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# Analysis of the Survival of Children Under Five in Indonesia and Associated Factors

Annisa Nur Islami Warrohmah<sup>1</sup>, Sarni Maniar Berliana<sup>2</sup>, Nursalam Nursalam<sup>3</sup>, Ferry Efendi<sup>3\*</sup>, Joni Haryanto<sup>3</sup>, Eka Misbahatul M Has<sup>3</sup>, Elida Ulfiana<sup>3</sup>, Sylvia Dwi Wahyuni<sup>3</sup>

<sup>1</sup>Statistics Indonesia (BPS), Kota Metro, Lampung

<sup>2</sup>Institute of Statistics- Statistics Indonesia (BPS), Jakarta

<sup>3</sup>Faculty of Nursing, Universitas Airlangga, Surabaya

Email: ferry-e@fkip.unair.ac.id

**Abstract.** The under-five mortality rate (U5MR) remains a challenge for developing nations, including Indonesia. This study aims to assess the key factors associated with mortality of Indonesian infants using survival analysis. Data taken from 14,727 live-born infants (2007–2012) was examined from the nationally representative Indonesian Demographic Health Survey. The Weibull hazard model was performed to analyse the socioeconomic status and related determinants of infant mortality. The findings indicated that mother factors (education, working status, autonomy, economic status, maternal age at birth, birth interval, type of births, complications, history of previous mortality, breastfeeding, antenatal care and place of delivery); infant factors (birth size); residence; and environmental conditions were associated with the childhood mortality. Rural or urban residence was an important determining factor of infant mortality. For example, considering the factor of a mother's education, rural educated mothers had a significant association with the survival of their infants. In contrast, there was no significant association between urban educated mothers and their infants' mortality. The results showed obvious contextual differences which determine the childhood mortality. Socio-demographic and economic factors remain critical in determining the death of infants. This study provides evidence for designing targeted interventions, as well as suggesting specific needs based on the population's place of residence, in the issue of U5MR. Further interventions should also consider other identified variables while developing programmes to address infant's needs.

**Keywords:** survival analysis, infant's mortality, Indonesian DHS

## 1. Introduction

Under-five Mortality (U5MR) remains a huge challenge in Indonesia despite concerted efforts by all sectors [1]. Although U5MR in Indonesia showed a significant decreased in recent years, achieving the Sustainable Development Goals (SDGs) target requires greater attention on this issue [2-3]. In addition, progress has been very slow, particularly among ASEAN countries [3].

Based on the 2007 Indonesia Demographic and Health Survey, the decline in Indonesian U5MR from 1991 to 1997 is quite sharp, but then sloped until 2012 [4]. Innovative initiatives have been deployed to address maternal and child health problems such as the *Suami Siaga* program [5], *Desa Siaga* [6] and other initiatives among stakeholders. Looking at the provincial data, there were differences in the achievement of U5MR between provinces across Indonesia [7]. As stated in the SDGs target, Indonesia should reduce Infant Mortality Rate (IMR) and U5MR by 25 deaths per 1000 live births



by2030 [3,8]. To achieve this target, it is imperative to examine factors associated with U5MR, particularly in Indonesia.

Previous studies have shown that, among Ethiopian mothers, U5MR is associated with mothers' education level, sex and mothers age at first birth [9]. Similar findings from Bangladesh have shown that size of child and mother's education level as having potential determinants in U5MR [10]. Other factors, such as inadequate housing and moderate housing material, were among predictors of U5MR in Nigeria [11]. In Indonesia's context, extensive research has been done to explore this issue [12, 13]. However, study with big sample size and utilising rigorous study methods has not been done to address this problem. In this paper, we focus on the factors associated with U5MR, and also examine the extent to which factors relate to geographical condition (urban and rural group).

## 2. Method

The data from the 2012 Indonesia Demographic and Health Survey (IDHS) as nationally representative data are utilised in this study. IDHS is a nationally representative household survey that collects data on a wide range of population, health and nutrition indicators [14], and has been conducted approximately every five years since 1987–1992 with the aim of improving the health of Indonesia's population [14]. Two-stage stratified cluster sampling was employed to determine the sample size. The data used in the present study were derived from the 2012 surveys. Survival analysis was used for analysis to scrutinise the event of death or progression as equal to the time from diagnosis to death [15].

Survival information was obtained from 14,727 singleton live-born infants of the most recent birth of 2012 IDHS. Our analysis was restricted to ever-married women aged 15–49 years. The dependent variable in this study was childhood mortality. The independent variables or risk factors for childhood mortality were mother factors (education, working status, autonomy, economic status, maternal age at birth, birth interval, type of birth, complications, history of previous mortality, size at births, breastfeeding, antenatal care and place of delivery); infant factors (birth size); residence; and environmental conditions. These identified factors were taken from the Mosley and Chen framework of factors determining child survival in developing countries [16]. Descriptive and inferential statistics were utilised to identify factors associated with U5MR.

## 3. Results and discussion

Of the 14,727 singleton live-born infants, there were 300 under-five child deaths across provinces of Indonesia. Table 1 presents the characteristics of respondents of children under the age of five for each covariate considered in the analysis. It shows that, among the educational level of mothers, 46.5% had attended middle schools. More than half the mothers had a job or were economically empowered (55%) and had a high level of autonomy (71.5%). The data show that the majority of Indonesian mothers went to hospital for delivery of their babies (89.7%). The table also summarises the variables for all the other covariates considered in this study.

In the survival analysis with Weibull distribution, the results showed the likelihood test value of  $526.98 > X^2_{(19;0.1)}$  with a p-value less than 0.1, which means that the model with covariate is better in describing the data of survival of Indonesian U5MR. Based on the hazard model, all variables significantly affected the survival of childhood mortality (Table 2).

