Case Study in the COVID-19 Pandemic: Stunting, Low Birth Weight, Maternal Mortality and Infant Mortality in Semarang, Central Java-Indonesia

ABSTRACT

Background and Objective: In recent years, stunting, low birth weight, maternal death, and infant mortality have all become public health issues, particularly in Semarang, Indonesia. Simultaneously, the COVID-19 epidemic is spreading. Between 2019 and 2021, the researchers intended to see how common stunting, low birth weight, and maternal and infant death were in Semarang. **Methods :** In this study, the Semarang City Health Office's secondary data analysis strategy was paired with a quantitative descriptive research methodology. Simple regression was used to check for trends in the incidence of stunting, low birth weight, maternal mortality, and infant mortality in the data. **Results:** According to the findings, the trend of stunting (modeling results y = 35,236 x + 361.77) and maternal mortality (modeling results 0.0218x+1.2921) increased between 2019 and 2021, whereas the trend of Low Birth Weight (modeling results y = - 0.5425x+60.008) and child mortality (modeling results y = -0.0028x+ 2.202) decreased. Stunting cases have the highest trend in the number of cases, while LBW cases have the least trend. **Conclusion**: In Semarang, the incidence of stunting increased, LBW decreased, maternal mortality increased, and child mortality decreased. This condition is at least influenced by the Covid-19 pandemic condition

Keywords: Stunting, Low birth weight, Maternal mortality, Infant mortality, Covid-19 pandemic

INTRODUCTION

Malnutrition begins in the womb and continues throughout childhood, affecting brain development and cognitive capacity. This is a risk for future stunting [1] (1) Stunting is a nutritional status determined by the PB/U or TB/U index, with measurement results falling under the -2 SD to -3 SD (dwarf) and -3 SD (dwarf) thresholds (Z-Score [2]. (3)

More than half of stunted children (56%) live in Asia, and more than a third (37%) live in Africa, according to the United Nations Children's Emergency Fund (UNICEF) [3] (2) After India, China, Nigeria, and Pakistan, Indonesia has the fifth greatest prevalence of stunting. Stunting affects around 38% of children under the age of five in South Asia [4] (4) According to the WHO, if the prevalence of stunting in children under the age of five reaches 20% or above, it becomes a public health issue. As a result, Indonesia's percentage of short toddlers remains high, indicating that this is a public health issue that must be addressed [5] (5)

Stunting in children is a severe issue since it is linked to increased morbidity and mortality, future obesity and noncommunicable diseases, short adults, poor cognitive development, and reduced productivity and income. Malnutrition is responsible for around 10.5 million child deaths per year. In developing nations, 98 percent of these deaths are reported. Stunting can be caused by a variety of circumstances, including low birth weight. If a baby's birth weight is less than 2,500 grams, he or she is at risk of mortality, stunted infant growth, and even being short if not handled properly.[6]. When compared to developed countries, infants with low birth weight (LBW) are more likely to undergo intrauterine development retardation due to poor maternal nutrition and higher infection rates [7]. The

maternal and newborn mortality are two separate yet connected phenomena. The maternal mortality rate and infant mortality rate are used to determine and measure the success of health-care implementation. According to the 2012 Indonesian Demographic and Health Survey (IDHS), the infant mortality rate (IMR) in Indonesia was 32 per 1000 live births.[8] The 2012 survey's infant death rate was lower than the 2007 survey's figure of 35 per 1000 live births. In the last five years, infant mortality has decreased. This result, however, falls well short of the 2015 Millennium Development Goals (MDGs) goal of reducing infant mortality to 23 per 1000 live births. [9] Maternal death occurs when a woman dies while pregnant or up to 42 days after giving birth, regardless of the length or location of the pregnancy, from any cause connected to pregnancy complications or care. [10].

Based on the health problems mentioned above, a projection is needed to identify the number of cases spreading in various places, one of which is Semarang, in order to assist the Semarang City Government in dealing with these problems. The government can implement various policy plans and preparations to deal with a surge or decrease in cases of health problems such as stunting, LBW, and maternal-infant mortality in the city of Semarang with predictions especially for several cases of health problems such as stunting, LBW, and maternal-infant mortality. Case histories of Stunting, Low Birth Weight, Maternal Mortality and Infant Mortality need appropriate treatment [11]. After that, the Semarang City Government developed a strategy to overcome the increase in stunting cases. Therefore, in 2021-2022 a research will be carried out in Semarang to get a general picture so that it can predict the incidence of stunting, low birth weight, and maternal-infant mortality in the future. The results of the research can be used as a base line by the Semarang city government in establishing a policy regarding the handling of stunting, LBW, and maternal-infant mortality.

