithelial cells and an acute decrease in kidney function). About 5% of paracetamol is metabolized via phase I metabolism (cytochrome P-450 pathway) to form Nacetyl-p-benzoquinone imine. The cytochrome P-450 pathway can be detected in both the kidney and liver, although

Table V. Number of Medicines Received by Inpatient CKD Patients

Number of Medicine	Number of Patients	Percentage (%)
5	16	20
4	16	20
3	13	16.25
7	11	13.75
6	10	12.5
8	5	6.25
2	3	3.75
11	3	3.75
9	1	1.25
10	1	1.25
12	1	1.25
Total	80	100

both are quite variable in each organ. This process produces lipid peroxides that lead to cell apoptosis and initiate programmed cell death. For this reason, tissue necrosis and organ dysfunction may occur.[25]

Ranitidine is one of the medicines used for symptoms or diseases related to stomach acid. In CKD patients, stomach acid is prone to increase, because decreased kidney function results in an increases product that should be excreted by the kidneys, one of which is gastrin which is a hormone that can stimulate gastric acid secretion.[26] Ranitidine also requires dose adjustments in CKD patients because ranitidine is excreted by the kidneys in unchanged form approximately 30% for oral doses and 70% for intravenous doses. Ranitidine experienced a prolonged elimination half-life in CKD patients. Prolonged elimination half-life of ranitidine will be proportional to the level of kidney damage which is described by the Glomerular Filtration Rate (GFR). Therefore, it is recommended to reduce or adjust the medicine dose of ranitidine in CKD patients.[27]

Dosage Appropriateness of Medicines that Require Dosage Adjustment in Inpatient CKD Patients

The appropriateness of medicine doses is assessed according to the appropriateness of medicine doses received by inpatient CKD patients with medicine doses in the Lexicomp or Renal Pharmacotherapy literature based on the patient's GFR. Based on Table VI, of the 18 types of medicines with a total of 149 medicines that required dose adjustments, there were 15 types of medicines with a total of 128 (85.91%) medicines with doses that were appropriate to the literature. There were 8 types of medicines with doses that were not appropriate to the literature, with a total of 21 (14.09%) medicines. Of the 128 medicines with appropriate doses, 4 types of medicines dominate, including calcium carbonate as many as 36 (28.13%) medicines, furosemide as many as 36 (28.13%) medicines, paracetamol as many as 16 (12.50%) medicines, and metoclopramide as many as 10 (7.81%) medicines. Of the 21 medicines with inappropriate doses, 4 types of medicines dominate, including ranitidine as many as 7 (33.33%) medicines, metoclopramide as many as 6 (28.57%) medicines, allopurinol as many as 2 (9.53%) medicines, and bisoprolol as many as 2 (9.53%) medicines.

Based on Table VII, calcium carbonate is the first most common medicine among 128 medicines whose dosage is appropriate with the literature. Calcium carbonate has a normal dose of 1.5 - 4 grams/day. Based on the Lexicomp, calcium carbonate in CKD patients with GFR < 60 mL/minute/1.73 m^2 is recommended to adjust the dose not to exceed 2,000 mg/day. In this study, CKD patients with GFR < 60 mL/minute/1.73 m^2, received a dose of 500 mg 2 - 3 times a day, where this dose is appropriate with the dose in the Lexicomp.

Based on Table VII, furosemide is the second most common medicine whose dosage is appropriate with the literature. Furosemide has a normal dose of 20 mg/day. Based on the Lexicomp, furosemide in CKD patients with GFR < 30 mL/minute/1.73m^2 is recommended to adjust the dose not to exceed 160 - 200 mg, whereas in furosemide continuous intravenous infusion, an initial dose of 20 mg/hour is recommended. In this study, CKD patients with GFR < 30 mL/minute/1.73 m^2, received an oral dose of 40 mg 2 - 3 times a day, an intravenous injection dose of 20 mg 2 - 3 times a day, 1 - 2 ampoules, and a dose of continuous intravenous infusion of 20 mg/hour, where all of these three doses are appropriate with the doses in the Lexicomp.

Based on Table VII, paracetamol (acetaminophen) is the third most common medicine whose dosage is appropriate with the literature. Paracetamol has a normal dose of 500 - 1,000 mg every 4 - 6 hours. Based on the

Table VI. Number of Medicines with Appropriate and Inappropriate Doses According to The Lexicomp or Renal Pharmacotherapy Literature

Type of Medicine	Number of Medicine	Percentage (%)
Medicines with doses that appropriate to the literature	128	85.91
Medicines with doses that are not appropriate to the literature	21	14.09
Total	149	100

Table VII. Type and Number of Medicines with Appropriate Doses According to The Lexicomp or Renal Pharmacotherapy Literature

Type of Medicine	Number of Medicine	Percentage (%)
Calcium carbonate	36	28.13
Furosemide	36	28.13
Paracetamol	16	12.50
Metoclopramide	10	7.81
Cefixime	5	3.90
Allopurinol	4	3.13
Bisoprolol	4	3.13
Ranitidine	4	3.13
Potassium Chloride	3	2.34
Ramipril	3	2.34
Clonidine	2	1.56
Digoxin	2	1.56
Tranexamic Acid	1	0.78
Cetirizine	1	0.78
Tramadol	1	0.78
Total	128	100

Renal Pharmacotherapy, paracetamol in CKD patients with GFR > 50 mL/minute/1.73 m^2 is recommended to adjust the dose to a maximum of 650 mg every 6 hours for oral preparations, and 1,000 mg every 6 hours for intravenous preparations. In CKD patients with GFR 10 - 50 mL/minute/1.73m^2, itis recommended to adjust the dose to a maximum of 650 mg every 6 hours in oral preparations, and a maximum of 1,000 mg every 6 hours in intravenous injection preparations, whereas in CKD patients with GFR < 10 mL/minute/1.73m^2, it is recommended to adjust the dose to a maximum of 650 mg every 8 hours in the oral preparation, and 1,000 mg every 8 hours in the intravenous preparation. In this study, CKD patients with a GFR of 10 - 50 mL/minute/1.73 m^2, receive a dose of 500 mg 4 times a day in an oral preparation, a dose of 1 gram 4 times a day, and a dose of 500 mg 4 times a day in an intravenous injection preparation. In CKD patients with GFR < 10 mL/minute/1.73 m^2, paracetamol is given at a dose of 500 mg 3 times a day in oral preparations, and a dose of 1 gram 3 times a day in intravenous injection preparations. These five doses are appropriate with the doses in the Renal Pharmacotherapy.

Based on Table VII, metoclopramide is the fourth most common medicine whose dosage is appropriate with the literature. Metoclopramide has a normal dose of 10 or 20 mg, 1 time per day. Based on the Renal Pharmacotherapy, metoclopramide in CKD patients with GFR > 50 mL/minute/1.73 m^2 is recommended to adjust the dose to 10 mg 4 times a day. In CKD patients with GFR < 10 mL/minute/1.73m^2, it is recommended to adjust the dose to 5 mg a maximum of 4 times a day, while in CKD patients with GFR 10 - 50 mL/minute/1.73m^2, it is recommended to adjust the dose to 7.5 mg maximum 4 times a day. In this study, CKD patients with GFR < 10 mL/minute/1.73 m^2, received a dose of 5 mg once a day, whereas in CKD patients with GFR 10 - 50 mL/minute/1.73 m^2, metoclopramide is given at a dose of 7.5 mg 1 - 3 times a day. Both doses are appropriate with the doses in the Renal Pharmacotherapy.

Based on Table VIII, ranitidine is the first most common medicine among 21 medicines whose dosage is inappropriate with the literature. Ranitidine has a normal dose of 50 mg every 6 - 8 hours (3 - 4 times a day).

Table VIII. Type and Number of Medicines with Inappropriate Doses According to The Lexicomp or Renal Pharmacotherapy Literature

Type of Medicine	Number of Medicine	Percentage (%)
Ranitidine	7	33.33
Metoclopramide	6	28.57
Allopurinol	2	9.53
Bisoprolol	2	9.53
Amoxicillin	1	4.76
Azathioprine	1	4.76
Captopril	1	4.76
Cetirizine	1	4.76
Total	21	100

Based on the Renal Pharmacotherapy, ranitidine in CKD patients with GFR > 50 mL/minute/1.73 m^2 is recommended to adjust the dose to 50 mg every 8 hours, while in CKD patients with GFR 10 - 50 mL/minute/1.73 m^2, it is recommended to adjust the dose to 50 mg every 12 hours. In CKD patients with GFR < 10 mL/minute/1.73 m^2, it is recommended to adjust the dose to 50 mg every 24 hours (1 time per day). In this study, there were CKD patients with GFR < 10 mL/minute/1.73 m^2 who received the ranitidine 50 mg 2 times a day, where this dose is inappropriate with the dose in the Renal Pharmacotherapy.

Based on Table VIII, metoclopramide is the second most common medicine whose dosage is inappropriate with the literature. Metoclopramide has a normal dose of 10 or 20 mg, once a day. Based on the Renal Pharmacotherapy, metoclopramide in CKD patients with GFR > 50 mL/minute/1.73 m^2 is recommended to adjust the dose to 10 mg 4 times a day, while in CKD patients with GFR 10 - 50 mL/minute/1.73 m^2, it is recommended to adjust the dose to 7.5 mg 4 times a day. In CKD patients with GFR < 10 mL/minute/1.73 m^2, it is recommended to adjust the dose to 5 mg a maximum of 4 times a day. In this study, there were CKD patients with GFR < 10 mL/minute/1.73 m^2 who received the metoclopramide 10 mg 3 times a day, where this dose is inappropriate with the dose in the Renal Pharmacotherapy.

Based on Table VIII, allopurinol is the third most common medicine whose dosage is inappropriate with the literature. Allopurinol has a normal dose of 600 - 800 mg/day. Based on the Renal Pharmacotherapy, allopurinol in CKD patients with GFR > 50 mL/minute/1.73 m^2 is recommended to adjust the dose to 200 mg once a day, while in CKD patients with GFR < 10 mL/minute/1.73 m^2, it is recommended to adjust the dose to 100 mg once a day. In CKD patients with GFR 10 - 50 mL/minute/1.73 m^2, it is recommended to adjust the dose to a maximum of 150 mg once a day. In this study, there were CKD patients with GFR 10 - 50 mL/minute/1.73 m^2 who received a dose of allopurinol 300 mg once a day, where this dose is inappropriate with the dose in the Renal Pharmacotherapy.

Based on Table VIII, bisoprolol is the fourth most common medicine whose dosage is inappropriate with the literature. Bisoprolol has a normal dose of 5 - 10 mg, a maximum of 20 mg, once a day. Based on the Renal Pharmacotherapy, bisoprolol in CKD patients with GFR > 50 mL/minute/1.73 m^2 is recommended to adjust the dose to 5 mg every 24 hours, while in CKD patients with GFR 10 - 50 mL/ minute/1.73 m^2, it is recommended to adjust the dose to 2.5 - 5 mg every 24 hours. In CKD patients with GFR < 10 mL/minute/1.73 m^2, it is recommended to adjust the dose to 2.5 mg every 24 hours (1 time per day). In this study, there were CKD patients with GFR < 10 mL/minute/1.73 m^2 who received a dose of bisoprolol 5 mg once a day, where this dose is inappropriate with the dose in the Renal Pharmacotherapy. The inappropriate of medicine doses received by inpatient CKD patients with the Lexicomp and Renal Pharmacotherapy literature can be caused by considerations from medical personnel who treat patients, regarding to the therapeutic needs of each inpatient CKD patients.[8]

Therapy Outcomes in Inpatient CKD Patients who Require Dosage Adjustments

Based on Table IX, of the 77 inpatients with CKD who required dose adjustments, there are 70 patients were discharged from the hospital with improved therapy outcomes, and 7 patients were discharged from the hospital with unimproved therapy outcomes. Of the 3 inpatients with CKD who did not require dose adjustments, there are 2 patients were discharged from the hospital with improved therapy outcomes, and 1 other patient was discharged from the hospital with unimproved therapy outcomes. Therapy outcomes in patients who require medicine dose adjustments and therapy outcomes in patients who do not require medicine dose adjustments

Table IX. Therapy Outcomes in CKD Patients who Require Dosage Adjustment

Therapy Outcomes in CKD Patients who Require Dosage Adjustment	Number of Patients	Percentage (%)
Improved	70	90.91
Not Improved	7	9.09
Total	77	100

Table X. Therapy Outcomes and Appropriateness of Medicine Doses in CKD Patients

Therapy Outcome / Dosage Appropriateness	Improved	Not Improved
Dosage Adjustment Appropriate with The Literature	121 medicines	7 medicines
Dosage Adjustment Inappropriate with The Literature	14 medicines	7 medicines

are known by looking at vital signs (such as body temperature, pulse, respiratory rate, and blood pressure), laboratory results (serum creatinine level) and information about the condition of being discharge from the hospital. Normal body temperature is in the range of 36.5 - 37.2°C, normal pulse is in the range of 60 - 100 times per minute, normal respiratory frequency is in the range of 95 - 100%, normal blood pressure is in the range of < 120/80 mmHg, and normal serum creatinine is in the range of 0.6 - 1.3 mg/dL. The therapy outcome is said to have improved if there is improvement in vital signs, laboratory result, and information about the condition of being discharged from the hospital, while the therapy outcome is said to have not improved if there is no improvement in vital signs, laboratory result, and information about the condition of discharge from the hospital.[7] The limitations of this study are that a newer GFR calculation formula has not been used, and the sample size is not large enough to provide a broader picture of dose adjustments in hospitalized CKD patients.

CONCLUSION

The majority of hospitalized CKD (Chronic Kidney Disease) patients are men. Most patients are in the age range of 53 - 59 years. The severity of CKD is highest at stage 5. The most common comorbidity is hypertension. The number of patients who required dose adjustments was 77 (96.25%) patients. The number of medicines requiring dose adjustment was 149 (34.89%) medicines. There were 128 (85.91%) medicines with doses appropriate to the literature, while there were 21 (14.09%) medicines with doses inappropriate to the literature. Therapy outcomes improved in 70 (90.91%) patients who required dose adjustments, and did not improve in 7 (9.09%) patients who required dose adjustments. It is recommended to use a new formula such as eGFR using CKD-EPI when calculating a patient's GFR, and collecting data with a larger number of samples.

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STATEMENT OF ETHICS

This research was declared to have passed ethical review by the Health Research Ethics Committee of Abdoel Wahab Sjahranie Samarinda Regional General Hospital (24/KEPK-AWS/III/2023) on March 3, 2023.

REFERENCES

1. Efendi, Z., Irwan, M., Zalni, R. I., Roni, Y. 2021. Faktor-Faktor Yang Berhubungan Dengan Kualitas Hidup Pasien Dengan Gagal Ginjal Kronik Yang Menjalani Hemodialisa. *Jurnal Kesehatan Maharatu:* 2(2):12-26.

2. Kementerian Kesehatan Republik Indonesia. 2013. *Hasil Utama Riskesdas 2013*. Jakarta: Badan Penelitian dan Pengembangan Kesehatan, Kementerian Kesehatan Republik Indonesia.
3. Kementerian Kesehatan RI. 2018. *Laporan Provinsi Kalimantan Timur Riskesdas 2018.* Jakarta: Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan, Kementerian Kesehatan Republik Indonesia.
4. DiPiro, Joseph T., Yee, Gary C., Posey, L Michael., Haines, Stuart T., Nolin, Thomas D., Ellingrod, Vicki. 2020. *Pharmacotherapy A Pathophysiologic Approach Eleventh Edition.* McGraw-Hill Education eBook.
5. Kidney Disease Improving Global Outcomes. 2021. Clinical Practice Guideline for the Management of Glomerular Diseases. O*fficial Journal Of The International Society Of Nephrology:* 100(45):S1-S276.
6. Gunawan. 2012. *Farmakologi Dan Terapi Edisi 5.* Jakarta : Departemen Farmakologi dan Terapeutik Fakultas Kedokteran Universitas Indonesia.
7. Andriani, S., Rahmawati, F., Andayani, T. M. 2021. Penyesuaian Dosis Obat pda Pasien Gagal Ginjal Kronis Rawat Inap di Rumah Sakit Kabupaten Tegal, Indonesia. *Majalah Farmaseutik:* 17(1):46-53.
8. Veryanti, P. R., Meiliana, M. L. 2018. Evaluasi Kesesuaian Dosis Obat Pada Pasien gagal Ginjal Kronik. *Saintech Farma:* 11(1):12-17.
9. Setyawan, Yuswanto. 2021. Merokok dan Gangguan Fungsi Ginjal. *e-CliniC*: 9(2):388-396.
10. Pongsibidang, G.S. 2017. Risiko Hipertensi, Diabetes, dan Konsumsi Minuman Herbal Pada Kejadian Gagal Ginjal Kronik Di RSUP Dr. Wahidin Sudirohusodo Makassar. *Jurnal Wiyata Penelitian Sains dan Kesehatan:* 3(2):162-167.
11. Puspitasari, P., Kusnadi, D. 2015. Hubungan Antara Konsumsi Minuman Berenergi Yang Mengandung Kombinasi Taurin Dan Kafein Dengan Angka Kejadian Gagal Ginjal Kronis. *Jurnal Kesehatan Hesti Wira Sakti:* 3(3):54-61.
12. Tjekyan, Suryadi. 2014. *Prevalensi dan Faktor Risiko Penyakit Ginjal Kronik di RSUP Dr. Mohammad Hoesin Palembang Tahun 2012*. Palembang: Fakultas Kedokteran Universitas Sriwijaya.
13. Septi, D., Apen, Afgani., AL, Garina. 2014. *Karakteristik Penderita Gagal Ginjal Kronis yang Dilakukan Hemodialisis di RSUD Al-Ihsan Tahun 2014*. Bandung: Universitas Islam Bandung.
14. Gajjala, PR., Sanati, M., Jankowski, J. 2015. Cellular and Molecular Mechanisms of Chronic Kidney Disease with Diabetes Melitus and Cardiovascular Disease as its Comorbidities. *Front Immunol:* 6:1-15.
15. Afiatin., Roesli, Rully M A. 2017. Laju Filtrasi Glomerulus Dengan Metoda eGFR. Universitas Padjadjaran: *Pustaka Ilmiah*.
16. Alldredge B.K., Corelli R.L., Ernest M.E., Guglielmo B.J., Jacobson P.A., Kradjan W.A., Williams B.R. 2013. *Koda-Kimble &Young's Applied Therapeutics the clinical use of medicines*. 10th edition. Philadelphia: Liippincott Williams & Wilkins.
17. Pradesya, Ezra Senna., Faesol, H. Ahmad. 2016. Hubungan Gagal Ginjal Kronik Dengan Edema Paru Ditinjau Dari Gambaran Radiologi. Universitas Muhammadiyah Yogyakarta: *Research Repository*.
18. Sholihah, Inayatush., Santoso, Joko., Rahardjoputro, Rolando. 2022. Gambaran Penggunaan Pengikat Fosfat pada Pasien Penyakit Ginjal Kronik dengan Hemodialisis. *INPHARNMED Journal (Indonesian Pharmacy and Natural Medicine Journal)*: 6(2):91-97.
19. Sorensen, M.D. Calcium Intake and Urinary Stone Disease. *Translational Andrology and Urology:* 3(3):235-240.
20. Bruyne, L.K.M De. 2003. Mechanisms and Management of Diuretic Resistance in Congestive Heart Failure. *Postgrad Med J*: 79(931):268-71.
21. Wilcox, C.S. 1996. Diuretics. In: Brenner BM, Rector FC, editors. The Kidney. Philadelphia: *WB Saunders.* 2299-330.
22. Joshi, Shivam., Chaknos, Michael. 2019. Diuretic Dosing in Heart Failure and Chronic Kidney Disease. *Journal of Clinical Nephrology & Kidney Diseases* Case Report: 4(1): 1019.
23. European Medicines Agency. 2014. Metoclopramide Art. 31 - Annex III -en. *European Medicines Agency: Science Medicines Health.*
24. Bertram G, Katzung. 2010. *Farmakologi Dasar dan Klinik 10th edition*. Jakarta: EGC.
25. Kanchanasurakit, Sukrit., Arsu, Aimusa., Siriplabpla, Wuttikorn., Duangjai, Acharaporn., Saokaew, Surasak. 2020. Acetaminophen Use and Risk of Renal Impairment: A Systematic Review and Meta-Analysis. *National Library of Medicine, National Center for Biotechnology Information, Kidney Research and Clinical Practice*: 39(1):81-92.
26. Hammer, G.D., McPhee, S.J. 2019. *Pathophysiology of Disease: An Introduction to Clinical Medicine. Seventh Edition*. New York: McGraw-Hill Education.

