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Spatial Analysis of Healthcare Facilities in Mersam Subdistrict

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ABSTRACT

This research aims to determine and analyze health facilities in Mersam District. The type of research used in this research is quantitative descriptive. using a regional study design with a spatial approach based on geographic information system software. The author here wants to know the distribution, reach and performance of these health facilities. Mersam District is the population unit in this research. The results of the research are that the distribution of health facilities in Mersam District includes community health center facilities, supporting community health center facilities and village health post facilities. The affordability of health facilities in Mersam District is 3000 meters for the Puskesmas health facility, 1500 meters for the Sub-Puskesmas health facility and 1000 meters for the Poskesdes health facility. The radius is obtained based on considerations from SNI 03-1733-2004, bConcerning Procedures for Planning the Urban Household Environment and SNI 03-1733-2004 Concerning Procedures for Planning Urban Residential Areas. and getting to health facilities has shown that the facilities are well accessible to the community. The performance of Health Facilities in Mersam District in providing services to the community through questionnaire surveys shows satisfaction and very dissatisfaction. For community health centers, the satisfaction questionnaire was addressed to Mersam Community Health Center, for community health centers that had a satisfaction questionnaire, it was Mersam Center, while Belanti Jaya Center had a very dissatisfied questionnaire. The Poskesdes showed that almost all were dissatisfied.

INTRODUCTION

In this ever-changing world, developing countries face numerous health-related challenges. The standard of living significantly depends on the availability and accessibility of healthcare resources (Luqman & Khan, 2021). Local authorities bear formal responsibility for all public services and facilities within a specific geographical area (Khedmati Morasae et al., 2024).

The historical context of national healthcare provision underscores its importance, as illustrated by Philos and Jones in Europe. Their work identifies key

processes linked to the influence of medical professionals and government healthcare policies driving socio-economic growth (Coldefy & Curtis, 2010). Recognizing the critical role of healthcare facilities, many nations have developed systems and policies aimed at equitable distribution of healthcare resources, ensuring all individuals, regardless of background, have access to quality services (Abulibdeh et al., 2024).

Healthcare services represent intangible interactions between consumers and providers. These include individual and collective efforts within organizations to maintain and improve health, prevent and treat diseases, and restore public health. The role of healthcare services involves implementing operational principles of primary, traditional, and referral healthcare, health insurance, pharmaceuticals, cosmetics, and traditional medicine (Andrianto, Pradikta & Nursikuwagus, 2023).

Health is a fundamental necessity, and individuals seek treatment when feeling unwell to regain their health. Those with severe conditions often turn to hospitals or other healthcare facilities for assistance. However, healthcare services are not always affordable, creating barriers for lower-income populations. Public health plays a crucial role in enhancing human resources, alleviating poverty, and fostering economic development. The Human Development Index (HDI) places health as one of the most critical indicators, alongside education and income (Hamka et al., 2022).

Many studies highlight the limited availability of healthcare facilities, such as doctors, hospital beds, nurses, and paramedics. Additionally, there is a gap in identifying underperforming administrative units (districts) in utilizing services and accessing facilities (Kumar & R.S., 2022).

The goal of evenly distributing basic needs, infrastructure, and urban services across various regions is to minimize gaps between neighborhoods and districts based on per capita considerations. Regional resource allocation should prioritize citizens' well-being while minimizing opposition to equitable health rights (Ghasemi et al., 2023). Better health outcomes result from improved access to healthcare, transportation, and human development opportunities. However, spatial inequities exacerbate urban health disparities, leading to advantages and disadvantages (Song et al., 2024).

Government-provided facilities in sub-districts include healthcare services. Village public facilities, such as transportation, healthcare, education, and security infrastructure, are vital for improving residents'

quality of life. These facilities must be provided by local governments and related entities to meet community needs effectively. Essential facilities, such as health centers (Puskesmas), auxiliary health centers (Pustu), and village health posts (Poskesdes), are critical for rural healthcare access (Fauzan & Prayogi, 2020).

These centers serve as referral points to community health centers and hospitals, offering outpatient and inpatient care to surrounding populations. At the tertiary level, central hospitals provide specialized services (Palk et al., 2020). Accessibility to welfare facilities for the elderly, including their proximity to frequently visited facilities, is another crucial aspect (Cho et al., 2021). Healthcare facilities encompass general service readiness, comprehensive obstetric care availability, and the average travel distance to health facilities (Khan et al., 2023).

Spatial analysis enables data clustering, helping authorities understand demographic similarities by examining data density in projected areas. It evaluates and models spatial data features, such as location, attributes, and relationships, revealing their geometric or geographic characteristics (Aspiyansah & Damayanti, 2019). Updated population patterns and geospatial cluster analysis provide insights into spatial and racial disparities (Wong et al., 2023).