METHODS

This study employed a quantitative descriptive research method with secondary data analysis from the Semarang City Health Office on cases of stunting, LBW, and maternal-infant mortality in Semarang from 2019 to 2021. The basic formula for predicting linear regression is used in this study, and secondary data in the form of information is retrieved or collected from previously published sources [12]

The following is a simple linear regression formula for determining predictions:

$Yn = a \pm b.x$

- Yn = the number of predicted results, In a certain time period,
- a = yearly average number of items $=\sum \boldsymbol{Y}/\boldsymbol{n}$
- b = yearly trend of increase/decrease = $\sum \boldsymbol{XY}/\sum \boldsymbol{X2}$
- x = year prediction order

RESULTS AND DISCUSSION

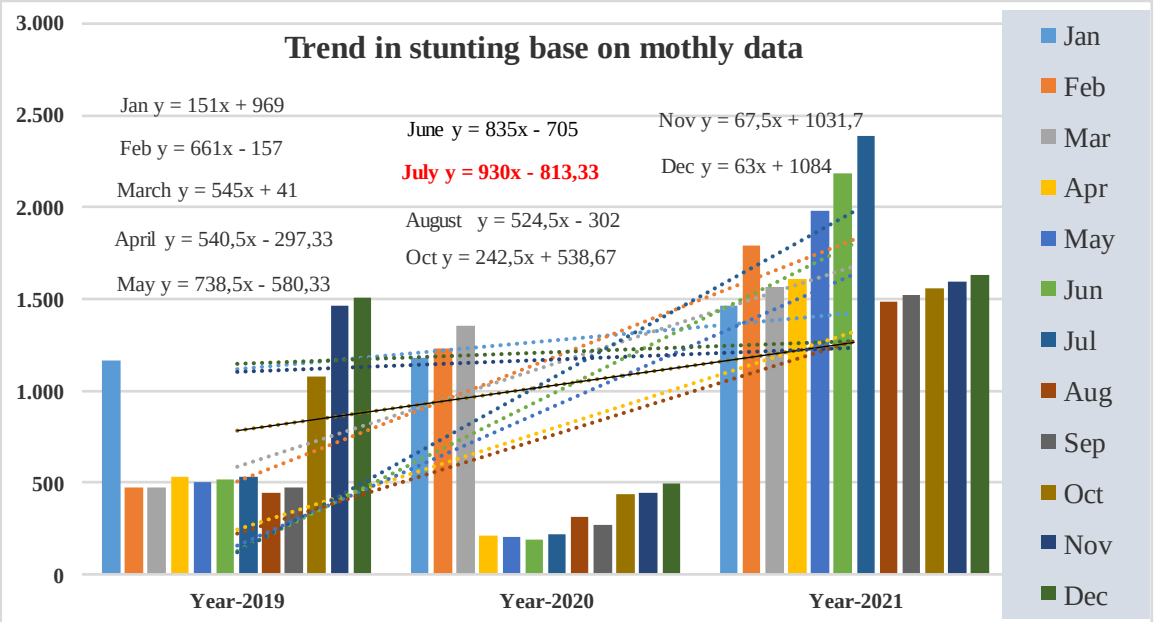
Based on secondary data from the Semarang City Health Office, the cases of stunting, ,Low birth weight and maternal-infant mortality in the city of Semarang from 2019 to 2021 are as follows :

1. Stunting case data

Table 1. Data on Semarang Stunting Cases for the 2019-2021 period

Month	Th2019	Th2020	Th2021
Jan	1.165	1.181	1.467
Feb	472	1.229	1.794
Mar	476	**1.351**	1.566
Apr	530	210	1.611
May	505	203	1.982
Jun	517	191	2.187
Jul	532	216	2.392
Aug	440	312	1.489
Sep	476	271	1.525
Oct	1.075	436	1.560
Nov	1.460	445	1.595
Dec	**1.504**	496	1.630
Avg	763	545	1.733

According to table 1, the incidence of stunting was highest in December (1504 cases) in 2019, March (1381 cases) in 2020, and July in 2021.



.Fig 1. Stunting case data is projected for 2019, 2020, and 2021 base on monthly data.

With the equation model y = 930 x - 813.33, graph 1 depicts the highest trend of stunting cases in July compared to other months.