27. Lucida, Henny., Trisnawati., Riah., Suardi, Muslim. 2011. Anlisis Aspek Farmakokinetika Klinik Pasien Gagal Ginjal pada Irna Penyakit Dalam RSUP Dr. M. Djamil Padang. Padang: *Repositori Universitas Andalas.*

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Knowledge, Attitudes, and Practices in Bungkulan Buleleng Village Communities Related to the Implementation of COVID-19 Vaccination

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ABSTRACT

Background: The contribution of the community through their knowledge, attitudes, and practices are essential to control COVID-19 through vaccination.

Objectives: This study aims to analyze the relationship between knowledge, attitudes, and practices of the community related to implementing the COVID-19 vaccine.

Methods: This observational study with a cross-sectional design was carried out from June to July 2023. Samples of 155 respondents were obtained through convenience sampling. Inclusion criteria include the community domiciled in Bungkulan Village, aged ≥18 years, and is willing to be involved in research, while respondents who didn't fill in the complete questionnaire are excluded from research. Data was collected using self-developed offline questionnaire. The relationship of knowledge, attitudes, and practices was analyzed by multiple linier regression and Spearman-rho test (95% CI).

Results: Findings showed that the majority of respondents were aged 25-29 years old (30.32%), male (76.13%), graduated from high school (65.16%), worked (89.68%), didn't experience comorbidities (96.13%) and AESI (87.10%), lack of knowledge (53.29 ± 23.24) but has a good attitude (75.18 ± 11.55) and practices (84.06 ± 16.17) related to the implementation of the COVID-19 vaccination. There is a significant relationship between knowledge with attitudes ($r = 0.352$; $p = <0.001$) and attitudes with practices ($r = 0.257$; $p = <0.001$), also knowledge and attitudes simultaneously influence the practice of Covid-19 vaccination ($p=<0.001$).

Conclusion: A person's attitudes and practices in a positive direction tend to begin with good knowledge. Strong sources of public health information and communication are necessary to develop good knowledge.

Keywords: attitudes; COVID-19; knowledge; practices; vaccination

INTRODUCTION

The coronavirus disease 2019 (COVID-19) has rapidly spread across the world, causing numerous deaths including in Indonesia. Bali, in particular, has experienced a significant rise in daily cases and deaths due to COVID-19. As of August 30, 2021, Bali Province has recorded the highest number of COVID-19 cases, with a total of 105.894 confirmed positive cases since 2020. Out of those, 6.221 people were hospitalized, 96.176 people have been declared cured, and 3.497 people have lost their lives due to the virus.[1] This increase in cases is due to high community mobility, and the reopening of Bali's tourism industry during the New Normal Bali era in July 2020. As a result, Bali's economy has contracted significantly, reaching -10.98%, especially in the second quarter of 2020.[2]

To effectively combat the spread of COVID-19, the World Health Organization (WHO) strongly recommends taking preventative measures such as increasing the body's defense system through vaccine administration and implementing health protocols. These protocols include diligently washing hands with soap

and running water, maintaining a safe distance from others while talking, avoiding touching your face with dirty hands, wearing a mask, and covering your nose and mouth when coughing. Vaccines are widely recognized as the most effective and economical way to prevent infectious diseases.[3,4] As a result, governments across the globe, including Indonesia, have implemented vaccination programs to combat the pandemic and return the world to normalcy.

Vaccination activities must ensure several critical factors, such as providing accurate information and education on vaccine eligibility, potential risks, administering the vaccine, and procedures for vaccinating the public. These aspects are essential to ensure the smooth functioning of the vaccination program and safeguard the community from any harm.[5] The research conducted by Mardiono et al[6] highlights that there are still challenges in implementing the COVID-19 vaccination program, such as non-compliance and community reluctance to follow instructions. The primary among these is the lack of clear and accurate information available to the public, leading to a lack of understanding and fear of vaccination. Additionally, the spread of false information, such as vaccines being dangerous and containing fatal side effects, is further contributing to this issue.[6,7]

The lack of information certainly poses a significant challenge to developing healthy behavior, particularly in influencing attitudes and practices toward the COVID-19 vaccination program. Abdul et al[8] conducted thorough research that revealed several multilevel predictors that explain people's non-compliance with government regulations and advice during the COVID-19 pandemic and one of the key factors is knowledge, especially at the individual level. Furthermore, the area of residence also has a substantial impact on individual knowledge, which in turn affects attitudes and perceptions regarding information about COVID-19. The perception of the benefits of Covid-19 is a crucial factor that determines people's willingness to get vaccinated.[9] There are stark disparities between the communication and information flow in rural and urban communities. The residents of urban areas can easily access electronic devices with robust internet signals. On the other hand, rural communities often struggle with limited access to communication and information, even if they possess devices, due to weak internet signals. This is especially true for those residing in highland or mountainous areas.[10] Research by Toar (2020) also found that limited access to health information can lead to low levels of health literacy during the COVID-19 pandemic.[11]

Extensive research has been conducted in different regions of Indonesia to analyze people's knowledge, attitudes, and practices regarding COVID-19 vaccination. In Badung Regency, Bali, Noviyanti et al[12] conducted research on communities and discovered that there were discernible differences in community practices after COVID-19 vaccination based on their level of knowledge ($p>0.05$), but the research did not explain the aspect of attitude. According to a study conducted by Hadning et al[13] in the Riau community of Indonesia, respondents exhibited a profound understanding of COVID-19 vaccination and exhibited highly positive attitudes and behaviors towards it. Although the study did not analyze the correlation between these variables, the results strongly indicate that the respondents are well-informed and supportive of COVID-19 vaccination efforts.[13] The research conducted in a community in South Sumatra by Yonantriza et al[14] has revealed a significant correlation between knowledge and attitudes toward receiving the COVID-19 vaccine, albeit partially. However, no simultaneous report was made on the influence of both knowledge and attitudes on the practice of receiving the COVID-19 vaccine.[14] National research in Indonesia has also been carried out by Efendi et al[15], which showed that there is a significant relationship between knowledge, attitudes, and self-confidence toward compliance with COVID-19 vaccination in young adults. However, the response rate was limited since the questionnaire was distributed online to rural communities.[15] Based on the above background, researchers are interested in analyzing the partial and simultaneous relationships between knowledge, attitudes, and practices of the community regarding the COVID-19 vaccination program, particularly in rural areas in Bungkulan Village, Buleleng Regency, Bali.

METHODS

Study design

This is an observational study that was conducted from June to July 2023, employing a cross-sectional design with data collected during that specific timeframe. It delves into the knowledge, attitudes, and practices of the of the residents of Bungkulan Village, Buleleng Regency, Bali, concerning the implementation of the Covid-19 vaccination program.

Population and samples

This study involved a total of 155 respondents, obtained through a convenience sampling technique. All respondents were thoroughly screened and confirmed to meet the research's inclusion and exclusion criteria. Only native people or those who live in Bungkulan Village and have lived there since before COVID-19 was declared a pandemic until the time of data collection were eligible to participate. Additionally, participants were required to be at least 18 years old, have received socialization about COVID-19 vaccination, and be willing to participate in the research by filling out an informed consent form. The only exclusion criteria were those who did not complete the questionnaire.

Study instruments

The research instrument utilized in this study is a self-developed questionnaire. The questionnaire was meticulously adjusted to the conditions and references in the form of regulations in Indonesia regarding the COVID-19 vaccination program issued by the Ministry of Health of the Republic of Indonesia including Decree of the Minister of Health of the Republic of Indonesia Number 4638 of 2021 and Regulation of the Minister of Health of the Republic of Indonesia Number 23 of 2021 concerning Technical Guidelines for Implementing Vaccination COVID-19, as well as Circular Number HK.02.02/II/252/2022 concerning Advanced Dose (Booster) COVID-19 Vaccination.[16,17,18] The construct of the questionnaire for each variable of knowledge, attitude, and practice was expertly adapted from research by Singh et al.[19] The questionnaire to assess knowledge comprises 15 questions (Q) that cover various domains, including the definition and benefits of vaccines (Q1, Q2, Q3), vaccination program targets (Q4, Q5, Q6), vaccination facilities and services (Q7, Q8), vaccination costs (Q9), also dosage, side effects, and vaccination procedures (Q10, Q11, Q12, Q13, Q14, Q15).[19] The questionnaire to assess attitudes consists of 10 questions that cover domains such as prevention attitudes (Q1, Q2, Q3, Q4), health-seeking attitudes (Q5, Q6, Q7, Q8), and risk considerations (Q9, Q10).[19] The questionnaire to assess practice consists of 10 questions that cover domains such as prevention behaviors (Q3, Q8, Q9, Q10) and health-seeking behaviors (Q1, Q2, Q4, Q5, Q6, Q7).[19] Before distributing the questionnaire, the researcher ensured that it had undergone rigorous validity testing using the Content Validity Index (CVI) method. The obtained CVI value was ≥0.80, as assessed by two experts who are doctors in charge of implementing the COVID-19 vaccination program, amounting to CVI=1.000. The questionnaire also underwent reliable testing using the internal consistency method through Cronbach's alpha value. The questionnaire was declared reliable as the alpha value was greater than the r table based on the number of test respondents (> 0.361). This was carried out on 30 test respondents, with consecutive alpha values for each variable of 0.590, 0.751, and 0.674.[20,21]

Data collection

Data was collected through a questionnaire comprising two parts: a form to gather the respondent's personal information and a questionnaire to assess their knowledge, attitudes, and practices concerning the implementation of the COVID-19 vaccine program. The form for personal information collects data on the respondent's age, gender, education level, working status, vaccination status, history of illness, and any Adverse Event of Special Interest (AESI) experienced after receiving the COVID-19 vaccine. These events include local reactions such as swelling, pain, redness at the injection site, and cellulitis, and systemic reactions such as headache, fever, weakness, muscle pain, and joint pain. Other reactions include allergic reactions such as syncope, anaphylactic reactions, edema, and urticaria.[22,23,24] Only fever was reported by respondents after receiving the COVID-19 vaccine in this study, despite the presence of many potential AESIs.

Data analysis

When assessing the answers to the knowledge and practice questionnaire, the Guttman scale is used. A score of 1 is given to answers that are correct or "yes," while a score of 0 is given to incorrect answers, "don't know," or "no." The results of the questionnaire are calculated as a percentage by adding the scores from correct answers and dividing by the maximum score. This percentage is then multiplied by 100 and categorized as poor (≤55%), sufficient (56-75%), or good (≥76%) based on achievement criteria.[25] The attitude questionnaire uses a Likert scale, with positive questions and answer choices ranging from "1=Disagree" to "4=Strongly agree." Responses from each respondent are calculated by adding the scores for each question, dividing by the maximum scale, and multiplying by 100. The average level of response for each respondent is categorized as extremely poor (<20%), poor (20-39.9%), moderate (40-59.9%), good (60-79.9%), and excellent (80-100%).[26] The sociodemographic characteristics of respondents are analyzed descriptively and presented as frequencies and percentages. To identify the relationship between variables, the Spearman-rho correlation test is used because

the data is not normally distributed (p<0.001), then a multivariate statistical test (linear regression model) is carried out with a confidence level of 95% to determine the variables (between knowledge and attitude, and simultaneously) that have the most influence on practice.

RESULTS AND DISCUSSION

Overview of Respondent Characteristics

The study's findings demonstrate that the majority of respondents were males (76.13%) over 40 years old (22.58%) (Table I). These results are consistent with the research conducted by Nuraini et al[27] which also noted that the majority of their respondents fell within this age range (41.5%). It is important to note that people in this age group are still highly productive and receptive to new information, knowledge, and ideas.[28] As individuals age, their level of maturity and strength in thinking increases, and their accumulated experience better prepares them to face different situations.[29] Furthermore, prior research conducted by Putra et al[30] corroborates our study's outcomes that most respondents were men (55.3%). Men are often perceived to have more leisure time and to be more conscious of their health, which makes them more likely to engage in healthy behaviors.[30]

The other results revealed that the majority of respondents had completed high school education (65.16%) and were employed in the private sector (70.97%). This aligns with previous research by Putra et al[30] which also found that the majority of respondents had secondary or higher education (62.3%) and were employed (42.1%). Other studies by Baroroh et al[31] and Handayanti & Gunawan[32] have demonstrated that education level can significantly influence a person's thoughts and boost their knowledge. Further, according to Situmorang and Yosi (2013), work experience can be a crucial factor in helping individuals gain valuable knowledge and experience, either directly or indirectly.[33]

This study provides valuable insights into the disease history and AESI of respondents who received the COVID-19 vaccine. The results indicate that the vast majority of respondents (96.113%) had no history of disease, and the majority (87.10%) did not experience AESI after receiving the vaccine injection (Table I). These findings highlight the significant role that the history of disease and the potential for AEFI plays in shaping the community's attitude towards COVID-19 vaccination. Research conducted by Tuloli et al[34] and Ratnasariani et al[35] supports the notion that individuals with a history of the disease are less likely to participate in or receive COVID-19 vaccination compared to those without a history of the disease. The Indonesian Ministry of Health has also emphasized that vaccines are only given to healthy individuals.[36] People with uncontrolled comorbidities such as hypertension or diabetes are not eligible to receive the COVID-19 vaccine. Before receiving the vaccine, all participants undergo a thorough medical check-up, and those with comorbidities must get approval from their treating doctor. This strict protocol is in place because people with accompanying or comorbid diseases tend to have a weak immune system, which makes it challenging to form antibodies.[37]

Research conducted by Kholidiyah et al[38] have shown that misinformation about AESI related to the COVID-19 vaccine can cause doubt and anxiety in individuals. Similarly, a study by Farsida et al[39] revealed that many people still struggle with the decision to undergo COVID-19 vaccination due to anxiety, doubt, or rejection, particularly because of poor knowledge about the vaccine. However, seeking accurate and reliable information about COVID-19 vaccination can help reduce these negative emotions and promote informed decision-making.[39] It is important to note that vaccines, including the COVID-19 vaccine, generally do not cause significant reactions in the body. Mild local or systemic reactions such as pain at the injection site or a mild fever are natural and expected parts of the body's immune response.[22] Several factors can influence the occurrence of AESI, including the individual's immune system and overall health, coincidental reactions, and vaccine components like adjuvants, stabilizers, and preservatives. Nonetheless, it is crucial to remember that the side effects of COVID-19 vaccination are typically mild and not harmful. In rare cases, side effects can occur due to incorrect injection procedures or anxiety associated with the fear of needles.[22,40,41]

Respondents Knowledge

According to the respondents' data, it is evident that the average level of knowledge attainment (%) falls under the "poor" category, as demonstrated in Table II. This finding is consistent with the research conducted by Yonatriza et al[14], which asserts that most respondents still lack sufficient knowledge about COVID-19 vaccination. The inadequate knowledge levels could be attributed to the lack of information about the significance of the COVID-19 vaccination program. Moreover, the abundance of misinformation and fake news in society has led to the formation of misconceptions among people.[14,15]

Table I. Sociodemographic characteristics

Charateristic		N (155)	%
Age (years old)			
	1. 18-20	16	10,32
	2. 21-24	28	18,06
	3. 25-29	47 [a]	30,32
	4. 30-34	21	13,55
	5. 35-40	8	5,16
	6. >40	35	22,58
Sex			
	1. Male	118[a]	76,13
	2. Female	37	23,87
Education level			
	1. Elementary school	2	1,29
	2. Middle school	8	5,16
	3. High school	101[a]	65,16
	4. Higher education	44	28,39
Employment status			
	1. Unemployed	16	10,32
	2. Private sector employee	110[a]	70,97
	3. Entrepreneur	26	16,77
	4. Laborer	1	0,65
	5. Farmer	2	0,13
Comorbidities			
	1. No	149[a]	96,13
	2. Yes (hypertension)	6	3,87
AESI COVID-19 vaccination			
	1. No	135[a]	87,10
	2. Yes (fever)	20	12,90

Abbreviation: (a), highest frequency; SD, the standard of deviation; COVID-19, Coronavirus disease-19; AESI, Adverse Event of Special Interest

Table II. Overall knowledge of the COVID-19 vaccination implementation

No.	Categories	N (%)	Mean (SD)
1.	Poor (≤55%)	94 (60.64)	37.73 (11.81)
2.	Moderate (56-75%)	33 (21.30)	65.45 (5.05)
3.	Good (76-100%)	28 (18.06)	91.19 (8.18)
	Total	155 (100)	53.30 (23.32)

Abbreviation: SD, the standard of deviation; COVID-19, Coronavirus disease-19

Having substantial knowledge about the COVID-19 vaccine is essential in shaping people's decisions and intentions to get vaccinated, which is crucial for the success of the vaccination program.[42] To educate and communicate with the public about COVID-19 vaccination, various promotional activities can be conducted through different media channels, such as outreach programs, health campaigns, and personal approaches, both offline and online.[43] Many factors can influence a person's knowledge level, including their educational background, age, and employment status, as well as external factors like cultural and environmental factors.[44] However, with proper education and communication, it is possible to increase people's understanding of the vaccine, which can lead to higher vaccination rates.[42]

Our recent studies have indicated limited knowledge among respondents regarding COVID-19 vaccination in several domains, which include definition and benefits, program targets, also dosage, side effects, and procedures (Table III). Faisal et al[9] have reported that low awareness levels about the advantages and effectiveness of the COVID-19 vaccine can lead to negative perceptions, potentially increasing the likelihood of

Table III. The respondent's knowledge domain descriptions of the COVID-19 vaccination implementation

No.	Domains	Range of score	Mean (SD)
1.	Definition and benefits	0.00-100.00	39.57 (37.37)
2.	Program targets	0.00-100.00	47.10 (28.12)
3.	Facilities and services	0.00-100.00	80.00 (34.47)
4.	Costs	0.00-100.00	72.90 (44.59)
5.	Doses, adverse effects, and procedures	0.00-100.00	51.08 (30.19)

