

Comparative Analysis of Sub-District Level Pregnancy Risk Factors in Surakarta City, 2023-2024

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ABSTRACT

Maternal mortality remains a significant public health problem, particularly in urban areas, where various risk factors can increase the likelihood of pregnancy complications. This study aimed to analyze the distribution of pregnant women's health risks by region in Surakarta City. A quantitative descriptive design was employed using total sampling of secondary data from the Satukan Solo website for the period January 2023 to May 2024, covering 15,687 pregnant women across five sub-districts. The analysis consisted of three stages: calculating the proportion of pregnant women at risk, identifying dominant risk factors, and comparing the distribution of risk factors among sub-districts. The results showed that the proportion of pregnant women at risk was very high across all sub-districts, ranging from 96.19% to 99.22%. The most dominant risk factors were fetal weight at risk, comorbidities, and anemia, while maternal height <140 cm, maternal age <20 years, and number of pregnancies <3 times had the lowest proportions. The distribution of risk factors varied between sub-districts. Banjarsari had comorbidities as its dominant risk factor, whereas the other four sub-districts were dominated by fetal weight at risk. These findings highlight the importance of region-based interventions and community empowerment through antenatal care education to improve early detection and reduce pregnancy complications. Targeted interventions may strengthen the utilization of maternal health services and support more effective maternal health program planning.

Keywords : Pregnant women; Pregnancy risk; Comparative analysis; Maternal health

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INTRODUCTION

Maternal mortality (AKI) remains an important indicator of the quality of maternal health services, with approximately 287,000 maternal deaths annually or ± 223 per 100,000 live births, most occurring in low- and middle-income countries. (1) In the Southeast Asian region, the AKI ranges from 140–190 per 100,000 live births and is still higher than in developed countries. (2) The *Sustainable Development Goals* (SDGs) target reducing AKI to below 70 per 100,000 live births by 2030, emphasizing the importance of improving the quality and utilization of *antenatal care* (ANC) for early detection of pregnancy complications. (3)

In Indonesia, AKI increased from 189 per 100,000 live births in 2020 to 205 in 2022. (4) Maternal conditions such as anemia contribute to obstetric complications, including postpartum hemorrhage, premature birth, and maternal and neonatal mortality. (5) Socio-demographic factors, including age, education, occupation, economic conditions, and residence, also influence pregnancy risks and health service utilization. (6) The completeness of ANC visits is affected by education, health insurance ownership, and access to health facilities, while regional inequalities in maternal health service utilization remain a challenge. (7)(8)

Previous studies have identified variations in ANC utilization and maternal risk factors between regions, influenced by socio-economic conditions, education, and access to health services (9) In Surakarta City, the 2024 Maternal Mortality Rate was 41.04 per 100,000 live births, with four maternal deaths recorded. (10) Although relatively low, risk factors such as anemia, Chronic Energy Deficiency (CED), at-risk maternal age, and high parity may increase the likelihood of complications if not detected early.

The implementation of maternal health programs in Indonesia still faces challenges in the coverage and quality of ANC services. Limited resources and inconsistent implementation of standards may result in incomplete ANC examinations and suboptimal identification of pregnancy risks. (11)(12)(13) In addition, the use of pregnant women's health data in program planning is still not optimal, so an evidence-based approach through regional analysis is needed to increase the effectiveness of interventions. (14)

The Surakarta City Government, through the Office of Women's Empowerment, Child Protection, Population Control, and Family Planning (DP3AP2KB), developed the Satukan Solo website as an integrated, region-based data system. The system collects data on at-risk families, including pregnant women, through the Family Assistance Team (TPK) and provides monthly data updates and graphical visualization. However, the data have not been cumulatively analyzed to comprehensively describe the distribution of maternal risk factors across sub-districts.

Although previous studies have examined AKI, ANC utilization, and maternal risk factors, most have focused on individual factors and have not comprehensively utilized integrated government data to compare risk patterns between regions. Consequently, differences in maternal risk profiles among sub-districts and the need for region-specific interventions remain insufficiently described. Therefore, this study aimed to analyze and compare the distribution of health risks among pregnant women across sub-districts in Surakarta City using Satukan Solo data from January 2023 to May 2024. The study also compared the number of pregnant women at risk and those receiving assistance and identified the dominant risk factors in each region to support more targeted maternal health interventions.