A child from a low-educated mother has a risk of 1,602 times to experience under-five mortality compared with a toddler from a high educated mother. The role of education as the key to reducing child mortality is well known in general in literature worldwide [17-19].

Indonesian mothers who were working having a risk of 2.22 times to experience U5MR compared with children from mothers who are not working. This aligns with a study by Basu who stated that occupation might influence a mother's time in paying attention to the baby [20].

**Table 1.** Demographic characteristics of mother and child (n=14,727)

Variable	Category	n	%
Mother's education	Low	1878	12.8
	Middle	6839	46.5
	High	6006	40.8
Working status	No	6632	45.0
	Yes	8095	55.0
Autonomy	Low	818	5.6
	Medium	3384	23.0
	High	10525	71.5
Economic status	Low	7202	48.9
	Middle	2718	18.5
	High	4807	32.6
Age	< 20 years	1376	9.3
	20-34	10936	74.3
	> 35 years	2415	16.4
Birth interval	<24	1147	7.8
	>24 & single	13580	92.2
Type of birth	Single	14634	99.4
	Twins	93	0.6
Complications	No	12868	87.4
	Yes	1859	12.6
History of previous mortality	No	13341	90.6
	Yes	1386	9.4
Residence	Urban	6766	45.9
	Rural	7961	54.1
Size at births	Average	7791	52.9
	Risk	6936	47.1
Environmental conditions	Not poor	8114	55.1
	Poor	6609	44.9
Breastfeeding	Yes	14031	95.3
	No	696	4.7
Antenatal care	At least 4	9947	67.5
	Less than 4	4780	32.5
Place of delivery	Hospital	13215	89.7
	Out of hospital	1512	10.3

**Table 2.** Estimation of Weibull regression model parameters of childhood survival (n=14,727)

Variables	Coefficient	Hazard ratio	P>z
Education			
Low	0,471	1,602	0,014**
Middle	0,265	1,303	0,078*
Occupation	0,774	2,169	0,000**
Autonomy			
Low	0,584	1,793	0,004**
Medium	0,474	1,607	0,000**
Economic status			
Low	0,352	1,421	0,068*
Medium	0,241	1,273	0,185
Age			
<20 years	0,451	1,569	0,015**
>=35 years	0,285	1,330	0,044**
Birth interval	0,631	1,880	0,000**
Type of birth	0,807	2,240	0,027**
Complications	0,363	1,438	0,018**
History of previous mortality	0,495	1,641	0,002**
Size at birth	0,212	1,236	0,072*
Residence	0,248	1,281	0,072*
Environmental conditions	0,310	1,363	0,045**
Breastfeeding	2,689	1,471	0,000**
Antenatal care visit	0,490	1,632	0,000**
Place of delivery	0,347	1,415	0,093*
_cons	-6,765		
/ln_p		-1,282	
P		0,278	
1/p		3,603	

Children from mothers of low autonomy category had a risk of 1.79 times to experience mortality compared to children from mothers who had high autonomy category. This supports the research of Williamson and Boehmer using data from 96 countries, including Indonesia, which found strong evidence showing autonomy is a significant variable and an important factor of survival of under-five children [21].

Children from low economic status households have a risk of 1.42 times to experience under-five mortality compared with households from high economic status. In a similar vein, studies in 55 developing countries using household asset indexes to measure wealth found that child mortality was significantly higher in low-status households than in high-status households [22].

This study shows that children born to a mother at the age of less than 20 years have a risk of 1.57 times to experience under-five mortality compared to under-five children born to ideal age (20-34 years old). This view is supported by Bhalotra and Soest (2008) who write that women who give birth too young or too old have a higher risk of child mortality [23].

Children born with birth interval less than two years have a risk to experience under-five mortality of 1.88 times compared to infants born with birth interval of 24 months or more. Children

born as twins have a risk of 2.24 times to experience under-five mortality compared to children born who are not twins. Interestingly, children who have experience of complications while in the pregnancy period have a risk of 1.44 times to experience under-five mortality compared to children who have no experience of complications. Children born with a history of sibling death has a risk of 1.64 times for experience under-five mortality compared to children born without a previous sibling's death. The findings also similar direction with bigger size at birth, reside in rural, worse environment, never had breastfeeding and less than four antenatal care visits having higher risk to experience under-five mortality. These results match those observed in earlier studies [20-25].

Findings have shown that children born in other than hospitals have a risk of 1,415 times to experience under-five mortality compared to infants who were born in hospital. Study conducted in Pakistan showed that the place of delivery significantly associated with childhood survival [24]. Similarly, Buwembo stated that the risk of mortality is 1.9 times in under-fives who were born in places other than the hospital compared to children who were born in hospital [25].

These results indicate that more specific interventions may be those that target individual level rather than group or communities level. In the same vein, another study of Indonesia revealed that improving access for women itself may be benefit to enhance maternal health and diminish mortality and morbidity [26]. The interventions should be embedded in social intervention conducted by the Government of Indonesia.

#### 4. Conclusion and suggestions

The U5MR of Indonesian children indicates a decline, but still slow progress despite the new indicators determined by SDGs. Socio-demographic and economic factors remain critical in determining the health of infants. Government programmes must address issues in education, empowerment, age and women's health issues. The results also suggest that government initiatives should direct towards the economic status of population. Specific targets may be better rather than community targets in order to accelerate the interventions. Poor and marginal mothers, particularly from coastal regions, need greater attention to improve the outcome.

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