**The Correlation of Environment Factors and Maternal Mortality Risk**

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**Abstract**

Maternal mortality has become a serious health problems over the world. Maternal Mortality Rate (MMR) is one of the main indicators which reflects the level of prosperity and health status of the country The identification of the factors which contribute to maternal mortality was important efforts to reduce MMR. Water and sanitation are two of many environment factors that independently contribute an important role in maternal mortality outcomes. Studies to find out how the correlation of water and sanitation to maternal mortality has still few, especially in developing countries. This study aim to analyze the correlation of and water and sanitation quality to maternal mortality risk in Bandar Lampung. This study used analytic epidemiology method with secondary data. Data were collected by medical records in Dr. H. Abdul Moeloek and environmental surveillance of Bandar Lampung regency. Population in this study were pregnant woman lived in Bandar Lampung and give birth at Dr. H. Abdul Moeloek Hospital in 2017. Total of 285 pregnant woman (61,9%) with good quality water and 152 have good sanitation (33%) were assessed in this study. Chi-square analysis showed water and sanitation quality were associated with increased risk of maternal mortality and logistic regression test analysis showed that pregnant women with poor sanitation had an increase of 15,572 times compared with good sanitation. While pregnant women with poor water quality have increased of 4.494 times to have mortality compared to pregnant women with good water quality (p = 0.031 and p = 0,000). This study shows that water and sanitation quality was associated with the increased of maternal mortality by the mechanisms.

**Keywords:** environment, MMR, water, sanitation

**Introduction**

Maternal mortality has become a serious health problems over the world, both in developing and developed countries. Maternal Mortality Rate (MMR) is one of the main indicators which reflects the level of prosperity and health status of the country, (Kemenkes RI, 2014). The Maternal Mortality Rate was defined as the number of maternal death during pregnancy and/or within 42 days after pregnancy, irrespective of the duration or site of the pregnancy, from any cause related or aggravated by the pregnancy or its management, but not from accident or incidental causes per 100.000 live births, (Ibrahim, 2016; Kemenkes RI, 2014).

The high number of maternal deaths in some areas of the world reflects inequality in acsess to quality health services and highlights the gap between rich and poor. Even world’s and MMR have shown the decreased during 1990-2017 periods, but not on the developing countries. In 2017 the MMR in low income countries was 462 per 100.000 live births, while in high income countries was 11 per 100.000 live births.  The situation might becaused by women in developing countries have a higher frequencies of pregnancies and have more risk of maternal death due to pregnancy than women in developed countries. WHO reported the women in developing countries have higher risk of maternal death with ratio 1:5400 vs 1:45, in developed countries developing countries respectivly, (WHO, 2019).

Indonesia is one of the developing country with high maternal mortality rate in South Asia. WHO have reported the MMR in 2017 over the world was 211 per 100.000 live births, while in Indonesia in 2014 base of Riskesdas Indonesia’s data was reported 305 per 100.000 live births. The situation make Indonesia’s has second highest rank in ASEAN after Laos. The MMR in Indonesia and the world still not yet reached the target of Sustainable Development Goals (SDGs), which is at 2030 the MMR should reach below 70 per 100,000 live births, (Kemenkes RI, 2014; WHO, 2019).The identification of the factor which contribute to maternal mortality was important efforts to reduce MMR, because 94% of maternal death in the World occurred in low-resource settings, and most could have been prevented, (WHO, 2019). McCarthy & Maine (1992) in their study explain that maternal death is complex which can be caused due to various of medical and non-medical factors.

There are three general stages or components that might play a role in the process of maternal mortality: closed, intermediate and distant determinant. Close determinants are a sequence of situations or outcomes that culminates in either disability or death; these outcomes are pregnancy complications. Intermediate determinants are factors most directly influenced by five sets: the health status of the woman; her reproductive status; her access to health services; her health care behavior (including her use of health services); distant determinants factors are socioeconomic and cultural background factors, (Bari, 2015; McCarthy & Maine, 1992). Socioeconomics have play role in maternal mortality process by inadequate health care were given to the pregnancies woman and the behavior of woman it self, (Fink et al., 2011; Golding et al., 1989; Urassa et al., 1995).