METHODS

This study uses a quantitative descriptive design with a proportional analysis approach. Secondary data was obtained from the Satukan Solo website which is managed and inputted by the Surakarta City Office of Women's Empowerment, Child Protection, and Population Control and Family Planning (DP3AP2KB). The data was collected by the Family Assistance Team (TPK) officers through direct visits to the target families in each Rukun Warga (RW) area, then input into the system according to the latest conditions in the field. The Satukan Solo application presents *real-time data* containing various information related to families, including data on pregnant women and their health risk factors. The data includes 15,687 pregnant women registered in the period from January 2023 to May 2024 in five sub-districts, namely Banjarsari (n=4,986), Jebres (n=3,964), Laweyan (n=3,070), Kliwon Market (n=2,508) and Serengan (n=1,159). Of this total, as many as 15,328 pregnant women are categorized as at health risk based on pregnant

women's health indicators identified through the Satukan Solo system. The "risky" category is determined if the pregnant woman has at least one health risk factor during pregnancy, namely anemia (Hb <11 g/dL), chronic energy deficiency (MUAC <23.5 cm), low body mass index (BMI <18.5), pregnant woman's age <20 years, mother's age >35 years, fetal weight at risk, risk of uterine fundus height, exposure to cigarettes, pregnancy ≥ 3 times, mother's height <140cm, and the presence of comorbidities during pregnancy.

The sampling technique used in this study is *total sampling* because all data on pregnant women in that period are analyzed. Data analysis was carried out in three stages. The first stage was the analysis of the proportion of pregnant women at risk between sub-districts in the city of Surakarta. The second stage is the analysis of the types of health risk factors in pregnant women in the city of Surakarta. The third stage is the analysis of the types of risk factors per sub-district in the city of Surakarta. The risk classification in this study refers to the presence of at least one recorded maternal or fetal health risk indicator in the Satukan Solo system. Therefore, the results represent the distribution of recorded risk indicators and should not be interpreted as the prevalence of confirmed pregnancy complications.

RESULTS

Based on data obtained from the Satukan Solo website during the period January 2023 to May 2024, an analysis was conducted to describe the distribution of recorded pregnancy health risk indicators and their variations between sub-districts in Surakarta City. The analysis was compiled in stages, starting from an overview of the proportion of pregnant women at risk in each sub-district, then continued with the identification of the most dominant type of risk factors, and ending with a comparison of the distribution of risk factors between sub-districts. The results of this analysis provide an overview of the health risk patterns of pregnant women in a comprehensive and region-based manner.

The first analysis was carried out to find out the general picture of the level of pregnancy risk in each sub-district by comparing the number of pregnant women at risk to the total number of pregnant women. The results of this analysis provide information about the level of vulnerability to the overall health of pregnant women in the city of Surakarta.

Table 1.

Proportion of Pregnant Women at Risk in Each District in Surakarta City

Districts	Number of Pregnant Women (n)	Number of Pregnant Women at Risk (n)	Risk Percentage (%)
Serengan	1.159	1.150	99,22%
Pasar Kliwon	2.508	2.468	98,41%
Laweyan	3.070	3.006	97,92%
Jebres	3.964	3.908	98,59%
Banjarsari	4.986	4.796	96,19%
Total	15.687	15.328	97,71%

Source: Author's analysis based on Satukan Solo data (2023–2024)

Based on data on the number of pregnant women in five sub-districts, the total number of pregnant women was 3,137.4 people, with an average of 3,065.6 pregnant women at risk. Overall, the percentage of pregnant women at risk is very high with an average of 97.71%. The sub-district with the highest number of pregnant women is Banjarsari (4,986 people), while the lowest number is in Serengan (1,159 people). The highest percentage of pregnant women at risk was found in Serengan District at 99.22%, followed by Jebres (98.59%) and Kliwon Market (98.41%), while the lowest percentage was in Banjarsari District at 96.19%. The proportion obtained in this study reflects the accumulation of recorded indicators within the Satukan Solo system. The relatively high proportion should be interpreted cautiously because the classification was based on the presence of one or more risk indicators and may include mild or preventive-risk conditions that do not necessarily develop into obstetric complications.

