Trends in Determinants of Birth Interval based on Data from the Indonesian Demographic Health Survey in 2007, 2012, and 2017

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Abstract

Background: Fertility is the main component of population dynamics that determines the population structure of a country. One method to measure fertility is to analyze the birth interval. This study aimed to identify determinants of birth interval based on the Indonesian Demographic and Health Survey (IDHS) data in 2007, 2012, and 2017.

Methods: This study design was descriptive using IDHS data from 2007, 2012, and 2017 with a cross-sectional study design. Samples were mothers who gave birth to their last living child in the last five years.

Results: In the IDHS 2007, the birth interval at risk (<24 months) was 11.8%, increased in the 2012 IDHS to 12.1%, and decreased in the 2017 IDHS to 9.8%. In the three-period IDHS, the same determinants of the birth interval were discovered, such as the age of the woman, duration of breastfeeding, use of contraception, the status of the child before the last child, mother's education level, and wealth quintile. However, in 2007, the sex of the child before the last child and the number of surviving children also influenced the birth interval. In 2017 the number of children who were still alive also affected the birth interval. The most dominant factor influencing the occurrence of short birth intervals after controlling for other variables was the survival status of the previous child.

Conclusion: The short birth interval is the most prevalent in the 2012 IDHS. Optimal birth interval has the potential to improve maternal, neonatal, and infant health.

Keywords: Birth interval, female reproduction, the health of mother and child

Introduction

Indonesia as one of the developing countries in Southeast Asia faces a big challenge, namely an excessive population, which is around 270 million people. Indonesia's total fertility rate (TFR) has decreased from 2.6 in 2007 to 2.4 in 2017 based on the 2007 and 2017 IDHS data.[1,2] Even though it has decreased in 10 years, this is still not in line with the Indonesian government plan. Fertility is one of the factors that play an important role in population growth.[3]

Fertility is the major component of population dynamics that determines the population structure of a country. Birth interval (time between two consecutive live births) is a more acceptable method of measuring fertility than other methods.[4] Delayed marriage, higher education, smaller family, absence of child death experience, and living in food secured households were associated with the small number of children. Fertility was significantly higher among women with no child sex preference.[5] Fertility behavior is usually influenced by the interaction of several biological, socioeconomic, and demographic factors. Birth interval is a good index of current fertility changes.[3]

The use of contraception is one of the factors that affect birth interval which has been supported through government programs. This is made clear by a study in Ethiopia that mentions the importance of contraceptive use factors in influencing birth interval. The short birth interval is still a concern for women due to religious factors,

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 https://doi.org/10.15850/amj.v9n2.2643

length of breastfeeding, unwanted pregnancy, and not using contraception. Increasing access and coverage of contraceptive use as well as involving religious leaders in family planning programs are important strategies that need attention.[6]

Factors that influence the family in determining the decision to adjust the birth interval include socioeconomic factors, partner psychology, partner age, and cultural factors. However, not all couples of childbearing age know the benefits of long-term pregnancy spacing, so there are still many couples of childbearing age who have children who are too close or too far apart.[7] In addition, several studies conclude that the factors that affect birth interval include; gender of the last child, maternal age, length of time breastfeeding before conception and pregnancy, use of contraception, and place of delivery of the last child.[8]

Birth intervals less than 24 months are considered short and intervals more than 5 years are considered long. Both short and long intervals are considered inadequate.[9] Birth interval that is very short or too long directly affects the occurrence of risky pregnancies. Pregnancy with a distance that is too close can cause bleeding, anemia, and premature rupture of membranes, so couples of childbearing age need to be able to plan and determine the spacing of pregnancies.[7] Besides being risky for the mother giving birth, the short birth interval is also a risk for the baby. The results of another study in Jambi[10] stated that respondents who had a short birth interval had a 1.94 times risk of experiencing low birth weight (LBW) compared to respondents who had an optimal birth interval. On the other hand, the long birth intervals can also affect the occurrence of preeclampsia. The incidence of preeclampsia is more at risk at birth intervals <2 years and birth ≥5 years.[11] This study aimed to identify determinants of birth interval based on Indonesian Demographic and Health Survey (IDHS) data in 2007, 2012, and 2017.

