



SPATIAL DISTRIBUTION ANALYSIS TO IDENTIFY HOTSPOT AND LOWSPOT OF ANTENATAL SERVICE COVERAGE AT THE SUB-DISTRICT LEVEL IN JAMBI MUNICIPALITY

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ABSTRACT

Accelerating the reduction of maternal and child mortality rates can be done by accessing quality maternal health services by antenatal care. This study aimed to identify the spatial distribution pattern of antenatal service coverage in Jambi Municipality in 2019-2021. Global and local Moran Index using Local Indicator for Spatial Autocorrelation (LISA) analysis was used in this study to map hotspots and lowspots of antenatal service coverage. This research used an ecological study with the unit of analysis of all sub-district in Jambi Municipality, totalling 62 sub-districts. Data on antenatal care coverage (K1 and K4) from 2019 to 2021 at the sub-district level were obtained from 20 community health centers. The results of this study found a positive autocorrelation of K1 and K4 from 2019 to 2021. The results of the analysis using LISA found that K1 and K4 coverage hotspots have the same pattern in the northwest direction of Jambi Municipality covering Danau Teluk, Pelayangan, Pasar Jambi districts and K1 and K4 lowspots with the same pattern in the Southwest, Southeast, and South directions covering Alam Barajo and Kota Baru districts. Knowing the pattern of distribution of antenatal service coverage (K1 and K4) can determine the priority areas that need to be improved antenatal service coverage in Jambi Municipality.

Keywords: antenatal service coverage; jambi municipality; hotspots; lowspots; spatial autocorrelation

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INTRODUCTION

Antenatal care helps in identifying threats to the health of the mother and unborn baby, as well as providing counseling on nutrition (Ali et al., 2020). Antenatal care is one of the four most fundamental pillars for women who are planning family planning, safe delivery, and essential obstetric care (John et al., 2019). Antenatal care is an examination in pregnancy that aims to improve the health of pregnant women, both physically and mentally optimally, preparation for childbirth and the postpartum period, preparation for exclusive breastfeeding, and restoring reproductive health (Kementerian Kesehatan Republik Indonesia, 2018). Sustainable Development Goals (SDG's) is a global action plan agreed by world leaders, including Indonesia. The SDG's contain 17 goals and 169 targets that are expected to be achieved by 2030. The third goal in the SDG's is good health and well-being, one of the indicators to see the well-being of the country can be seen from the Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR) (Kementerian PPN/ Bappenas, 2017). The Ministry of Health in its regulation says one way to reduce maternal mortality is to provide antenatal care that includes K1 and K4-K6 indicators (Permenkes No 21 Tahun 2021, 2021).

K1 coverage is the first contact or visit of a pregnant woman to a health worker for antenatal care. K4-K6 is the contact or visit of pregnant women to health workers at least 4 times during pregnancy. In accordance with the government's recommendation that services provided to pregnant women must be fulfilled with the regulations that have been set in each trimester, namely 1 time in the first trimester with a gestational age of 1-12 weeks, 1 time in the second trimester with a gestational age of 13-26 weeks and 2 times in the third trimester with a gestational age of >26 weeks or until the time of delivery (Permenkes No 21 Tahun 2021, 2021). Based on data from the Basic Health Research (Riskesdas) in 2018, K1 coverage in Indonesia was 94.1% while K4 coverage was 74.1% (Kementerian Kesehatan Republik Indonesia, 2018). Data from the Jambi Province Health Profile shows that K1 coverage in Jambi Province in 2020 was 1003.24% and K4 coverage was 92.68% (Dinkes Provinsi Jambi, 2020). The coverage of K1 and K4 in the Jambi Municipality area in the same year was 96.55% and K4 was 82.5% (Dinas Kesehatan Kota Jambi, 2021). Geographical aspects are a key dimension of health disparities. Geographical variations in antenatal care coverage can reveal health disparities between regions. Identifying spatial distribution patterns of antenatal care is the first step in finding and addressing social, economic and health inequalities at the smallest level. Targeting health interventions to areas and communities in need could be an appropriate approach to reduce maternal and child mortality (Tessema & Akalu, 2020).