The next analysis aims to identify the most dominant types of health risk factors for pregnant women in the city of Surakarta. This analysis is important to identify the main risk factors that need to be prioritized in maternal health interventions.

Types of Health Risks for Pregnant Women from Total Pregnant Women at Risk In Surakarta City (n=15,328)

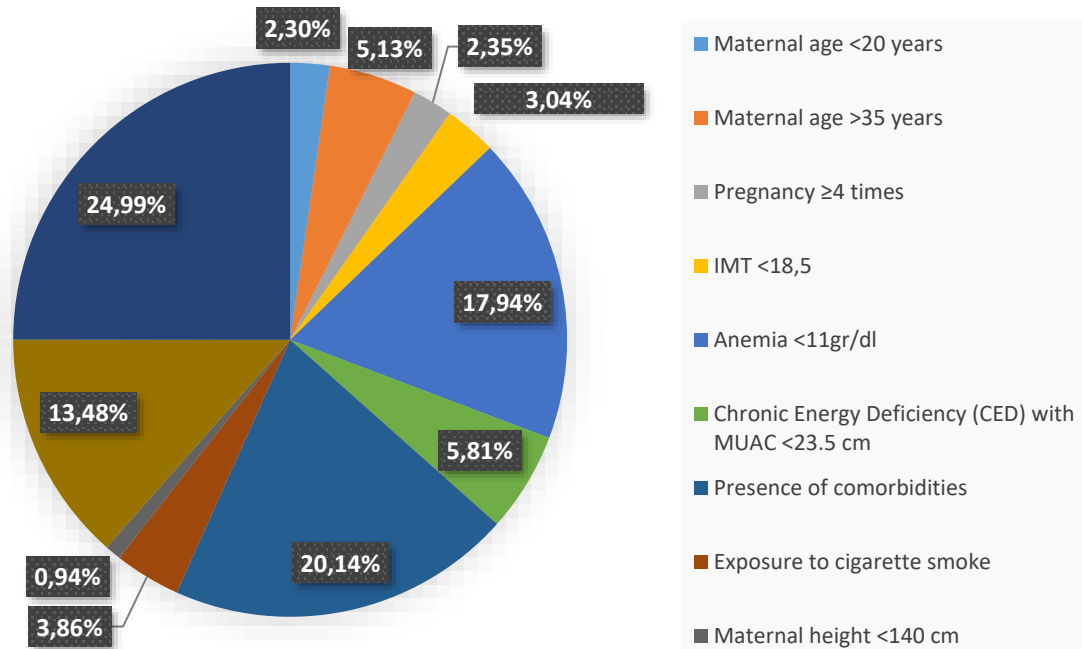


Image 1. Proportion of Risk Factors in Pregnant Women at Risk in Surakarta City

The results of the analysis illustrate the distribution of the types of health risk factors of pregnant women in the city of Surakarta. The most common risk factors were fetal weight at risk (24.99%), followed by mothers with comorbidities (20.14%) and anemia with hemoglobin levels <12 g/dL (17.94%). On the other hand, the risk factors with the lowest proportion were maternal height <140 cm (0.94%), maternal age too young (<20 years) (2.30%), and the number of pregnancies less than three times (2.35%). In general, most of the risk factors found are related to the physiological health conditions of the mother and fetus.

The last analysis was carried out to compare the distribution of the types of health risk factors for pregnant women in each sub-district. This analysis aims to identify variations in risk factor patterns by region, so that they can be the basis for specific and location-based intervention planning.