Mersam is one of eight sub-districts in Batang Hari Regency, covering an area of 801.90 km^2 at an elevation of up to 100 meters above sea level. It is bordered by Tanjung Jabung Barat Regency to the north, Muara Tembesi and Pemayung Sub-districts to the east, Batin XXI Sub-district to the south, and Maro Sebo Sub-district to the west. The region's topography is predominantly flat (Central Bureau of Statistics, 2019).

In 2019, Mersam's population density was 27,577 people, increasing to 33,537 by 2022. This growth impacts the demand for facilities, including healthcare services, which require attention to meet community needs (Central Bureau of Statistics, Batang Hari Regency).

Advancements in technology enable interactive GIS usage, allowing users to view spatial information in maps and location details. Geographic Information Systems (GIS) are computer systems designed to handle spatially-referenced information. They capture, manage, integrate, process, analyze, and display data related to field conditions (Perrina, 2021). Addressing this knowledge gap requires reasonable spatial and temporal development strategies that incorporate techno-economic analysis, raw material availability, and policy frameworks, making this technology's adoption feasible

(Reed et al., 2022). Geospatial models can estimate the minimum travel time needed for treatment access for individuals (Palk et al., 2020).

The importance of spatial accessibility to medical facilities cannot be underestimated for three reasons. First, spatial accessibility dimensions relevant to healthcare access include proximity, medical quality, and availability of transportation (Shen & Tao, 2022). Second, economic benefits from facilities should align with actual utilization (Bhuiyan et al., 2024). Lastly, accessibility studies assessing spatial equity measure horizontal spatial equity by examining access equality in urban areas (Ashik et al., 2020). Physical accessibility to testing facilities remains low for walking and motorized travel modes. Both geographic accessibility and its equity are higher with motorized transportation compared to walking, emphasizing the need for motorized transport access for all (Krishnakumari et al., 2024).

METHOD

The research method employed in this study is descriptive quantitative research. Descriptive quantitative research involves describing, investigating, and explaining phenomena as they are, using numerical data or statistics to draw conclusions from observable phenomena. The data collected were subsequently analyzed using buffer and overlay analysis. The buffer method is used to represent the coverage radius within Mersam District. Proximity analysis is a common approach for determining land-use strategies. Overlay analysis, often best conducted using raster overlays, is applied to identify locations that meet specific criteria (Sa'adah et al., 2022).

Spatial data processing provides significant convenience for users. One of the advantages offered by geographic information systems (GIS) is that users are not required to conduct on-site fieldwork to analyze the data needed to achieve the intended objectives (Zella et al., 2020). This combination illustrates the attributes of various phenomena, such as an individual's age, types of roads, and information regarding residential locations and road networks (Handayani Dewi, 2015). In this study, the sample size for the third variable—health facility performance—is as follows:

Table 1. Research Sample

No	Village/Subdistrict	Health Facility	Sample Size
1	Sengkati Kecil	Poskesdes (Village Health Post)	5
2	Mersam	Pustu (Sub-District Health Post)	5
3	Benteng Rendah	Poskesdes	5
4	Kembang Paseban	Mersam Community Health Center	5
5	Kembang Tanjung	Poskesdes	5
6	Sengkati Baru	Poskesdes	5
7	Pematang Gadung	Poskesdes	5
8	Teluk Melintang	Poskesdes	5
9	Sengkati Gedang	Pustu	5
10	Sengkati Kecil	Poskesdes	5
11	Sungai Puar	Pustu	5
12	Rantau Gedang	Poskesdes	5
13	Tapah Sari	Pustu and Poskesdes	5
14	Bukit Harapan	Poskesdes	5
15	Bukit Kemuning	Pustu and Poskesdes	5
16	Belanti Jaya	Pustu	5
17	Simpang Rantau Gedang	Pustu	5
18	Sengkati Mudo	Pustu	5
19	Tanjung Putra	Sungai Puar Community Health Center	5
20	Sungai Puar	Pustu	5
Total			100

In this study, the researcher employed data collection techniques using secondary data. During the survey activities conducted to obtain direct information from the research area, observations, field surveys, and questionnaires were utilized. This aligns with the opinions of scholars regarding data collection in research and optimizing research outcomes.

RESULTS AND DISCUSSION

Mersam District is one of the 11 districts within the administrative region of Batang Hari Regency. It is located in Batang Hari Regency, Jambi Province, Indonesia. The