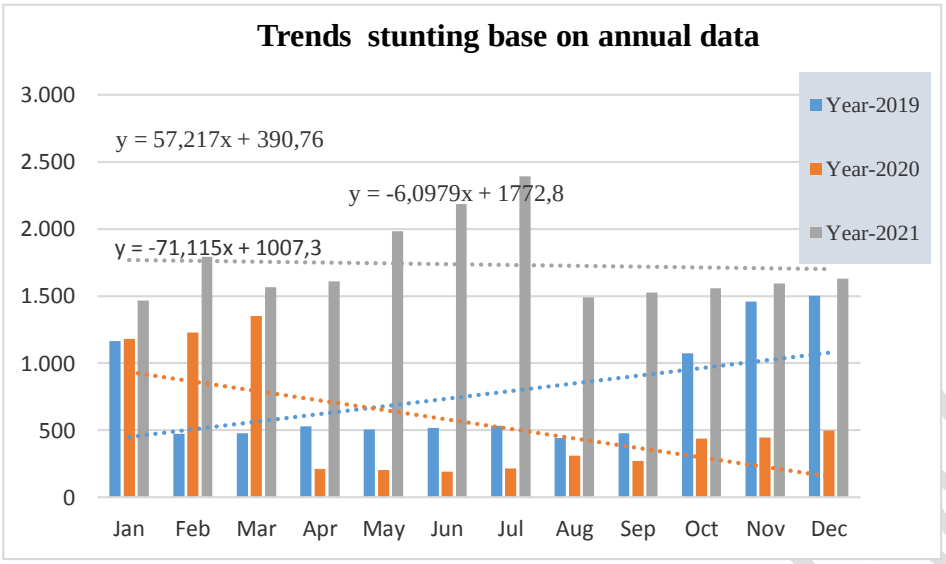


Fig 2. Stunting case data is projected for 2019, 2020, and 2021 base on annual data

The incidence of stunting cases reached its peak in 2019 (y=57,217x+390.76), then began to decline in 2020 (-71.115x+1007.3) and 2021 (y=-6.0978x+1772.8).

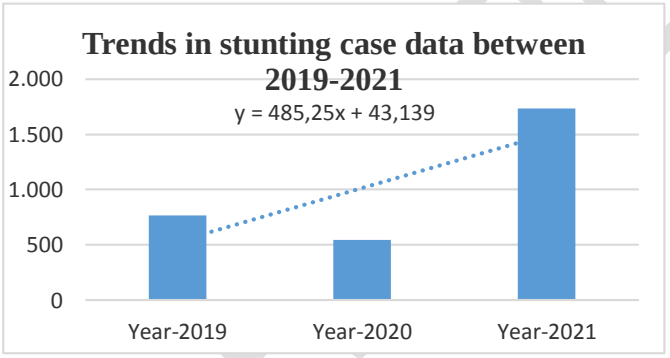


Fig 3. Trends in combined stanting case data between 2019 and 2021

With the equation y = 485.25x+43.139, the trend of stunting incidents from 2019 to 2021 shows a rise.

Childhood stunting is the best overall indication of children's well-being and the most accurate reflection of socioeconomic inequality. City According to the data, Semarang has a relatively high number of stunting cases, with up to 25 sub-districts serving as the main point for stunting cases [13]. Local governments are concerned about the frequency of stunting in Semarang, which has prompted the construction of an Integrated Stunting Reduction Intervention.

The rising stunting rate is due to the reduction in socioeconomic conditions during the pandemic. The pandemic phase in 2020 will increase global poverty levels, have an impact on socioeconomic conditions, and, of course, have a slew of bad consequences, including newborn birth delays and an increase in stunting instances around the world. [14] This demonstrates that the COVID-19 pandemic affects stunting, particularly in low- and middle-income nations. [15]. If this condition persists, the

economics of the community will deteriorate, leading to an increase in stunting instances. [16]. The city government's policies have changed since the issuance of the Mayor of Semarang's Decree No. 443/227 of 2020 concerning the Determination of the Emergency Response Status of the Corona Virus Outbreak (Covid-19) in the City of Semarang in March 2020, with many hospitals and health centers focusing more on Covid-19 patients. Hospitals and health-care facilities are focusing more on serving Covid 19 patients during the pandemic. On the other hand, the Semarang City Government continues to make efforts to reduce the number of undernourished people (stunting and wasting). To combat stunting, all stakeholders work together across sectors and initiatives. [17].

2. Low birth weight case data

Low birth weight (LBW) is a public health issue in the city of Semarang that requires special attention. [18]. Table 2 shows data on cases of newborns born with LBW in Semarang from 2019 to 2021.

. Table 2. Data on Semarang Low Birth Weight (LBW) Cases for the 2019-2021 period

Month	th2019	th2020	th2021
Jan	67	28	27
Feb	56	53	40
Mar	55	64	26
Apr	70	56	59
May	72	54	52
Jun	61	74	39
Jul	44	50	37
Aug	57	77	43
Sept	45	82	42
Oct	38	66	42
Nov	40	28	41
Dec	35	39	40
Avg	53	56	41

According to the data in table 2, the occurrence of Low Birth Weight (LBW) in 2019 (72 case) will be in May, 2020 in September (82 case) , and 2021 in April (59 case).