Abbreviation: SD, the standard of deviation; COVID-19, Coronavirus disease-19

refusal to get vaccinated. To encourage people to get vaccinated, it is essential to disseminate accurate information about the vaccine's efficacy, safety, targets, and vaccination procedures.[45] The resulting study by Rosiana et al conducted at a community health center in Indonesia also explained that public knowledge about COVID-19 vaccination includes a comprehensive understanding of the vaccine's dosage, side effects, and vaccination procedures.[46]

Respondents Attitudes

The data indicates that respondents' attitudes towards the COVID-19 vaccination program are overwhelmingly positive, according to Table IV. The average attitude achievement falls under the "good" category. These findings are supported by research conducted by Widjaja et al[47], which revealed that both health workers and the general public had very positive attitudes toward the implementation of the COVID-19 vaccination program (99% and 94%, respectively). Similarly, research conducted by Mamoto et al[48] reported that a majority of respondents had positive attitudes toward COVID-19 vaccination (64.1%). It is worth noting that having a positive attitude towards COVID-19 vaccination is crucial as it is a strong indicator of an individual's decision to seek vaccination services.[49]

The mean value of each attitude domain is close to the overall mean value of all attitudes, as shown in Table V. In this research, attitudes related to health-seeking are beliefs, feelings, or intentions that help people seek the COVID-19 vaccine at a health service without any difficulty, at no cost. This enables people to feel less anxious about the transmission of COVID-19. Furthermore, a preventive attitude is the belief that COVID-19 vaccination, as instructed by the government and assisted by health workers, can help prevent the transmission of COVID-19 for both the community and individuals. The third attitude domain is risk consideration, which is the belief that the COVID-19 vaccine is safe for the public, and people should remain vigilant even after vaccination. These three attitude domains encourage people to participate in vaccination activities and help shape society's efforts to prevent the spread of COVID-19. By agreeing and taking real action to participate in the COVID-19 vaccination program, people can protect themselves and others from exposure to the virus. This is an effort to break the chain of the COVID-19 pandemic and shows the belief that the Indonesian people can fight and control the transmission of COVID-19 through the vaccination program.[13,46]

A study conducted by Al-Jayyousi et al investigated the various factors that impact people's attitudes toward getting vaccinated against COVID-19. The study found that demographic characteristics play a significant role. For instance, elderly individuals are more willing to receive the vaccination in comparison to younger adults who may exhibit indifference or have doubts about the vaccine's safety and efficacy. Additionally, a person's level of literacy in obtaining information and knowledge about COVID-19 vaccines, such as their efficacy and safety, can also influence their attitude toward vaccination. Factors such as gender, race, ethnicity, religion, culture, health conditions, employment status, marital status, and location of residence also play a role in shaping one's attitude toward vaccination. The study also identified low levels of trust in the government and vaccine manufacturers as potential barriers to vaccination.[50]

Respondents Practices

The study shows that respondents have achieved an average practice score of 84.06% ± 16.17% in implementing the COVID-19 vaccination program, which is a good achievement within the range of 80-100%. The results of this research are consistent with previous studies conducted by Putra et al[30] and Mamoto et al.[48], which confirm that the majority of respondents exhibit good practices (65%; 66.7%) in implementing COVID-19 vaccination. This positive trend in good practices can be attributed to the respondents' strict adherence to the government's directions and policies related to COVID-19 vaccination.[51] The government has set a target of

Table IV. Overall attitude toward the COVID-19 vaccination implementation

No.	Categories	N (%)	Mean (SD)
1.	Extremely poor (0%-19.99%)	0	0
2.	Poor (20%-39.99%)	0	0
3.	Moderate (40%-59.99%)	7 (4.51)	55.36 (2.47)
4.	Good (60%-79.99%)	89 (57.41)	68.57 (4.98)
5.	Excellent (80%-100%)	59 (38.06)	87.50 (6.90)
	Total	155 (100)	75.40 (11,58)

Abbreviation: SD, the standard of deviation; COVID-19, Coronavirus disease-19

Table V. The respondent's attitude domain description of the COVID-19 vaccination implementation

No.	Domains	Range of score	Mean (SD)
1.	Prevention	25.00-100.00	74.52 (14.64)
2.	Health-seeking attitude	50.00-100.00	74.40 (13.86)
3.	Risk considerations	50.00-100.00	78.06 (15.69)

Abbreviation: SD, the standard of deviation; COVID-19, Coronavirus disease-19

Table VI. Overall practices toward the COVID-19 vaccination implementation

No.	Categories	N (%)	Mean (SD)
1.	Poor (≤55%)	7 (4.51)	45.71 (7.28)
2.	Moderate (56-75%)	40 (25.80)	66.00 (4.90)
3.	Good (76-100%)	108 (69.68)	93.24 (7.91)
	Total	155 (100)	84.07 (16.22)

Abbreviation: SD, the standard of deviation; COVID-19, Coronavirus disease-19

achieving herd immunity, and the respondents have taken the directives and policies seriously, which has contributed to their excellent practices.[52] Moreover, respondents are also well aware of the risks associated with contracting COVID-19, and that has further encouraged them to follow the best practices in implementing the COVID-19 vaccination program.[52]

According to this study, despite the domain of prevention behaviors having a slightly lower value than the overall practice average, it still falls under the category of good practice (Table VII). Prevention behaviors involve the conscious efforts taken by the community to prevent COVID-19, including getting vaccinated adhering to health protocols, and encouraging others to do the same. These practices are known to significantly improve personal and social health.[13] In countries like Singapore[53] and Thailand[54], individuals who have received vaccination continue to follow protective measures with the same level of diligence as before getting vaccinated, leading to a significant reduction in COVID-19 morbidity and mortality. Research conducted by Ngamchaliew et al[54] cites several reasons for this behavior, such as concerns about the emergence of new virus variants due to SARS-CoV-2 mutations, the efficacy of the vaccine, and apprehension regarding the side effects of using mixed and matched vaccines.

The Relationship between Knowledge and Attitudes

The results of the correlation test demonstrate a significant and positive relationship between knowledge and attitudes towards the COVID-19 vaccination program. The significance value (p) was 0.001 (<0.005), and the correlation coefficient (r) was 0.587 (Table VIII), indicating that individuals with a higher level of knowledge are more likely to have positive attitudes towards the program. Previous research by Putri et al[55] also showed that knowledge and willingness to be vaccinated against COVID-19 are correlated (p=0.000). Knowledge plays a critical role in shaping individuals' attitudes and practices, serving as an essential domain for the formation of real-world practices. Good knowledge can positively influence attitudes, which in turn leads to positive practices. On the other hand, a lack of public knowledge can lead to negative attitudes.[56] Greyling and Rossouw in their research suggest that providing additional information about vaccine safety and side effects can increase positive

Table VII. The respondent's practice domains description of the COVID-19 vaccination implementation

No.	Domains	Range of score	Mean (SD)
1.	Prevention behaviors	25.00-100.00	76.29 (1.12)
2.	Health-seeking behaviors	33.33-100.00	89.25 (0.96)

Table VIII. The relationship between respondent's knowledge and attitude toward COVID-19 vaccination implementation

K	A (N (Mean (SD))					Total N	r value	p value
	E	G	M	P	EP			
G	23 (91.41 (6.43))	5 (76.00 (1.37))	0	0	0	28	0.587**	<0.001*
M	16 (86.56 (6.18))	16 (71.25 (4.65))	1 (57.50 (0.00))	0	0	33		
P	20 (83.75 (5.99))	68 (67.39 (4.56))	6 (55.00 (2.74))	0	0	94		
Total N	59	89	7	0	0	155		

Abbreviation: (*) significant at the 0.05 level; (**) significant at the 0.01 level; K, knowledge; A, attitude; G, good; M, moderate; P, poor; E, excellent; EP, extremely poor; SD, the standard of deviation; COVID-19, Coronavirus disease-19

attitudes toward vaccines, which can help build public trust in vaccines. However, strict regulations and increasing vaccine accessibility are also crucial factors that need to be taken into consideration.[57]

The Relationship between Attitudes and Practices

The results from Table XI indicate a significant and positive correlation between attitudes and practices related to the implementation of the COVID-19 vaccination program (p-value was <0.001; r-value was 0.566). This means that individuals who have positive attitudes towards the COVID-19 vaccination program are likely to have better practices in implementing it. These findings are consistent with previous research conducted by Angelina and Tjandra[58] that suggested a positive correlation between attitudes and practices. The study's results also align with research conducted by Hutapea et al[59], which found a relationship between attitudes and practices related to willingness to receive COVID-19 vaccinations (p=0.004).

The Influence of Knowledge and Attitudes on Practice

The data presented in Table X affirms that both knowledge and attitudes significantly influence the implementation of COVID-19 practices (p<0.05), whether considered separately or together. However, the study shows that knowledge and attitudes combined only account for 34.2% of the respondents' practices, with other factors playing a decisive role. This finding is supported by Kimbler et al[62] who explain that people's fear of COVID-19 infection, normative beliefs, interpersonal concerns, and personality traits, such as agreeableness and openness, have a positive correlation with vaccination activities, along with their knowledge and attitude. In addition to this, workplace requirements, community culture, family support, personal experience with COVID-19, and sociodemographic factors like age, income, employment, and education level also affect people's practices.[14,15,46]

We acknowledge that certain limitations in this research could potentially cause bias or variations in the results. The sample size was limited due to restricted access and time for data collection, which may have introduced bias in the research. This research did not differentiate between individuals who had received the COVID-19 vaccine and those who had not, the absence of data regarding the type of vaccine received, nor did it distinguish between individuals who had received different vaccine doses or those who were part of priority groups, such as health workers and the general public. This could affect the understanding of each group's response to the vaccination outreach. Additionally, the research uses self-report questionnaires to measure different variables, which are subject to the respondents' memory and perception. Despite these limitations, the research suggests that there is potential to improve vaccination practices by increasing knowledge and promoting positive attitudes. We believe that this can be achieved through various efforts, such as strengthening information and communication sources related to public health and implementing strict regulations, policies,

Table XI. The relationship between respondent's attitudes and practice toward COVID-19 vaccination implementation

A	P ((N (Mean (SD))			Total N	r value	p value
	G	M	P			
E	55 (96.18 (5.77))	3 (70.00 (0.00))	1 (50.00 (0.00))	59	0.566**	<0,001*
G	48 (89.79 (8.38))	36 (79.52 (13.88))	5 (71.86 (15.03))	89		
M	5 (94.00 (8.94))	1 (60.00 (0.00))	1 (30.00 (0,00))	7		
P	0	0	0	0		
EP	0	0	0	0		
Total N	108	40	7	155		

Abbreviation: (*) significant at the 0.05 level; (**) significant at the 0.01 level; A, attitude; P, practice; G, good; M, moderate; P, poor; E, excellent; EP, extremely poor; SD, the standard of deviation; COVID-19, Coronavirus disease-19

Table X. Factors that influence respondent's practices in carrying out COVID-19 vaccination include knowledge and attitudes

Variable	p-value	R^2 value
Knowledge to practices[a]	<0.001*	
Attitudes to practices[a]	<0.001*	
Knowledge and attitudes toward practices[b]	<0.001*	0.342

Abbreviation: (*) significant at the 0.05 level; (a), partial regression test; (b), simultaneous significance test; COVID-19, Coronavirus disease-19

or standards.[57,63] We appreciate the importance of these efforts and believe that they can support the implications of this research.

CONCLUSION

This research shows that there is a significant relationship between knowledge, attitudes, and practices related to the implementation of the COVID-19 vaccination program with an illustration of the average percentage achievement of respondents who are classified as having poor knowledge, but who have good attitudes and practices. There needs to be support from strong sources of information and communication in the community to avoid fake and untrue news so that it can increase the potential for attitudes and practices of vaccination in a positive direction, that vaccination is carried out because of the benefits it provides for oneself and society, not because it follows a certain trend in society.

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CONFLICT OF INTEREST

None to declare.

STATEMENT OF ETHICS

The study obtained Ethical clearance No. 205/EA/KEPK-BUB-2023, published on July 20, 2023, by the Health Research Ethics Committee of Sekolah Tinggi Kesehatan Bina Usada Bali.

REFERENCES

1. Negara INAK, Budhitresna AAG, Sari LNEPK. Hubungan Antara Komorbiditas Dengan Derajat Keparahan Infeksi Covid-19 Di Rumah Sakit Sanjiwani Gianyar. *Aesculapius Med. J*. 2022;2(1):13–20.

2. Pratyaksa IGT, Putri NLWE. Strategi Komunikasi Pemerintah Provinsi Bali Communication Strategy of the Bali Provincial Government in Addressing the Covid-19 Pandemic. *Communicate*. 2021,2:172–183.
3. Lin Y, Hu Z, Zhao Q, Alias H, Danaee M, Wong LP. Understanding COVID-19 vaccine demand and hesitancy: A nationwide online survey in China. *PLoS Negl Trop Dis*. 2020;14(12):e0008961.
4. Saraswati KC, Sunarta IN. Implementasi Kebijakan Vaksinasi COVID-19 Dalam Mengurangi Tingkat Penyebaran Virus Corona Di Kota Denpasar. *Restorica J. Ilm. Ilmu Adm. Negara dan Ilmu Komun*. 2021;7:21–27.
5. Rachman FF, Pramana S. Analisis Sentimen Pro dan Kontra Masyarakat Indonesia tentang Vaksin COVID-19 pada Media Sosial Twitter. *Health Information Management Journal.* 2020;8(2):100–109.
6. Mardiono, S, Alkhausari, Saputra, AU. Edukasi dan Sosialisasi Vaksinasi (COVID-19) Kepada Masyarakat di Wilayah Kelurahan Dua Puluh Tiga Ilir Palembang. *EMASS J. Pengabdi. Kpd. Masy*. 2022;4(1):15–19.
7. Sukmana R, Apriyani, Iyansyah MI, Wijaya BA, Kurniawati MF. Implementasi Strategi Komunikasi Kesehatan dalam Meyakinkan Masyarakat untuk Pelaksanaan Vaksinasi COVID-19 di Kabupaten Barito Kuala. *Jurnal Sains Sosio Humaniora*. 2021;5(1):409-419.
8. Abdul AR, Nuraini A, Elisa K, Iman S. Faktor-Faktor Psikososial dari Ketidakpatuhan Masyarakat pada Masa Pandemik. *Artikel.* 2020**;**19;1–10.
9. Faisal DR, Ramadhan N, Nur A, et al. Persepsi Masyarakat Terhadap Vaksin COVID-19 di Kota Banda Aceh. Maj Kesehat. 2022;9(4):225-238.
10. Juditha C. People Behavior Related to The Spread of COVID-19's Hoax. *Journal Pekommas*. 2020;5(2):105-116. (9)
11. Toar JM. Faktor Yang Mempengaruhi Literasi Kesehatan Pada Penderita Diabetes Melitus Tipe 2 Di Kota Manado. *Jurnal Keperawatan*. 2020;8(2);1–8. (10)
12. Noviyanti NPAW, Dewi PRS, Febianingsih NPE. Knowledge and Prevention Behavior of Post-COVID-19 Vaccination. *Babali Nurs Res*. 2022;3(2):143-152.
13. Hadning I, Putri FRA, Ardhana SS. Indonesian community knowledge, attitude, and behavior towards COVID-19 vaccination. *Bali Med J*. 2022;11(3):1649-1655.
14. Yonatriza H, Fari AI, Rini MT. Pengetahuan dan Sikap Masyarakat terhadap Penerimaan Vaksin Covid-19. *J Akad Baiturrahim Jambi*. 2023;12(1):20.
15. Efendi D, Rifani SR, Milanti A, et al. The Role of Knowledge, Attitude, Confidence, and Sociodemographic Factors in COVID-19 Vaccination Adherence among Adolescents in Indonesia: A Nationwide Survey. *Vaccines*. 2022;10(9):1489.
16. Kemenkes RI. 2021. Keputusan Menteri Kesehatan Republik Indonesia Nomor 4638 Tahun 2021 tentang Petunjuk Teknis Pelaksanaan Vaksinasi Dalam Rangka Penanggulangan Pandemi *Corona Virus Disease* 2019 (Covid-19). Jakarta: Kementerian Kesehatan Republik Indonesia.
17. Kementerian Kesehatan Republik Indonesia. 2021. Peraturan Menteri Kesehatan Republik Indonesia Nomor 23 Tahun 2021 tentang Perubahan Ketiga Atas Peraturan Menteri Kesehatan Nomor 10 Tahun 2021 Tentang Pelaksanaan Vaksinasi Dalam Rangka Penanggulangan Pandemi Penanggulangan Pandemi *Corona Virus Disease* 2019 (Covid-19). Jakarta: Kementerian Kesehatan Republik Indonesia.
18. Kementerian Kesehatan Republik Indonesia. 2022. Surat Edaran Nomor HK.02.02/II/252/2022 tentang Vaksinasi Covid-19 Dosis Lanjutan (*Booster*). Jakarta: Kementerian Kesehatan Republik Indonesia Direktorat Jenderal Pencegahan dan Pengendalian Penyakit.
19. Singh PK, Anvikar A, Sinha A. COVID-19 related knowledge, attitudes, and practices in Indian Population: An online national cross-sectional survey. Farrukh MJ, ed. *PLOS ONE*. 2022;17(3):e0264752.
20. Yusoff MSB. ABC of Content Validation and Content Validity Index Calculation. *Educ Med J*. 2019;11(2):49-54.
21. Anggraini FDP, Aprianti A, Setyawati VAV, Hartanto AA. Pembelajaran Statistika Menggunakan Software SPSS untuk Uji Validitas dan Reliabilitas. *J Basicedu*. 2022;6(4):6491-6504.
22. Yulyani V, Hasbie NF, Farich A, Valentine A. Hubungan Status Demografi, Komorbid Dengan KIPI Post Vaksin COVID-19 Pada Tenaga Kesehatan. *J Ilm Kesehat Sandi Husada*. 2022;11:153-160.
23. Sumara R, Saputra SH, Sumarliyah E, Nuraini R. Identifikasi Gejala Pasca vaksinasi COVID-19 Dosis Ke-3 (Booster). *J Keperawatan Muhammadiyah*. 2023:39-44.
24. Setyoningsih H, Wicaksono TZ, Palupi DA. Identifikasi Kejadian Ikutan Pasca Imunisasi (KIPI) Vaksin Covid-19 pada Kelompok Komorbiditas di Desa Blaru Kecamatan Pati Kabupaten Pati. *JPSCR J Pharm Sci Clin Res*. 2023;8(3):394.