Methods

This study used the data collected in the Indonesian Demographic and Health Survey (IDHS). In 2007, 2012, and 2017 IDHS was conducted by the National Population and Family Planning Board (*Badan Kependudukan dan Keluarga Berencana Nasional*, BKKBN), Statistics Indonesia (*Badan Pusat Statistik*, BPS), and the Ministry of Health (*Kementerian Kesehatan*, Kemenkes) with a nationally representative sample. The sample frame of the IDHS was the master sample of Census Blocks (CBs) from the 2000 and 2010 Population Census. The frame for the household sample selection was the updated list of ordinary households in the selected census blocks. The IDHS sample was selected using a stratified, two-stage cluster design and CBs was the sampling unit for the first stage. For the 2017 IDHS, a representative sample of approximately 47,963 households from 1,970 CBs was selected. In the first stage, 1,970 CBs were selected from the list of enumeration areas based on the sampling frame. In the second stage, a complete listing of 25 households was carried out in each selected CBs. The analyzes presented in this study on birth interval in 2007, 2012, and 2017 IDHS was based on the 9,980, 10,703, and 10,446 women respectively who had at least one birth during a five-year period selected from the IDHS data.

Variable observed for this study was the age of the woman at the time of delivery of the child before the last child, the sex of the child before the last child, duration of breastfeeding for the previous child, number of surviving children, contraceptive use, the status of the child before the last child, mother's education level, place of residence, and wealth quintile.

The data were analyzed in two phases. First, descriptive analysis was used to provide an overview of birth interval by an independent study. Bivariate analysis using the chi-square test to determine the significance of the relationship between birth interval and the independent variables studied. Second, the likelihood ratio test and Wald test were used in multivariate logistic regression analysis. Multivariate logistic regression analysis of the determinants of the birth interval was performed.

The IDHS data collection was downloaded from the DHS website in compliance with the Access Policy (https://microdata.worldbank.org/index.php/catalog/3477). The procedures and questionnaires for IDHS were following the Standard DHS survey protocol approved by the ICF Institutional Review Board (IRB) and conforming with the U.S. Department of Health and Human Services regulations for the Protection of Human Subjects (45 CFR 46) (https://dhsprogram.com/methodology/Protecting-the-Privacy-of-DHS-Survey-Respondents.cfm). The ethical clearance of the 2017 IDHS has referred to the DHS-7 project which was an ethical review carried out by ICF IRB on March 11, 2015.

Results

The results showed that in the 2007 IDHS, the risk birth interval (<24 months) was 11.8%, increased in the 2012 IDHS by 12.1%, and decreased in the 2017 IDHS by 9.8%.

The independent variables that affect birth interval in the 2007 IDHS, 2012, and 2017 are shown in Table 1. The age of women at risk (age <20 years and >35 years) decreased starting from the 2007 IDHS by 23.9%, in 2012 by 22%, and in 2017 by 18.2%. The gender of the previous child was more male in the 2007 IDHS, 2012, and 2017. Infants who were not breastfed in the 2007 IDHS were 11.6%, in 2012 it was 7.5%, and in 2017 it was 4.7%. The number of living children (>2 children) in the 2007, 2012, and 2017 IDHS were almost the same, namely 50.8%, 49.5%, and 48.9%. Similarly, the survival status of children was almost the same at 94.1%, 94.6%, and 95.7%. The use of contraception fluctuated from the 2007 IDHS, 2012 to the 2017 IDHS from 91.7%, 91%, and 93.6%. Women who did not go to school decreased from the 2007 IDHS, 2012 to 2017 by 4.5%, 3.5%, and 1.7%, respectively. Most of the respondents lived in rural areas in the 2007 IDHS, 2012, and 2017, namely 40.8%, 54.8%, and 51.3%. Furthermore, the wealth quintile fluctuated from 2007 by 23.3%, increased in 2012 to 30.6%, and in 2017 decreased to 27.9%.