Water and sanitation are two of many environment factors that independently contribute an important role in maternal mortality outcomes. Poor water and sanitation were related to increased maternal mortality rate due to some of direct and indirect mechanisms, (Benova et al., 2014; Cheng et al., 2012). One accepted mechanism is through poor hygiene at the time of delivery, whereby infection may be introduced to the genital tract either via poor hand hygiene or contaminated surfaces. The use of poor water and sanitation can be lead to infection and sepsis which are 3rd higher maternal mortality cause. The mechanisms is through by daily use of water, and at delivery process also by health behaviour. The latest global estimates there are 8% of all maternal deaths are caused by sepsis, (Cameron et al., 2019; Campbell et al., 2015; Cheng et al., 2012; WHO & UNICEF, 2012).Poor sanitation practices can increase risk of infection, induce stress during pregnancy and may contribute to adverse pregnancy outcomes even death, (Padhi et al., 2015). It was estimated in individual-level studies showed that women in households with poor sanitation had 3.07 (95% CI 1.72–5.49) higher odds to get health problems and maternal mortality, (Benova et al., 2014).

Studies to find out how the correlation of water and sanitation to maternal mortality has still few, especially in developing countries. Indonesia is one of developing countries with high MMR, and the studies to find out the correlation of the determinant to contributed maternal mortality were never conducted. It is necessary to conduct an analysis of the correlation of water and sanitation quality to maternal mortality.

**Methods**

This study was an analytic epidemiology method crossectional design to analyze the correlation of water and sanitation quality to risk of maternal death due to maternal complications during pregnancy in Bandar Lampung regency. Population in this study were pregnant woman domiciled in Bandar Lampung and delivery at Dr. H. Abdul Moeloek Hospital in 2017. Sample in this study are case and control group. Case group consist of all occurrences of mother’s death (16 cases of maternal death) in Bandar Lampung 2017 and control group consist of 445 pregnant woman domiciled in Bandar Lampung and delivery at Dr. H. Abdul Moeloek were collected with purposive sampling. Data were analyzed by logistic regression test. Data were collected with medical records in Dr. H. Abdul Moeloek hospitals and environment surveillance of Bandar Lampung regency.

Water quality was water to used for daily with fulfill the health quality requirements and can be consumed after cooked. The health quality requirements according to physically requirements, chemical content, and not contamination with bacteriological (*coliform*), (Kementerian Kesehatan RI, 1990). While the sanitation is an effort to actualize hygiene and sanitary behavior to improve community health status which consists of using closed latrine, washing hands, managing water and household food, processing of household waste, and secured of access to household liquid waste, (Kementerian Kesehatan RI, 2014).

**Result**

Total of 461 pregnant woman were analyzed in this study with 285 pregnant woman (61,9%) have good quality water and 152 have good sanitation (33%) (table 2).Statistical analysis (chi-square) showed water and sanitation were associated with increased risk of maternal mortality (p = 0.031 and p = 0,000) (table 3).

The logistic regression was conducted in this study to analyze the increased risk odds of maternal mortality contributed by water and sanitation. The results showed that pregnant women with poor sanitation had an increase of 15,572 times compared with good sanitation. While pregnant women with poor water quality have increased of 4.494 times to have mortality compared to pregnant women with good water quality.