distance from Jambi City to Mersam District is approximately 120 kilometers, or about a 2-hour journey by motor vehicle. Mersam District is situated along the Batang Hari River, covering an area of 801.90 square kilometers. The district is geographically positioned between 0° S to 5° N latitude and 100° E to 105° E longitude, with an elevation ranging from 25 to 100 meters above sea level and an area of 790.82 square kilometers.
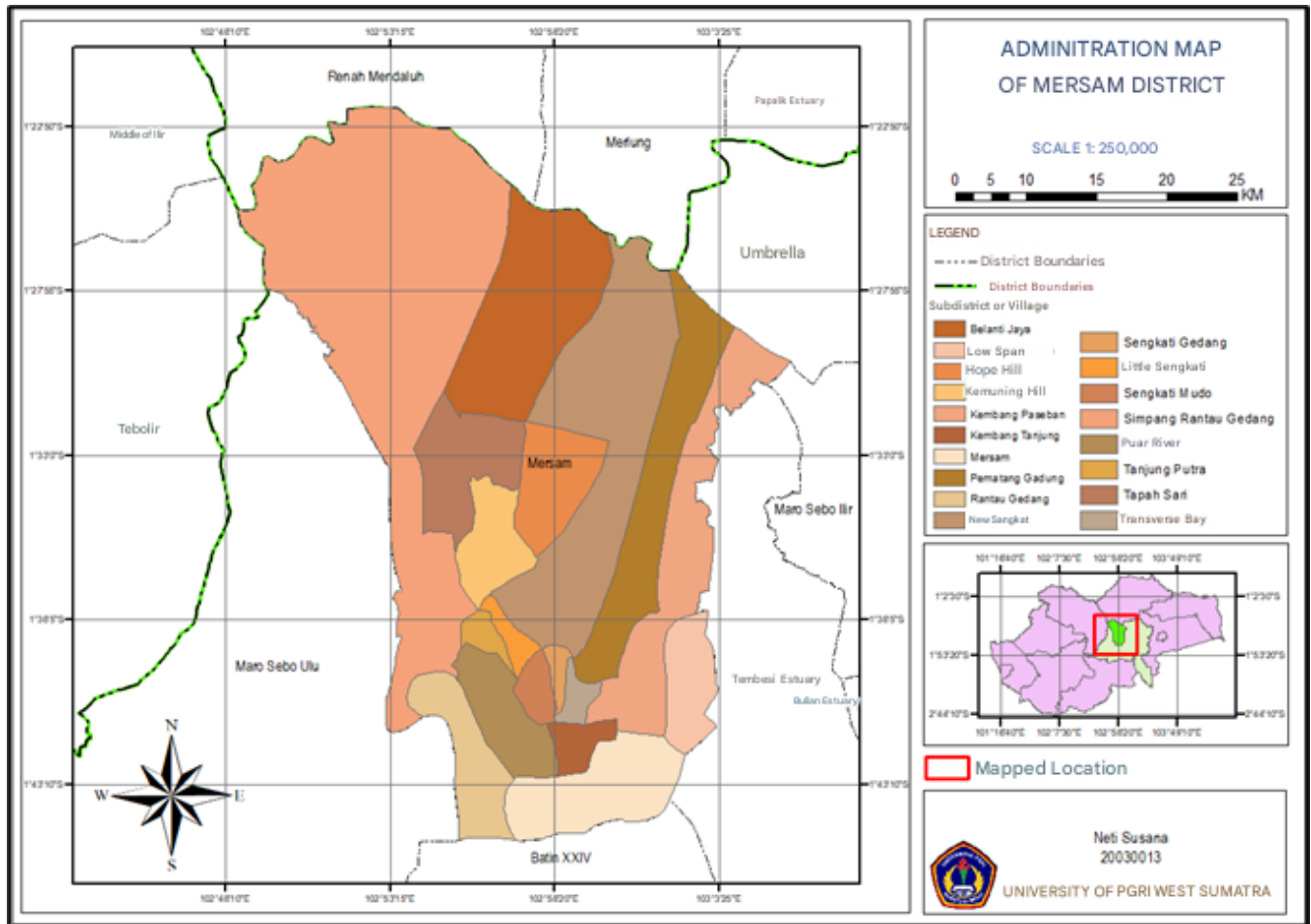
Figure 1. Research location

1. Distribution of Health Facilities

The location of health facilities can be identified based on the type of location where these facilities are situated (Umam et al., 2012). Geospatial analysis techniques are used to determine the placement of health facilities in the field by utilizing spatial and temporal applications, ensuring that health services are adequately provided and remain easily accessible to the community (Reed et al., 2022). In Mersam District, health facilities include two community health centers (puskesmas), nine auxiliary community health centers (pustu), and nine village health posts (poskesdes). The operational area is divided into two units: UPTD Puskesmas Sungai Puar and UPTD Puskesmas Mersam. The distribution of health facilities across the villages in Mersam District can be observed based on their respective locations.