25. Hastuti D, Alfiyani N. Tingkat Pengetahuan Ibu Mengenai Penggunaan Vitamin A Di Desa Gulurejo Lendah Kulon Progo. *Pharmanaja*. 2022;1(1):32–43.
26. Febtriko A, dan Puspitasari I. Mengukur Kreatifitas Dan Kualitas Pemograman Pada Siswa SMK Kota Pekanbaru Jurusan Teknik Komputer Jaringan Dengan Simulasi Robot. *Rabit : Jurnal Teknologi dan Sistem Informasi Univrab*. 2018; 3(1):1–9.
27. Nuraini, Fajrah S, Jumain. Pengetahuan Dan Sikap Masyarakat Tentang Vaksin Covid-19 Di Puskesmas Lompe Ntodea Kecamatan Parigi Barat Kabupaten Parigi Moutong. *Jurnal Ilmiah Kesmas IJ (Indonesia Jaya)*. 2023;23(1):21-27.
28. Puspitasari CE, Muliasari H, Ananto AD. Analisis tingkat pengetahuan penggunaan antibiotik di masyarakat Desa Lebah Sempage Kabupaten Lombok Barat. *INDRA J. Pengabdi. Kpd. Masy*. 2022;3:9–12.
29. Restiyono A. Analisis Faktor yang Berpengaruh Dalam Swamedikasi Antibiotik Pada Ibu Rumah Tangga di Kelurahan Kajen Kebupaten Pekalongan. *Jurnal Promosi Kesehatan Indonesia*. 2016;11(1):14-27.
30. Putra AIY, Pratiwi MSA, Yani MVW, Gunawan GRD, Ganesha GM, Aminawati AMAE, Aryana IPGDW, Suryawati IGAA. Gambaran Karakteristik Pengetahuan, Sikap dan Perilaku Risiko Covid-19 Dalam Kerangka Desa Adat di Desa Gulingan, Mengwi, Bali. *J. Kesehat. Andalas*. 2020;9(3):313-319.
31. Baroroh HN, Utami ED, Maharani L, Mustikaningtias I. Peningkatan Pengetahuan Masyarakat Melalui Edukasi Tentang Penggunaan Antibiotik Bijak dan Rasional. *AdDawaa' Journal of Pharmaceutical Sciences*. 2018;1(1):8–15.
32. Handayanti L., Gunawan S. Hubungan Tingkat Pendidikan Dan Pengetahuan Dalam Penggunaan Antibiotika Di Lingkungan SMA/SMK Kecamatan Tambelang Kabupaten Bekasi. *Tarumanagara Medical Journal*. 2021;3(2):337-343.
33. Situmorang S, Yosi A. Gambaran Pengetahuan Masyarakat Kota Medan Mengenai Penggunaan Obat Anti Jamur Topikal. *E- Journal FK USU*. 2013;1(1):4-5.
34. Tuloli TS, Abdulkadir W, Paneo MA, Abdullah N. Tingkat Pengetahuan Dan Persepsi Masyarakat Tentang Vaksin Covid-19 Studi Kasus: Kota Gorontalo. *Indonesian Journal of Pharmaceutical (e-Journal).* 2023;3(1):175-185.
35. Ratnasariani W, Assa I, Bouway DF, Asriati, Tambing Y, Rumainum A. Determinan Implementasi Vaksin Covid-19 di Perguruan Tinggi di Kota Jayapura. *Jurnal Farmasi Klinik Best Practice*. 2023; 2(1):1-10.
36. Kementerian Kesehatan Republik Indonesia. Survei Penerimaan Vaksin Covid-19 di Indonesia. Kementerian Kesehatan RI. *Published online*. 2020.
37. Kementerian Kesehatan Republik Indonesia. Vaksinasi COVID-19 Nasional. Kementerian Kesehatan RI. *Published online*. 2021.
38. Kholidiyah D, Sutomo N, Kushayati N. Hubungan Persepsi Masyarakat Tentang Vaksin Covid-19 Dengan Kecemasan Saat Akan Menjalani Vaksinasi Covid-19. *Jurnal Keperawatan*. 2021;14(2):8-20.
39. Farsida, Aufah YM, Utami YH. Hubungan Pengetahuan terhadap Kecemasan Kejadian Ikutan Pasca Imunisasi (KIPI) Peserta Vaksinasi Covid-19 di Puskesmas Bambu Apus. *Jurnal Kedokteran dan Kesehatan*. 2022;18(2): 229-237.
40. Hulu VT, Lubis SA, Sri Mahyuni. Gambaran Karakteristik Kejadian Ikutan Pasca Imunisasi Vaksin COVID-19 di Puskesmas Namorambe Tahun 2021. *J Kedokt Ibnu Nafis*. 2022;11(1):37-48.
41. Setyoningsih H, Wicaksono TZ, Palupi DA. Identifikasi Kejadian Ikutan Pasca Imunisasi (KIPI) Vaksin Covid-19 pada Kelompok Komorbiditas di Desa Blaru Kecamatan Pati Kabupaten Pati. *JPSCR J Pharm Sci Clin Res*. 2023;8(3):394.
42. Zheng H, Jiang S, Wu Q. Factors influencing COVID-19 vaccination intention: The roles of vaccine knowledge, vaccine risk perception, and doctor-patient communication. *Patient Educ Couns*. 2022;105(2):277-283.
43. Arsyad AW, Boer KM, Noor M. Communication on COVID-19 Vaccination in Indonesia and the Truth of the Digital Society. *Bp Int Res Crit Inst-J BIRCI-J*. 2021;4(4):9459-9472.
44. Monayo ER. Pengetahuan Dan Minat Vaksinasi Covid-19 Masyarakat di Kota Gorontalo dan Kabupaten Bone Bolango. *Jambura Nurs J*. 2022;4(1):32-43.
45. Ananda CP, Paujiah E. Socialization of the Covid-19 Vaccination Through Print Media to Improve Public Understanding About the Importance of the Covid-19 Vaccination. *Proceeding UIN Sunan Gunung Djati Bdg*. 2021;1(32):52-62.
46. Rosiana W, Andriati R. Hubungan Pengetahuan dan Sikap Masyarakat dengan Penerimaan Vaksinasi COVID-19 di Wilayah Kerja Puskesmas Sidamulya. *Frame Health J*. 2022;1(1):29-37.

47. Widjaja JT, Nathania E. Perbandingan Pengetahuan, Sikap, dan Keikutsertaan Tenaga Kesehatan dan Masyarakat Umum di Rumah Sakit Immanuel Bandung terhadap Vaksin Covid-19. J. Med. Heal. 2022;4(1);43-55.
48. Mamoto R, Pinontoan O, Kawatu P. Gambaran Pengetahuan, Sikap Dan Praktik Tentang Vaksinasi Covid-19 Pada Pekerja Informal Di Desa Pontak Satu. Fak. Kesehat. Masy. Univ. Sam Ratulangi Manad. Abstr. 2022.
49. Fauzia A, Hamdani F. Pendekatan Socio-Cultural dalam Pelaksanaan Vaksinasi Covid-19 di Indonesia. *Proceeding Seminar Nasional Hukum Universitas Negeri Semarang*. 2021;7(1):323-338.
50. Al-Jayyousi GF, Sherbash MAM, Ali LAM, El-Heneidy A, Alhussaini NWZ, Elhassan MEA, Nazzal MA. Factors Influencing Public Attitudes towards COVID-19 Vaccination: A Scoping Review Informed by the Socio-Ecological Model. *Vaccines*. 2021;9(6):548.
51. Wiranti SA, Kusumastuti W. Determinan kepatuhan masyarakat Kota Depok terhadap kebijakan pembatasan sosial berskala besar dalam pencegahan COVID-19. Jurnal Kebijakan Kesehatan Indonesia. 2020;9(3):117–124.
52. Saraswati KC, Sunarta IN. Implementasi Kebijakan Vaksinasi COVID-19 Dalam Mengurangi Tingkat Penyebaran Virus Corona di Kota Denpasar. *Restorica J. Ilm. Ilmu Adm. Negara dan Ilmu Komun*. 2021;7:21–27.
53. Cheng JYJ, Loong SSE, Ho CESM, et al. Knowledge, Attitudes, and Practices of COVID-19 Vaccination among Adults in Singapore: A Cross-Sectional Study. *Am J Trop Med Hyg*. 2022;107(3):540-550.
54. Ngamchaliew P, Kaewkuea N, Nonthasorn N, et al. Changes in preventive behavior after COVID-19 vaccination in Thailand: a cross-sectional study. *BMC Public Health*. 2022;22(1):2039.
55. Putri KE, Wiranti K, Ziliwu YS, Elvita M, Frare DY, Purdani RS, Niman S. Kecemasan Masyarakat akan Vaksinasi Covid-19. *Jurnal Keperawatan Jiwa*. 2021;9(3):539–548.
56. Fitriah R, Mardiati N. Pengaruh Faktor Sosiodemografi Terhadap Pengetahuan Dan Sikap Tentang Penggunaan Antibiotik Dikalangan Masyarakat Perkotaan. *Jurnal Penelitian Dan Kajian Ilmiah Kesehatan*. 2019;5(2):107-114.
57. Greyling T, Rossouw S. Positive attitudes towards COVID-19 vaccines: A cross-country analysis. Gesser-Edelsburg A, ed. *PLOS ONE*. 2022;17(3):e0264994.
58. Angelina S, Tjandra O. Hubungan antara Pengetahuan dan Sikap Ibu terhadap Perilaku Penggunaan Antibiotik pada Anak di Kelurahan Tomang Periode Januari-Maret 2017. *Tarumanagara Med. J*. 2017;1(2):410–416.
59. Hutapea MAO, Rizka Y, Lestari W. Pengetahuan Dan Sikap Masyarakat Tentang Vaksin Covid-19 Berhubungan Dengan Kesediaan Untuk Dilakukan Vaksinasi Covid-19. *J Penelit Perawat Prof*. 2022;4(1):917-924.
60. Notoatmodjo S. 2014. Pendidikan dan Perilaku Kesehatan. Jakarta: Rineka Cipta.
61. Lee M, Kang BA, You M. Knowledge, attitudes, and practices (KAP) toward COVID-19: a cross-sectional study in South Korea. *BMC Public Health*. 2021;21:295.
62. Kimbler KJ, Gromer C, Ayala M, Casey B. Correlates of COVID-19 Preventative Behaviors before and after Vaccination Availability. *Behav Sci*. 2023;13(6):501.
63. Sobierajski T, Rzymski P, Wanke-Rytt M. Impact of the COVID-19 Pandemic on Attitudes toward Vaccination: Representative Study of Polish Society. *Vaccines*. 2023;11(6):1069.

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Community Knowledge, Attitude and Practice toward Self-Medication and Its Influencing Factor in Central Java: A Cross-Sectional Study

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ABSTRACT

Background: Self-medication refers to people selecting and using medications to treat self-identified diseases or symptoms. Self-medication practices vary between communities and are impacted by a variety of factors. Understanding self-medication knowledge, attitude, and practice is essential to minimize risks and negative consequences.

Objectives: This study aims to analyze the community's knowledge, attitude, and practice (KAP) concerning self-medication and the factors that influence it.

Methods: A cross-sectional study was undertaken among the general community in Central Java, Indonesia. In this study, 396 participants were recruited and interviewed using a validated Knowledge, Attitudes, and Practices questionnaire focused on self-medication. The sociodemographic variables and levels of knowledge, attitudes, and practices were represented using descriptive statistics in the statistical analysis. Bivariate and multivariable logistic regression analysis tests were employed to determine the relationship between socio-demographic characteristics and levels of knowledge, attitudes, and practices.

Results: The results showed that the age group of 36-45 years had the most significant percentage of participation, with 103 individuals. The sample consisted of 235 females, 59.3% of the total participants. Respondents had a sufficient level of knowledge (39.6%), good attitudes (51.8%), and good practice (75%).

Conclusion: There was a significant correlation between age, education, and income regarding the knowledge around self-medication with a p-value <0.05. There also remained a significant correlation between knowledge, attitude, and practice.

Keywords: attitude; knowledge; self-medication; practice

INTRODUCTION

The World Health Organization (WHO) defines self-medication as individuals selecting and using drugs to address illnesses or symptoms they have identified themselves. Self-medication is taking medicines without a physician's advice, and it has become more common in developing countries.[1] The root cause could be anything from a shortage of physicians to financial factors. However, most people are not aware of the ill effects and drug reactions brought on by self-medication. Medication also relates to the act of excessively utilizing prescribed medicine for oneself or other family members, particularly in the case of young people or the elderly. Self-medication is managing minor ailments without seeking medical advice to promptly and efficiently alleviate symptoms. This practice is commonly employed to minimize strain on healthcare facilities, particularly in remote locations that lack sufficient medical personnel and accessibility.[2] The use of self-medication has the potential to decrease the amount of time patients have to wait for doctor's appointments. It may also reduce medical costs by conserving limited medical resources for less severe conditions. Nevertheless, engaging in untimely self-

medication practice can lead to health hazards such as inaccurate self-diagnosis, adoption of wrong therapy, prolonged and excessive usage, detrimental side effects, adverse drug reactions, the inability to seek appropriate medical guidance promptly, and polypharmacy.[3,4] Moreover, engaging in self-medication can result in drug interactions that could have been avoided if the patient had sought treatment from a qualified healthcare professional.[5]

Self-medication is a global phenomenon, and its prevalence has varied across different countries; for example, in developing countries, such as India, 60%[6], Vietnam 83.3%[7], Nepal 38.2%[8], Ethiopia 78.2%[9]. Based on Central Bureau of Statistics (BPS), self-medication in Indonesia reached 61.35% in 2015 and increased to 84.23% in 2021. [10] The increasing prevalence of self-medication can be ascribed to a multitude of variables, including the desire for self-care, concern for ill family members, limited access to healthcare facilities, and unavailability of medications, as well as time and financial limitations. Ignorance, misconceptions, widespread advertising, and the accessibility of drugs in non-pharmacy establishments further contribute to this rising phenomenon.[11]

To be able to do good self-medication, one of the things needed is sufficient knowledge. Some research results show that knowledge about self-medication still needs to be improved. For example, a study in Saudi Arabia showed that the level of community knowledge of self-medication was 49.3%[12], while Ahmad's research in rural India showed similar results; the level of community knowledge was 24%.[13] Data in Indonesia also shows that knowledge still needs to improve. There are still few studies in rural areas of Central Java, so this research is necessary.

This study examined medication knowledge, attitude, and practice among residents in Grobogan district, Central Java Province, Indonesia. Our goal was to identify the factors that influence knowledge among residents. Additionally, we aimed to support pharmacists, particularly in the community, by enabling them to provide appropriate pharmacy services and conduct public education activities on rational drug use.

METHODS

Study design

A quantitative, cross-sectional study was conducted in Grobogan District, Central Java, between November 2022 and January 2023.

Population, samples and data collections

The sample was obtained by convenience sampling, based on the following inclusion criteria: individuals who have engaged in or are currently practicing self-medication during the past 6 months, are seeking to participate as a respondent, and are at least 18. The exclusion criteria include those employed in the healthcare field or with a healthcare background and those with visual, auditory, or communication problems.

The sample size was determined using Raosoft[14] software with a population size of Grobogan citizents is 1.5 million[15], power of 80%, response distribution of 50%, and confidence interval and margin of error set at 95% and 5%, respectively. The minimum required sample size was 385. The number of samples obtained through this study was 396 respondents.

The sampling process was conducted in person by visiting respondents directly, and questionnaires were distributed to each eligible participant who met the inclusion criteria of this study. Individuals who expressed willingness to participate in the study were requested to complete and sign an informed consent form. Before this, the research goal was clarified to the participant, and the confidentiality of the respondents' identities was guaranteed.

Study instruments

This study employed a questionnaire research instrument with four sections: demographic information, knowledge, attitudes, and practice. The initial segment (six questions) concentrated on sociodemographic traits such as gender, age, educational attainment, monthly income, and prevalent illnesses managed through self-medication. The second, third, and fourth sections contain 15 questions to assess knowledge, attitude, and behavior about self-medication. The questionnaire was based on previous research[12,16] and the Ministry of Health Indonesia Guidelines[17].

The knowledge variable question is a closed-ended inquiry with response alternatives of "True," "False," and "Don't Know." The questionnaire measures the respondent's attitude towards self-medication using a Likert scale format. Scales ranging from strongly disagree, disagree, neutral, agree, and strongly agree, with scores ranging from 1 to 5. Inquiries regarding practice variables with "Yes" and "No" response choices.

The questionnaire's validity was assessed using Pearson's Product Moment correlation coefficient. The validity test was conducted using a sample size of 40 respondents. The validity test findings for the knowledge, attitude, and practice questionnaire indicated that all 15 statement questions were valid. This determination was based on the estimated r value, which exceeded the critical r table value of 0.312.

The reliability of the questionnaire in this study was assessed using the Cronbach's Alpha test method. The Cronbach's Alpha values obtained during reliability testing for each statement's knowledge, attitude, and practice variables are 0.728, 0.745, and 0.734, respectively. Based on this result, it can be inferred that the questionnaire utilized in this study yields reliable and consistent outcomes. Cronbach's Alpha value is more significant than 0.6, meaning all questions are reliable.

Data Analysis

The collected data was inputted into a Microsoft Excel spreadsheet and afterward exported to the statistical analysis software (SPSS, 25 version). Both descriptive and analytical methods were used to evaluate the data. The knowledge, attitudes, and practice level is classified as “High” for knowledge or "Good" for attitude and practice if the total score reaches 75%. If the score is below 75%, it is labeled "poor" for knowledge and “bad” for attitude and practice. Descriptive analysis described demographic data, self-medication knowledge, attitudes, and practice. Bivariate and multivariable logistic regression analyses were employed to determine genuinely linked components and manage confounding influences. Independent variables with a p-value of less than 0.25 were chosen for multivariable logistic regression analysis. The odds ratio (OR) with a 95% confidence interval (CI) and the associated P-value were calculated for each variable. A P value less than 0.05 has been considered statistically significant.

RESULTS AND DISCUSSION

Characteristic of respondents

During this study, 396 participants met the inclusion criteria and agreed to follow the research. Data was collected by directly visiting community residences or attending community groups. Out of all the participants, the age group of 36-45 years had the most significant proportion, with 102 individuals accounting for 25.8% of the total. The average age of the participants recruited in this study was 40.30±14.80. More than half are female, with 235 (59.3%) individuals. Regarding the education level, 154 participants (38.9%) had completed high school, while 94 participants (3.5%) had only attended primary school. By occupation, according to the data, 116 individuals (29.3%) were classified as housewives, while 93 individuals (23.5%) were categorized as privately employed. There were only 9 individuals whom the government hired. Of the participants, 364 individuals, accounting for 91.4%, had a monthly income equal to or below IDR 1,800,000. IDR 1,800,000 is the regional minimum wage in the Grobogan District. Table I displays the distribution of participants based on their general characteristics.

The prevalence of self-medication is higher among individuals aged 36-45 compared to those in older age groups. This finding aligns with a study conducted in India [11], China[18], Ethiopia[19], and Iraq[20], which reported that self-medication is more prevalent among young than older people. Women and homemakers predominantly engaged in self-medication in this study. This finding is consistent with previous studies.[21] Housewives responsible for the family's well-being are more inclined to engage in self-medication to save time and reduce doctor visits.

The mean knowledge score about medication among Grobogan residents, Central Java province, was 70.24±15.96, with "high" knowledge levels. The scores were classified as "high" in 150 (37.9%) participants and "poor" in 246 (62.1%) participants. The disparities in medication scores were statistically significant. Meanwhile, the overall attitude and practice scores were “good” according to the scoring standard, averaging 75.35±9.85 and 83.04±11.43, respectively. The majority of respondents, 223 (56.3%) in total, assessed the attitude as "good," while 173 (43.7%) respondents scored it as "bad." Thus, regarding self-medication practice, 297 (75%) respondents were assessed as having a "good" score, and 99 (25%) respondents were rated as having a "poor" score.

