Unnes Journal of Public Health 12 (1) (2023)

Unnes Journal of Public Health

http://journal.unnes.ac.id/sju/index.php/ujph

Trends and Determinants of the Maternal Mortality Ratio Based on Healthcare Resources

Eka Nur Sejati[1]✉, Elsye Maria Rosa[1], Bayu Anggileo Pramesona[2]

[1]Department of Public Health, Master of Hospital Administration, Universitas Muhammadiyah Yogyakarta
[2]Department of Public Health, Faculty of Medicine, Universitas Lampung

Article Info

Article History:
Submitted June 2022
Accepted December 2022
Published January 2023

Keywords:
Trends; Determinants; Healthcare Resources; Maternal Mortality Ratio; Sustainable Development Goals

DOI
https://doi.org/10.15294/ujph.v12i1.57020

Abstract

Health resources play an essential role in realizing the unattainable Sustainable Development Goals targets in lowering the maternal mortality ratio (MMR) globally. The study aimed to analyze trends and determinants of MMR based on the number of healthcare resources in Indonesia. This study is an explanatory study using repeated cross-sectional data from Central Java 2016-2020. Data were analyzed using bivariate analysis with scatter plots, statistical analysis with Pearson correlation tests, and a linear regression model using Tableau software. Results showed that the MMR decreased in 2016-2019. However, it increased in 2020. The ratio of obstetrics-gynecology specialists and nutritional personnel had an impact on the MMR in 2016. In 2017, the ratio of general practitioners affected the MMR, whereas, in 2019 and 2020, the ratio of nutritional workers had an effect. Our study concluded that the trend of MMR in Indonesia was affected by the number of healthcare personnel resources. It is recommended that the Indonesian government should fulfill the quantity and equalization of the distribution of healthcare personnel resources particularly the obstetrics-gynecology specialists, general practitioners, and nutritional workers so the MMR could be decreased.

INTRODUCTION

The quality and development of reproductive health services can be reflected by decreasing the maternal mortality ratio (MMR) (Geller et al., 2018). The MMR is known by calculating the number of maternal deaths by the number of live births and multiplying by 100,000 to obtain the maternal mortality rate per 100,000 live births (Hoyert, 2020). Maternal mortality is a mother who dies during pregnancy, childbirth, and the postpartum period (42 days after giving birth) regardless of gestational age and location of the pregnancy. The cause of death of a pregnant woman is related to or aggravated by her pregnancy or pregnancy treatment and is not attributable to unforeseeable circumstances such as accidents or intentional acts such as suicide or homicide (Merdad and Ali, 2018).

The target MMR is listed in the Sustainable Development Goals (SDGs) 2030. The SDGs for the 2030 agenda focus on sustainable development that encourages social, economic, and environmental development (Diaz Sarachaga et al., 2018). In the aspect of social development, the

✉ Corespondence Address:
Department of Public Health,
Master of Hospital Administration,
Universitas Muhammadiyah Yogyakarta, Indonesia
E-mail: eka.nur.sejati.unimus@gmail.com

Open Access
pISSN 2252-6781
eISSN 2548-7604

SDGs strive to improve people's health and well-being through the third goal of the SDGs by ensuring a healthy life and encouraging well-being for all people of all ages (WHO, 2018). SDG-3's first target is to lower the global MMR to below 70 per 100,000 live births (Callister and Edwards, 2017).

Globally, in 2017 the MMR reached 211 per 100,000 live births (295,000 cases). In Southeast Asia, the MMR was 137 per 100,000 live births (16,000 cases). Developing countries account for the world's most significant MMR of 415 per 100,000 live births compared to developed countries with only 12 per 100,000 live births (WHO, 2019).

In Indonesia, the MMR in 2019-2020 increased from 87.9 per 100,000 live births to 97.6 per 100,000 live births (Kemenkes, 2021). The maternal deaths in Central Java province, Indonesia from 2019 to 2020 increased from 76.9 per 100,000 live births to 98.6 per 100,000 live births (Dinkes, 2021). The increment of MMR in 2019-2020 in Indonesia and Central Java province was a setback for achieving the SDG-3 target. SDG-3 has 13 targets and the 26 most indicators to achieve among the 17 existing SDGs goals (Cerf, 2018).

A comprehensive strategy is needed to follow up on the surge in the MMR to achieve the SDG-3 target so that this problem does not become a global crisis. The MMR is influenced by close determinants (pregnancy and its complications), distant determinants (socio-cultural, economic, and religious factors, education level, and knowledge), and intermediate determinants (maternal health status, reproductive status, access to health services, and behavior of using health service facilities) (Manyeh et al., 2018, Kartiningrum, 2017). Population growth is expected to outpace the rise in health resources in the future. Therefore, healthcare resources play an important role in realizing SDG-3 goals to meet the community's need for health services (WHO, 2016). Equalization and ease of access to health services embody efficiency and equality in healthcare resources (Pascoe et al., 2020, Sun and Luo, 2017).

Healthcare resource availability supports healthcare professionals in receiving information, diagnosing, and providing intervention to maternity and postpartum pregnant women (Pascoe et al., 2020). Adequate and well-distributed healthcare personnel resources contributed to lowering MMR. Previous studies have analyzed the impact of some access factors and quality of health services on maternal deaths in Indonesia (Zhao et al., 2019, Singh and Barik, 2021, Cameron et al., 2019). A study that examined the effect of basic public health care programs on maternal health services found that there was a negative correlation between the level of prenatal examinations, the level of maternal health records, and the level of postpartum visits to the MMR. With the basic public health service program, maternal health services will increase and maternal mortality will decrease (Zhao et al., 2019). Another study found that the availability of healthcare resources and the quality of healthcare were indicators related to MMR. The low availability of healthcare resources will cause the quality of healthcare to decline so more mothers will die (Singh and Barik, 2021).

The number of medical doctors and midwives at the primary healthcare facilities and the distance to healthcare facilities has been considered the most contributing factors to the MMR in Indonesia (Cameron et al., 2019). However, the study that uses the latest data over the past five years to find out the trends and determinants of MMR based on the number of healthcare resources in Indonesia is scarce.