a) Operational Area of Puskesmas Mersam

According to the Regulation of the Minister of Health of the Republic of Indonesia No. 43 of 2019, a Community Health Center (puskesmas) is a primary healthcare facility that provides both community health services and individual health services, with a greater emphasis on promotive and preventive measures within its designated operational area.
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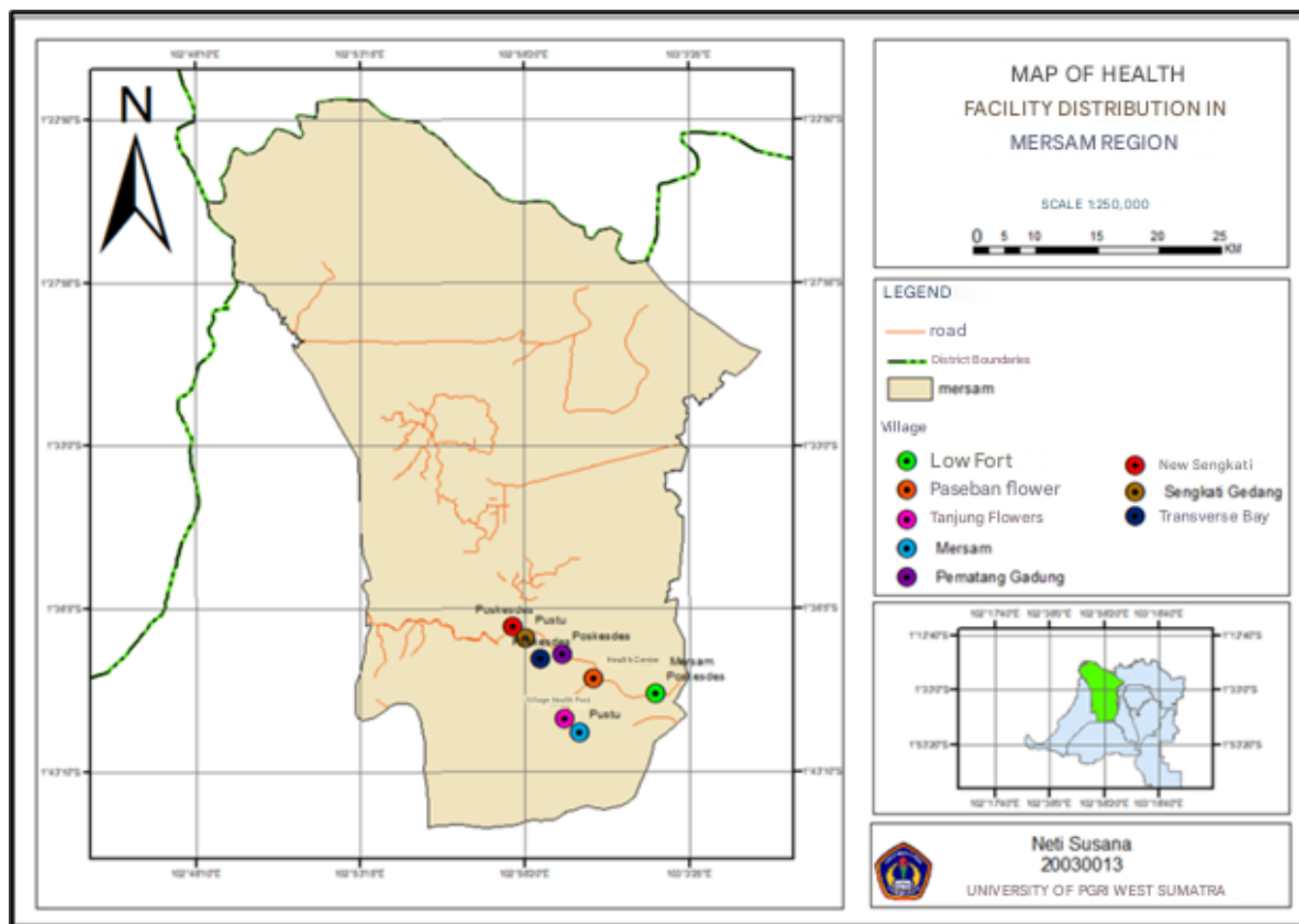
Figure 2. Map of Health Facility Distribution in the Operational Area of Puskesmas Mersam

b)   Operational Area of Puskesmas Sungai Puar

The Health Law of the Republic of Indonesia No. 36 of 2009 states that health development aims to enhance awareness, willingness, and the ability to lead a healthy life for every individual, thereby achieving the highest possible standard of public health as an investment in the development of socially and economically productive human resources.