In the IDHS 2017, the factors influencing the occurrence of birth intervals were the age of women, duration of breastfeeding, number of children born alive, use of contraception,

Table 1 Distribution of Research Variables from the IDHS Data for the Year 2007, 2012 and 2017*

Variable		IDHS 2007		IDHS 2012		IDHS 2017	
		n	%	n	%	n	%
Birth Interval	≥24 months	8,807	88.2	9,403	87.9	9,424	90.2
	<24 months	1,173	11.8	1,300	12.1	1,022	9.8
Age of woman at birth the child before the last child	20–35 years	7,592	76.1	8,350	78.0	8,548	81.8
	<20 and >35 years	2,388	23.9	2,353	22.0	1,898	18.2
Child's gender before the youngest child	Male	5,181	51.9	5,584	52.2	5,434	52.0
	Female	4,799	48.1	5,119	47.8	5,012	48.0
Breastfeeding duration	Not breastfed	1,153	11.6	805	7.5	495	4.7
	≤18 months	6,560	65.7	8,150	76.1	6,113	58.5
	>18 months	2,267	22.7	1,748	16.3	3,838	36.7
Number of children still alive	≤2 children	4,908	49.2	5,408	50.5	5,342	51.1
	>2 children	5,072	50.8	5,295	49.5	5,104	48.9
Ever used contraceptive	Yes	9,152	91.7	9,737	91.0	9,782	93.6
	No	828	8.3	966	9.0	664	6.4
Child status before the last child	Still living	9,389	94.1	10,125	94.6	9,999	95.7
	Death	591	5.9	578	5.4	447	4.3
Education level	No education	452	4.5	375	3.5	182	1.7
	Primary	4,602	46.1	3,849	36.0	3,097	29.6
	Secondary	4,299	43.1	5,334	49.8	5,620	53.8
	Higher	628	6.3	1,145	10.7	1,547	14.8
Place of residence	Urban	4,047	40.6	4,835	45.2	5,092	48.7
	Rural	5,933	59.4	5,868	54.8	5,354	51.3
Household wealth index	The poorest	2,324	23.3	3,270	30.6	2,917	27.9
	Poor	1,967	19.7	2,094	19.6	2.040	19.5
	Middle	1,966	19.7	1,917	17.9	1,908	18.3
	Rich	1,866	18.7	1,776	16.6	1,831	17.5
	The richest	1,857	18.6	1,646	15.4	1,750	16.8
		9,980	100.0	10,703	100.0	10,446	100.0

Note: IDHS= Indonesian Demographic and Health Survey, *IDHS secondary data, 2007, 2012, and 2017, processed

Table 2 Relationship between Birth Interval and Observed Independent Variables*

Variable	IDHS 2007 (n=9,980)				p-value	IDHS 2012 (n=10,703)				p-value	IDHS 2017 (n=10,446)				p-value
	≥24 months		<24 months			≥24 months		<24 months			≥24 months		<24 months		
Age of woman at birth the child before the last child															
20–35 years	6,767	89.1	824	10.9	0.000	7,445	89.2	905	10.8	0.000	7,740	90.5	808	9.5	0.016
<20 and >35 years	2,039	85.4	349	14.6		1,958	83.2	395	16.8		1,684	88.7	214	11.3	
Child's gender before youngest child															
Male	4,534	87.5	647	12.5	0.018	4,902	87.8	682	12.2	0.824	4,924	90.6	510	9.4	0.154
Female	4,273	89.0	526	11.0		4,501	87.9	618	12.1		4,500	89.8	512	10.2	
Breastfeeding duration															
Not breastfed	978	84.8	175	15.2	0.000	684	85.0	121	15.0	0.019	435	87.9	60	12.1	0.001
≤18 months	5,875	89.6	685	10.4		7,166	87.9	984	12.1		5,475	89.6	638	10.4	
>18 months	1,953	86.2	314	13.8		1,553	88.8	195	11.2		3,514	91.6	324	8.4	
Number of children still alive															
≤2 children	4,289	87.4	619	12.6	0.010	4,733	87.5	675	12.5	0.283	4,856	90.9	486	9.1	0.016
>2 children	4,517	89.1	555	10.9		4,670	88.2	625	11.8		4,568	89.5	536	10.5	
Ever used contraceptive															
Yes	8,139	88.9	1013	11.1	0.000	8,667	89.0	1,070	11.0	0.000	8,881	90.8	901	9.2	0.000
No	668	80.6	160	19.4		736	76.2	230	23.8		543	81.8	121	18.2	
Child status before the last-child															
Still living	8,408	89.6	980	10.4	0.000	9,011	89.0	1,114	11.0	0.000	9,100	91.0	899	9.0	0.000
Death	398	67.4	193	32.6		392	67.8	186	32.2		324	72.5	123	27.5	
Education level															
No education	394	87.3	58	12.7	0.000	298	79.5	77	20.5	0.000	150	82.4	32	17.6	0.000
Primary	4,148	90.1	454	9.9		3,452	89.7	397	10.3		2,861	92.4	236	7.6	
Secondary	3,757	87.4	542	12.6		4,710	88.3	624	11.7		5,089	90.6	531	9.4	
Higher	508	80.9	120	19.1		943	82.4	202	17.6		1,324	85.6	223	14.4	
Place of residence															
Urban	3,578	88.4	469	11.6	0.673	4,262	88.1	573	11.9	0.396	4,600	90.3	492	9.7	0.684
Rural	5,229	88.1	704	11.9		5,141	87.6	727	12.4		4,824	90.1	530	9.9	
Household wealth index															
The poorest	1,969	84.7	355	15.3	0.000	2,750	84.1	520	15.9	0.000	2,528	86.7	389	13.3	0.000
Poor	1,734	88.2	233	11.8		1,863	89.0	231	11.0		1,866	91.5	174	8.5	
Middle	1,764	89.7	202	10.3		1,719	89.7	198	10.3		1,775	93.0	133	7.0	
Rich	1,695	90.9	171	9.1		1,602	90.2	174	9.8		1,670	91.2	161	8.8	
The richest	1,644	88.5	213	11.5		1,469	89.2	177	10.8		1,585	90.6	165	9.4	
Total	8,807	88.2	1,173	11.8		9,403	87.9	1,300	12.1		9,424	90.2	1,022	9.8	