Illness treated by self-medication

The most prevalent ailment managed through self-medication among the population is illustrated in Figure 1. According to the study findings, the most pervasive ailments for which self-medication is practiced are headache, influenza, and cough. The number of participants who engaged in self-medication were 142, 117,

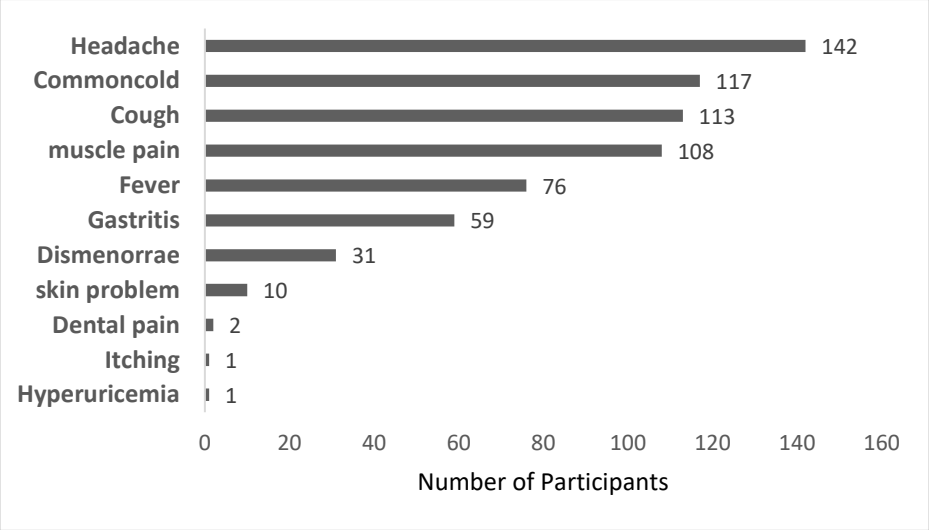

Figure 1. The most common disease treated with self-medication in the community

Table I. Socio-demographic Characteristics of Studied

Variables	N = 396	Percentage (%)
Age group (years)		
18-25	81	20.5
26-35	77	19.4
36-45	102	25.8
46-55	59	14.9
56-65	60	15.2
>65	17	4.3
Gender		
Male	161	40.7
Female	235	59.3
Education level		
Primary school	94	23.7
Junior high school	103	26.0
High school	154	38.9
Undergraduate/Post	45	11.4
Employment status		
Unemployed	45	11.4
Government employee	9	2.3
Private employee	93	23.5
Trader	75	18.9
Housewife	116	29.3
Farmer	58	14.66
Monthly income		
≤ IDR 1,800,000	364	91.9
> IDR 1,800,000	32	8.1

and 113, respectively. It is essential to mention that several participants practiced self-medication for different illnesses.

This study's primary reasons for self-medication were headaches, common colds, and coughs. Based on a systematic review of self-medication in Ethiopia, headache is also identified as the primary reason for individuals

engaging in self-medication, followed by gastrointestinal tract diseases and respiratory diseases.[22] Previous studies have also shown that headache is the primary reason for self-medication.[8,21,23,24] Although the motivations behind self-medication were not examined in this study, prior research suggests that treating the symptoms of minor illnesses is one of the motivations.[18] Headaches are common illnesses that can be self-treated without a visit to the doctor. Patients may be deterred from obtaining medical consultation due to these illnesses' benign and self-limiting characteristics. According to the findings of Berha et al. (2017), the majority of those who self-medicated for the sole reason of obtaining instant alleviation did so due to the non-serious nature of the illness (70.3%).[25] Patients should not, nevertheless, overlook the fact that protracted or recurrent occurrences of these illnesses/symptoms warrant further examination by medical professionals, as they could potentially indicate more severe conditions.

The presence of self-medication in the healthcare system is now widely acknowledged. The awareness of individuals' accountability for their well-being and the realization that seeking professional assistance for minor ailments is often unnecessary have influenced this perspective.[1] While using over-the-counter medicine intended for self-medication and known to be effective and safe, it can have severe consequences if misused due to a lack of understanding of their side effects and interactions.[26]

Knowledge, Attitude, and Practice Domains

Figures 2, 3, and 4 define knowledge, attitudes, and practice separately, categorized into six domains: the definition of self-medication, therapeutic class, drug storage, drug indication, side effects, and drug expiration date. Based on this study, it is evident that the population needs to gain sufficient knowledge of drug usage and drug therapy categories, including information on specific drug names. Like knowledge, it was discovered that individuals encountered difficulties in medicinal names regarding their attitude and practice. Meanwhile, the drug storage domain could be higher at the practice level.

Inadequate knowledge about self-medication might result in the incorrect choice of medications for self-treatment, hence leading to unsuccessful treatment. The question "All classes of drugs can be purchased without a doctor's prescription" still gets a low score. Presuming universal availability of all pharmaceuticals without prescription can result in complications, such as the purchase of antibiotics without prescription, potentially contributing to the development of drug resistance.[27]

Influencing Factors with Knowledge, Attitude, and Practice of Self-Medication

Multivariable binary logistic regression determined that knowledge about self-medication was associated with age, education level, and employment status. At the same time, gender and monthly income did not show any statistically significant influence, as shown in Table II. Education level affects high knowledge 3 times while age affects good knowledge 0.78 times, with an AOR value of respectively; AOR at 95%CI: 3.145 (2.199-4.497) and 0.785 (0.660-0.935). Self-medication was linked to various kinds of variables. Wu et al. (2018) revealed that the variables that significantly influenced medication knowledge were age, medical insurance coverage, and education level.[28] The remaining variables showed no statistical significance (P>0.05). In the same year, Shafie et al. found a significant relationship between self-medication and female respondents who were married, had a secondary education, and belonged to the low monthly income category.[23] From these findings, the lack of affordability of medicine expenses may contribute to self-medication.

Age, gender, level of education, employment status, monthly income, and level of knowledge were identified as bivariate correlates of attitude toward self-medication and incorporated into the multivariate regression analysis, as shown in Table III. In this analysis, a good attitude is significantly impacted by both level of education and level of knowledge. In addition, participants with a good level of knowledge are 47 more likely to have a positive attitude, and the AOR at 95% CI: 47.109 (17.459-127.117). This study's results differ from research in China, which shows that only the level of knowledge affects attitudes.[28] In contrast, research in Ethiopia shows that only a place of residence, which is living in a rural area, affects attitudes.[29]

In the practice of self-medication, as shown in Table IV, factors performed in multivariate regression analysis from bivariate correlative are age, degree of education, employment status, monthly income, level of knowledge, and attitude. Individuals who possessed adequate knowledge scores and good attitude were 3.12 and 3.35 times more likely to have good practice with self-medication compared to those who scored low on the knowledge scale and bad attitude (AOR at 95%CI: 3.129 (1.297-7.551) and 3.356 (1.726-6.524), respectively).

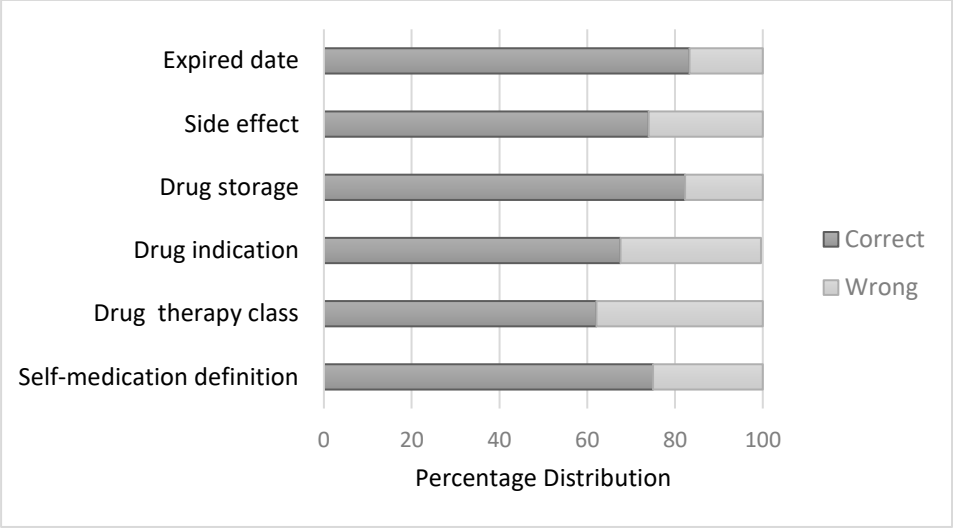

Figure 2. Percentage distribution of knowledge level in 6 domains

Table II. Associated Independent Variables with Knowledge About Self-Medication

Variabel	Knowledge		AOR	95% CI		P Value
	High	Poor		Lower	Upper	
Age group (years)						
18-25	52	29				
26-35	36	41				
36-45	36	66	0.793	0.649	0.970	0.024*
46-55	17	42				
56-65	6	54				
>65	3	14				
Gender						
Male	53	108	1.663	0.979	2.826	0.060
Female	97	138				
Education level						
Primary school	10	84				
Junior high school	26	77	3.145	2.199	4.497	0.000*
High school	70	84				
Undergraduate/Post	44	1				
Employment status						
Unemployed	22	23				
Government employee	7	2				
Private employee	45	48	0.785	0.660	0.935	0.007*
Trader	30	45				
Housewife	36	80				
Farmer	10	48				
Monthly income						
≤ 1,800,000	126	238	2.363	0.899	6.214	0.081
< 1,800,000	24	8				

***Statistically significant**

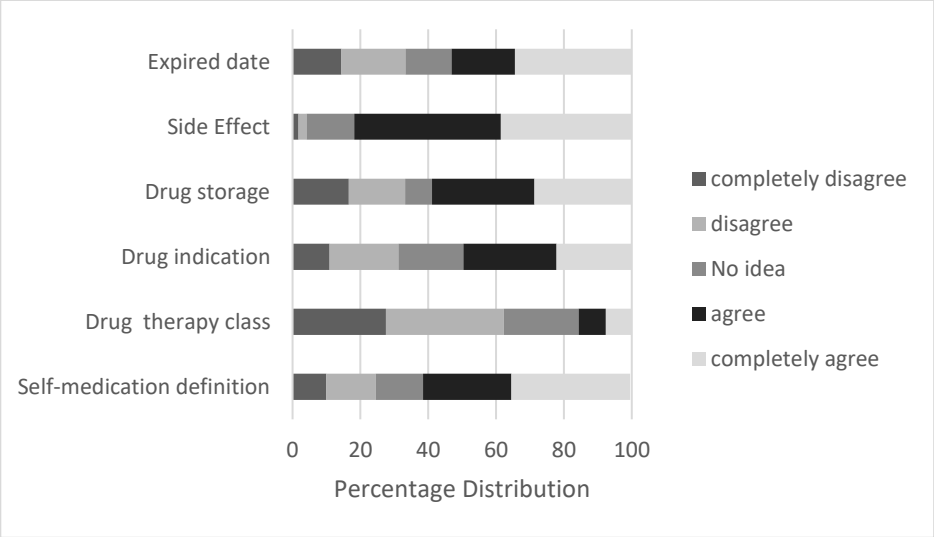

Figure 3. Percentage distribution of attitude level in 6 domains

Table III. Associated Independent Variables with Attitude About Self-Medication

Variabel	Attitude		AOR	95% CI		P Value
	Good	Bad		Lower	Upper	
Age group (years)						
18-25	62	19				
26-35	51	26				
36-45	63	39	0.971	0.767	1.229	0.805
46-55	28	31				
56-65	13	47				
>65	6	11				
Gender						
Male	80	81	1.145	0.628	2.087	0.659
Female	143	93				
Education level						
Primary school	21	73				
Junior high school	49	54	2.116	1.387	3.226	0.001*
High school	109	45				
Undergraduate/Post	44	1				
Employment status						
Unemployed	26	19				
Government employee	7	2				
Private employee	52	41	1.218	0.987	1.504	0.066
Trader	51	24				
Housewife	66	50				
Farmer	21	37				
Monthly income						
≤ 1,800,000	197	167	0.484	0.124	1.887	0.296
< 1,800,000	26	6				
Knowledge						
Good	78	158	47.109	17.459	127.117	0.000*
Poor	145	5				

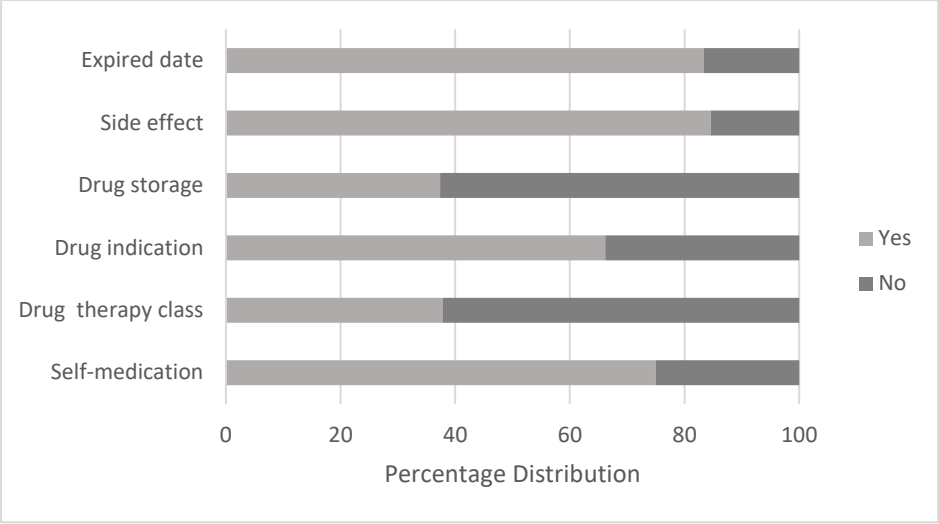

Figure 4. Percentage distribution of practice level in 6 domains

Table IV. Associated Independent Variables with Practice About Self-Medication

Variabel	Practice		AOR	95% CI		P Value
	Good	Bad		Lower	Upper	
Age group (years)						
18-25	69	12				
26-35	65	12				
36-45	80	22	0.797	0.646	0.985	0.035*
46-55	43	16				
56-65	30	30				
>65	10	7				
Education level						
Primary school	56	38				
Junior high school	73	30	0.911	0.620	1.338	0.634
High school	127	27				
Undergraduate/Post	41	4				
Employment status						
Unemployed	35	10				
Government employee	8	1				
Private employee	69	24	1.054	0.884	1.257	0.561
Trader	63	12				
Housewife	82	34				
Farmer	40	18				
Monthly income						
≤ 1,800,000	270	94	0.858	0.370	2.731	0.796
< 1,800,000	27	5				
Knowledge						
High	140	10	3.129	1.297	7.551	0.011*
Poor	157	89				
Attitude						
Good	200	23	3.356	1.726	6.524	0.000*
Bad	97	76				

Limitation

This study did not provide specific details regarding the substances utilized for self-medication, nor did it investigate the underlying motivations for engaging in self-medication. Self-medication by respondents was done in the last 6 months, so the risk of bias could occur in this study. Additional research is required to look further into the practice of self-medication.

Due to the absence of multicentre research, the current study has limitations regarding its capacity to be applied to a broader population. The study employed an easy way of sampling from around rural regions. Future research will further update the survey style and increase the sample size to know more effectively about the residents' needs for self-medication.

CONCLUSION

Self-medication is a prominent healthcare practice among residents of Grobogan District in Central Java. Socio-demographics show it is more prevalent among younger people, females, those with high school education, private employees, and those with low income. Age, educational level, employment status, and monthly income affect knowledge. There is a significant correlation between knowledge, attitude, and practice.

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STATEMENT OF ETHICS

This study was approved by the health research ethics committee of Dr. Moewardi General Hospital Surakarta, No. 1.367/X/HREC/2022.

REFERENCES

1. WHO. Guidelines for the Regulatory Assessment of Medicinal Products for Use in Self Medication. Published online 2000.
2. Bennadi D. Self-medication: A current challenge. *J Basic Clin Pharm*. 2013;5(1):19-23. doi:10.4103/0976-0105.128253
3. Hughes CM, McElnay JC, Fleming GF. Benefits and Risks of self-medication. *Drug Saf*. 2001;24(14):1027-1037. doi:10.2165/00002018-200124140-00002
4. Panda A, Pradhan S, Mohapatra G, Mohapatra J. Drug-related problems associated with self-medication and medication guided by prescription: A pharmacy-based survey. *Indian Journal of Pharmacology*. 2016;48(5):515. doi:10.4103/0253-7613.190728
5. Selvaraj K, Kumar SG, Ramalingam A. Prevalence of self-medication practices and its associated factors in Urban Puducherry, India. *Perspect Clin Res*. 2014;5(1):32-36. doi:10.4103/2229-3485.124569
6. Rathod P, Sharma S, Ukey U, et al. Prevalence, Pattern, and Reasons for Self-Medication: A Community-Based Cross-Sectional Study From Central India. *Cureus*. 2023;15(1):e33917. doi:10.7759/cureus.33917
7. Ha TV, Nguyen AMT, Nguyen HST. Self-medication practices among Vietnamese residents in highland provinces. *J Multidiscip Healthc*. 2019;12:493-502. doi:10.2147/JMDH.S211420
8. Paudel S, Aryal B. Exploration of self-medication practice in Pokhara valley of Nepal. *BMC Public Health*. 2020;20(1):714. doi:10.1186/s12889-020-08860-w
9. Kifle ZD, Mekuria AB, Anteneh DA, Enyew EF. Self-medication Practice and Associated Factors among Private Health Sciences Students in Gondar Town, North West Ethiopia. A Cross-sectional Study. *INQUIRY*. 2021;58:00469580211005188. doi:10.1177/00469580211005188
10. Badan Pusat Statistik. Makin Banyak Orang Indonesia Pilih Berobat Sendiri saat Sakit. Published 2022. Accessed December 7, 2023. https://dataindonesia.id/kesehatan/detail/makin-banyak-orang-indonesia-pilih-berobat-sendiri-saat-sakit
11. Rathod P, Sharma S, Ukey U, et al. Prevalence, Pattern, and Reasons for Self-Medication: A Community-Based Cross-Sectional Study From Central India. *Cureus*. 15(1):e33917. doi:10.7759/cureus.33917