Percentage Distribution of Pregnancy Risk Factors in Pregnant Women by Sub-district

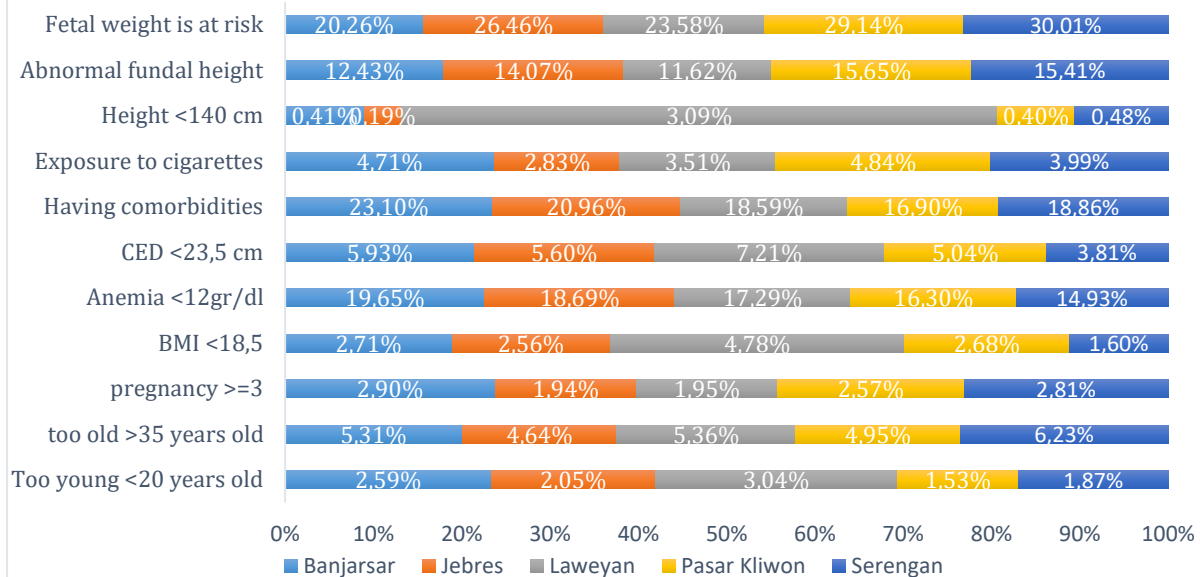


Image 2. Distribution of Pregnancy Risk Factor Percentage in Pregnant Women at Risk by Sub-district in Surakarta City

Based on the distribution bar chart of the health risk factors of pregnant women in each sub-district in Surakarta City, it can be seen that there are variations in proportions between regions, although in general the pattern of risk factors is relatively similar. Risk factors for estimating the weight of the fetus at risk were the most dominant in almost all sub-districts, with the highest proportion in Serengan District (30.01%), followed by Kliwon Market (29.14%), Jebres (26.46%), and Laweyan (23.58%). Meanwhile, Banjarsari District shows a slightly different pattern, where the highest risk factor is comorbidities (23.10%), although the weight of the fetus at risk still ranks second (20.26%).

Risk factors for anemia also show a fairly high proportion in all sub-districts, ranging from 14.93% to 19.65%. In addition, the high risk of uterine fundus is also quite dominant, especially in Kliwon Market (15.65%) and Serengan (15.41%). Meanwhile, risk factors such as too young (<20 years), maternal height <140 cm, and low parity (<3 pregnancies) have a relatively small proportion in all sub-districts.

Overall, the bar chart shows that most of the dominant risk factors have to do with the physiological condition of the mother and fetus, particularly those related to nutritional status and health during pregnancy. Although the general pattern showed similarities between regions, variations were observed in the dominant indicators of each sub-district. These differences may reflect variations in maternal characteristics, population conditions, healthcare access, and the implementation of maternal health monitoring programs.

DISCUSSION

The analysis showed that a high proportion of pregnant women had at least one recorded health risk indicator in the Satukan Solo system. This finding should be interpreted cautiously because the classification was based on the presence of recorded indicators rather than confirmed pregnancy complications. The high proportion may be influenced by the number of indicators used and the nature of secondary data collection, which can potentially lead to overestimation of pregnancy risk prevalence. These findings indicate that maternal health monitoring remains an important concern in Surakarta City, involving biological, healthcare, and social factors that may influence pregnancy outcomes. These findings are in line with research in Indonesia that shows that high pregnancy risk is closely related to the suboptimal quality of ANC services, especially in terms of the regularity of visits and the implementation of screening since the first trimester. Pregnant women who do not receive standard ANC services tend to have a higher risk of complications compared to mothers who have a complete ANC visit. (8)(12) In addition, the suboptimal quality of ANC also contributes to the delay in the detection of pregnancy risk factors, so that interventions cannot be carried out in a timely manner.