Note: IDHS= Indonesian Demographic and Health Survey, *IDHS secondary data, 2007, 2012, and 2017, processed

previous child's life status, women's education, and wealth quintile (Table 2). There were 7 factors affected birth interval in the IDHS 2017. Meanwhile, in the 2012 IDHS, the factors affecting the occurrence of birth interval were the age of women, duration of breastfeeding, contraceptive use, previous child's life status, women's education, and wealth quintile. There were 6 factors affected birth interval in the 2012 IDHS. In contrast to what happened in the

Table 3 Odds Ratio Based on Binary Logistic Regression for the Effect of Observed Independent Variables on a Birth Interval, IDHS 2007, 2012 and 2017*

Variable	IDHS 2007			IDHS 2012			IDHS 2017		
	OR	p-value	CI 95%	OR	p-value	CI 95%	OR	p-value	CI 95%
Age of woman at birth the child before the last child									
20–35 years	1.27	0.013	1.05–1.53	0.89	0.194	0.76–1.06	0.77	0.002	0.65–0.91
<20 and >35 years	1.00			1.00			1.00		
Child's gender before the youngest child									
Male	1.13	0.054	0.99–1.28	0.97	0.596	0.86–1.09	0.89	0.897	0.79–1.02
Female	1.00			1.00			1.00		
Breastfeeding duration									
Not breastfed	1.16	0.041	1.04–1.37	1.55	0.001	1.21–1.99	1.37	0.043	1.01–1.85
≤18 months	1.24	0.000	1.10–1.38	1.11	0.207	0.94–1.32	1.21	0.010	1.05–1.39
>18 months	1.00			1.00			1.00		
Number of children still alive									
≤2 children	1.08	0.283	0.94–1.23	0.95	0.407	0.84–1.07	0.73	0.000	0.64–0.84
>2 children	1.00			1.00			1.00		
Ever used contraceptive									
Yes	0.55	0.000	0.45–0.67	0.48	0.000	0.40–0.57	0.57	0.000	0.45–0.70
No	1.00			1.00			1.00		
Child status before the last child									
Still living	0.21	0.000	0.16–0.27	0.28	0.000	0.23–0.36	0.25	0.000	0.20–0.32
Death	1.00			1.00			1.00		
Education level									
No education	0.31	0.000	0.21–0.46	0.45	0.000	0.32–0.64	0.54	0.007	0.35–0.85
Primary	0.30	0.000	0.24–0.39	0.32	0.000	0.26–0.39	0.30	0.000	0.24–0.38
Secondary	0.51	0.000	0.41–0.65	0.49	0.000	0.40–0.59	0.50	0.000	0.42–0.60
Higher	1.00			1.00			1.00		
Place of residence									
Urban	1.15	0.075	0.98–1.34	1.21	0.009	1.05–1.39	1.24	0.006	1.06–1.45
Rural	1.00			1.00			1.00		
Household wealth index									
The poorest	2.28	0.000	1.78–2.90	2.36	0.000	1.87–2.97	2.42	0.000	1.89–3.09
Poor	1.69	0.000	1.33–2.14	1.52	0.000	1.21–1.93	1.35	0.019	1.05–1.73
Middle	1.31	0.019	1.05–1.65	1.30	0.026	1.03–1.64	1.01	0.943	0.78–1.30
Rich	0.99	0.957	0.79–1.25	1.09	0.468	0.87–1.37	1.15	0.246	0.91–1.46
The richest	1.00			1.00			1.00		