Based on the number of health facilities in the operational area of Puskesmas Mersam, the distribution of these facilities can be identified using their XY coordinate points. The spatial distribution of health facilities is visually represented on the map provided below for greater clarity.
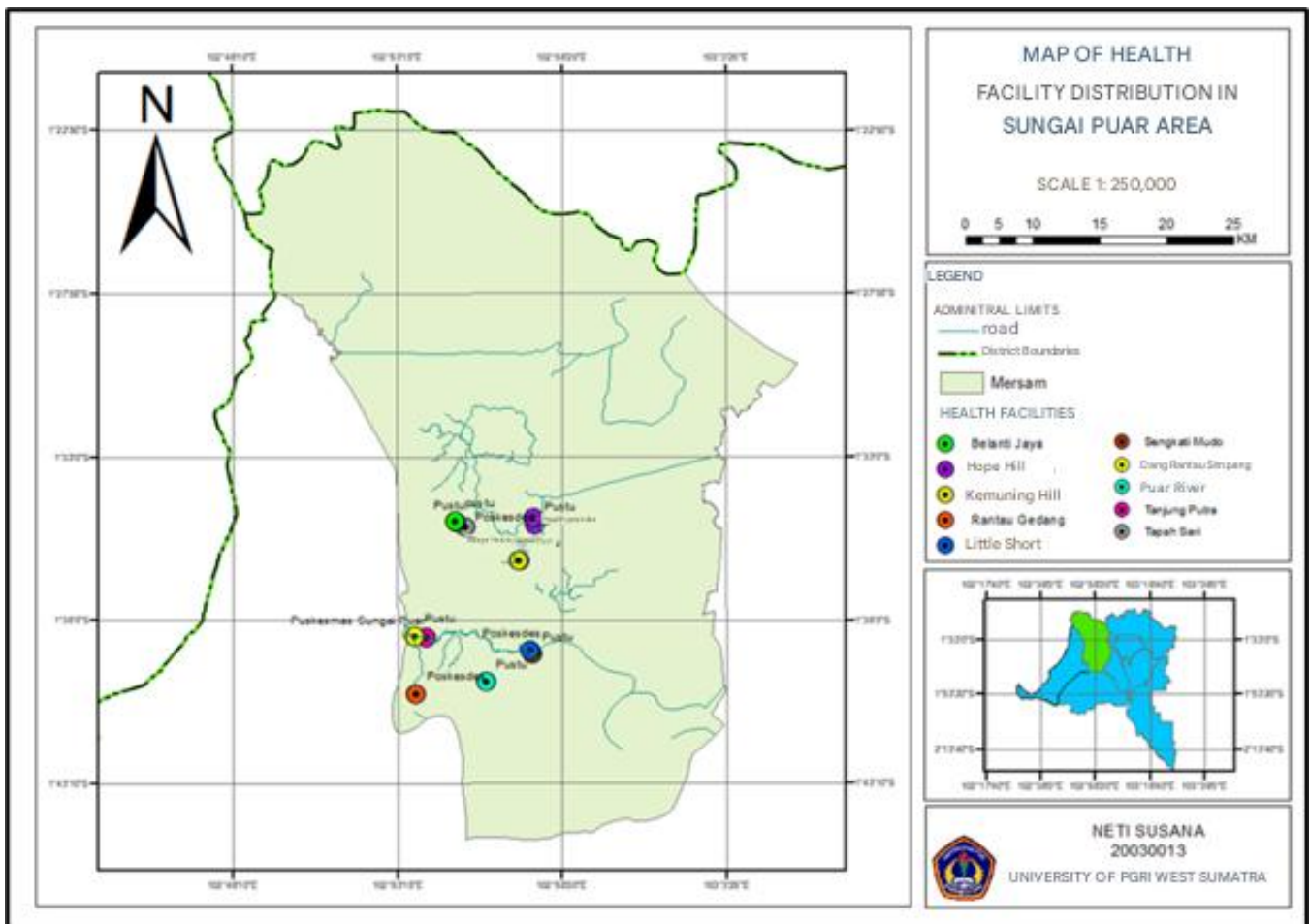
Figure 3. Map of Health Facility Distribution in Mersam District

2. Accessibility of Facilities

The concept of accessibility refers to the ease of reaching a specific point. In other words, accessibility is the maximum distance that can be covered from one area to another. Accessibility depends not only on distance but also on the availability of supporting infrastructure and facilities (Patrisius A. Fanataf et al., 2020). Access to healthcare services must be available, acceptable, financially affordable, and geographically proximate (Iamtrakul et al., 2023).

The spatial accessibility concept can be analyzed from two main perspectives: (1) potential Accessibility:

An estimated percentage of the catchment population assumed to have easy access to healthcare facilities within a predetermined or acceptable time interval, and (2) revealed Accessibility: The actual percentage of the catchment population using the nearest facility and consuming healthcare services (Okundi & Varol, 2024).