This study aimed to analyze the trends and determinants of MMR based on the number of healthcare resources in Central Java province, Indonesia. This study would be beneficial for mapping and equalizing the health resources, particularly the healthcare personnel to improve the healthcare services for mothers during pregnancy, childbirth, and the postpartum period.

METHODS

Study Design

An explanatory study with a cross-sectional approach was conducted based on secondary data, the health program achievements data from 2016 to 2020 which was published by the Central Java Provincial Health Office, Indonesia. The data which consisted of the "Health Pocket Book," "Basic Data Book for Health Centers and Hospitals," and "Health Profile Book" can be accessed at http://dinkesjatengprov.go.id.

Sample and Sampling Technique

The data comes from a total of 2,961,030 pregnant women, mothers in labor, and postpartum mothers aggregated in 35 districts in Central Java province from 2016 to 2020. Therefore, the sample is 175 data points. Sampling with the total sampling technique.

Independent and Dependent Variables

The independent variables that were estimated as predictors of maternal mortality were the number of healthcare resources, such as the

ratio of obstetrics-gynecology specialists, general practitioners, midwives, nutrition personnel, public health centers, and the number of hospitals. The dependent variable in this study was the MMR per 100,000 live births.

Data Analysis

Tableau software was used to conduct statistical analysis. In this study, descriptive statistics were used to determine whether the distribution of MMR is demographically significant and an intriguing variable. The researcher performed a bivariate analysis to determine the determinants of the MMR by plotting the dependent and independent variables together. Pearson's correlation test (r) was employed to confirm the link between the dependent and independent variables. Additionally, the linear regression models were used to determine the percentage of influence of the independent variable on the dependent variable. With a confidence interval of 95%, the value of $p<0.05$ was considered significant.

RESULTS AND DISCUSSION

Our study found that the total population of pregnant women in Central Java province, Indonesia for five years (2016-2020) was 2,961,030 people, with a total of live births 2,702,415 cases, and 2,444 death cases. Those death cases occured during the postpartum period (61%), pregnancy (25%), and delivery period (14%). After five years, the MMR in the study area was still higher than the SDG-3 goal of 70 per 100,000 live births (Mean=90.37 per 100,000 live births, SD=12.36) (Table 1) (WHO, 2019).

From 2016 to 2019, the ratio of maternal deaths in Central Java province, Indonesia has continuously decreased, from 109.66 in 2016 to 76.93 per 100,000 live births in 2019. However, in 2020 there was a significant increment in MMR of 21.67 (from 76.93 to 98.60 per 100,000 live births). The average number of maternal deaths in Central Java province, Indonesia for five years (2016-2020) was 90 per 100,000 live births (Figure 1).

Table 1. Descriptive (unstandardized) (N = 175)

Variable	Years					Mean	SD
	2016	2017	2018	2019	2020		
Obstetrics-gynecology Specialists (*a*)	1.55	1.48	2.05	1.31	1.33	1.54	0.27
General Practitioner (*a*)	5.11	4.33	5.08	5.72	7.71	5.59	1.15
Midwife (*a*)	36.37	39.53	45.06	43.91	46.91	42.36	3.86
Nutrition Personnel (*a*)	2.36	2.22	2.48	3.14	3.61	2.76	0.53
Public Health Centers (*b*)	1.53	1.54	1.54	1.53	1.53	1.53	0.00
Number of Hospitals	279	280	289	307	317	294	15.12
Maternal Mortality Ratio (*c*)	109.66	88.05	78.60	76.93	98.60	90.37	12.36

Note: (*a*) per 100,000 population; (*b*) per subdistrict; (*c*) per 100,000 live births.

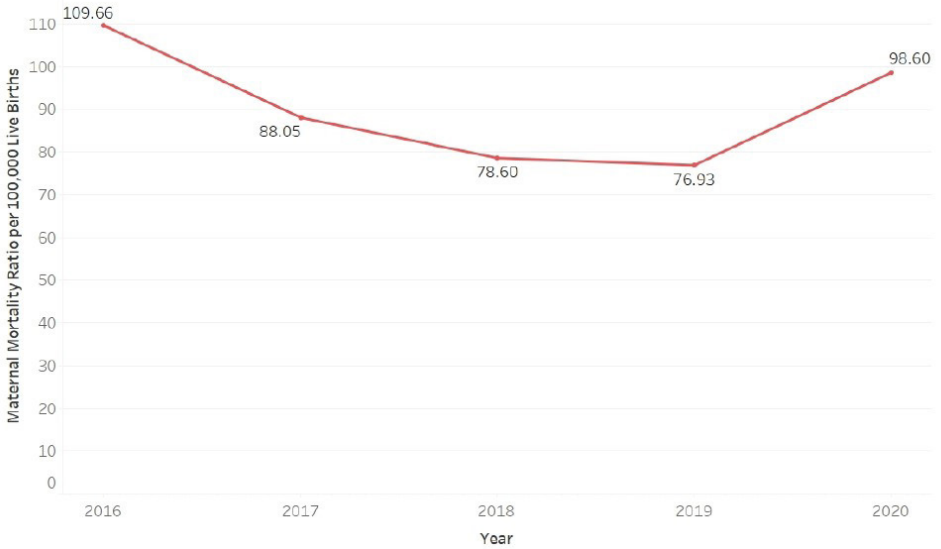

Figure 1. MMR Trends per 100,000 Live Births in Central Java Province, Indonesia in 2016-2020