Note: IDHS= Indonesian Demographic and Health Survey, *IDHS secondary data, 2007, 2012, and 2017, processed

2007 IDHS, those that affected the occurrence of birth intervals were the age of the woman, the gender of the child, the number of children born alive, the duration of breastfeeding, the use of contraception, the previous life status of the child, women's education, and wealth quintile. There were 8 factors affected birth interval in the 2007 IDHS.

In the 2007–2017 range in the IDHS data for 2007, 2012, and 2017, the factors that influenced birth interval were the woman's age, duration of breastfeeding, contraceptive use, previous child's life status, education level, and household wealth index. The number of children born alive (parity) was significantly affected by the birth interval in the 2007 and 2017 IDHS, while the child's gender factor significantly affected on birth interval only in the 2007 IDHS.

The results of the multivariate analysis of the factors that influenced short birth interval can be seen in Table 3. The factor that did not affect the birth interval in the 3 IDHS periods was the gender of the previous child. In the 2007 IDHS, the factors that significantly influenced birth interval were the woman's age, duration of breastfeeding, contraceptive use, previous child's life status, education

level, and household wealth index. In contrast to the 2012 IDHS, the factors that significantly influenced birth interval were duration of breastfeeding, contraceptive use, previous child's life status, education level, place of residence, and household wealth index. Meanwhile, in the 2017 IDHS, the factors that significantly influenced birth interval were the woman's age, duration of breastfeeding, contraceptive use, previous child's life status, education level, place of residence, and household wealth index.

Discussion

Birth interval is the period between the previous child's birth date and the last child's birth date.[12] Optimal birth interval is beneficial for the health of the mother and baby for the better. Short birth interval (space between births less than 24 months) can be detrimental to the health of mother and child.[13] The ideal birth spacing is more than 24 months. Reproductive organs can prepare to get pregnant again at that time.[14] Therefore, it is very important to pay attention to the distance because it is closely related to the reproductive health of women and the health of children born. The risk of low birth weight (LBW) babies will also be reduced by keeping the distance between births.[8]

A healthy reproductive age range is a safe age for women to experience pregnancy and childbirth, which is 20 to 35 years.[15] Meanwhile, age <20 years and >35 years are the ages that are at risk for women to experience pregnancy and childbirth. This is because, after <20 years, a woman's uterus and pelvis have not yet grown to their adult size. Likewise, at the age of >35 years, maternal diseases such as hypertension, diabetes mellitus, obesity, and aging of the uterine organs (cell degeneration) are easy to occur. All of these are things that increase the risk for women who experience pregnancy and childbirth at that age.[16] The age of the mother referred to in this study is the age of the mother at the time of giving birth to the child before the last child. This is because this study used secondary data from the IDHS, so the birth spacing data were obtained by comparing the data of the last child with the previous child. The results of the bivariate analysis in this study found that maternal age significantly affected birth intervals in the 2007 IDHS, 2012, and 2017. Meanwhile, the results of multivariate analysis showed that women aged 20–35 years had a higher chance of experiencing short birth spacing than women aged <20 years and >35 years old.

The effect of women's age with short birth interval is probably due to the current trends of marriage. The delay in marriage causes the reproductive age to be shorter. Therefore, women who marry late will speed up the birth gap. This is confirmed by research which explains that women who experience social pressure due to late marriage will try to accelerate the birth rate (by shortening the birth distance).[16] This is also in line with research in Ethiopia which states that women who marry late are closely related to the birth interval. Women who marry late are getting older, so they should have children immediately after marriage and plan to have the desired number of children before the end of their reproductive period.[17]

Our study has shown that the duration of breastfeeding affects birth intervals. Women who do not breastfeed have a higher risk of experiencing shorter birth intervals compared to women who breastfeed >18 months (OR:1.16; OR:1.55; OR 1.37). This proves that the duration of breastfeeding in the previous child shows a relationship with a short birth interval. Three studies found an association between shorter birth intervals and shorter breastfeeding duration. One study found shorter birth intervals without breastfeeding compared to exclusive or mixed breastfeeding.[18] In line with research in Iran[19] that the duration of breastfeeding is an independent factor of birth interval. This shows that breastfeeding duration of more than 2 years is more likely to have a longer birth interval than a breastfeeding duration of less than 6 months.[19] It can be concluded that breastfeeding duration can prolong the birth spacing period by slowing down female fertility.