The concept of accessibility defines whether or not a location can be reached from another. Accessibility is influenced by the distance traveled, which is measured by physical distance and various constraints encountered in the field.
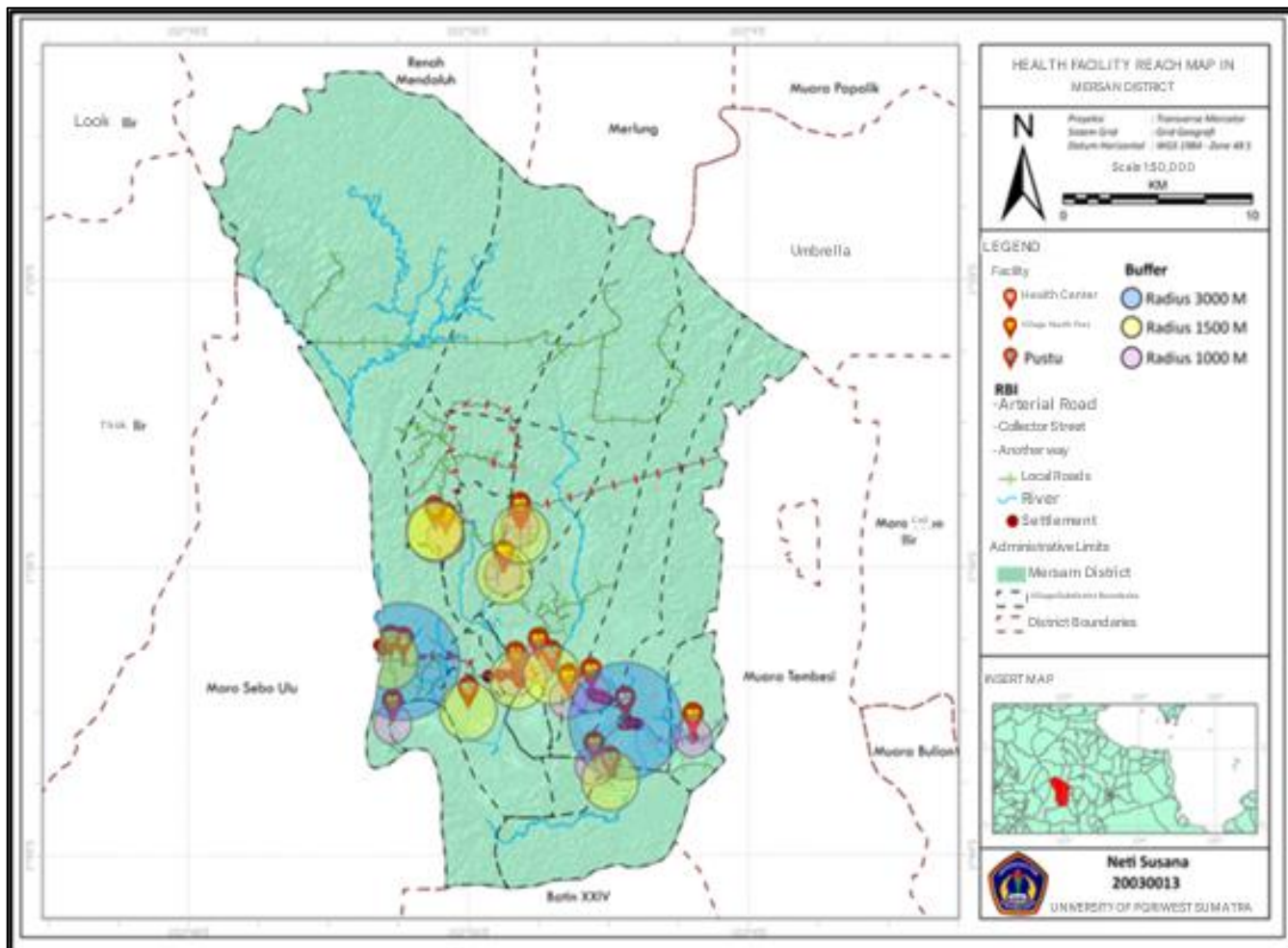
Figure 4. Map of Health Facility Accessibility in Mersam District

3. Performance of Health Facilities in Mersam District

The performance of healthcare workers refers to the outcomes achieved by an individual in carrying out assigned tasks according to established criteria. Human resources are the most dominant factor in achieving good performance. Even with well-structured and organized planning, it becomes futile if the personnel executing it lack quality or enthusiasm for work (Ida Ayu Laksmi Arnita Utari & Dety Mulyanti, 2023).

Performance is defined as the work results achieved by individuals or groups in completing their tasks and responsibilities, which contribute to the organization's goals based on agreed success measures (Rosvita et al., 2023).

The performance of health facilities in providing services to the community is evaluated through surveys conducted with respondents. The survey results indicate the presence of 21 health facilities distributed across the villages in Mersam District, comprising 2 community health centers (puskesmas), 9 auxiliary health centers (pustu), and 9 village health posts (poskesdes). However, based on the survey responses, the health facilities in Mersam District have not fully met public satisfaction.

Table 1. Service Dimension Items

No	Indicator	Question
1	Very Dissatisfied	0 – 20%
2	Dissatisfied	21 – 40%
3	Somewhat Dissatisfied	41 – 60%
4	Satisfied	61 – 80%
5	Very Satisfied	81 – 100%