Spatial autocorrelation analysis can be used to identify hotspot and lowspot areas. Hotspots can be defined as areas with low antenatal care coverage that are also surrounded by areas with low antenatal care coverage. Lowspots are defined as areas with high antenatal care coverage that are also surrounded by areas with high antenatal care coverage (Kondo, 2016). Several studies have been conducted to assess the spatial pattern of antenatal care (Abebe et al., 2023; Burgert-Brucker et al., 2015; Olopha et al., 2022). Spatial and temporal studies related to the distribution patterns of K1 and K4 coverage have not been conducted in Jambi Municipality. Like other health issues, K1 and K4 coverage are interdependent and require spatial relationships. Based on data obtained from the Jambi Municipality Health Office, the coverage of care between regions in Jambi Municipality still varies, so a study using spatial distribution patterns is needed to see the coverage of K1 and K4. Studies concerning distribution patterns that affect K1 and K4 coverage can be useful in helping those involved in efforts to develop effective programs to see the distribution of K1 and K4 coverage in Jambi Municipality.

METHOD

This study used an ecological study design to study the distribution of K1 and K4 coverage in Jambi City. The data used is secondary data with aggregate data of sub-district. This study was conducted in Jambi Municipality located at 1030'2.98"- 1040'1.07" South latitude and 103040'1.67"-103040'0.22" East longitude. Jambi Municipality is a capital city of Jambi Province with the total area 205.38 km². Jambi Municipality is the most densely area in Jambi Province with total population approximately 612 thousand people. Jambi Municipality has 11 districts and 62 sub-districts (BPS Kota Jambi, 2021; Pemerintah Kota Jambi, 2021). The area of Jambi Municipality can be seen in the figure 1. Coverage of antenatal care (K1 and K4) at the village level in Jambi Municipality obtained from the Maternal and Child Health Services section of all 20 health centers in Jambi Municipality. This study analyzed data from 2019 to 2021. The choropleth map of the distribution of antenatal service coverage (K1 and K4) in the study was created using the open source application Geoda 10.2. Spatial autocorrelation analysis using Global Moran's Index and cluster maps to see hotspots and lowspots areas were made using the Local Indicator for spatial autocorrelation (LISA) method. Data analysis began by entering data on the number of antenatal services by village

into the MS Excel application and then joining the table with a shapefile map of the Jambi Municipality area by village using the QGIS application. Moran and LISA analysis was conducted using the open source application Geoda 10.2. Geoda is a spatial analysis application used to process data and display cluster maps, significance maps and scatter plots to determine the distribution of K1 and K4 coverage in Jambi Municipality in 2019-2021.

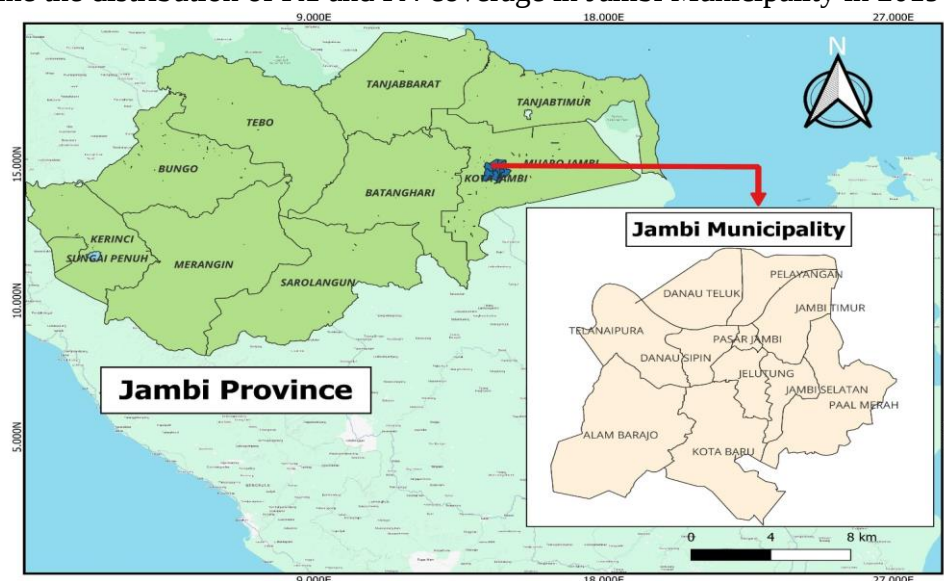
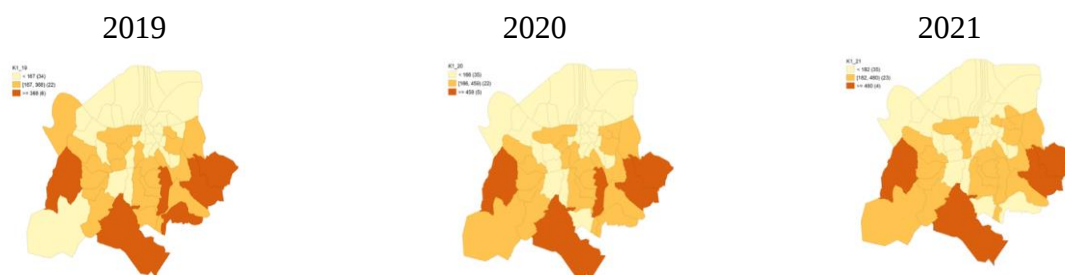