Low birth weight (LBW) case data is projected for 2019, 2020, and 2021, based on the year of occurrence, as follow :

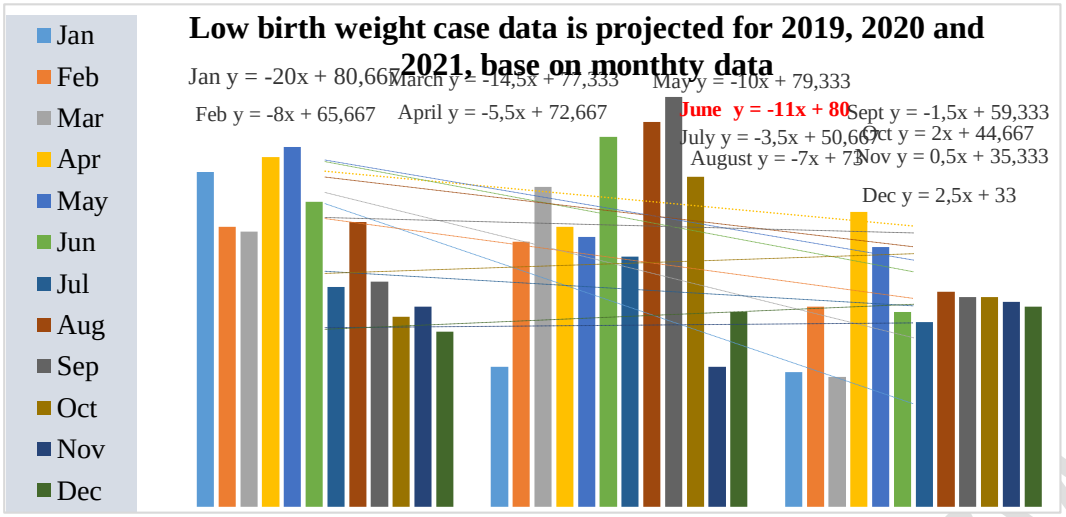


Fig 4. Low birth weight (LBW) case data is projected for 2019, 2020, and 2021 base on monthy data

Fig 4 displays the biggest trend in cases of low birth weight in January the equation model y = -20x +80,667

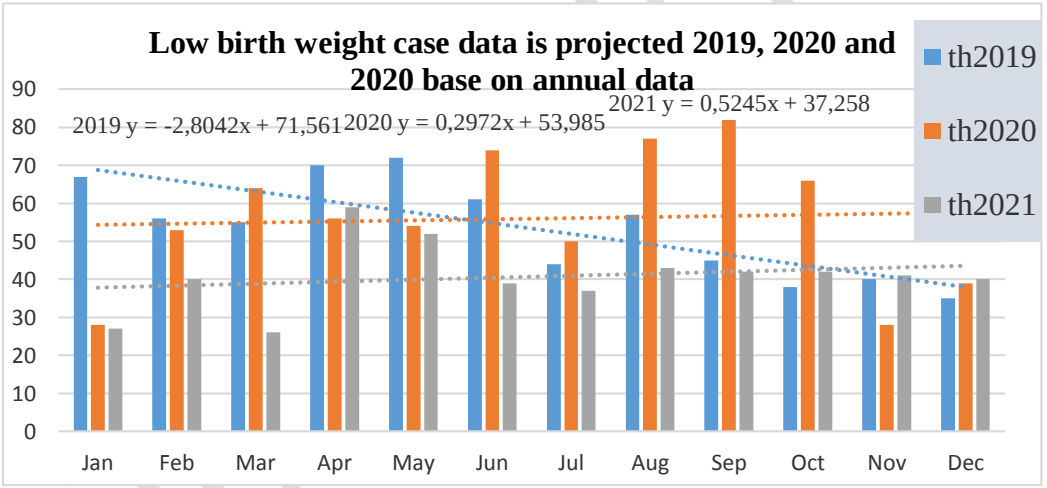


Fig 5. Low birth weight (LBW) case data is projected for 2019, 2020, and 2021 base on annual data

Low birth weight was on the decline in 2019 (y=-2.8042x + 71.561), but began to rise in 2020 (0.2972x+52.985) and 2021 (y=0.5245x+37.258).

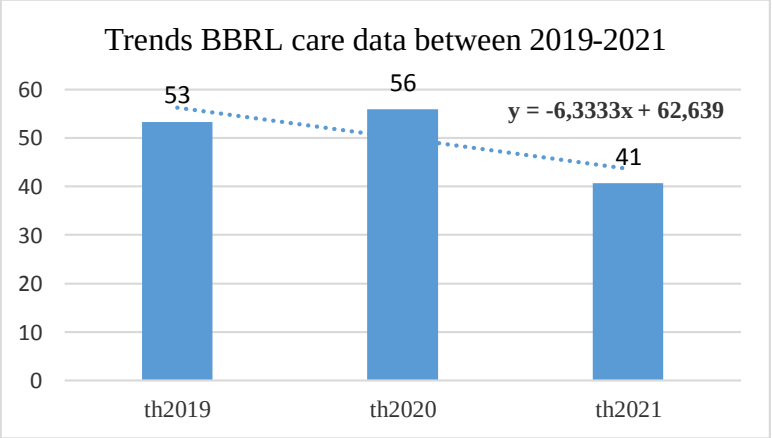


Fig 6. Trends in combined low birth weight case data between 2019 and 2021

With the equation y = = 6.3333x + 62.639, the trend of the incidence of LBW from 2019 to 2021 shows a decrease.