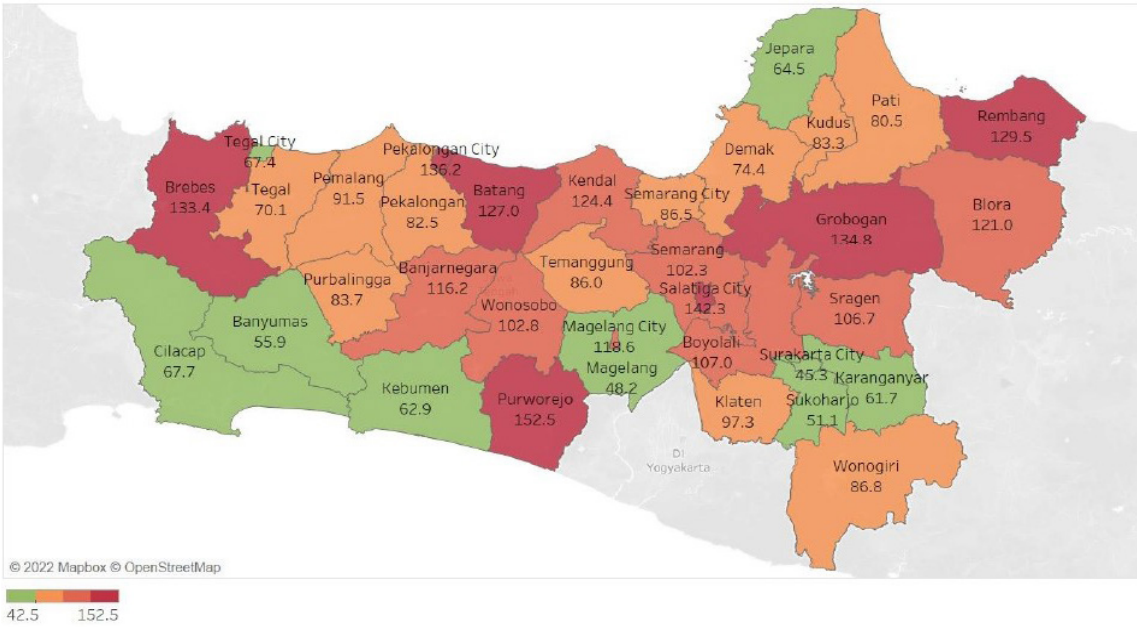

Figure 2. Average Distribution of MMR per 100,000 Live Births in Central Java Province, Indonesia in 2016-2020

The ratio of maternal deaths during pregnancy, childbirth, and postpartum in Central Java province, Indonesia for five years (2016-2020) is still under the SDG-3 target. When viewed from the cause, maternal deaths in Central Java province, Indonesia from 2016 to 2020 consistently occurred during the postpartum period in the 20-34 year age group. Healthcare workers need to pay attention and care to the mother during postpartum (Susilawati and Nilekesuma, 2020). Healthcare providers should provide adequate education for postpartum mothers by visiting their homes (Xiao et al., 2020). Young mothers who have just given birth are most at risk of postnatal complications because they did not have maternal-related experience. by providing sufficient knowledge, maternal death due to health problems could be prevented by getting proper postpartum care (Ayazbekov et al., 2020). Therefore, healthcare providers need to increase the number of medical personnel to reduce cases of maternal death, especially during the postpartum period. In developed countries such as Norway, MMR was very low because they provided health workers who were paid to visit and monitor maternal health (Kotsadam et al., 2018).

The contribution of COVID-19 as a cause of maternal death to the increase in the number of maternal deaths in 2020 cannot be ascertained. The Central Java provincial health officials did not explain the number of maternal deaths caused by COVID-19 in the results of the 2020 health program. The emergence of the COVID-19 pandemic in 2020 prompted the Ministry of Health of the Republic of Indonesia to issue a policy so that medical examinations are carried out based on agreements with doctors and ultrasound examinations are temporarily postponed (Ifdil et al., 2020). During a pandemic, mothers are required to stay at home and study books on maternal and child health as a means of obtaining information about maternal health. This makes it more likely that mothers will not get enough information about their health. This is because not all mothers will read the book.

In previous studies, it was known that anemia played a significant role in the death of pregnant women due to COVID-19. Anemia during pregnancy in Indonesia is mostly caused by iron deficiency. Women with anemia are prone to complications in pregnancy, which can cause maternal death (Akbar et al., 2022). Informing pregnant women about nutrition can help prevent iron deficiency anemia, which can cause complications in pregnant women.

Of the total 35 districts and cities in Central Java province, Indonesia, the MMR was mainly above the SDG-3 target of 70 per 100,000 live births (74%) (Figure 2). Maternal deaths were dominated by hypertension in pregnancy, bleeding, and other diseases such as circulatory disorders, metabolic disorders, and respiratory disorders (Dinkes, 2021). The three causes that dominate the mother's death were the competence of obstetrics-gynecology specialists in the hospital (Putra et al., 2020).

Maternal mortality cases need to be reduced by treating hypertension during pregnancy, bleeding, and other diseases such as circulatory disorders, metabolic disorders, and respiratory disorders in mothers during pregnancy, childbirth, and especially during the puerperium. Handling the three causes of maternal death can be successfully implemented when the number of hospitals in the district and city has adequate. Hospitals often refused referral patients from public health centers because the beds in the hospital were full. In addition, due to the small number of hospitals, the distance between some public health centers and referral hospitals is too far. It causes problems in implementing referrals and delays in patient handling (Ekasafitri et al., 2018, Wirakusumah et al., 2019). In a previous study, it was stated that the ratio of hospitals per district and city positively affects maternity coverage in healthcare facilities (Laksono and Sandra, 2020). Therefore, the government should increase the number of hospitals in districts and cities that have not been able to meet the community's needs to reduce the ratio of maternal deaths.

The ratio of the obstetric-gynecological specialist has a statistically significant correlation with the MMR (b = -0.033(0.231), p <0.01) (Table 2). Lower ratio of obstetrics-gynecology specialists in districts and cities, the ratio of maternal deaths tends to be higher. In addition, the ratio of the obstetrics-gynecology specialists affected 23.1% of the MMR. This number is expected to be higher to increase the good quality of health services, particularly for women during pregnancy, childbirth, and postpartum. The lack performance of obstetrics-gynecology specialists plays a role in causing maternal death (Mahmood et al., 2018, Omer, 2019). A previous study reported that the availability of obstetrics-gynecology specialists and primary care physicians has resulted in lowering the MMR due to their role in managing complications and chronic diseases before, during, and after pregnancy (Snyder et al., 2020). Therefore, increasing the number of obstetrics-gynecology specialists in districts and cities with medical personnel could decrease the MMR.