**Table 2: Distribution of water and sanitation qualities**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Mother’s death | | Pregnant woman | | Total | |
| n | % | n | % | n | % |
| Water quality | Good | 14 | 4.9 | 271 | 95.1 | 285 | 61.9 |
|  | Poor | 2 | 1.1 | 174 | 98.9 | 176 | 38.1 |
| Sanitation | Good | 14 | 9.2 | 138 | 90.8 | 152 | 33 |
|  | Poor | 2 | 0.6 | 307 | 99.4 | 309 | 67 |

**Tabel 3: The correlation of water and sanitation qualities to maternal mortality**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | *p* | OR | IK95% | |
| Min | Maks |
| Water quality | Good | 0.031 | 4.494 | 1.009 | 20.018 |
|  | Poor |  | Ref |
| Sanitation | Good | 0.000 | 15.572 | 3.492 | 69.453 |
|  | Poor |  | Ref |

**Discussion**

Reducing the MMR have been concern of all countries in the world, especially in developing countries which have the biggest MMR in the world, (WHO, 2019).Various works have been done to reduce the MMR, one of its by the identification of factors which contribute to maternal mortality to find out which sectors to be improved to prevent maternal mortality. This study was concern to analyze the correlation of water and sanitation quality to maternal mortality. The results showed there are still 38,1% people use poor water as daily needs. This results should to be concern, because Bandar Lampung city is Capital city of Lampung Province.

Poor water and sanitation can affect the maternal health by some mechanism: 1. “In-water” associations: (a)inorganic contaminants, (b) ‘water-system’ related infections, (c) ‘water-based’ infections, and (d) ‘water borne’ infections. 2. ‘Behaviour’ associations: (e) Behaviours leading to water-washed infections, (f) Water-related insect vector infections, and (g-i) Behaviours leading to non-infectious diseases/conditions.The ‘in-water’ associations related to two main areas: inorganic contaminants and infectious agents. Many settings have high naturally occurring levels of arsenic and fluoride in groundwater. Studies have linked exposure to arsenic in drinking water with higher risks of spontaneous abortion and stillbirth, (Cherry et al., 2008; Milton et al., 2005; Rahman et al., 2007). While exposure of mercury, potassium was associated with spontaneous abortion, (Aschengrau et al., 1989).

Behaviour of water utilization also have important role to health status of pregnancy women which can lead to maternal health problems if it’s not interfered with attention. There are many examples of water borne infections related to behaviour of water ulitilization. The association between puerperal sepsis and poor hygiene of birth attendants. The causal agent of water washed infection were *Streptococcus A* and *E.Coli*. Sepsis in pregnancy or the puerperium is mainly caused by unhygienic practices and poor infection control, including lack of hand-washing, unclean surfaces and unhygienic vaginal examination or cord-cutting in health facilities or in the home, (Ali et al., 2006; Darmstadt et al., 2009).

This study has analyze the sanitation quality as others environment factors which have important role to contribute high maternal mortality. The results showed there are 67% people in Bandar Lampung still have poor sanitation which use in theirs daily. And the results of multivariate analysis showed the pregnant women with poor sanitation had 15,572 higher odds to have maternal mortality risk, and pregnant women with poor water quality had 4.494 higher odds (*p=0.031* dan *p=0.000*). The results obtained in this study are consistent with several studies before, Godefay *et al*, (2015) in his study before was aim to analyze the correlation of sanitation and maternal mortality which linked to other factors such as population density, availability of health services, and access to health services.

Environment factors and maternal health are both systems issues who should keep on stability. Good water and sanitation quality are essential factors to prevent maternal mortality and morbidities, (Carlson, 2011). Poor sanitation practices can promote infection, induce stress during pregnancy and may contribute to adverse pregnancy outcomes even death. Adverse pregnancy outcomes among woman with open defecation practice compared with access to latrine were 2,38 and 2,22 odds ratio, (Padhi et al., 2015). Fifteen percent of all maternal mortality case in the world were caused by infections during 6 weeks postpartum due to hygiene issues of delivery, (Carlson, 2011).

Base on the results and theories, the vailability of good water and sanitation in daily use were important to decrease maternal mortality. This problems are not only for pregnant woman/families but also should be concern of the government because high MMR was the indicators to reflects the level of their prosperity and health status.

**Conclusion**

Increased of maternal mortality has a strong relation by the availability of good water and sanitation quality. Poor water quality and sanitation will increase the risk of maternal mortality by 4,494 and 15,572 higher odds (p = 0.031 and p = 0,000).

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