When viewed by region, most sub-districts in Surakarta City have an above-average percentage of pregnant women at risk, namely Serengan, Jebres, Pasar Kliwon, and Laweyan Districts, while Banjarsari Sub-district is slightly below average but remains in the very high category. This pattern indicates that recorded pregnancy risk indicators are distributed across all sub-districts, suggesting that maternal health monitoring and preventive programs are needed throughout Surakarta City. In conditions of widespread high risk prevalence, the most effective intervention approach

is a population-based approach through strengthening primary health services, especially at the health center level, as well as improving the quality of routine screening during pregnancy. (14) This approach allows early detection to be carried out thoroughly, so that it can reduce the risk of complications at the population level.

Pregnancy risk indicators identified during ANC are important because several maternal and fetal conditions have been associated with adverse pregnancy outcomes, including preeclampsia, preterm birth, and maternal complications. Therefore, early identification and management of these indicators remain essential components of maternal healthcare. In Indonesia, most cases of maternal mortality are still caused by delays in detecting risk factors and delays in handling pregnancy complications. (1)(3) This shows that preventive efforts through early detection have a very crucial role in reducing maternal pain and mortality. Therefore, improving the quality of ANC is not only important in terms of coverage, but also in terms of service quality, including the competence of health workers and the completeness of examinations.

Regional factors also play a role in influencing the high risk of pregnancy. The higher proportion of recorded risk indicators in Serengan District may be related to differences in population characteristics, maternal conditions, healthcare access, or reporting practices. Further studies incorporating socioeconomic and healthcare capacity variables are needed to explain these regional differences. Although the number of health facilities is relatively adequate, the dominance of primary services such as health centers and general practitioner practices causes limitations in handling high-risk cases. (15) This is in line with the finding that areas with high density and uneven distribution of health facilities have a higher risk of maternal mortality. (16) Thus, population density and health service capacity factors are important aspects in region-based pregnancy risk analysis.

In addition to healthcare factors, pregnancy outcomes may also be influenced by social and behavioral determinants, including maternal knowledge, family support, healthcare accessibility, and availability of health workers. These factors can affect ANC utilization and early detection of pregnancy risk indicators. (18) The use of non-optimal ANC is often influenced by low maternal knowledge, lack of family support, limited access to health facilities, and availability of health workers. (19) The combination of these

factors causes delays in the detection and handling of risks, thereby increasing the potential for pregnancy complications.

In terms of the type of risk, the results of the study showed that the dominant factors found were fetal weight at risk, comorbidities, and anemia. The dominance of these factors suggests that the mother's health condition before and during pregnancy has a major influence on fetal growth and pregnancy outcomes. Maternal nutritional status, metabolic diseases, as well as hematologic disorders during pregnancy have been shown to be closely related to an increased risk of obstetric complications and fetal growth disorders. (20)

Fetal weight at risk, which includes low birth weight (LBW) and macrosomia, is an important indicator of a mother's health condition during pregnancy. Maternal nutritional status, both before and during pregnancy, has a significant role in determining fetal growth. (21) Maternal conditions such as preeclampsia and other health disorders are also associated with an increased incidence of LBW. (22) In addition, chronic energy deficiency (CED) in pregnant women reflects suboptimal nutritional status and contributes to fetal growth disorders. Indicators such as body mass index, upper arm circumference, and weight gain during pregnancy have been shown to have a significant relationship with the baby's weight at birth. (23) Therefore, nutritional interventions through regular monitoring in ANC are very important to prevent these risks.

Comorbidities such as hypertension and gestational diabetes are also important risk factors in pregnancy. This condition can interfere with placental function and cause complications such as preeclampsia, premature delivery, and fetal growth disorders. (24)(25) The increase in the prevalence of chronic diseases in pregnant women is also influenced by changes in people's lifestyles, such as obesity, lack of physical activity, stress, and unhealthy consumption patterns, which contribute to hypertension in pregnancy. (26) This shows that maternal health problems are not only related to the pregnancy itself, but also to the general health condition of the mother before pregnancy.