The ratio of the nutrition personnel also has a significant correlation with the MMR (b= -0.013(0.175), p <0.05). A lower the ratio of nutrition personnel in districts and cities, the ratio of maternal mortality tends to higher. The ratio of the nutrition personnel affected 17.5% of the MMR. The more nutrition personnel, is expected to lower the MMR. Mothers who received health education from nutrition personnel would increase their knowledge and attitude towards the nutritional needs (Amalia et al., 2018). Mothers with an optimal nutritional status would be able to safely pursue the habit so that the maternal mortality rate could decrease (Ernawati, 2017). Therefore, it is a need to increase the number of nutritional personnel in public health centers to reduce the MMR. In addition, the general practitioner, midwife, public health centers ratio, and number of the hospitals have no statistically significant correlation on the MMR, respectively (Figure 3).

The general practitioner ratio has a significant correlation with the MMR (b = 0.029(0.163), p <0.05) (Table 2). With a higher ratio of general practitioners in districts and cities, the MMR tends to be higher as well. This contradicts the

Table 2. Pearson Correlation Test Results and Linear Regression Models

Variable	Values (R2)				
	2016	**2017**	**2018**	**2019**	**2020**
Obstetrics-gynecology Specialists (*a*)	-0.033** (0.231)	-0.005 (0.001)	0.015 (0.029)	0.004 (0.010)	<-0.001 (<0.001)
General Practitioner (*a*)	-0.009 (0.020)	0.029* (0.163)	0.016 (0.043)	0.004 (0.003)	0.013 (0.017)
Midwife (*a*)	0.062 (0.043)	-0.033 (0.018)	0.023 (0.002)	0.066 (0.027)	0.076 (0.053)
Nutrition Personnel (*a*)	-0.013* (0.175)	0.006 (0.025)	0.004 (0.017)	0.016** (0.196)	0.012* (0.146)
Public Health Centers (*b*)	<-0.001 (0.002)	0.001 (0.013)	<0.001 (0.001)	0.001 (0.009)	<0.001 (0.003)
Number of Hospitals	-0.013 (0.010)	-0.021 (0.039)	-0.020 (0.018)	-0.033 (0.046)	-0.024 (0.036)

Note: *p<0.05; **p<0.01.

Determinants of MMR in 2016

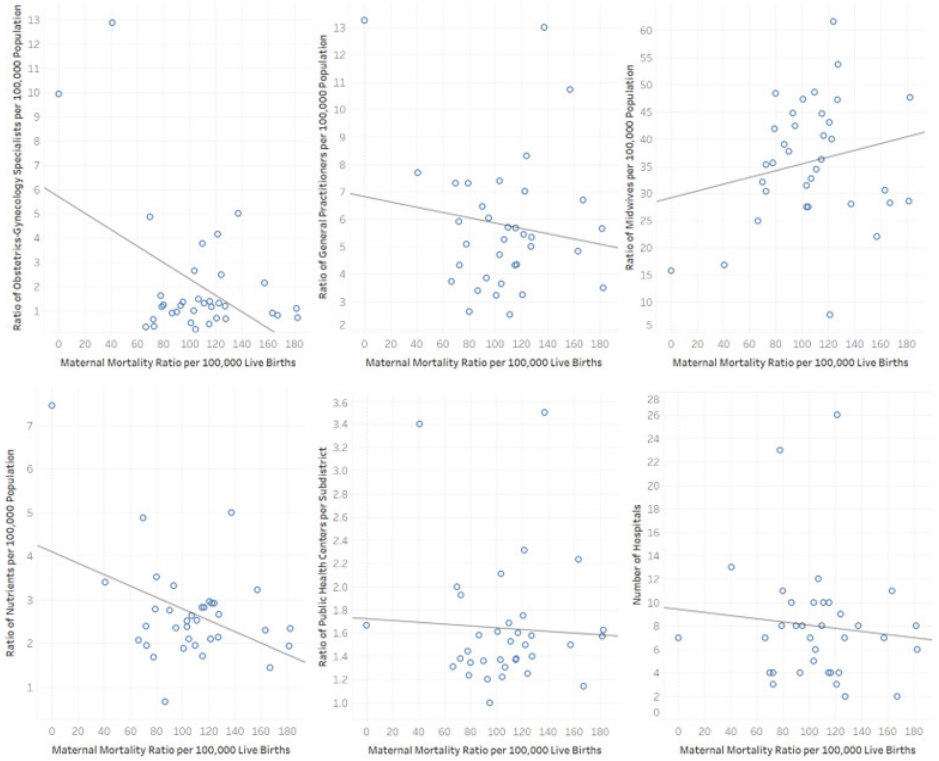

Figure 3. Scatter Plot Ratio of Maternal Mortality and Variable Quantity of Health Resources in Central Java Province, Indonesia in 2016