Figure 1: Map of the study area

RESULTS

A map of the distribution of antenatal care coverage (K1 and K4) by neighborhood was created using the natural breaks classification method. Natural breaks optimize the natural clustering of data:

Distribution of K1 Coverage



Distribution of K4 Coverage

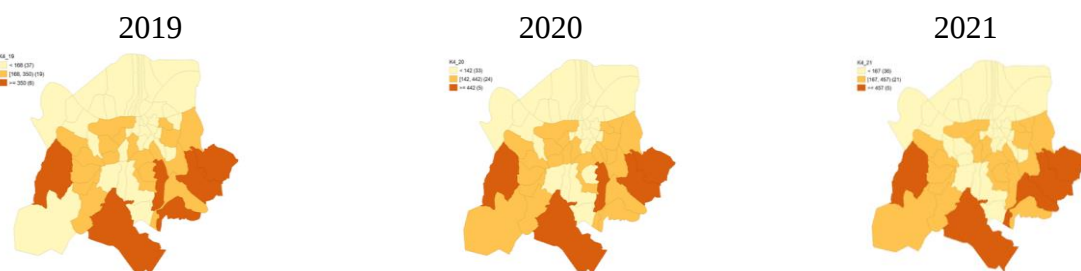


Figure 2. Choropleth map of the distribution of K1 and K4 coverage at the urban village level in Jambi Municipality from 2019 to 2021.

In Figure 2 above, the distribution of K1 coverage in the high category is mostly found in the Alam Barajo and Kota Baru sub-districts, while K1 in the low category is spread in the Danau Teluk, Pelayangan, Pasar Jambi sub-districts. In line with K1 coverage, the distribution of K4 coverage in the high category is also spread in the Alam Barajo and Kota Baru sub-districts. Low category coverage is spread in Danau Teluk, Pelayangan, Pasar Jambi sub-districts.

Table 1.

Distribution pattern of K1 and K4 coverage in Jambi Municipality from 2019 to 2021

Pattern of distribution of K1 coverage				Pattern of distribution of K4 coverage			
Year	Moran's Index	P value	Distribution pattern	Year	Moran's Index	P value	Distribution pattern
2019	0.4564	0.001	Clustered	2019	0.374	0.001	Clustered
2020	0.3959	0.001	Clustered	2020	0.344	0.001	Clustered
2021	0.4051	0.001	Clustered	2021	0.437	0.001	Clustered

Table 1 shows the results of the autocorrelation analysis showing K1 coverage consecutively from 2019 to 2021 found autocorrelation with clustered distribution of cases. K4 coverage from 2019 to 2021 also found autocorrelation with clustered distribution. Local Indicator of Spatial Autocorrelation (LISA) test aimed to produce clustering of K1 and K4 coverage. The results of the local spatial autocorrelation analysis are as follows:

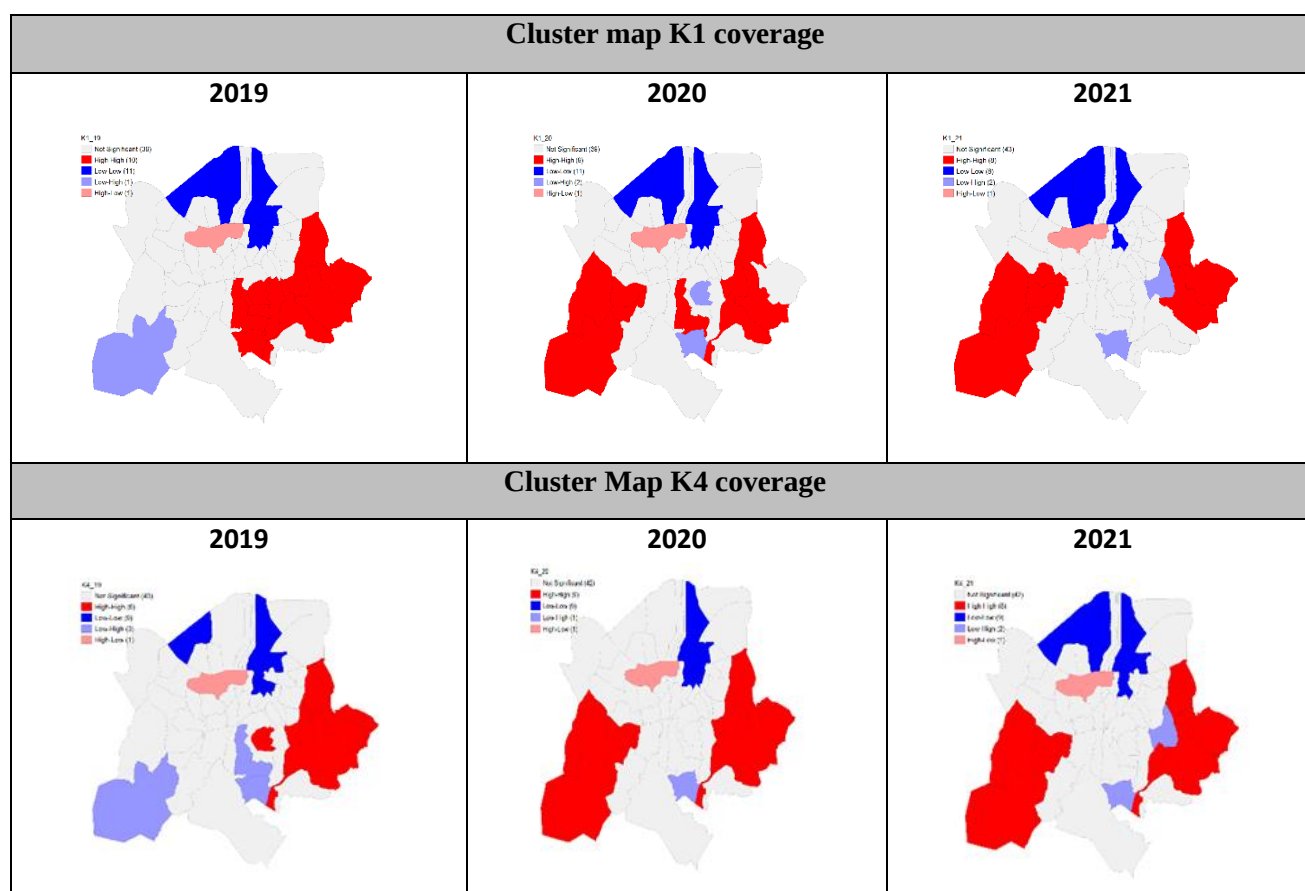


Figure 3. LISA Cluster Map of K1 and K4 Coverage in Jambi Municipality 2019-2021

LISA results found that K1 and K4 hotspots together consistently occurred from 2019 to 2021 in the northwestern part of Jambi Municipality covering Danau Teluk, Pelayangan, Pasar Jambi sub-districts. Lowspot K1 and K4 also consistently occurred in the southwestern part of Jambi Municipality, covering the sub-districts of Alama Barajo and Kota Baru. In this study, hotspot areas are represented in blue and lowspot areas are represented in red. Kelurahan that are hotspots and lowspots of K1 and K4 coverage in detail can be seen in table 2 below:

Table 2.
Hotspot and lowspot areas for K1 and K4 coverage at the urban village level in Jambi Municipality from 2019 to 2021.