Source: Research data, 2024
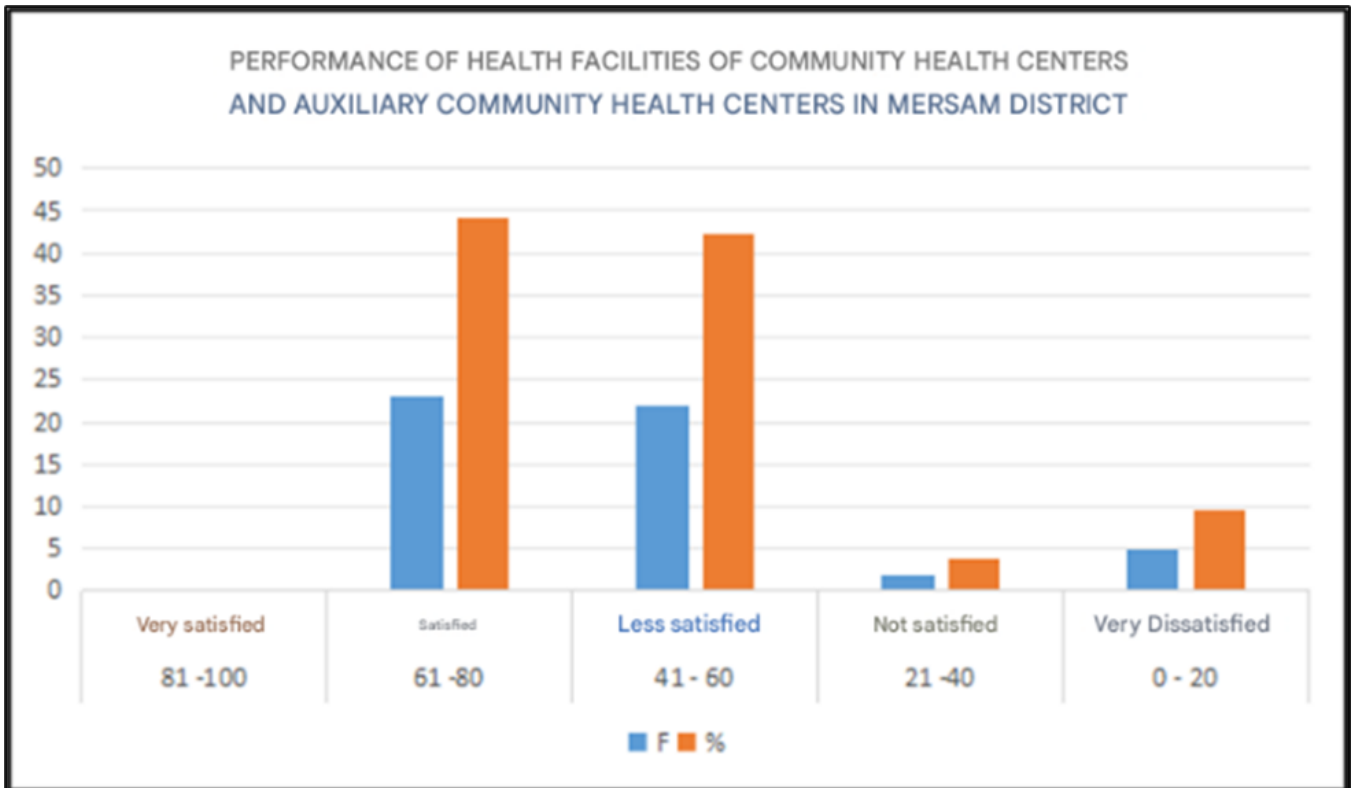
Figure 5. Bar Chart of Puskesmas and Pustu Facilities
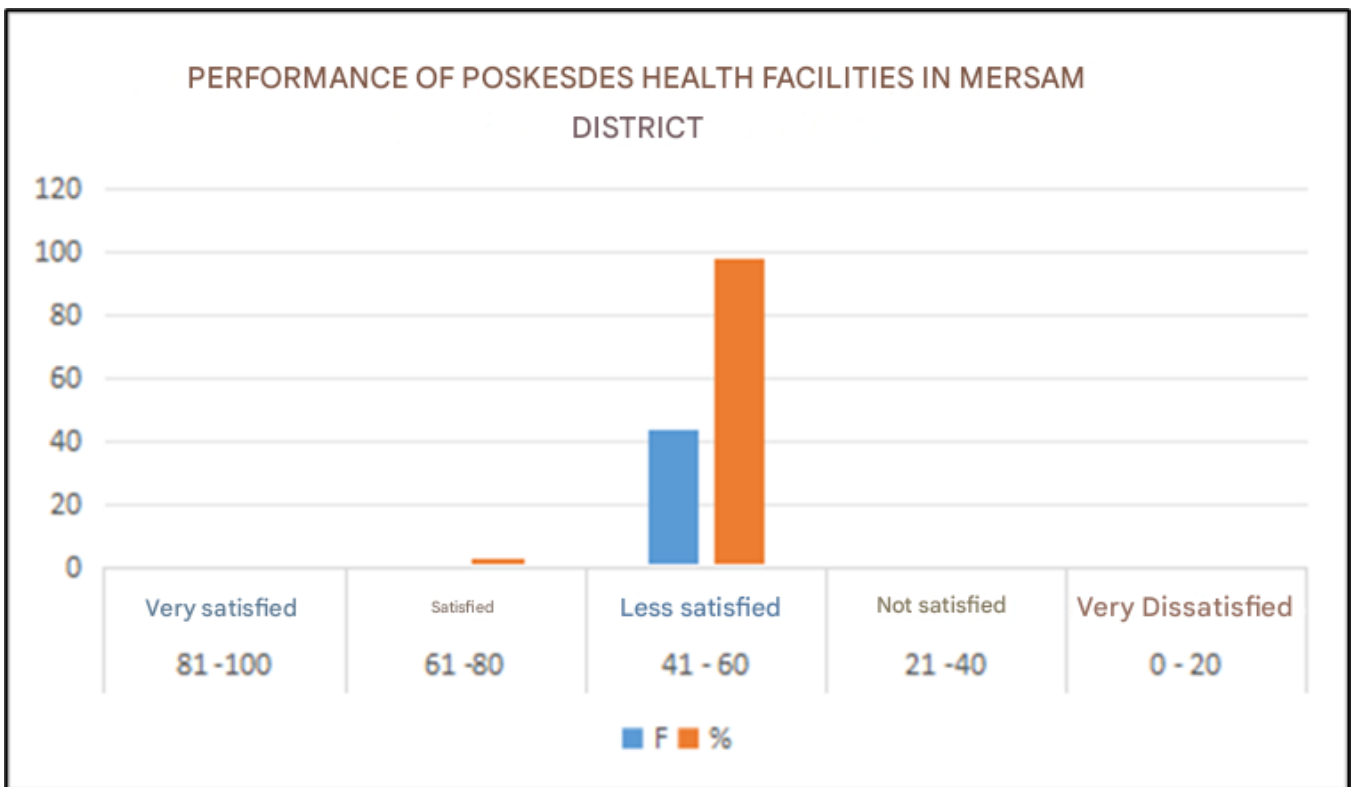
Figure 6. Bar Chart of Poskesdes Facilities