Determinants of MMR in 2017

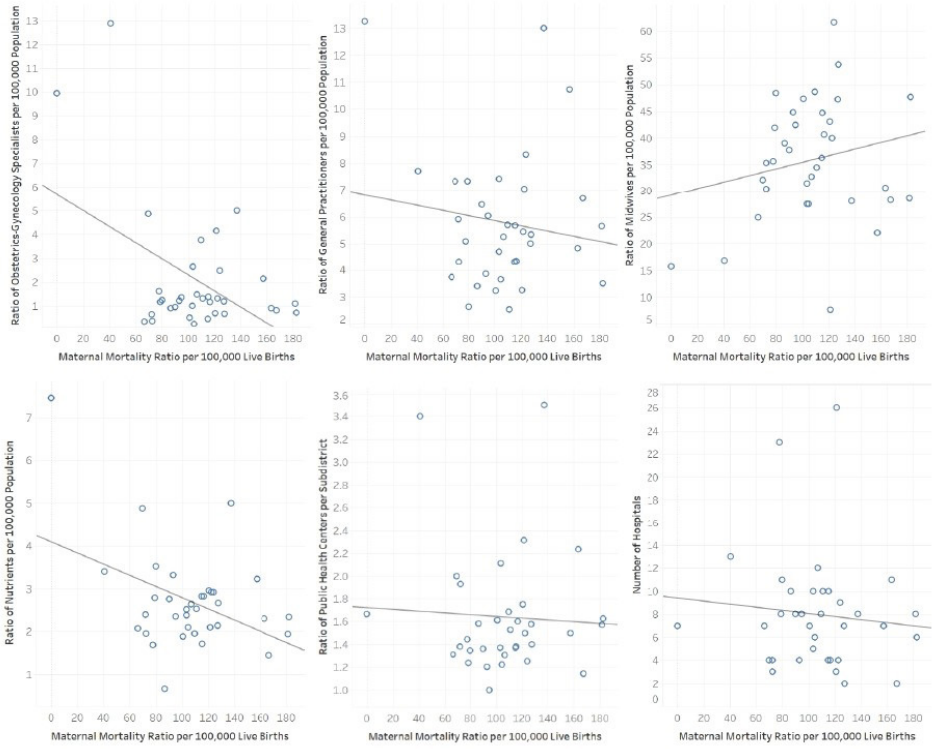

Figure 4. Scatter Plot Ratio of Maternal Mortality and Variable Quantity of Health Resources in Central Java Province, Indonesia in 2017

existing theory that the increasing number of general practitioners means that more health workers are capable of providing maternal services during pregnancy, childbirth, and postpartum and can prevent maternal deaths. The results of this study may have been caused by the use of bivariate analysis, so in order to do more research, multivariate analysis needs to be used.

Furthermore, general practitioner ratio affected 16.3% of the maternal mortality ratio. The number of GPs in districts and cities has a positive tendency and is related to the MMR. The uneven distribution of general practitioners in Central Java Province, Indonesia affected the MMR. The number of general practitioners is more concentrated in urban areas. The ratio of GPs in urban areas can be up to 5 times higher than GPs in rural areas. Therefore, the government can equalize the distribution of general practitioners in Central Java Province, Indonesia so that the ratio of maternal deaths decreases. According to previous research, it is known that the number of doctors in first-level healthcare facilities contributes to reducing the MMR (Cameron et al., 2019). In addition, the ratio of obstetrics-gynecology specialists, midwives, nutrition personnel, public health centers ratio, and the number of hospitals have no statistically significant correlation on the MMR, respectively (Figure 4).

In 2018, the ratio of obstetric-gynecological specialists, general practitioners, midwives, nutrition workers, public health centers, and the number of hospitals did not play a role in the MMR because it showed a random scatter plot pattern (Figure 5). The coverage of health services that began to expand since the National Health Insurance (NHI) era in 2018 has caused the distribution of health resources in Central Java, Indonesia to be even (Choirunnisa, 2021). In line with previous studies, because of the NHI era, all communities have health financing guarantees so that obstacles to accessing health services due to financing problems can be reduced, and eventually it has impacted the MMR (Arifin and Gusnedi, 2014).

Ratio of the nutrition personnel has a significant correlation with the MMR (b= 0.016(0.296), p <0.01) (Table 2). With a higher ratio of nutrition personnel in districts and cities, there is a tendency for the MMR to be higher. This goes against the prevailing assumption, according to the rise in nutrition professionals will lead to more mothers learning about their needs in terms of nutrition in order to avoid anemia or

Determinants of MMR in 2018

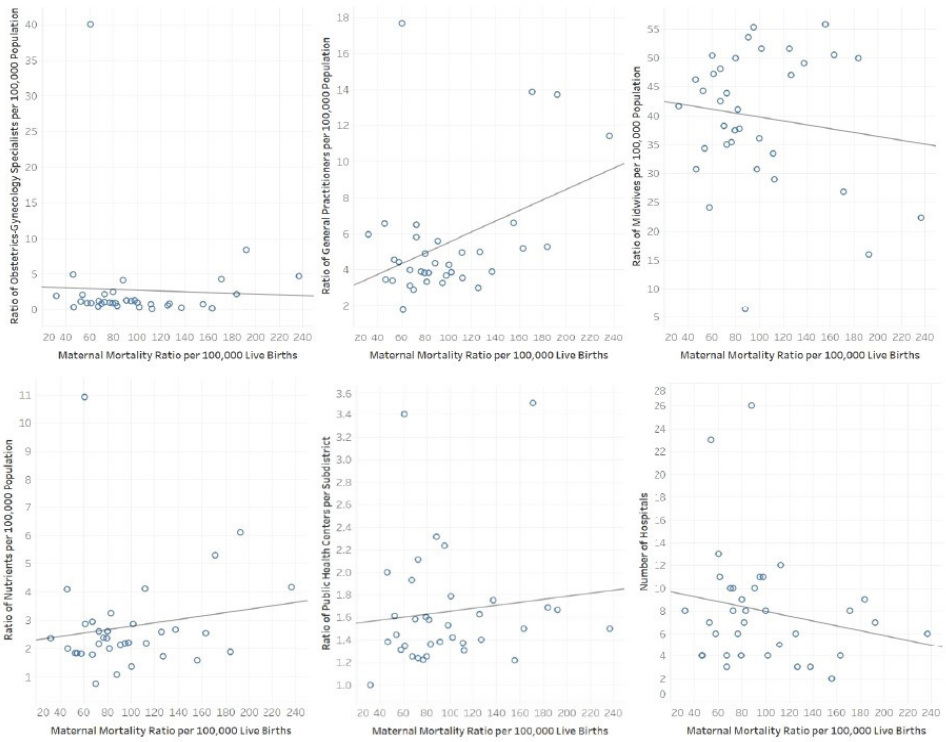

Figure 5. Scatter Plot Ratio of Maternal Mortality and Variable Quantity of Health Resources in Central Java Province, Indonesia in 2018