Types of antenatal care	Years	Hotspot	Lowspot
K1	2019	Kelurahan Sulanjana, Kasang, Rajawali, Orang Kayo Hitam, Pasar Jambi, Sungai Asam, Arab Melayu, Mudung Laut, Tahtul Yaman, Pasir Panjang, Dan Olak Kemang	Kelurahan Pasir Putih, Thehok, Paal V, Kenali Asam Atas, Kebun Handil, Handil Jaya, Talang Bakung, Payo Selincih, Eka Jaya, dan Paal Merah
	2020	Kelurahan Sulanjana, Kasang, Rajawali, Orang Kayo Hitam, Pasar Jambi, Sungai Asam, Arab Melayu, Mudung Laut, Tahtul Yaman, Pasir Panjang, Dan Olak Kemang	Kelurahan Pasir Putih, Paal V, Kenali Besar, Rawasari, Bagan Pete, Beliung, Talang Bakung, Payo Selincih, dan Paal Merah
	2021	Kelurahan Orang Kayo Hitam, Sungai Asam, Arab Melayu, Mudung Laut, Tahtul Yaman, Pasir Panjang, Olak Kemang, dan Tanjung Pasir	Kelurahan Simpang IV Sipin, Kenali Besar, Rawasari, Bagan Pete, Beliung, Talang Bakung, Payo Selincih, dan Eka Jaya
K4	2019	Kelurahan Sulanjana, Kasang, Orang Kayo Hitam, Pasar Jambi, Sungai Asam, Arab Melayu, Mudung Laut, Tahtul Yaman, dan Pasir Panjang	Kelurahan Pasir Putih, Kebun Handil, Talang Bakung, Payo Selincih, Eka Jaya, dan Paal Merah
	2020	Kelurahan Sulanjana, Kasang, Rajawali, Orang Kayo Hitam, Pasar Jambi, Sungai Asam, Arab Melayu, Mudung Laut, dan Tahtul Yaman	Kelurahan Pasir Putih, Kenali Besar, Rawasari, Bagan Pete, Beliung, Talang Bakung, Payo Selincih, Eka Jaya dan Paal Merah
	2021	Kelurahan Kasang, Orang Kayo Hitam, Pasar Jambi, Sungai Asam, Arab Melayu, Mudung Laut, Tahtul Yaman, Pasir Panjang, dan Olak Kemang	Kelurahan Kenali Besar, Rawasari, Bagan Pete, Beliung, Talang Bakung, Payo Selincih, Eka Jaya, dan Paal Merah

DISCUSSION

This research is the first study to apply geospatial analysis to antenatal care indicators conducted in Jambi Municipality. This study analyzed antenatal service coverage data (K1 and K4) obtained at 20 health centers in Jambi Municipality. The analysis was conducted to see the spatial autocorrelation of K1 and K4 coverage at the urban village level in Jambi Municipality. This analysis aims to determine whether there are low and high coverage groupings and to determine hotspots and lowspots of K1 and K4 coverage in Jambi Municipality. The results of this study found an autocorrelation of K1 and K4 coverage from 2019 to 2021 with a clustering distribution category. Several studies have also conducted the same analysis and found clustered distribution patterns in antenatal coverage. Research conducted in Ethiopia by Hailegebreal, et al (2021) by analyzing the 2019 Demographic and Health Survey (SDKI) data found a positive autocorrelation of antenatal service use coverage (Hailegebreal et al., 2021). Another study conducted in the same place by Yeneneh, et al (2018) found clusters of antenatal care utilization in Somalia region with low utilization, and Addis Ababa with high coverage. The study also found that wealth quintile, number of children, education level and living in urban areas and age were associated with antenatal care

utilization in the region (Yenenah et al., 2018).

Efforts to achieve the target to reduce mortality in mothers and children is to maximize antenatal services. Antenatal services aim to monitor the health and safety of mothers and children from the womb to delivery. Service indicators in the form of K1 and K4 visits or more are very important in preventing early and detecting unwanted things that might appear during pregnancy (Idris & Sari, 2023). A study of 63 low- and middle-income countries found that there has been an increase in antenatal care coverage, but there is still variation in coverage by region (Arroyave et al., 2021). Differences in coverage between regions can occur due to differences in socioeconomic and cultural environments that have an impact on differences in access to health services (Ataguba et al., 2023; Shibre & Mekonnen, 2019). The results also show that at the regional level there are still disparities in the utilization of antenatal services in Indonesia (Laksono et al., 2020). The sub-districts of Danau Teluk, Pelayangan, and Pasar Jambi are areas with antenatal care coverage (K1 and K4) that fall into the hotspot category. This is possible because the area is separated by the Batanghari river, which hampers access to health services. Malay social culture also influences the low coverage of K1 and K4 in these areas.