Anemia is also a consistently high risk factor in all sub-districts. This condition is generally caused by iron deficiency, unbalanced diet, and low adherence to Fe tablet consumption. Anemia in pregnant women increases the risk of postpartum bleeding, premature delivery, and LBW. Adherence to Fe tablet consumption has been shown to

have a significant association with the incidence of anemia. (24) However, compliance with Fe tablet consumption is still influenced by educational factors and the quality of counseling provided by health workers. (25) Maternal nutrition factors and the quality of implementation of maternal health programs also play a role in the incidence of anemia in pregnant women. (27) In addition, compliance with ANC visits also plays an important role in reducing the incidence of anemia. (28) This shows that educational interventions and improving the quality of ANC services still need to be strengthened.

The distribution of risk factors between sub-districts shows a relatively homogeneous pattern, especially the dominance of the weight of at-risk fetuses in almost all regions. This indicates that the problem of nutrition of pregnant women is the main systemic issue in the city of Surakarta. A region-based approach is needed to identify intervention priorities more specifically, so that health programs can be tailored to the characteristics of each region. (29) In addition, the high distribution of at-risk uterine fundus in several sub-districts also indicates the potential for fetal growth disorders that need to be anticipated through more intensive ANC monitoring. (30)

Although there are small variations between regions, the relatively uniform pattern of risk factors suggests that the health problems of pregnant women in Surakarta City require an integrated intervention approach. Community-based interventions are one of the effective strategies, as they can improve access to health services and strengthen early detection of pregnancy risks. (31)(32) One form of intervention that can be applied is community-based health services with a ball pick-up system, which allows health workers to reach pregnant women directly in their neighborhoods.

This approach is considered effective in overcoming barriers to access, such as distance and mobility limitations, as well as increasing the coverage of ANC services. (32) In addition, integrating ANC services with monitoring nutritional status and regular iron supplementation can help reduce the risk of anemia and fetal growth disorders. (33)

On the other hand, community empowerment through health education also has an important role in improving the health of pregnant women. Effective education can increase mothers' knowledge and awareness of the importance of ANC, thereby encouraging adherence to visits. (34) The support of families and health workers has also been shown to have a significant effect on the utilization of ANC services. (35) Therefore,

a community-based approach that involves the family and the social environment is an important strategy in efforts to reduce the risk of pregnancy complications.

Overall, this study demonstrates that recorded pregnancy risk indicators in Surakarta City involve multiple maternal and regional characteristics. The findings highlight the importance of strengthening maternal health monitoring systems, improving ANC quality, and developing region-specific interventions based on the distribution pattern of identified indicators. Therefore, a comprehensive approach is needed, including strengthening health services, region-based interventions, and community empowerment, to improve the quality of health of pregnant women and reduce the risk of pregnancy complications.

CONCLUSIONS AND RECOMMENDATIONS

This study identified the distribution pattern of recorded pregnancy health risk indicators among pregnant women in Surakarta City using data from the Satukan Solo system. The findings showed variations in the proportion and characteristics of risk indicators between sub-districts. The results indicate that maternal nutritional conditions, fetal growth indicators, and maternal health conditions are important aspects requiring continuous monitoring. The most dominant risk factors are fetal weight at risk, comorbidities, and anemia, which indicate that the mother's health condition and nutritional status are still the main problems.

Maternal health interventions should be developed based on the dominant risk indicators identified in each sub-district. Areas with higher fetal growth-related indicators require strengthened nutritional monitoring and fetal growth assessment, while areas with higher maternal health conditions require improved screening and management of comorbidities. Strengthening ANC quality, improving data recording systems, and involving families and communities are also needed to support early identification and prevention of pregnancy complications. In addition, it is necessary to improve nutrition education, prevent anemia, handle comorbidities, and empower communities and families so that early detection is more optimal and the risk of pregnancy complications can be reduced.

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