Determinants of MMR in 2019

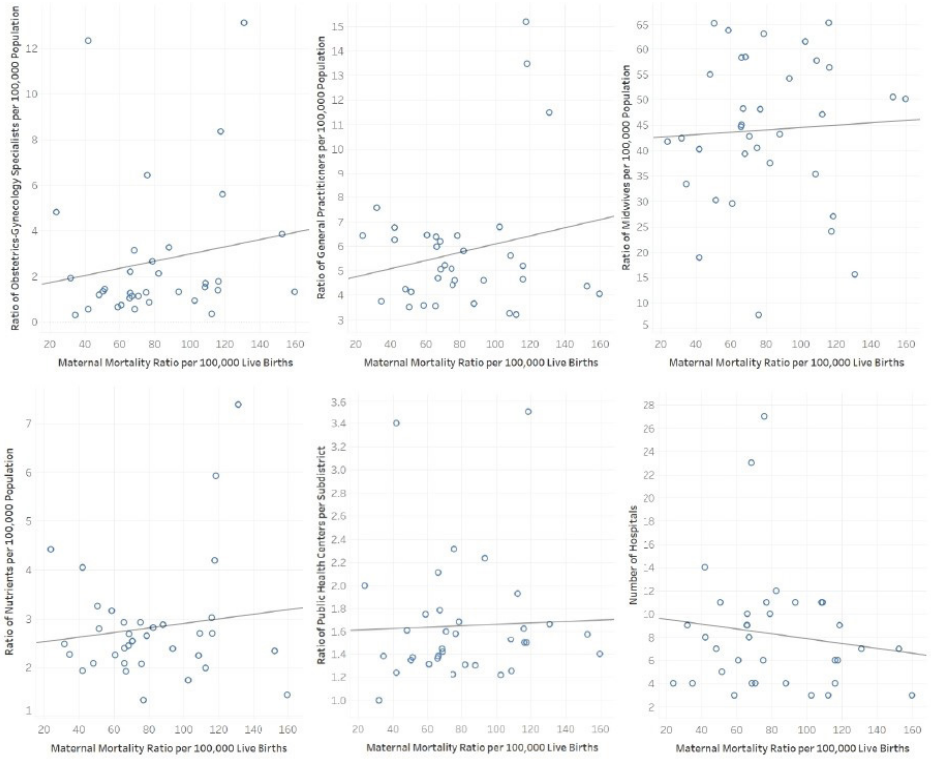

Figure 6. Scatter Plot Ratio of Maternal Mortality and Variable Quantity of Health Resources in Central Java Province, Indonesia in 2019

Determinants of MMR in 2020

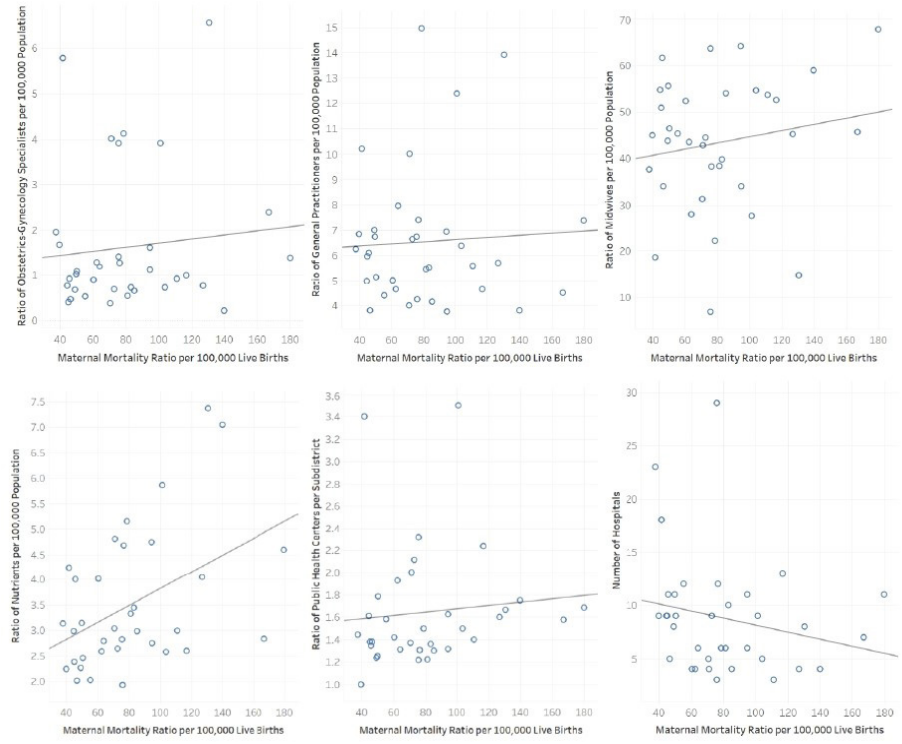

Figure 7. Scatter Plot Ratio of Maternal Mortality and Variable Quantity of Health Resources in Central Java Province, Indonesia in 2020

other long-term nutritional issues. Bivariate analysis may have caused the results of this study; therefore, multivariate analysis is required for further study.

Ratio of the nutrition personnel affected 19.6% of the MMR. The distribution of nutrition workers in 2019 in Central Java Province, Indonesia was again uneven. The addition of nutrition workers in 2019 tended to be higher in several districts and cities than in 2018 (Dinkes, 2020). Based on other studies, maternal nutritional status is very influential on maternal mortality (Diana et al., 2020). The unequal distribution of nutrition workers who play a role in providing nutrition education to mothers can affect MMR. Therefore, the government can equalize the distribution of nutritional personnel again to maintain a decrease in the MMR. Ratio of the obstetrics-gynecology specialists, general practitioner, midwives, public health centers, and number of hospitals have no statistically significant correlation on the MMR, respectively (Figure 6).

Ratio of nutrition personnel has a significant correlation with the MMR in Central Java, Indonesia in 2020 ($b = 0.012(0.146)$, $p < 0.05$) (Table 2). With a higher ratio of nutrition personnel in districts and cities, there is a tendency for the MMR to be higher. This contradicts the previously explained theory. The use of bivariate analysis may have contributed to the findings of this study, making multivariate analysis crucial for future research.