12. Almalki ME, Almuqati FS, Alwezainani MO, et al. A Cross-Sectional Study of the Knowledge, Attitude, and Practice of Self-Medication Among the General Population in the Western Region of Saudi Arabia. *Cureus*. 14(10):e29944. doi:10.7759/cureus.29944
13. Ahmad A, Khan M, Srikanth A, et al. Evaluation of Knowledge, Attitude and Practice about Self-medication Among Rural and Urban North Indian Population. In: ; 2015. Accessed February 23, 2024. https://www.semanticscholar.org/paper/Evaluation-of-Knowledge-%2C-Attitude-and-Practice-and-Ahmad-Khan/eb3d9d054bee815764b47b619f1ad2eb067aaf96
14. Raosoft. http://www.raosoft.com/samplesize.html.
15. Grobogan DK. Data Agregat Kependudukan Tahun 2023 Semester I. https://dispendukcapil.grobogan.go.id/. Accessed May 4, 2024. https://dispendukcapil.grobogan.go.id/detail/data-agregat-kependudukan-tahun-2023-semester-i
16. AlShibly DMNR, Hasan LA, Abdulsada AR. Knowledge and practices of Self-medication among sample of outpatients attendant to Baghdad teaching hospital,2019. *Journal of Population Therapeutics and Clinical Pharmacology*. 2021;28(2). doi:10.47750/jptcp.2022.863
17. DepKes RI. Pedoman Penggunaan Obat Bebas dan Bebas terbatas. Published online 2006.
18. Lei X, Jiang H, Liu C, Ferrier A, Mugavin J. Self-Medication Practice and Associated Factors among Residents in Wuhan, China. *Int J Environ Res Public Health*. 2018;15(1):68. doi:10.3390/ijerph15010068
19. Mamo S, Ayele Y, Dechasa M. Self-Medication Practices among Community of Harar City and Its Surroundings, Eastern Ethiopia. *J Pharm (Cairo)*. 2018;2018:2757108. doi:10.1155/2018/2757108
20. Al Shibly MNR, Hasan LA, Abdulsada AR. Knowledge and practice of self-medication. *J Popul Ther Clin Pharmacol*. 2022;28(2):e62-e70. doi:10.47750/jptcp.2022.863
21. Thenmozhi B, Sharmil SH. Self-medication Practices of the Rural Community People: A Cross-Sectional Study. *Indian J Community Med*. 2023;48(4):619-622. doi:10.4103/ijcm.ijcm_842_22
22. Ayalew MB. Self-medication practice in Ethiopia: a systematic review. *Patient Preference and Adherence*. 2017;11:401-413. doi:10.2147/PPA.S131496
23. Shafie M, Eyasu M, Muzeyin K, Worku Y, Martín-Aragón S. Prevalence and determinants of self-medication practice among selected households in Addis Ababa community. *PLoS One*. 2018;13(3):e0194122. doi:10.1371/journal.pone.0194122
24. Ogwuche P, Adepoju A, Bah A. Knowledge, Attitude and Practice of Self-medication Among People of Central Monrovia, Liberia. Published online November 2, 2023. Accessed February 24, 2024. https://papers.ssrn.com/abstract=4621385
25. Berha A, Getachew E, Doboch A, Poulos E, Abdurahman K, Woldu M. Knowledge, Attitude and Practice of Self Medication among Pharmacy Students of Rift Valley University, Abichu Campus, Addis Ababa, Ethiopia. *Journal of Health & Medical Informatics*. 2017;08. doi:10.4172/2157-7420.1000269
26. Kazemioula G, Golestani S, Alavi SMA, Taheri F, Gheshlagh RG, Lotfalizadeh MH. Prevalence of self-medication during COVID-19 pandemic: A systematic review and meta-analysis. *Frontiers in Public Health*. 2022;10. Accessed December 8, 2023. https://www.frontiersin.org/articles/10.3389/fpubh.2022.1041695
27. Bogale AA, Amhare AF, Chang J, et al. Knowledge, attitude, and practice of self-medication with antibiotics among community residents in Addis Ababa, Ethiopia. *Expert Rev Anti Infect Ther*. 2019;17(6):459-466. doi:10.1080/14787210.2019.1620105
28. Wu YX, Wang EH, Zhao XJ, et al. Knowledge, attitude, and practice of medication among Haikou residents. *Annals of Palliative Medicine*. 2021;10(6):6883891-6886891. doi:10.21037/apm-21-1295
29. Siraj EA, Yayehrad AT, Kassaw AT, et al. Self-Medication Prevalence and Factors Associated with Knowledge and Attitude Towards Self-Medication Among Undergraduate Health Science Students at GAMBY Medical and Business College, Bahir Dar, Ethiopia. *Patient Prefer Adherence*. 2022;16:3157-3172. doi:10.2147/PPA.S390058

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Profile of Dermatologic Side Effects of Tyrosine Kinase Inhibitor (EGFR-TKIs) in Lung Cancer Patients

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ABSTRACT

Background: Epidermal Growth Factor Receptor Tyrosine Kinase Inhibitor (EGFR-TKIs) drugs are commonly used target therapies in patients with advanced-stage non-small cell carcinoma lung cancer (NSCLC).

Objectives: This study aims to provide an overview of dermatologic side effects and quality of life index of NSCLC patients who received EGFR-TKIs targeted therapy at Dharmais Cancer Hospital.

Methods: This study used a cross-sectional design. Inclusion criteria were patients who received EGFR-TKIs targeted therapy, namely gefitinib, erlotinib, and afatinib, in September - October 2023, who were willing to be research subjects, and patients who were not in a medical emergency. In total, 52 patients filled out the dermatology life quality index (DLQI) questionnaire through interviews and medical records. Data evaluation was performed descriptively in the form of percentages.

Results: The most common occurrence of dermatologic side effects was skin hypersensitivity reactions with mild severity (grade 1) by 59.6%, moderate severity (grade 2) by 19.2%, and severe severity (grade 3) by 1.9%, and no drug dermatologic side effects by 19.2%. In comparison, the most DLQI was in the category of not affecting patient life. In general, side effects with moderate (grade 2) and severe (grade 3). The severity will decrease to mild severity (grade 1) when already getting topical corticosteroid drugs or combinations with oral antibiotics and antihistamine drugs.

Conclusion: The most severe side effect was grade 1, which slightly affected the patient's quality of life. Education and monitoring of side effects and management of symptoms are necessary to reduce the severity and improve patients' quality of life.

Keywords: Dermatologic side effects; DLQI; EGFR-TKIs; Non-small cell lung cancer (NSCLC)

INTRODUCTION

Lung cancer is the leading cause of malignancy in the world, accounting for up to 13 percent of all cancer diagnoses. In addition, lung cancer also causes one-third of all cancer deaths in men.[1] In the United States, there were an estimated 213,380 new cases and 160,390 deaths from lung cancer in 2007. Based on the WHO cancer profile report, lung cancer is the highest contributor to the incidence of cancer in men in Indonesia, followed by colorectal, prostate, liver, and nasopharyngeal cancer, and is the fifth most significant contributor to cases in women after breast, cervical-uterine, colorectal, and ovarian cancer. Cancer registry data from Dharmais Hospital in 2003-2007 showed that trachea, bronchus, and lung cancer was the second most common malignancy in men (13.4%) after nasopharynx (13.63%). They were the cause of most cancer deaths in men (28.94%).[1] World Health

Organization (WHO) epidemiological studies show that nearly 85% of lung cancers are non-small cell carcinoma lung cancer.[1]

About 40% of lung cancer cases in Asia have epidermal growth factor receptor (EGFR) mutations.[2] Tyrosine kinase inhibitors (TKIs) are one of the commonly used targeted therapies for NSCLC with Epidermal Growth Factor Receptor (EGFR) mutations. In recent decades, the treatment of lung cancer with epidermal growth factor receptor (EGFR) mutations has been revolutionized, starting from the first generation of erlotinib, gefitinib, and icotinib, the second generation of dacomitinib and afatinib, and the third generation of osimertinib. Gefitinib, erlotinib, and afatinib are the first- and second-generation EGFR-TKIs most commonly used for the treatment of NSCLC, and they are in the national formulary.[3] These targeted therapies are aimed at molecular mechanisms that contribute to cancer development and progression. Although target therapy is significantly better than chemotherapy, it often causes side effects.[4,5] Previous studies have consistently shown that Epidermal Growth Factor Receptor Tyrosine Kinase Inhibitors (EGFR-TKIs) are well tolerated but show some adverse events, including skin, gastrointestinal tract, liver, and lung.[2]

The most commonly observed side effect of treatment with targeted therapy is skin toxicity.[6] A severe and prolonged degree of skin pain can affect the patient's quality of life, including the patient's physical, emotional, and psychological condition and well-being.[6,7] All dermatologic effects due to treatment with EGFR-TKIs are reversible and asymptomatic. If treated promptly, the side effects are lower and can usually help improve quality of life.[8] The previous study reported in August 2018-December 2019 showed that out of a total of 146 NSCLC patients who received EGFR-TKI therapy in the first 3 months after diagnosis, about 93.2% of patients had skin toxicity. About 70% of patients had skin toxicity in the form of xerosis and pruritus. About 50% had toxicity in the form of papulopastular eruptions and paronycia.[9] These skin toxicities have a significant impact on the quality of life of advanced-stage NSCLC patients receiving EGFR-TKI therapy.[7,10] The quality of life of NSCLC patients who experienced dermatologic side effects was measured using the Dermatology Life Quality Index (DLQI) questionnaire in accordance with the Clinical Practice Guidelines for Dermatologists in Indonesia.[11] The Dermatology Life Quality Index (DLQI) questionnaire consists of 10 questions covering physical symptoms and feelings, daily activities, recreation, and work/ school.[12] The University of Indonesia has validated the Indonesian language of the DLQI, with validity and reliability test results considered good, so the questionnaire is a quality of life measure for patients experiencing skin toxicity.[13]

Therapy to treat dermatologic adverse events depends on the severity of the adverse event. The severity of drug side effects and their definitions can be seen based on the CTCAE (Common Terminology Criteria for Adverse Event) Version 5.0 criteria.[14,15] Grade 1 dermatologic adverse events (macular or papular eruption or erythema) without symptoms will be treated with topical steroids twice daily or topical antibiotics clindamycin 1-2%, erythromycin 1-2%, or metronidazole 1%. Patients with grade 2 dermatological side effects (macular or papular eruptions or erythema with pruritus or with other associated symptoms), localized desquamation, or lesions covering <50% of body surface area are treated with oral antibiotics (doxycycline 100 mg) 2x daily for 6 weeks or minocycline 100 mg twice daily and topical steroids twice daily. Patients with grade 3 adverse events (severe, generalized erythroderma or macular, papular, or vesicular eruptions covering 50% of the body surface area, generalized exfoliative, ulcerative, or bullous dermatitis, will be treated with oral antibiotics (doxycycline 100 mg twice daily, minocycline 100 mg twice daily) for 6 weeks with topical steroids twice daily with discontinuation of TKI treatment and then resumed when the degree of adverse events switches to grade 2.[14] The previous study reported that patients who received EGFR therapy (cetuximab, erlotinib, lapatinib, panitumumab, or gefitinib) were given the skindex-16 questionnaire.[16] The grade of side effects assessed using NCI-CTCAE (National Cancer Institute Common Terminology Criteria for Adverse Events) version 3.0, namely pruritus grade, xerosis grade, paronychia grade, alopecia grade, telangiectasia grade, and mucositis grade. [16] The results of this study were that toxicity, including rash, xerosis, paronychia, and pruritus, affected quality of life, and the rash had a greater impact on reducing quality of life than other toxicity.[16] The other study, which involved a critical review of journals, aimed to investigate the impact of dermatology's side effects on quality of life by using targeted therapy.[17]. Maintaining a good quality of life is highly important in patients receiving EGFR-TKI to achieve good treatment compliance.[18] However, no appropriate methods have been established to evaluate the degree to which skin condition affects patient quality of life during EGFR-TKI therapy.[18] Therefore, it is interesting to investigate the profile and overview of dermatologic side effects and quality of life index of NSCLC patients who received EGFR-TKI targeted therapy, especially at Dharmais Cancer Hospital, Jakarta.

METHODS

Study design

This study is an observational study with a cross-sectional design. It used primary and secondary data from 52 Patients with a diagnosis of advanced-stage NSCLC who were receiving one of the EGFR-TKI therapies, namely gefitinib, erlotinib, or afatinib, from September to October 2023 at Dharmais Cancer Hospital. The sampling technique used the purposive sampling technique and consecutive method, where samples that met the inclusion criteria were determined as research subjects.

Population and samples

The study was conducted on 52 patients who were the total number of non-small cell carcinoma lung cancer patients who received EGFR-TKI therapy during the study period. The inclusion criteria of this study were as follows: a) Patients with a diagnosis of advanced non-small cell carcinoma lung cancer (NSCLC) who received EGFR-TKIs targeted therapy, namely gefitinib, erlotinib, and afatinib in the period September - October 2023 at Dharmais Cancer Hospital; b) Willing to become research respondents; c) No dermatological diseases before using EGFR-TKI class drugs; d) Patients who are easy to communicate with. Patients who are easy to communicate with. Patients in medical emergencies were excluded.

Study instruments

The instruments used in this study were the quality of life questionnaire DLQI (Dermatology Life Quality Index) and a data collection sheet containing patient identity in the form of initials name, date of birth, medical record number, stage of lung cancer, ECOG PS Score and date of first use of EGFR-TKIs class drugs and informed consent to research participation. The use of this data collection sheet is intended to facilitate data collection during the study.

Data collection

The degree of severity of dermatologic side effects is the value of dermatologic side effects of patients undergoing lung cancer treatment after the use of drugs during the last week, divided into three degrees, namely Degree 1: Treated with topical steroid or topical antibiotic, second degree: Treated with oral antibiotics for 6 weeks and topical steroids, third degree: Treated with oral antibiotics for 6 weeks and topical steroids and discontinuation of EGFR-TKIs treatment. For quality of life, namely a person's ability to carry out his life functions in normal activities according to health conditions or existing complaints according to his perceptions using a quality of life questionnaire (Dermatology Life Quality Index) with a score of 0-1: Does not affect the patient's entire life, scoring 2-5: Affects the patient's life slightly, scoring 6-10: Moderately affects the patient's life, scoring 11-20: Strongly affects the patient's life, scoring 21-30: Extremely affecting the patient's life.[12,19]

Data Analysis

Data analysis was carried out by describing patient characteristic data, including age, sex, education level, disease stage, comorbidities, and Eastern Cooperative Oncology Group Performance Scale (ECOG PS) scores. The ECOG Performance Scale consists of numbers 0 to 5, where number 0 means that the patient is fully active and can carry out activities as before the disease without obstacles. An ECOG scale score of 1 means that the patient has limitations in doing strenuous activities but can still be ambulatory and can do light work such as household chores or light office work. An ECOG scale score of 2 means that the patient is ambulatory and able to care for themselves but unable to perform work and, less than 50% of the time, must lie down. An ECOG scale score of 3 means that the patient is only able to care for themselves in a limited way and, more than 50% of the time, must lie or sit. An ECOG scale score of 4 means the patient must lie down continuously, while a score of 5 means the patient has died. Data regarding the description of side effects of EGFR-TKIs were analyzed descriptively in the form of percentages.

RESULTS AND DISCUSSION

Patient Characteristics

The EGFR-TKIs drug administration in patients with lung cancer type NSCLC involved 52 patients during the study period. Data on patient demographic characteristics can be seen in Table I, which includes sex, age, education level, disease stage, comorbidities, EGFR-TKI drugs, Eastern Cooperative Oncology Group Performance Scale (ECOG PS) scores, and Dermatology Life Quality Index (DLQI) scores.

Table I. Demographic Characteristics of NSCLC Type Lung Cancer Patients at Dharmais Cancer Hospital

Characteristics	Number of patients (n)	Percentage (%)
Age in years		
≤50 years	13	25
>50 years	39	75
Education		
Primary School	4	7.7
Junior School	7	13.5
High School	30	57.7
Bachelor	6	11.5
Magister	5	9.6
Sex		
Male	20	38.5
Female	32	61.5
Stage		
IIIB	17	32.7
IV	35	67.3
Comorbidities		
Without comorbidities	35	67.3
With comorbidities	17	32.7
EGFR-TKI Drug Types		
Gefitinib	28	53.8
Erlotinib	4	7.7
Afatinib	20	38.5
ECOG		
0	3	5.8
1	27	51.9
2	22	42.3
Severity of Dermatologic Side Effect		
No skin side effects	10	19.2
Mild severity (*grade 1*)	31	59.6
Moderate severity (*grade 2*)	10	19.2
Severe severity (*grade 3*)	1	1.9
DLQI Score		
Does not affect the patient's life	16	30.8
Slightly affects the patient's life	15	28.8
Moderate impact on patient's life	7	13.5
Dramatically impact on patient's life	12	23.1
Extreme impact on patient's life	2	3.8

Description: ECOG: Eastern Cooperative Oncology Group, DLQI: Dermatology Life Quality Index

In the description of Table I, it is known that the average age of non-small cell carcinoma lung cancer (NSCLC) patients who received EGFR-TKIs therapy was >50 years, which is about 75% of the total sample. This is in accordance with the research of several studies, where in the study, it was reported that the average age of NSCLC patients who received EGFR-TKIs therapy was 65.4±12.1.[9,20,21] Another study, conducted at Dr. Soetomo Hospital, Surabaya, East Java, from January 2016 to August 2018, also stated that the average age of those who used gefitinib therapy was 56, and the average age of those who used erlotinib was 59.[22] Table I also presents that most NSCLC patients are female, around 32 patients or 61.5%. In the previous study, out of 146 research subjects, there were about 95 (65.1%) female patients[8], whereas in the other study, there were about 56 (59.6%) women and about 38 (40.4%) men.[22]

The level of education presented in Table I was primarily high school education, reaching 57.7%. This indicates a relatively good level of education in receiving education about the disease and its treatment. The severity or stage of lung cancer is grouped into stage IIIB and stage IV. The most severe stage is stage IV metastases, which is 67.3%. This result is in line with the previous study conducted in four hospitals in Taiwan

from August 2018 to December 2019, patients who received EGFR-TKIs stage IV therapy 114 (94.2%) patients, and stage IIIB 7 (5.8%) patients.[7]

Comorbidities are additional clinical conditions that have occurred together or possibly during the clinical course of a patient.[18] This study shows that the most extensive sample population is patients who do not have comorbidities, namely 69.2%. Whereas in the previous study, the comorbid status in the sample population used the SCS (Simplified Comorbidity Score) score. The sample population who had an SCS score <9 was 117 (96.7%) patients. In comparison, the SCS score ≥9 was 4 (3.3%) patients[10]. This study also described the influence between SCS scores and the quality of life of lung cancer patients, but the results were not significant. In contrast to breast cancer patients, a high comorbid index correlates with worsening quality of life.[7]

Table I also illustrates that the most widely used EGFR-TKIs drug is gefitinib, used by 28 (53.8%) patients, followed by afatinib, used by 20 (38.5%) patients, and erlotinib, used by 4 (7.7%) patients. The most common performance status (ECOG PS) was ECOG 1 was 27 (51.9%), while ECOG 2 was 22 (42.3%) and ECOG 0 was 3 (5.8%). A similar result also reported that the majority of ECOG PS is ECOG PS 0-1 (89.2%).[7] Another study reported that the majority of ECOG PS was 0, with 108 (74%) subjects.[9] Meanwhile, the results of filling out the Dermatology Life of Quality Index (DLQI) questionnaire were the most in the category of not affecting the patient's quality of life, namely 16 (30.8%), followed by the category of slightly affecting the patient's life 15 (28.8%), the category of moderate effect on the patient's life as many as 7 (13.5%), the category of significantly affecting the patient's life as many as 12 (23.1%) patients and very extreme affecting the patient's life as many as 2 (3.8%).

Incidence of Drug Side Effects

Table II describes that 52 patients who received EGFR-TKI therapy mostly experienced dermatologic side effects, whereas 43 (80.8%) patients experienced dermatologic side effects from mild (grade 1) to severe (grade 3). In comparison, 9 (19.2%) patients did not experience dermatologic side effects. The results are also similar to those of the previous study.[9] The study found that 136 (93.2%) patients experienced dermatologic side effects ranging from mild to severe (grade ≥1)[8]. This study also showed that the highest degree of severity of dermatological side effects was mild (grade 1), namely 31 (59.6%) patients. This was followed by moderate severity of dermatologic side effects (grade 2) with 10 (19.2%) patients and severe degree (grade 3) with 1 (1.92%) patient.