The results of this study also found that K1 and K4 lowspot areas occurred in the southwestern region of Jambi Municipality, including the sub-districts of Alam Barajo and Kota Baru. Alam Barajo and Kota Baru sub-districts are areas in Jambi Municipality with diverse ethnicities and tribes, as well as diverse socioeconomic and educational levels (BPS Kota Jambi, 2021a, 2021b). Data from the Jambi Municipality Health Office shows that in the region there are also quite a number of posyandu and spread out, making it easier for pregnant women to do pregnancy checks at posyandu. The large number of posyandu in an area is one of the factors that affect the regularity of pregnant women in checking pregnancy because at posyandu pregnant women can not only check pregnancy but also get education and motivation about pregnancy and also pregnant women also get many other activities such as pregnant women's classes that can increase the knowledge of pregnant women. This is in line with research conducted previously that posyandu, especially posyandu cadres, has a very important role in the regularity of examinations because posyandu cadres are often face-to-face so that people have confidence to check their pregnancy to cadres in the posyandu compared to other health workers (Retnaningtyas et al., 2022). In addition, in line with the number of posyandu, it will be in line with the number of midwives. The role of midwives is one of the determining factors in the completeness of ANC visits for pregnant women (Natalia Melani, 2022).

This study has limitations that need to be considered. Jambi Municipality is the capital city of Jambi Province with a large number of private health services. Data on antenatal care visits (K1 and K4) may be small because most pregnant women seek care at clinics or go directly to hospitals. Pregnant women who go to clinics for antenatal care will not be recorded as part of antenatal care visits at puskesmas. The visit data in this study must take this aspect into account when interpreting the results. This could lead to bias in the study, so caution is needed in reading and interpreting it. The areas identified as hotspots in this study may be inaccurate, as may the lowspot areas.

CONCLUSION

This study found a positive autocorrelation of K1 and K4 from 2019 to 2021. The results of the analysis using LISA found that K1 and K4 coverage hotspots have the same pattern in the northwest direction of Jambi Municipality covering Danau Teluk, Pelayangan, Pasar Jambi

sub-districts and K1 and K4 lowspots with the same pattern in the southwest, southeast, and south covering Alam Barajo and Kota Baru sub-districts. Knowing the pattern of distribution of antenatal service coverage (K1 and K4) can determine the priority areas that need to be improved antenatal service coverage in Jambi Municipality.

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REFERENCES

- Abebe, G. F., Birhanu, A. M., Alemayehu, D., Girma, D., Berchedi, A. A., & Negesse, Y. (2023). Spatial distribution, and predictors of late initiation of first antenatal care visit in Ethiopia: Spatial and multilevel analysis. *PloS One*, 18(7). <https://doi.org/10.1371/JOURNAL.PONE.0288869>
- Ali, N., Elbarazi, I., Alabboud, S., Al-Maskari, F., Loney, T., & Ahmed, L. A. (2020). Antenatal Care Initiation Among Pregnant Women in the United Arab Emirates: The Mutaba'ah Study. *Frontiers in Public Health*, 8(June), 1–7. <https://doi.org/10.3389/fpubh.2020.00211>
- Arroyave, L., Saad, G. E., Victora, C. G., & Barros, A. J. D. (2021). Inequalities in antenatal care coverage and quality: an analysis from 63 low and middle-income countries using the ANCq content-qualified coverage indicator. *International Journal for Equity in Health*, 20(1), 1–10. <https://doi.org/10.1186/S12939-021-01440-3/FIGURES/4>
- Ataguba, J. E., Nwosu, C. O., & Obse, A. G. (2023). Is socioeconomic inequality in antenatal care coverage widening or reducing between- and within-socioeconomic groups? A case of 19 countries in sub-Saharan Africa. *SSM - Population Health*, 23, 101402. <https://doi.org/10.1016/J.SSMPH.2023.101402>
- BPS Kota Jambi. (2021a). Kecamatan Alam Barajo Dalam Angka. In *Statistik* (Issue 1).
- BPS Kota Jambi. (2021b). *Kecamatan Kota Baru Dalam Angka Tahun 2021*.
- BPS Kota Jambi. (2021c). *Penduduk Provinsi Jambi Menurut Kabupaten-Kota dan Jenis Kelamin (Jiwa) 2018-2020*. Badan Pusat Statistik (BPS) Provinsi Jambi.
- Burgert-Brucker, C. R., Yourkavitch, J., Assaf, S., & Delgado, S. (2015). Geographic variation in key indicators of maternal and child health across 27 countries in sub-Saharan Africa . *DHS Spatial Analysis Reports No. 12* , September. <http://dhsprogram.com/pubs/pdf/SAR12/SAR12.pdf>
- Dinas Kesehatan Kota Jambi. (2021). *Cakupan Pelayanan Antenatal Care di Kota Jambi*.
- Dinkes Provinsi Jambi. (2020). *Profil Kesehatan Provinsi Jambi 2020*.
- Hailegebreal, S., Gilano, G., Seboka, B. T., Ahmed, M. H., & Simegn, A. E. (2021). Spatial distribution and associated factors of antenatal care utilization in Ethiopia in 2019: Spatial and multilevel analysis. *ResearchSquare*. <https://doi.org/10.21203/rs.3.rs-537337>
- Idris, H., & Sari, I. (2023). Factors associated with the completion of antenatal care in Indonesia: A cross-sectional data analysis based on the 2018 Indonesian Basic Health Survey. *Belitung Nursing Journal*, 9(1), 79. <https://doi.org/10.33546/BNJ.2380>