Ratio of the nutrition personnel affected 14.6% of the MMR. The distribution of nutrition workers in Central Java Province, Indonesia has not been evenly distributed from 2019 to 2020. In some districts and cities with a high MMR, the number of nutritional workers was still limited (Dinkes, 2020). The government can immediately add nutritional personnel in districts and cities with a high MMR. Another reason for the increment of the MMR in 2020 is due to the Covid-19 pandemic. The social restrictions (lockdown) and fear of contracting the Covid-19 virus when visiting health services made almost all people were stayed at home, including mothers. This Covid-19 pandemic situation has impacted the decreased coverage of maternal health services (pregnant women, maternity mothers, and postpartum mothers) in health facilities, causing delays in detecting pregnancy complications, referral decisions, and delays in handling (Kevaladandra and Martha, 2021).

The ratio of obstetrics-gynecology specialists, general practitioner, midwives, public health centers ratio, and number of hospitals have no statistically significant correlation with the MMR, respectively (Figure 7).

This study is a retrospective study using the latest data that has been available since the start of the SDGs in the last five years. Due to its type, this study relies on the accuracy of reporting data to the Central Java Provincial Health Office in Indonesia. Suppose there are still unreported occurrences of maternal deaths-mothers who move to other districts or die. In that case, mistakes in recording maternal mortality data and reporting the number of health resources are not adequate, and the analysis results will be impacted. Nevertheless, these obstacles can be controlled because the reporting system for maternal deaths and the number of health resources in Central Java Province in Indonesia has been organized.

CONCLUSION

The ratio of maternal deaths in Central Java Province in Indonesia from 2016 to 2020 has not reached the SDG-3 target. The ratio of obstetricians to gynecologists, general practitioners, and nutritional personnel was associated with the MMR. The number of other healthcare resources, such as the midwife, public health centers, and the number of hospitals, were not associated with the ratio of maternal mortality. However, it is known that districts and cities with a smaller number of hospitals and public health centers have a higher ratio of maternal mortality.

The decrease in MMR will be helpful to realize the development of social aspects in the 2030 SDGs, as well as an indicator of the quality of reproductive health services. The target ratio of maternal mortality that has not been achieved indicates the need for further research to assess the adequacy of the needs of necessary health resources with the quantity available. The Indonesian Ministry of Health needs to pay more attention, especially to districts and cities with a high MMR related to the equal distribution of obstetrics-gynecology specialists, general practitioners, nutrition workers, and the number of hospitals. The distribution and fulfillment of the needs of these health resources play a role in reducing the MMR.

Suggestions for policymakers can include conducting an assessment of whether caesarean sections for high-risk pregnant women can help reduce the MMR. In the short term, it is easier to educate people in areas with high MMRs to be able to visit public health centers as most of the costs are borne by national health insurance. Teach midwives to carefully evaluate people who are at high risk and move them quickly to the

nearest district with better health care.

The mechanism linking healthcare resources and MMRs should be an agenda item for future studies. This is a temporary solution until more obstetricians, midwives, and practitioners can be produced and placed in high MMR districts. Suggestions for further research to be able to perform data analysis on one data set and one interaction effect between years. Multivariate analysis is advised for future research.

ACKNOWLEDGMENT

The researcher would like to thank the Information Management and Documentation Officer of the Central Java Provincial Health Office, Indonesia for providing the health data.

REFERENCES

Akbar, M. I. A., Irwinda, R., Dewantiningrum, J., Bernolian, N., Sitepu, M., Chalid, M. T., Noryanto, M., Yeni, C. M., Wantania, J. & Budayasa, A. A. G. R. 2022. Clinical Factors Associated with Maternal Death in Pregnant Women Infected by COVID-19 in Indonesia: A Multicenter Prospective Study. Research Square.

Amalia, F., Nugraheni, S. A. & Kartini, A. 2018. Pengaruh Edukasi Gizi Terhadap Pengetahuan dan Praktik Calon Ibu dalam Pencegahan Kurang Energi Kronik Ibu Hamil (Studi pada Pengantin Baru Wanita di Wilayah Kerja Puskesmas Duren, Bandungan, Semarang). Journal of Public Health (Undip), 6, 370-377.

Arifin, Z. & Gusnedi, G. 2014. Hambatan Dan Potensi Sumber Daya Lokal Dalam Upaya Mengurangi Resiko Kematian Ibu Di Kecamatan Tigo Lurah Kabupaten Solok, Provinsi Sumatera Barat. Indonesian Journal of Reproductive Health, 5, 1-13.

Ayazbekov, A., Nurkhasimova, R., Kulbayeva, S., Bolat, K., Kurmanova, A. M., Yeskarayeva, A., Sarbassova, M. & Kemelbekov, K. S. 2020. Features of Pregnancy, Childbirth and Postpartum Period of Young Mothers. Electronic Journal of General Medicine, 17.

Callister, L. C. & Edwards, J. E. 2017. Sustainable development goals and the ongoing process of reducing maternal mortality. Journal of Obstetric, Gynecologic & Neonatal Nursing, 46, e56-e64.

Cameron, L., Contreras Suarez, D. & Cornwell, K. 2019. Understanding the determinants of maternal mortality: An observational study using the Indonesian Population Census. PloS one, 14, e0217386.

Cerf, M. E. 2018. The Sustainable Development Goals: Contextualizing Africa's Economic and Health Landscape. Global Challenges, 2, 1800014.

Choirunnisa, S. 2021. Perbandingan Pengaturan Pelayanan Ibu Hamil pada Jaminan Persalinan (Jampersal) dan Jaminan Kesehatan Nasional (JKN-BPJS). Master Thesis. Malang: Universitas Muhammadiyah Malang.

Diana, S., Wahyuni, C. U. & Prasetyo, B. 2020. Maternal complications and risk factors for mortality. Journal of Public Health Research, 9.

Diaz-Sarachaga, J. M., Jato-Espino, D. & Castro-Fresno, D. 2018. Is the Sustainable Development Goals (SDG) index an adequate framework to measure the progress of the 2030 Agenda? Sustainable Development, 26, 663-671.

Dinkes, J. 2020. Buku Saku Kesehatan Tahun 2019. Semarang: Dinas Kesehatan Provinsi Jawa Tengah.