Low birth weight is a potential risk factor for COVID19, although data on the occurrence of low birth weight in the city of Semarang from 2019 to 2020 shows a decrease, albeit remaining in a high category (average 50 incidents per year) [19] The city government of Semarang is attempting to reduce the incidence of low birth weight babies (LBW) through a variety of health education programs, supervision and monitoring, infant hypothermia prevention, no-cost therapy, measuring the nutritional status of pregnant women, performing calculations, and preparing health-related steps and These efforts are proposed to be made by the mother herself, or by health-care cadres in health-care facilities [20].

The COVID-19 pandemic has had an impact on the incidence of low birth weight over the world (LBW). Despite a decrease in the number of low birth weight (LBW) cases, the Semarang City Government must exercise caution because Covid-19 cases have not abated, and LBW appears to be a separate risk factor for severe COVID-19, potentially increasing risk stratification. LBW babies are at a higher risk of developing a variety of health issues [22] . Several measures can be made to prevent and control LBW, including giving proper health education about LBW to pregnant women. [24] If efforts to prevent and control LBW are properly carried out, success in increasing baby weight will be realized; the mother's level of knowledge in managing the distance between pregnancies and knowing unsafe ages to undergo pregnancy and childbirth, as well as providing nutrition beginning during pregnancy and childbirth, will be realized. Maintain the health of yourself and the kid in the womb until it reaches the age of two years, and pay close attention to the cleanliness of the environment [23]. Health education, supervision and monitoring, avoidance of hypothermia in infants, free therapy that can be done, testing the nutritional status of pregnant women, and calculating and preparing steps in health are all part of these prevention and control initiatives. (Antenatal Care) [25] LBW is a public health issue that requires special attention in a number of countries, particularly in emerging or low-income countries. LBW cases in children are similar to the consequences of the global COVID-19

epidemic (infants). The financial situation of parents, diminishing parental income, understanding of child (infant) health, and lack of regular baby check-ups at health service centers or hospitals all play a role in the occurrence of LBW

3. Data on maternal death cases and infants in Semarang

Maternal and child mortality is a multidimensional issue that necessitates a complete solution and strategy based on a collaborative partnership approach. This is a critical issue that must be addressed immediately because it has a significant impact on future generations' quality of life as well as maternal health. The Maternal Mortality Rate is a measure of how well the health sector has progressed. In response to this problem, the Semarang City Health Office, through the Semarang City Regional Regulation Number 2 of 2015 concerning maternal and child safety, seeks to reduce maternal mortality by involving various stakeholders, including developing collaborative integrative programs based on partnerships involving multiple stakeholders. Promotively, preventively, and curatively, the health service innovation program is a type of solution and action for mother and child health concerns. [24] Maternal and Child Health Surveillance officers will visit clients' homes to provide support (homecare) to pregnant women, postpartum moms, and babies in an effort to prevent high-risk pregnancies. In the city of Semarang, it is intended that this approach can reduce maternal and child mortality.[27]

Data on maternal mortality in Semarang from 2019 to 2021

Table 3 shows the following data on maternal mortality in the city of Semarang from 2019 to 2021:

Table 3. Data on maternal mortality cases in Semarang City for the 2019-2021 period

Month	th2019	th2020	th2021
Jan	4	1	2
Feb	2	1	1
Mar	1	2	1
Apr	2	1	1
May	1	0	1
Jun	3	4	8
Jul	0	1	2
Aug	0	1	2
Sep	2	2	2
Oct	2	1	2
Nov	0	1	2
Dec	1	2	2
Avg	1,5	1,4	2,2

According to table 1, the months with the highest rates of maternal death are January 2019 (4 instances), June 2020, and 2020. (8 cases each)

Based on monthly data, Figure 6 depicts maternal mortality case data projections for 2019, 2020, and 2021, as follow :

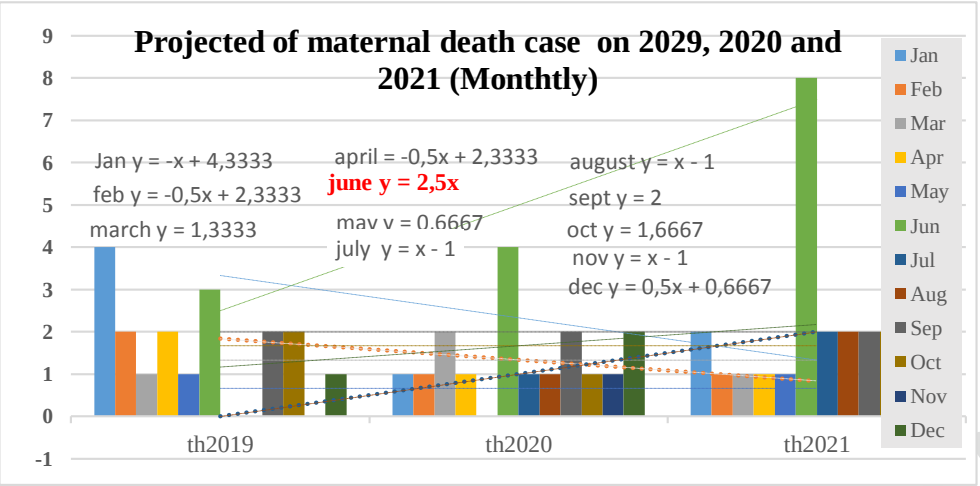


Fig 7. Maternal death cases is projected for 2019, 2020, and 2021 base on monthy data