- John, A. E., Nilima, Binu, V. S., & Unnikrishnan, B. (2019). Determinants of antenatal care utilization in India: a spatial evaluation of evidence for public health reforms. *Public Health*, 166, 57–64. <https://doi.org/10.1016/j.puhe.2018.09.030>
- Permenkes No 21 tahun 2021, 5 Kementerian Kesehatan 40 (2021). [file:///C:/Users/IDEAPAD/3/Downloads/2021-Permenkes-nomor-21 Tahun 2021_\(peraturanpedia.id\).pdf](file:///C:/Users/IDEAPAD/3/Downloads/2021-Permenkes-nomor-21%20Tahun%2021_(peraturanpedia.id).pdf)
- Kementerian Kesehatan Republik Indonesia. (2018). *Profil Kesehatan Indonesia* (Vol. 1, Issue 4). <https://doi.org/10.1080/09505438809526230>
- Kementerian PPN/ Bappenas. (2017). *Sustainable Development Goals (SDGs) target tahun 2030*.
- Kondo, K. (2016). Hot and cold spot analysis using Stata. *The Stata Journal*, 16(3), 613–631.
- Laksono, A. D., Rukmini, R., & Wulandari, R. D. (2020). Regional disparities in antenatal care utilization in Indonesia. *PloS One*, 15(2). <https://doi.org/10.1371/JOURNAL.PONE.0224006>
- Natalia Melani, A. N. (2022). Analisis Faktor yang Berhubungan dengan Demand atas Pemanfaatan Penolong Persalinan di Provinsi Banten : Analisis Data Susenas 2019. *Fakultas Kesehatan Masyarakat, Universitas Indonesia*, 2(10), 3175–3184.
- Olopha, P., Aladeniyi, O., & Oladuti, O. (2022). Investigating Spatial Patterns and Determinants of Optimal Antenatal Care Attendance Among Pregnant Women in Nigeria. *Spatial Demography*, 10(2), 311–328. <https://doi.org/10.1007/s40980-021-00083-w>
- Pemerintah Kota Jambi. (2021). *Kondisi Geografis Kota Jambi*.
- Retnaningtyas, E., Wahyuni, C., Palupi, R., Siwi, Y., Natalia, S., Wulandari, A., Novani, E., Putri, K., & Kader, P. (2022). *Faktor-faktor Yang Mempengaruhi Keteraturan Pemeriksaan Antenatal care Pada Ibu Hamil Aterm*. 2(1), 1–10. <https://doi.org/10.55642/phasij.v2i01>
- Shibre, G., & Mekonnen, W. (2019). Socio-economic inequalities in ANC attendance among mothers who gave birth in the past 12 months in Debre Brehan town and surrounding rural areas, North East Ethiopia: A community-based survey. *Reproductive Health*, 16(1), 1–14. <https://doi.org/10.1186/S12978-019-0768-8/FIGURES/2>
- Tessema, Z. T., & Akalu, T. Y. (2020). Spatial Pattern and Associated Factors of ANC Visits in Ethiopia: Spatial and Multilevel Modeling of Ethiopian Demographic Health Survey Data. *Advances in Preventive Medicine*, 2020, 1–13. <https://doi.org/10.1155/2020/4676591>
- Yeneneh, A., Alemu, K., Dadi, A. F., & Alamirrew, A. (2018). Spatial distribution of antenatal care utilization and associated factors in Ethiopia: Evidence from Ethiopian demographic health surveys. *BMC Pregnancy and Childbirth*, 18(1), 1–12. <https://doi.org/10.1186/S12884-018-1874-2/TABLES/2>