Dinkes, J. 2021. Profil Kesehatan Provinsi Jawa Tengah Tahun 2020. Semarang: Dinas Kesehatan Provinsi Jawa Tengah.

Ekasafitri, D., Hikayati, H. & Kusumaningrum, A. 2018. Pengalaman Pelaksanaan Sistem Rujukan Kasus Kegawatdaruratan Maternal dan Neonatal di Puskesmas Indralaya. Proceedings of the National Seminar on Nursing, 2018 Sumatera Selatan, Indonesia. Ogan Ilir: Program Studi Ilmu Keperawatan Fakultas Kedokteran Universitas Sriwijaya, 96-102.

Ernawati, A. 2017. Nutritional Problems in Pregnant Women. Journal of R&D: Research, Development and Science and Technology Information Media, 13, 60-69.

Geller, S. E., Koch, A. R., Garland, C. E., MacDonald, E. J., Storey, F. & Lawton, B. 2018. A global view of severe maternal morbidity: moving beyond maternal mortality. Reproductive health, 15, 31-43.

Hoyert, D. L. 2020. Maternal mortality rates in the United States, 2019 [online]. Available: https://stacks.cdc.gov/view/cdc/113967/cdc_113967_DS1.pdf [Accessed March 13, 2022].

Ifdil, I., Fadli, R. P., Gusmaliza, B. & Putri, Y. E. 2020. Mortality and psychological stress in pregnant and postnatal women during COVID-19 outbreak in West Sumatra, Indonesia. Journal of Psychosomatic Obstetrics & Gynecology, 41, 251-252.

Kartiningrum, E. D. 2017. Faktor yang Mempengaruhi Angka Kematian Ibu. Surakarta: CV Kekata Group.

Kemenkes, R. I. 2021. Profil Kesehatan Indonesia 2020. Jakarta: Kementerian Kesehatan Republik Indonesia.

Kevaladandra, Z. & Martha, E. 2021. Dampak COVID-19 Terhadap Pelayanan KIA di Kota Cilegon. Jurnal Keperawatan Muhammadiyah, 6.

Kotsadam, A., Lind, J. T. & Modalsli, J. 2018. Call the Midwife-Health Personnel and Mortality in Norway 1887-1921.

Laksono, A. D. & Sandra, C. 2020. Analisis Ekologi Persalinan di Fasilitas Pelayanan Kesehatan di Indonesia. Health System Research Bulletin, 23, 1-9.

Mahmood, M. A., Mufidah, I., Scroggs, S., Siddiqui, A. R., Raheel, H., Wibdarminto, K., Dirgantoro, B., Vercruyssen, J. & Wahabi, H. A. 2018. Root-cause analysis of persistently high maternal mortality in a rural district of Indonesia: role of clinical care quality and health services organizational factors. BioMed research international, 2018.

Manyeh, A. K., Nathan, R. & Nelson, G. 2018. Maternal mortality in Ifakara health and demographic surveillance system: spatial patterns, trends and risk factors, 2006–2010. PLoS One, 13, e0205370.

Merdad, L. & Ali, M. M. 2018. Timing of maternal death: levels, trends, and ecological correlates using sibling data from 34 sub-Saharan African countries. PLoS One, 13, e0189416.

Omer, S. 2019. The social and cultural factors of maternal mortality in the context of three delays: the perspective of lady health workers of South Punjab, Pakistan. Pakistan Vision, 20, 1.

Pascoe, M., Mahura, O. & Dean, J. 2020. Health resources for South Africa: A scoping review. Health SA Gesondheid, 25.

Putra, M. A. R., Yo, E. C., Phowira, J. & Anggraeni, T. D. 2020. Upaya Menurunkan Angka Kematian Ibu akibat Perdarahan Pasca Persalinan di Indonesia melalui Inovasi Sistem Pelayanan Kesehatan. Mirror of the Medical World, 47, 785-791.

Singh, V. & Barik, A. 2021. Maternal Near-Miss as a Surrogate Indicator of the Quality of Obstetric Care: A Study in a Tertiary Care Hospital in Eastern India. Cureus, 13.

Snyder, J. E., Stahl, A. L., Streeter, R. A. & Washko, M. M. 2020. Regional variations in maternal mortality and health workforce availability in the United States. Annals of Internal Medicine, 173, S45-S54.

Sun, J. & Luo, H. 2017. Evaluation on equality and efficiency of health resources allocation and health services utilization in China. International journal for equity in health, 16, 1-8.

Susilawati, D. & Nilekesuma, N. F. 2020. Quality of Comprehensive Midwifery Care as A Determinants of The Quality of Life of A Postpartum Mother. JHE (Journal of Health Education), 5, 72-77.

WHO. 2016. Health workforce requirements for universal health coverage and the sustainable development goals.(human resources for health observer, 17) [online]. Available: https://apps.who.int/iris/bitstream/handle/10665/250330/9789241511407-eng.pdf [Accessed December 7, 2022].

WHO. 2018. A vision for primary health care in the 21st century: towards universal health coverage and the Sustainable Development Goals [online]. Available: https://apps.who.int/iris/handle/10665/328065 [Accessed December 8, 2021].

WHO. 2019. Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division [online]. Available: https://apps.who.int/iris/handle/10665/327596 [Accessed May 24, 2022].

Wirakusumah, F. F., Sukandar, H., Husin, F., Hidayat, Y. M. & Yudatmo, U. 2019. Analisis Peran Faktor Penyebab Kematian Maternal yang dapat dicegah terhadap Keterlambatan Rujukan dan Penanganan di Kabupaten Karawang Provinsi Jawa Barat. Indonesian Trust Health Journal, 2, 214-225.

Xiao, X., Ngai, F.-w., Zhu, S.-n. & Loke, A. Y. 2020. The experiences of early postpartum Shenzhen mothers and their need for home visit services: a qualitative exploratory study. BMC pregnancy and childbirth, 20, 1-12.

Zhao, P., Diao, Y., You, L., Wu, S., Yang, L. & Liu, Y. 2019. The influence of basic public health service project on maternal health services: an interrupted time series study. BMC Public Health, 19, 824.