The trend of growing maternal death occurs in June (y = 2,5 x) , according to fig 6, the prediction of maternal mortality cases from 2019 to 2021, based on monthly data.

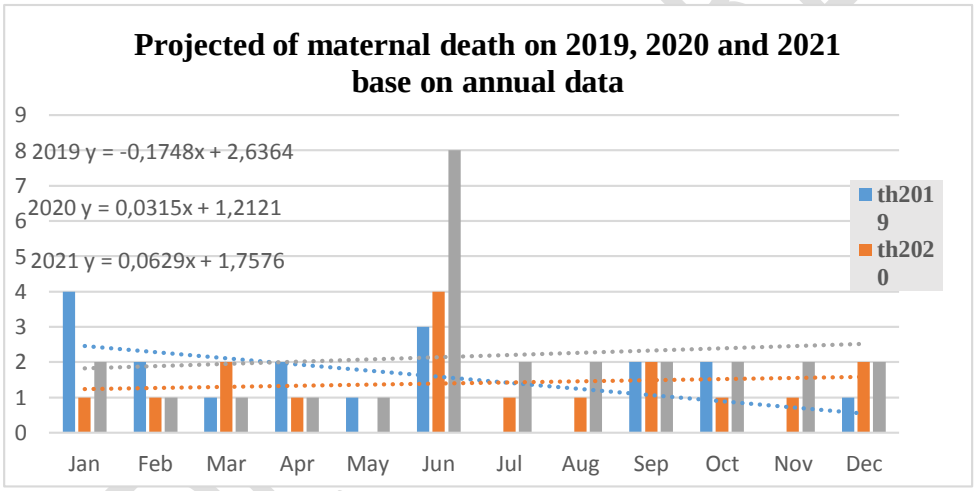


Fig 8. Maternal death cases is projected for 2019, 2020, and 2021 base on annual data

According to fig 7, the maternal mortality cases prediction from 2019 to 2021 based on annual data, the trend of increasing maternal mortality occurs in 2020 (y=0.0315x + 1.2121), then 2021 (y = 0.0629x+1, 7576), and finally 2019 (y = - 0.1748+2.6364).

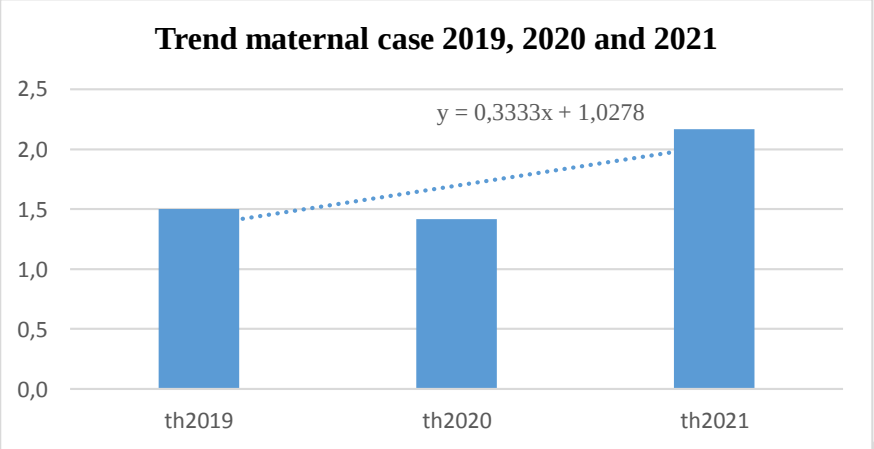


Fig 9. Trends in combined maternal death case data between 2019 and 2021

Maternal mortality cases between 2019 and 2021 show a positive or growing trend (y=0.3333x+1.0278) based on the combined data (fig 8). This shows that the number of maternal deaths during the pandemic may increase. As most hospitals and health institutions are overcrowded with COVID-19 patients, services for pregnant women are being neglected. As a result, there may be incorrect management or delayed delivery in the hospital. This could be related to the concerns of some mothers about having their condition checked in the hospital for fear of contracting or transmitting COVID-19.