Table II shows that afatinib caused the most skin side effects, ranging from mild to severe, followed by gefitinib and erlotinib. These results are comparable to those of previous research.[2] The study is a systematic review and network meta-analysis registered in the Prospective Register of Systematic Reviews (PROSPERO). It consists of 40 randomized controlled trial studies involving 13,352 patients, concluding that toxicity is generally caused more by dacomitinib and afatinib than by osimertinib and gefitinib.[2] Another study reported that the group using afatinib had the highest SSI (Skin Symptom Impact) score when compared to the erlotinib and gefitinib groups.[9] Meanwhile, the gender that experienced more side effects of mild to severe severity was female. The percentage of age that experienced milder to severe side effects was ≤50 years old. The education of the research subjects who experienced the most side effects was elementary school, followed by junior high school, undergraduate, graduate, and high school. The percentage of research subjects with stage IV experienced more dermatologic side effects, research subjects without comorbidities experienced more dermatologic side effects, and research subjects with ECOG 2 experienced milder to severe side effects.

Table III shows that most of the subjects who experienced side effects of mild severity (grade 1), which slightly affected the patient's quality of life, followed by DLQI, which moderately or severity affected the quality of life patient's life. Furthermore, it is followed by DLQI, which does not affect the patient's quality of life and is very extreme in affecting the patient's life. The majority of research subjects who experienced side effects of moderate severity had a DLQI, which greatly affected the patient's quality of life, and research subjects who experienced side effects with severe severity had a DLQI, which greatly affected the patient's quality of life.

A previous study reported that dermatological side effects, such as pruritus accompanied by pain with a severity grade of ≥ 3 or pruritus with a severity grade of > 7, were associated with worsening quality of life.[7] The same report also showed that of the 21 studies identified, 6 studies analyzed the relationship between the intensity of dermatological symptoms and the severity of toxicity on quality of life.[17] The results of this research showed that 4 studies had significant relationships and positive correlations, while the other 2 studies had insignificant relationships and negative correlations in larger samples. The same study also reported in research

Table II. Incidence of Dermatologic Side Effects of NSCLC at Dharmais Cancer Hospital

Patient Demographics	Skin side effects n (%)				Total Skin side effects n (%)
	No skin side effect (%)	Mild	Moderate	Severe	
Name of Medicine					
Gefitinib	6(21.43)	18(64.29)	4(14.29)	0	22(78.58)
Erlotinib	1(25)	2(50)	1(25)	0	3(75)
Afatinib	3(15)	11(55)	5(25)	1(5)	17(85)
Sex					
Male	5 (25)	12(60)	2(10)	1(5)	15(75)
Female	5(15.63)	19(59.38)	8(25)	0	27(84.38)
Age					
≤50 years	2(15.38)	6(46.15)	4(30.77)	1(7.7)	11(84,62)
>50 years	8(20.51)	25(64.10)	6(15.38)	0	31(79.48)
Education					
Primary school	0	3(75)	1(25)	0	4(100)
Junior school	1(14.29)	5(71.43)	1(14.29)	0	6(85.72)
High school	7(23.33)	17(56.67)	6(20)	0	23(76.67)
Bachelor	1(16.67)	3(50)	1(16.67)	1(16.67)	5(83.34)
Magister	1(20)	3(60)	1(20)	0	4(80)
Stage					
IIIB	4(23.53)	9(52.94)	3(17.65)	1(5.88)	13(76.47)
IV	6(17.14)	22(62.86)	7(20)	0	29(82.86)
Comorbidities					
None	5(14.29)	21(58.33)	8(22.22)	1(2.78)	30(85.71)
With Comorbidities	5(29.41)	10(58.82)	2(11.76)	0	12(70.59)
ECOG					
0	1(33.33)	1(33.33)	1(33.33)	0	2(66.66)
1	6(22.22)	15(55.56)	6(22.22)	0	21(77.78)
2	3(13.64)	15(68.18)	3(13.64)	1(4.55)	19(86.36)

Description: ECOG: Eastern Cooperative Oncology Group, DLQI: Dermatology Life Quality Index

Table III. Incidence of Side Effects of NSCLC with Quality of Life

Degree of skin side effects (n)	Does not affect the patient's life	Slightly affects the patient's life	Moderate impact on patient's life	Greatly affects the patient's life	Very extremes affecting the patient's life	Total
No side effect	10(100)	0	0	0	0	10
Mild severity	5(16.13)	13(41.94)	6(19.35)	6(19.35)	1(3,23)	31
Moderate severity	1(10)	2(20)	1(10)	5(50)	1(10)	10
Severe severity	0	0	0	1(100)	0	1
TOTAL	16	15	7	12	2	52

Description: DLQI: Dermatology Life Quality Index

of 32 patients showed a significant correlation between skin toxicity of EGFR-TKI drugs in the form of acneiform rash, xerosis, and pruritus in different weeks since the drug was used.[10 9]

CONCLUSION

This study revealed that the most grade of side effect was grade 1 which slightly affected the patient's quality of life. The important role of the pharmacist is to provide information on side effects that may occur and manage these side effects to improve the quality of life of patients.

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STATEMENT OF ETHICS

This study has received ethical approval from the Research Ethics Committee of Dharmais Cancer Hospital No. 286/KEPK/VIII/2023.

REFERENCES

1. Komite Nasional Penaggulangan Kanker. *Pedoman Nasional Pelayanan Kedokteran Kanker Paru*. Jakarta: Kementerian Kesehatan Republik Indonesia; 2017. 88 p.
2. Zhao Y, Cheng B, Chen Z, Li J, Liang H, Chen Y, *et al*. Toxicity profile of epidermal growth factor receptor tyrosine kinase inhibitors for patients with lung cancer: A systematic review and network meta-analysis. *Crit Rev Oncol Hematol*. 2021;160:103305. doi:10.1016/j.critrevonc.2021.103305
3. Kementerian Kesehatan RI. Keputusan Menkes Republik Indonesia No. HK.01.07/Menkes/6485/2021 Tentang *Formularium Nasional*. Kementerian Kesehatan Republik Indonesia; 2021. 167 p.
4. Colombino M, Paliogiannis P, Cossu A, Santeufemia DA, Sardinian Lung Cancer Study G, Sini MC, et al. EGFR, KRAS, BRAF, ALK, and cMET genetic alterations in 1440 Sardinian patients with lung adenocarcinoma. *BMC Pulm Med*. 2019;19(1):209. doi:10.1186/s12890-019-0964-x
5. Fatmawati F. Profil Pasien Kanker Paru Jenis Karsinoma Bukan Sel Kecil Yang Mendapatkan Inhibitor Tirosin Kinase Sebagai Terapi Lini Pertama di RSUD Dr. Soetomo. *Thesis*. Universitas Airlangga; 2016.
6. Macdonald JB, Macdonald B, Golitz LE, LoRusso P, Sekulic A. Cutaneous adverse effects of targeted therapies: Part I: Inhibitors of the cellular membrane. *J Am Acad Dermatol*. 2015;72(2):203-18. doi:10.1016/j.jaad.2014.07.032
7. Chen JY, Liang SK, Chuang TY, Chu CY, Tu CH, Yeh YJ, *et al*. The impact of comorbidities, neutrophil-to-lymphocyte ratio, and drug toxicities on quality of life in lung cancer patients receiving EGFR-TKI therapy. *J Formos Med Assoc*. 2024;123(2):198-207. doi:10.1016/j.jfma.2023.07.017
8. Giuliani J, Bonetti A. The Pharmacological Costs for the Management of Skin Toxicity in Patients With Cancer Treated With Epidermal Growth Factor Receptor-Inhibitors. *Clin Lung Cancer*. 2016;17(6):471-3. doi:10.1016/j.cllc.2016.04.006
9. Tseng LC, Chen KH, Wang CL, Weng LC. Effects of tyrosine kinase inhibitor therapy on skin toxicity and skin-related quality of life in patients with lung cancer: An observational study. *Medicine* (Baltimore). 2020;99(23):e20510. doi:10.1097/MD.0000000000020510
10. Chan JC, Lee YH, Liu CY, Shih HH, Tsay PK, Tang WR. A Correlational Study of Skin Toxicity and Quality of Life in Patients With Advanced Lung Cancer Receiving Targeted Therapy. *J Nurs Res*. 2019;27(6):e51. doi:10.1097/jnr.0000000000000339
11. Neo AG, Perez A, Lopez C, Castedo L, Tojo G. Photocyclization of tosylstilbenes as a key reaction in the preparation of an analogue of the antitumor agent CC-1065. *J Org Chem*. 2009;74(8):3203-6. doi:10.1021/jo900140t
12. Finlay AY, Khan GK. Dermatology Life Quality Index (DLQI)--a simple practical measure for routine clinical use. *Clin Exp Dermatol*. 1994;19(3):210-6. doi:10.1111/j.1365-2230.1994.tb01167.x
13. Rahmatina. Uji validitas dan reliabilitas Dermatology Life Quality Index (DLQI) berbahasa indonesia pada pasien di Poliklinik Ilmu Kesehatan Kulit Dan Kelamin Rumah Sakit Dr Cipto Mangunkusumo = Validity and reliability test of Indonesian version of Dermatology Life Quality Index (DLQI) on patients attending the dermatovenereology clinic at Dr Cipto Mangunkusumo Hospital. Jakarta. *Thesis.* Universitas Indonesia; 2013.
14. U.S. Department of Health and Human Services. *Common Terminology Criteria for Adverse Events (CTCAE) Version 5.0 2017*. https://ctep.cancer.gov/protocoldevelopment/electronic_applications/docs/ctcae_v5_quick_reference_5x7.pdf. Published November 27, 2017. Accessed August 6, 2024.
15. Ding PN, Lord SJ, Gebski V, Links M, Bray V, Gralla RJ, et al. Risk of Treatment-Related Toxicities from EGFR Tyrosine Kinase Inhibitors: A Meta-analysis of Clinical Trials of Gefitinib, Erlotinib, and Afatinib in Advanced EGFR-Mutated Non-Small Cell Lung Cancer. *J Thorac Oncol*. 2017;12(4):633-43.

16. Joshi SS, Ortiz S, Witherspoon JN, Rademaker A, West DP, Anderson R, *et al*. Effects of epidermal growth factor receptor inhibitor-induced dermatologic toxicities on quality of life. *Cancer*. 2010;116(16):3916-23. doi:10.1002/cncr.25090
17. Charles C, Bungener C, Razavi D, Mateus C, Routier E, Lanoy E, *et al*. Impact of dermatologic adverse events induced by targeted therapies on quality of life. *Crit Rev Oncol Hematol*. 2016;101:158-68. doi:10.1016/j.critrevonc.2016.03.003
18. Masago K, Imamichi F, Masuda Y, Ariga N, Fujitomi K, Fukumine Y, et al. Team Management of Skin Rash Associated with Use of Epidermal Growth Factor Receptor-Tyrosine Kinase Inhibitors. *Asia Pac J Oncol Nurs*. 2018;5(4):430-4. doi:10.4103/apjon.apjon_33_18
19. Preedy VR, Watson RRR. *Handbook of disease burdens and quality of life measures*. Handbook of disease burdens and quality of life measures. 2010. p. 6. v-. v.
20. Passaro A, Di Maio M, Del Signore E, Gori B, de Marinis F. Management of nonhematologic toxicities associated with different EGFR-TKIs in advanced NSCLC: a comparison analysis. *Clin Lung Cancer*. 2014;15(4):307-12. doi:10.1016/j.cllc.2014.04.006
21. Annunziata MC, Ferrillo M, Cinelli E, Panariello L, Rocco D, Fabbrocini G. Retrospective Analysis of Skin Toxicity in Patients under Anti-EGFR Tyrosine Kinase Inhibitors: Our Experience in Lung Cancer. *Open Access Maced J Med Sci*. 2019;7(6):973-7.
22. Laitupa AAW, L. Efficacy of Gefitinib and Erlotinib in Non-Small-Cell Lung Carcinoma. *The New Armenian Medical Journal*. 2019;13(3):4-10.

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The Relationship of Drug Therapy Problems and Outcome Therapy in Tuberculosis Patients in Surabaya Health Center

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ABSTRACT

Background: Tuberculosis (TB) is a highly contagious disease and is difficult to eradicate in Indonesia. Indonesia ranks second in the number of TB sufferers in the world. Generally, TB patients use more than two types of drug therapy, it can affect the drug therapy problems that arise and can affect the success of treatment.

Objectives: This study aims to see the effect of the number of drugs used by TB patients on the number of drug therapy problems (DTP) and therapy outcomes in tuberculosis patients.

Methods: This study was a cross-sectional study with purposive sampling conducted at health centers in the Surabaya area in January-June 2024. The sample inclusion criteria included pulmonary tuberculosis patients who had undergone treatment for over one month, were at least 17 years old, and could communicate well using a guided interview method.

Results: The results showed that out of 110 patients, 30.0% used 4 types of drugs and 30.0% had two DTPs. Spearman's correlation test between the number of drugs and the number of DTPs with a p-value = 0.000 and a correlation coefficient of 0.472. Spearman's correlation test between the number of DTPs and therapy results with a p-value = 0.430 and a correlation coefficient of -0.076.

Conclusion: From this study, it can be concluded that there is a significant relationship between the number of drugs and the number of DTPs in TB patients and there is no relationship between DTP and the results of therapy in TB patients. Therefore, pharmacists at health centers need to keep helping patients understand how to follow their TB treatment correctly, including the right dose, timing, intervals, and length of the treatment.

Keywords: DTPs; Health centers; Outcome therapy; Tuberculosis

INTRODUCTION

Tuberculosis (TB) disease is an infectious disease caused by the bacteria *Mycobacterium tuberculosis*. The TB bacteria are easily spread through the air when TB patients cough, sneeze, and talk without wearing a mask [1]. Data from the Global Tuberculosis Report 2022, reports that there are 10.6 million tuberculosis (TB) cases in the world, 6.4 million (60.3%) people who have undergone treatment, and 4.2 million (39.7%) who have not been diagnosed. The number of TB cases in Indonesia in 2021 was 9.2% of world TB cases, making it the country with the second most cases after India. The number of TB death cases in Indonesia is high, reaching 93,000 per year or the equivalent of 11 deaths per hour [2].

The country's location on the equator causes Indonesia to receive large amounts of sunlight, as a result of which evaporation occurs in Indonesia so that the high humidity level in the air causes TB transmission to occur easily. In 2021, the number of TB cases found was 397,377 cases. East Java 44.6%, and Central Java 44.6% are the provinces with the highest number of TB cases in Indonesia [3]. Surabaya, with a total of 10,382 TB cases, is the city with the highest number of TB cases in East Java. The recovery rate of TB patients in Surabaya reached 56.8%, which is still below the minimum figure that must be achieved, namely 85.0% [4].

Anti-TB drugs that are included in the first line are isoniazid, ethambutol, pyrazinamide, rifampicin and streptomycin. The administration of anti-TB drugs must be in the form of a combination of several types of drugs to prevent resistance, given in sufficient quantities, and in the right dose according to the treatment category [5]. Therefore, tuberculosis patients must use medications correctly, following the five rights: the right medication, right dosage, right timing, right intervals, and right duration. Patient compliance with TB treatment is crucial for achieving recovery, preventing transmission, and avoiding drug resistance. Patient recovery can be achieved through effective collaboration between patients, health care professional, health service providers, and the community [6]. A study at the Pegirian Health Center revealed that out of 44 TB patients, 42 experienced Drug Therapy Problems (DTP), with 13.5% having too low a dose, 73.1% experiencing unwanted drug reactions, 1.9% receiving too high a dose, and 11.5% being non-compliant [7]. DTP refers to problems related to drug therapy that can interfere with treatment goals, requiring assessment by health care professional or pharmacists to resolve [8]. In 2022, Indonesia's national TB treatment success rate was 86.0%, with success rates per province ranging from 72.1% to 96.2%. East Java Province achieved a success rate of 89.0% [3]. TB treatment faces challenges related to patient compliance, which can be influenced by factors such as the long duration of treatment, patients prematurely stopping medication due to feeling cured, lack of knowledge, reluctance to seek treatment, lack of family support, low self-motivation, and low levels of education [9].

Due to the lengthy TB treatment, the high incidence of DTPs in TB patients, and the low rates of successful therapy, this study seeks to investigate the possible correlation between the number of DTPs in patients and the outcomes of TB treatment and research like this has never been conducted on TB patients in Surabaya.

METHODS

Study design

This research is a descriptive study with a cross-sectional approach with accidental sampling carried out in four community health centers in the Surabaya region (Dr. Soetomo Health Center, Perak Timur Health Center, Pacar Keling Health Center, and Sidotopo Wetan Health Center) in January-June 2024.

Population and samples

The study sample included patients who had been diagnosed with pulmonary tuberculosis and had undergone treatment for more than one month, were at least 17 years old, and could communicate effectively. The research sample excluded patients with multidrug-resistant or drug-resistant TB. The researchers used the Slovin formula to calculate the sample size from a population of 573 cases, resulting in an initial estimate of 85 samples. However, the researchers later increased the sample size to 110 [4].

Study instruments and Data collection

Data collection was conducted using a structured interview method. It included gathering demographic data, patient lifestyle, disease history, treatment history, patient compliance with treatment, and observe the results of the acid-fast bacillus test in the patient's medical records.

Data Analysis

The determination of DTP is based on the existing standards in the textbook Pharmaceutical Care Practice 3rd Edition. Unnecessary drug therapy DTP occurs when a patient receives a drug that is not indicated. Additional drug therapy DTP occurs when a patient requires additional drug therapy to treat other complaints and achieve therapeutic targets. Ineffective drug therapy DTP occurs when the drug used by the patient does not provide a therapeutic effect. Too low a dose DTP occurs when the dose of the drug used is too low from the standard and does not reach the desired target. Too high a dose of DTP occurs when the dose of the drug used exceeds the standard and causes toxic effects. Adverse drug reactions DTP happen when there is an undesirable drug reaction to the therapeutic dose of the drug. Non-compliance DTP occurs when the patient does not comply with using the drug according to the doctor's instructions [8].

The treatment progress is assessed based on the results of the acid-fast bacillus test in the patient's medical record. The research findings, presented in tabular form, include descriptive data, and correlation tests are performed using statistical analysis software.

RESULTS AND DISCUSSION

In Table I the demographic profile of 110 research participants is presented. The sample consisted of 60.0% males, and 72.7% of the participants were aged between 19 and 59 years. 42.7% of the participants had an elementary school education, and 40.0% were unemployed. According to the World Health Organization (2022), the prevalence of tuberculosis is higher in men compared to women [2]. This is attributed to factors such as higher mobility of men outside the home, heavier workloads, and unhealthy lifestyles including smoking and alcohol consumption, which can weaken the immune system [10]. These findings align with the health data profile of the City of Surabaya in 2020, which also indicates a higher incidence of tuberculosis among men compared to women [4].