Figure 5 shows the bar chart of respondent satisfaction with the health facilities at the Puskesmas and Pustu. The chart illustrates that the frequency and percentage of satisfaction fall within the 41-60% and 61-80% ranges, categorized as "Somewhat Dissatisfied" and "Satisfied," respectively. The 21-40% range is categorized as "Dissatisfied," and the 0-20% range indicates a "Very Dissatisfied" level of satisfaction.

Figure 6 presents a similar bar chart depicting the satisfaction survey results for the Poskesdes health facilities. The data follows the same frequency and percentage categories, showing varying levels of satisfaction among the respondents.

In Figure 7, the bar chart depicting the healthcare facilities at the Poskesdes (community health posts) shows that the majority of respondents are in the category of "dissatisfied" (41-60%), a much higher proportion compared to other satisfaction categories. This study aims to analyze the spatial distribution of healthcare facilities in Mersam District, Batanghari Regency.

First, regarding the distribution of healthcare facilities in Mersam District, field studies were conducted to assess the locations of healthcare facilities. Mersam District is served by two main health centers: the Mersam UPTD Public Health Center, which has eight community health posts (Poskesdes) or auxiliary health posts (Pustu), and the Sungai Puar UPTD Public Health Center, which covers ten villages.

Second, the accessibility of healthcare facilities in Mersam District is discussed in terms of distance. Poskesdes such as Sengkati Baru, Teluk Melintang, and Benteng Rendah are located within 1000 meters, while the Mersam Public Health Center and its surrounding Pustu and Poskesdes are generally within a 1000-3000 meter radius. This is in accordance with the standards of SNI 03-1733-2004 regarding urban residential area planning.

Third, based on the tabulation of responses regarding satisfaction with healthcare facilities, it is evident that the respondents gave varied scores for the facilities. The maximum score for the public health centers and Pustu was 85, whereas the Poskesdes scored a maximum of 65. The average satisfaction percentage for public health centers and Pustu was 66.6%, while for the Poskesdes, it was 78.3%.

The table also highlights that the majority of respondents (23 people) rated the public health centers and Pustu facilities as "satisfied." These facilities include the Mersam Public Health Center, Mersam Pustu, Sengkati Mudo Pustu, Bukit Kemuning Pustu, Sungai Puar

Public Health Center, and Bukit Harapan Pustu. However, 22 respondents rated the facilities as "less satisfied," including those at the Sungai Puar Pustu, Simpang Rantau Gedang Pustu, Bukit Harapan Pustu, and others. A small number of respondents expressed dissatisfaction or "very dissatisfied" ratings, particularly at facilities like Pustu Tapah Sari. As shown in Table 3.25, the Poskesdes in Belanti Jaya had the highest number of "less satisfied" responses, with 44 people, and only 1 respondent was "satisfied."

CONCLUSION

The research concludes that Mersam District is equipped with a total of 21 healthcare facilities, including 2 public health centers, 9 Pustu, and 9 Poskesdes. The distribution of these facilities is fairly spread out across the district. The accessibility of healthcare facilities falls within the required 1000 to 3000 meter radius, in line with national standards for urban and residential area planning. The highest satisfaction levels are found in public health centers and Pustu, with 23 people indicating satisfaction, while a significant portion of respondents (22 people) expressed dissatisfaction, particularly at the Poskesdes in Belanti Jaya, which was rated poorly by most.

Conflict of interest: The author has no competing interests to declare that are relevant to the content of this article.

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