The frequency of maternal mortality owing to Covid-19 contributed 20% of the maternal mortality rate in Indonesia during the pandemic, according to national data (Indonesia). In July, 536 pregnant women were reported to have been infected with the coronavirus, a threefold rise over the previous month. Of those, 52 percent, or 278 pregnant women, tested positive for Covid-19 but showed no symptoms. [26] Obstetricians and gynecologists are on high alert since they are at risk of catching the corona virus as a result of this condition. [28] This pandemic has an influence on all parts of life, including the availability and quality of health care, particularly maternal and child health services. This service program has become a national priority because it affects maternal and neonatal mortality, which is a national problem. [29] Efforts undertaken during the Covid 19 outbreak were insufficient, resulting in three years of data in Semarang being insufficient

Data on Child/infant mortality case data in Semarang from 2019 to 2021

The government's top objective in the 2015-2019 National Preventive Development Plan is the Newborn Mortality Rate, which is a target for the Sustainable Development Goals that must be met by 2030 [30]. The Semarang City Government offers a comprehensive and high-quality service program, which includes integrated antenatal services provided by health workers through health services such as pregnancy, childbirth, postpartum, and family planning counseling, which includes promotive, preventive, curative, and rehabilitative counseling. satisfy every pregnant woman's right to high-quality antenatal care, allowing her to have a healthy pregnancy, give birth safely, and have a

healthy baby. The program's adoption has been fairly limited due to the policy of keeping a gap between minimizing the larger risk of getting COVID-19 during the COVID-19 pandemic.

Table 4 shows data on child (infant) mortality case in Semarang city in the period 2019 to 2021, as follows:

Table 4. Data on child/infant mortality cases in periode 2019 to 2021

Month	th2019	th2020	th2021
Jan	0	2	10
Feb	12	9	11
Mar	14	9	6
Apr	9	9	9
May	8	11	5
Jun	12	10	6
Jul	9	9	**11**
Aug	18	10	9
Sept	14	13	9
Oct	15	**17**	9
Nov	14	13	8
Dec	16	0	8
Avg	12	9	8

Based on the statistics in table 4, the largest child mortality cases occurred in August 2019 (18 cases), October 2020 (17 cases), and July and February 2020 (11 cases each)

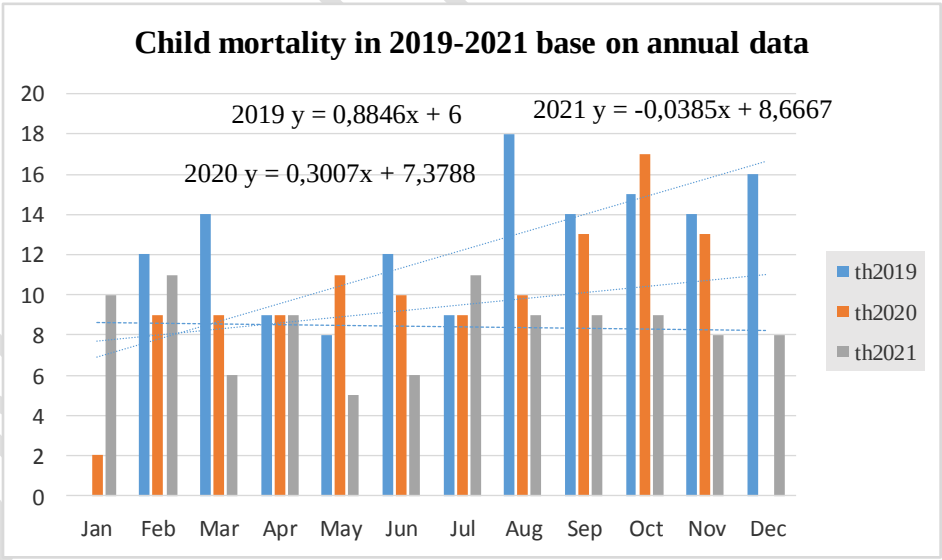


Fig 10. Child (infant) mortality cases for 2019, 2020, and 2021 base on monthty data

According to annual statistics on child mortality cases, the biggest number of child deaths occurred in 2019 (0.8846x+6), next in 2020 (y=0.3007x+7.3788), and finally in 2021 (y= -0.0385x+8.6667). People have understood and implemented wearing masks, maintaining distance, and washing hands with soap in 2019 and 2020, and incidences of COVID-19 transmission have decreased in 2021 because people have understood and implemented wearing masks, maintaining distance, and washing hands with soap. Simultaneously, the program to reduce child mortality instances has begun to be properly executed and intensive

Figure 9 depicts the child (infant) mortality cases for the years 2019, 2020, and 2021, based on annual data, as follow:

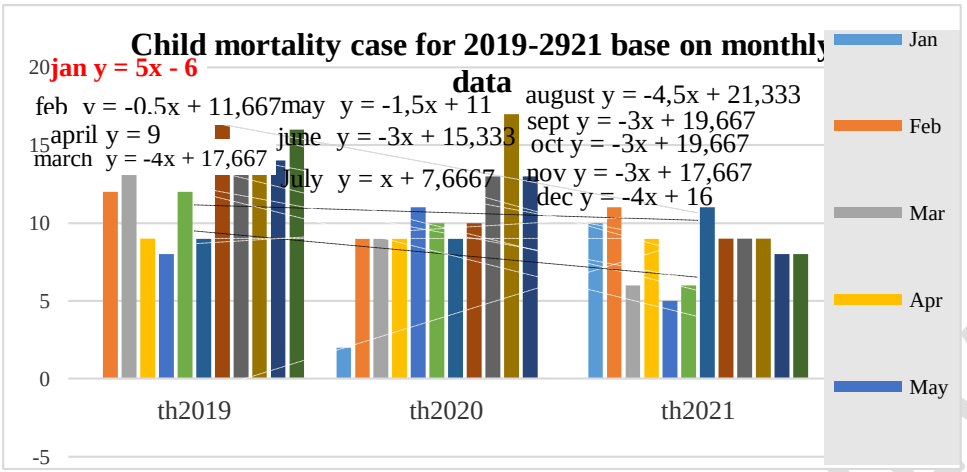


Fig 11. Child (infant) mortality cases for 2019, 2020, and 2021 base on annual data

Figure 9 shows the highest trend with the linear equation model y = 5x – 6) for child (infant) mortality cases for 2019, 2020, and 2021 based on annual data.

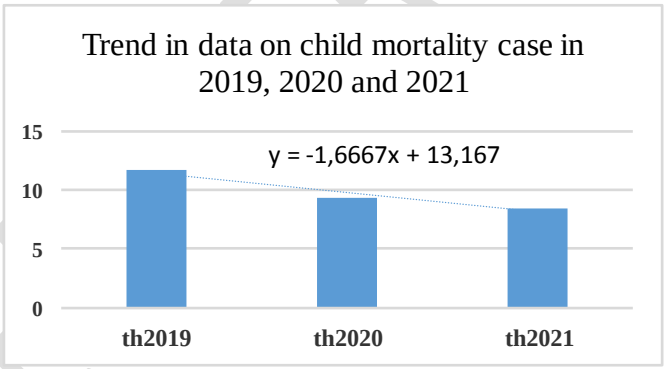


Fig 12. Trends in combined child (infant) mortality case data between 2019 and 2021

Base on fig 10 data Trends in combined child (infant) mortality case data between 2019 and 2021, there is a decreasing trend with the equation model y = -1.6667x+13.67

Despite the fact that the Semarang city government's program was successful in lowering newborn death rates. During this pandemic, it's important to keep an eye on things since an increase in covid 19 transmission, particularly cases caused by virus mutations, is still a potential [21]

A linear regression equation model is a method for predicting an event's quality or quantity. This is because it can be used as a starting point for formulating decisions or policies by estimating several parameters as a summary.

CONCLUSION.

In the city of Semarang, the highest rates of stunting were recorded in December (1504 cases) in 2019, March (1381 cases) in 2020, and July in 2021. The highest trend is described by the equation model y = 930 x - 813.33, while the incidence of stunting peaked in 2019 (y=57,217x+390.76) and decreased in 2020 (-71.115x+1007.3) and 2021 (y=-6,0978x+1772.8). Stunting is becoming more common in general (y= 485.25x+43.139)

In 2019, the highest incidence of Low Birth Weight (LBW) occurred in May (72 cases), September (82 cases) in 2020, and April in 2021. (59 cases). Low birth weight instances peaked in July (y = 930 x - 813.33), then declined in 2019 (y = -2.8042x + 71.561), before beginning to rise in 2020 (y=0.2972x +52,985) and 2021 (y=0.5245x+37,258). In general, the BBRL trend is downward (y = = 6.3333x + 62.639).

January 2019 (4 cases), June 2020 (8 cases), and 2020 have the greatest maternal death rates (8 cases). In June (y = 2.5 x), the biggest increasing trend occurred, while the prediction for 2019 showed a decline (y = - 0.1748+2.6364), but an increase in instances in 2020 (y=0.0315x + 1.2121), and similarly in 2021 (y = 0.0629x+1, 7576). Between 2019 and 2021, the number of cases of maternal death increased (y=0.3333x+1.0278).

August 2019 (18 cases), October 2020 (17 cases), July (11 cases), and February 2020 were the months with the most child deaths (11 cases). January has the greatest child death rate (y = 5x-6) and the trend for the incidence of child mortality is by year period, with the highest child mortality in 2019 (0.8846x+6), 2020 (y=0.3007x +7,3788), and finally 2021 (y = - 1.6667x+13.67). Child mortality is decreasing on a global scale.

DATA AVAILABILITY

The working papers and accompanying information files contain all necessary information. This research will aid researchers in identifying critical areas related to stunting, low birth weight, maternal mortality, and infant mortality in Semarang, Indonesia.

CONSENT As per international standard or university standard, respondents' written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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