The study results revealed that the majority (72.7%) of respondents were aged 19-59 years. Tuberculosis is often found in the 19-59 age group because the immune system generally begins to decline in this range, making people more susceptible to contracting tuberculosis [11]. This correlates with the findings of Andayani's research in 2017, which showed that individuals in the productive age group are highly active outside the home, frequently interacting with others, including tuberculosis sufferers [12]. Elementary school graduates represent the largest percentage of education levels in this study, at 42.7% of respondents. This finding is consistent with Mientarini's (2018) research, which reported that 33.0% had an elementary school education, the highest percentage [13]. Education plays a crucial role in enhancing knowledge, attitudes, and behaviors related to understanding tuberculosis. The level of education among tuberculosis patients can impact their understanding of tuberculosis treatment and prevention [14].

Based on Table II, it is known that the largest number of drug items obtained by each respondent was a combination of 4 drugs (30.0%). The combination of 4 drugs obtained by patients consisted of variations of anti-TB, anti-nausea, antiplatelet, antihistamine, anti-asthma, antidiabetic, antipyretic, analgesic, cough medicine, and vitamins. TB patients, in addition to receiving anti-TB, also received other drugs to treat symptoms that appear together with tuberculosis infection [15]. These results are in line with research by Fortuna et al. (2022), which stated that in addition to anti-TB, patients also received many other drugs such as cough medicine, bronchodilators, antipyretics, vitamins and minerals, and others [16].

In Table III, it was observed that out of 110 respondents, there were numerous cases of Drug Therapy Problems (DTPs). The DTP analysis was based on the drugs used, the complaints reported by the respondents, and the behavior or experiences of the patients during treatment. A total of 202 DTPs cases were identified from the 110 respondents, with the highest number of DTPs (81 cases, 40.1%) being related to adverse drug reactions.

Unnecessary drug therapy DTP can occur when the drugs prescribed to a patient are compared with the doctor's diagnosis or the patient's complaints, and it's found that the patient doesn't actually need to take those drugs. In a recent study, 3 cases (1.5%) of unnecessary drug therapy DTP were identified. These cases involved patients who were using antacids, Na diclofenac, and simvastatin without indicating their use of these drugs. Additionally, some patients were given domperidone therapy even though they didn't experience nausea and vomiting. These findings contrast with those of other researchers who reported a 0.0% rate of unnecessary drug therapy DTP [7,17]. This disparity might be due to differences in the methods of collecting data in the field, such as how patient information is gathered. If information collection is thorough and detailed, including laboratory data and careful observation of patient symptoms and complaints, the study results are likely to be more accurate.

The need for additional drug therapy DTP can be determined by evaluating any new complaints or conditions experienced by the patient. In this study, 3.9% of patient complaints required additional drug therapy, including cases of diarrhea, high cholesterol, and itching. Research conducted by Khotimah et al. in 2023 showed that 12.0% of patients required additional drug therapy DTP [17]. In this study, there was 1 case (0.5%) of ineffective drug DTP. This DTP occurred in TB patients with comorbid DM who consumed dexamethasone tablets. Dexamethasone is used to treat sore throat and needs close monitoring of blood glucose in patients with DM, because it can cause increased gluconeogenesis in the liver and insulin resistance [18]. Therefore, dexamethasone is not effective in curing sore throats, and the risks outweigh the benefits.

Too high a drug dose is caused by the patient taking more medicine than the recommended dosage based on their weight. This exceeds the guidelines for the management of tuberculosis in Indonesia and the regulation of the Minister of Health No. 67 of 2016 [5]. Additionally, a high dose of DTP can also result from drug interactions, leading to increased drug levels in the blood and toxic effects. In a recent study, 15 cases (7.4%) of drug doses DTP were found to be too high. For example, a patient weighing 45 kg should have taken 3 tablets but took 4 tablets, and a patient weighing 32 kg should have taken 2 tablets but took 3 tablets. There is a drug interaction

Table I. Demographic data of respondents

Characteristics of respondents	N (%)
Sex	
Man	66 (60.0)
Woman	44 (40.0)
Age (years)	
17-18	8 (7.3)
19-59	80 (72.7)
60-80	22 (20.0)
Education	
No Educated	6 (5.5)
Elementary School	47 (42.7)
Junior High School	18 (16.4)
High School	36 (32.7)
Bachelor's Degree	3 (2.7)
Occupation	
Not Working	44 (40.0)
Students	9 (8.2)
Self-Employed	25 (22.7)
Private Employee	32 (29.1)

Table II. Number of drugs used per patient

Number of drug Items per patient	N (%)
1 drug	9 (8.2)
2 drugs	25 (22.7)
3 drugs	21 (19.1)
4 drugs	33 (30.0)
5 drugs	16 (14.6)
≥6 drugs	6 (5.4)
Total	110 (100.0)

Table III. Types of DTP that occurred to respondents

Type of DTP	N (%)
Unnecessary drug therapy	3 (1.5)
Need additional drug therapy	8 (3.9)
Ineffective drug	1 (0.5)
Dosage too high	15 (7.4)
Dosage too low	50 (24.8)
Adverse drug reactions	81 (40.1)
Non-compliance	44 (21.8)
Total	202 (100.0)

between isoniazid and dexamethasone, with isoniazid influencing the inhibition of CYP3A4 enzyme metabolism, leading to increased dexamethasone levels, and consequently, increased side effects and toxicity of dexamethasone [19].

The text indicates that a low dose of a drug can result from using fewer tablets than necessary or from drug interactions reducing drug levels in the blood. For instance, 50 cases (24.8%) were found where the dose was too low DTP. One example given is for patients taking anti-TB drugs, where a patient weighing 58 kg should take 4 tablets but only took 3. Furthermore, dose reductions can occur due to drug interactions, such as rifampicin decreasing the concentration of glimepiride in the blood of TB patients with comorbid DM. This is

caused by the induction of the cytochrome p450 CYP2C9 enzyme by rifampicin, requiring monitoring of blood sugar levels and an increase in the dose of glimepiride [5,20].

The data on adverse drug reactions (ADR) related to DTP were collected through interviews and patient observations. Patients reported experiencing side effects from the drugs they were using, including nausea and vomiting from rifampicin, tingling in the feet from isoniazid, blurred vision from ethambutol, and joint pain from pyrazinamide [5]. Similarly, research by Tajudin et al. (2022) revealed that 31 respondents (39.2%) experienced nausea as a side effect [21]. It was found that taking rifampicin before bedtime can help reduce the nausea caused by its active metabolite, which acts as an emetogenic agent stimulating the vagus and releasing 5-hydroxy tryptamine (5-HT3) [22]. The study indicated a total of 81 cases (40.1%) of adverse drug reactions to DTP. Other studies mentioned even higher rates of ADR cases, with Priyandani et al. (2014) reporting 73.1% and Khotimah et al. (2023) mentioning 80.8% [7,17].

Treatment supervisors play an important role in improving TB patients' adherence to their anti-TB treatment. They remind patients to take their medication, directly supervise their medication intake at home, accompany them to health check-ups at health centers, and provide motivation [23]. In this study, patient non-compliance with treatment was 21.8%. Other studies found a non-compliance rate of 11.5% in a survey conducted by Priyandani et al in 2014 and 1.6% in a study conducted by Khotimah et al in 2023 [7,17].

In Table IV, it is noted that 11.8% of patients did not receive DTP, as they only used anti-TB drugs. The dosage of anti-TB drugs administered to patients adhered to guidelines, and no complaints of side effects were reported. Additionally, at most 30.0% of patients had 2 DTPs. The combinations of 2 DTPs varied, including the need for additional drugs, no necessity for drug therapy, ineffective drugs, too high or too low doses of drugs, and non-compliance.

From the results of the study in Table V, data was obtained that 83.6% of patients experienced improvement in outcomes after receiving anti-TB treatment. Anti-TB drugs must be given for a sufficient period, including the early stage/intensive phase and advanced stage. In general, the duration of treatment for pulmonary TB without complications and comorbidities is 6 months [24]. In extra pulmonary TB and TB with comorbidities, treatment can last more than 6 months. Improvement in outcomes is assessed by reducing TB symptoms such as coughing, increased appetite, and weight gain. In addition, it can also be seen from the results of the acid-fast bacillus (AFB) test. A decrease in the number of TB bacterial colonies is indicated by a change from AFB (3+) to AFB (2+), from AFB (2+) to AFB (1+), and from AFB (1+) to AFB (-). AFB is a type of bacteria that causes tuberculosis and other types of mycobacterial infections, such as leprosy (Hansen's disease). The AFB test is usually performed for people with symptoms of active tuberculosis, commonly known as TB. 1-10 AFB per field in at least 50 fields is reported as “2+”. Note that a plus sign must appear after the number. This is a positive result. More than 10 AFB per field in at least 20 fields is reported as “3+”. Negative AFB means there is no infection, the symptoms are caused by something other than mycobacteria, or the mycobacteria are not numerous enough to be seen under the microscope [25].

In Table VI, Spearman's correlation test showed a strong relationship between the number of drugs used and the number of DTPs in TB patients. The test resulted in a p-value of 0.000 and a correlation coefficient of 0.472, indicating a significant positive correlation. This means that as the number of drugs used by patients increases, the number of DTPs also increases.

The Spearman's correlation test (Table VII) between the number of DTP and the results of therapy in TB patients obtained a p-value of 0.430 and a correlation coefficient of -0.076. A p-value greater than 0.05 indicates that there is no relationship between the number of DTPs occurring in patients and improvements in patient therapy results. Conflicting results were obtained from the study of Ayu et al. (2021), which showed a relationship between the occurrence of drug-related problems (DRPs) and patient treatment results (p-value < 0.05) [26]. This discrepancy may be due to the different types of DTPs experienced by patients. Despite experiencing various DTPs like drug side effects, patients must adhere to their medication as per the guidelines. Adhering to the doctor's instructions is crucial for patients to recover from TB. The results of therapy in TB patients are greatly influenced by patient compliance in using anti-TB drugs, including the right dose, interval, frequency, and duration of treatment.

The study has some limitations. Firstly, it was conducted cross-sectional, which means that researchers were unable to monitor the progress of patients during therapy and there was no follow-up after identifying the type of DTP. Additionally, the research samples were non-randomly selected, so the conclusions cannot be generalized.

Table IV. Number of DTP per patient

Number of DTP Per Patient	N (%)
0 DTP	13 (11.8)
1 DTP	31 (28.2)
2 DTPs	33 (30.0)
3 DTPs	25 (22.7)
4 DTPs	7 (6.4)
5 DTPs	1 (0.9)
Total	110 (100.0)

Table V. Patient Therapy Outcome

Patient Therapy Outcome	N (%)
Improved	92 (83.6)
Not Improved	18 (16.4)
Total	110 (100.0)

Table VI. Correlation test of drug amount and DTP amount

			Number of drugs	Number of DTPs
Spearman's rho	**Number of drugs**	**Correlation Coefficient**	**1.000**	**0.472****
		Sig. (2- tailed)		0.000
		N	110	110

**) Correlation is significant at the 0.01 level (2-tailed)

VII. Correlation test of DTP and therapy outcome

			Number of drugs	Therapeutic outcomes
Spearman's rho	**Number of drugs**	**Correlation Coefficient**	**1.000**	**-0.076****
		Sig. (2- tailed)		0.430
		N	110	110

P=0.430>0.05: There is no relationship between the number of DTPs and therapy outcome

CONCLUSION

Based on the study results, it can be concluded that there is a significant relationship between the number of drugs used by patients and the number of Drug Therapy Problems (DTPs) per patient. There is no relationship between the number of DTPs in patients and the success of TB treatment. Therefore, pharmacists at health centers should continue to strive to improve patient understanding and compliance with TB treatment, including adherence to dose, frequency, interval, and duration of anti-TB treatment.

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STATEMENT OF ETHICS

This research is accompanied by an ethical certificate from the Research Ethics Commission of the Faculty of Dentistry, Airlangga University Number 0161/HRECC.FODM/III/2024.

REFERENCES

1. Namdar R, Peloquin C. Tuberculosis. In: DiPiro JT, Yee GC, Posey L, Haines ST, Nolin TD, Ellingrod V. Pharmacotherapy: A Pathophysiologic Approach. 11th ed. McGraw-Hill Education; 2020.

2. World Health Organization (WHO). *Global Tuberculosis Report*. Geneva, Switzerland; 2022. https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2022.
3. Ministry of Health Republic of Indonesia. Stop Tuberculosis. Jakarta: Republic of Indonesia Ministry of Health; 2022.
4. Surabaya City Health Service. *Surabaya Health Profile 2020*. Surabaya: Surabaya City Health Service; 2020.
5. Ministry of Health Republic of Indonesia. Regulation of the Minister of Health of the Republic of Indonesia Number 67 of 2016 concerning Tuberculosis Management. Jakarta: Indonesian Ministry of Health; 2016.
6. Ministry of Health Republic of Indonesia. National Guidelines for Tuberculosis Management Medical Services. Jakarta: Indonesian Ministry of Health; 2019.
7. Priyandani, Y., A.A.F., Agung, N.A.F., Ramadhani, N., Nita, Y., Mufarrihah, Dian, S.C., Utami, W., & Athijah, U. Profile of Drug Therapy Problems in Tuberculosis Patients in Several Community Health Centers in Surabaya. Journal of Community Pharmacy. 2014; 1(2): 30–35.
8. Cipolle, R.J., Strand, L.M., & Morley, P.C. Pharmaceutical Care Practice: The Patient-Centered Approach to Medication Management. Third Edition. United State of America: The McGraw-Hill Companies, Inc.; 2012.
9. Fitriyani, Identification of Drug Related Problems (DRPs) Category of Drug Interaction with Drugs on Hypertension Patients at Haji Makassar Regional Hospital. Undergraduate (S1) thesis. Makasar: Alauddin State Islamic University of Makassar; 2017.
10. Sunarmi and Kuriawaty. Relationship between characteristics of pulmonary TB patients and the incidence of tuberculosis. *Aisyiyah Medika Journal*. 2022; Vol. 7 No. 2. https://jurnal.stikes-aisyiyah-palembang.ac.id/index.php/JAM/article/download/865/604
11. Ministry of Health Republic of Indonesia. National Guidelines for Tuberculosis Management Medical Services. Jakarta: Republic of Indonesia Ministry of Health; 2020.
12. Andayani S, Astuti Y. Prediction of the incidence of pulmonary tuberculosis based on age in Ponorogo Regency 2016-2020. Indonesian Journal Health Science. 2017; Vol. 1, No. 2: 29. DOI : 10.24269/ijhs.v1i2.482
13. Mientarini, E.I., Sudarmanto, Y., and Hasan, M. The Relationship between Knowledge and Attitudes towards Medication Compliance in Advanced Phase Pulmonary Tuberculosis Patients in Umbulsari District, Jember. Ikesma, 2018; Vol. 14 No. 1: p. 11-18. DOI: 10.19184/ikesma.v14i1.10401.
14. Absor, S., Nurida, A., Levani, Y., & Nerly, W. S. The relationship between education level and compliance with treatment for pulmonary TB sufferers in the Lamongan Regency area in January 2016-December 2018. *Medica Arteriana (Med-Art)*. 2020; 2(2): 80-87. https://jurnal.unimus.ac.id /index.php/ MedArt/article/view/6143.
15. Mar'iyah, K., & Zulkarnain. Pathophysiology of tuberculosis infection. Proceedings of the National Seminar on Biology, 2021. https://doi.org/10.24252/psb.v7i1.23169.
16. Fortuna, T. A., Rachmawati, H., Hasmono, D., & Karuniawati, H. Study of the Use of Anti-Tuberculosis Drugs (OAT) in Advanced Stages in New BTA Positive Patients. Pharmacon: Indonesian Pharmacy Journal, 2022; 19(1): 62-71. DOI: 10.23917/pharmacon.v19i1.17907chrome-extension: //efaidnbmnnnibpcajpcglclefindmkaj/https://repository.unair.ac.id/77666/1/C-24.pdf.
17. Khotimah, K., & Sutrisna, E. M. Identification of drug-related problems (DRPs) in the intensive phases of tuberculosis treatment in geriatric patients at RSUP Surakarta. Medical Science Scientific Journal of Pharmacy, 2023; 8(3): 945-954. DOI: 10.37874/ms.v8i3.750.
18. Cui, A., Fan, H., Zhang, Y., Zhang, Y., Niu, D., Liu, S., Liu, Q., Ma, W., Shen, Z., Shen, L ., Liu, Y., Zhang, H., Xue, Y., Cui, Y., Wang, Q., Xiao, X., Fang, F., Yang, J., Cui, Q., & Chang, Y. Dexamethasone-induced Krüppel-like factor 9 expression promotes hepatic gluconeogenesis and hyperglycemia. The Journal of clinical investigation. 2019; 129(6), 2266–2278. https://doi.org/10.1172/JCI66062.
19. Baxter K. Stockley's Drug Interactions. Eighth edition. London: Pharmaceutical Press; 2008.
20. Azzahra, Sevilla Elza., Iswandi and Sumaryana. Study of Potential Drug Interactions in Pulmonary TB Patients at Dr. Hospital. Gondo Suwarno, Semarang Regency. *Indo Pharm Journal*. 2022; Vol. 2 No.2. https://jurnal.umsb.ac.id/index.php/IJPR/article/view/3941.

21. Tajudin, T., Ulfah, U., & Permana, D. A. S. Identification of Adverse Drug Reactions to the Use of Anti-Tuberculosis Pulmonary Drugs in the UPTD of the Kroya. Proceedings of the National Seminar on Dissemination of Research Results of the Undergraduate Pharmacy Study Program, 2022; Vol. 2, No. 1. https://ejurnal.universitas-bth.ac.id/index.php/PSNDP/article/view/978.
22. Kenward, H., Pelligand, L., Savary-Bataille, K., & Elliott, J. Nausea: current knowledge of mechanisms, measurement and clinical impact. *The Veterinary Journal*. 2015; 203(1), 36-43. https://doi.org/10.1016/j.tvjl.2014.10.007.
23. Pasaribu, G. F., Handini, M. C. ., Manurung, J., Manurung, K., Sembiring, R. ., & Siagian, M. T. Non-compliance with taking medication in pulmonary TB patients: A qualitative study. *Jurnal Prima Medika Sains*. 2023; 5(1), 48-56. https://doi.org/10.34012/jpms.v5i1.3788.
24. Charles A. Peloquin. *Tuberculosis*. In: DiPiro JT, Yee GC, Posey L, Haines ST, Nolin TD, Ellingrod V. Pharmacotherapy: A Pathophysiologic Approach. 7th ed. New York: McGrew-Hill Companies, Inc; 2012.
25. Fathiyah Isbaniah, Erlina Burhan, Bintang YM Sinaga, Dewi Behtri, Yanifitri, Diah Handayani, Harsini, Heidy Agustin, I Nengah Artika, Jatu Aphridasari, Rohani Lasmaria, Russilawati, Soedarsono, Yani Jane R. Sugiri. *TUBERKULOSIS Guidelines for Diagnosis and Management in Indonesia*. Jakarta: Indonesian Lung Doctors Association; 2021.
26. Ayu Fortuna, Fita Rahmawati, Nanang Munif Yasin. Association between Drug Related Problems (DRPs) and Outcomes Therapy in Tuberculosis Patients with Diabetes Mellitus. *Journal of Management and Pharmacy Practice*. 2021; Vol. 11(2). DOI : 10.22146/jmpf.62602.

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