Couples need to set the ideal pregnancy distance, which is >2 years (Qur'an Surah Al Baqoroh verse 233), and thus, a mother should breastfeed her children for 2 full years because breastfeeding is a natural way to space out pregnancy up to 2 years. The T-interval that is too close results in the inability of families to take good care of their children, it is hoped that mothers will breastfeed their babies for up to 18 to 24 months so that the baby's nutrition is fulfilled.[20]

Birth interval is also affected by contraceptive use. Couples who do not use contraception have a higher chance of experiencing shorter birth intervals than couples who use contraception (OR 1.82 in the IDHS year 2007; OR 2.08 in the IDHS

year 2012; OR 1.75 in the IDHS year 2017). This is in line with a study in Ethiopia[6] that stated the importance of contraceptive use factors in influencing birth interval. Short birth interval is still a concern for Ethiopian women due to factors such as religion, length of breastfeeding, unwanted pregnancies and not using contraception.[6] Important strategies that need to be considered are the coverage of contraceptive use, increasing access, and involvement of religious leaders in family planning programs.[6]

In addition, the factor that most influences birth interval is the use of contraceptive methods.[12] The results of another study also stated that women who did not use any contraceptive method were more likely to have shorter birth intervals than women who used all forms of contraception.[21]

The survival status of children born previously also affects the occurrence of birth intervals. The short birth interval was 4 times more likely to occur in women who had a previous child death than in women whose children had previously lived (OR 4.76 in the IDHS year 2007, OR 3.57 in the IDHS year 2012, and OR 4 in the IDHS year 2017). This shows that the previous child's survival factor is the most dominant influencing birth interval. When a baby/child dies, the mother will stop breastfeeding (unless the children are twins), and the mother will be at risk of getting pregnant more quickly than if she still has babies.[22] This is also to the research that says that short birth interval tends to occur. in subsequent births in couples who experience child death. Spouses tend to want to make efforts to have children immediately to replace lost children.[19]

The results of the study prove that birth interval can be influenced by a woman's education level. Short birth interval is more at risk for women who graduate from college than women who do not go to school. In 2007, the possibility of short births in women who graduated from college was 3 times (AOR= 3.22) than women who did not attend school. Furthermore, it decreased in 2012 the risk of 2 times (AOR = 2.22) and decreased again in 2017 the risk of 1 time (AOR= 1.85) experienced short birth interval in women who graduated from college compared to women who did not attend school. The short birth interval that occurs in college graduates is probably due to a delay in marriage. Higher education women tend to marry late, limiting their reproductive years and the number of children.[21]

This is not in line with research related to women's education in Bangladesh[19] which states that women without formal education tend to have a short birth in subsequent births. Likewise, research in Ethiopia[12] shows that education level affects short birth intervals. The short birth interval is 3 times more likely to occur in women without formal education compared to women with formal education.[12] Women with low formal education are at risk for experiencing short birth intervals. Mothers' low education is related to their lack of information and knowledge about various things including how to maintain reproductive health. This is also explained in another study which stated that low formal education affects women's understanding and/or knowledge about contraception and birth interval as well as behavior seeking information on reproductive health.[16] Unlike what happened in Indonesia, it was found that women who did not attend school were at risk of this to happen. The short birth interval was lower than female university graduates (AOR=0.31; AOR=0.45; AOR=0.54). The possibility of this happening could be due to the successful family planning program carried out by the Indonesian government. This can be seen from the increasing percentage of women aged 15–49 years who use family planning tools/methods from the 1991–2017 IDHS.[2] In addition, half of the women have been exposed to information about family planning by the media.[23]

This study found that women from the lowest wealth quintile are twice as likely to experience short birth intervals as women from the top wealth quintile. This statement is in line with other studies which state that women with low-income levels have shorter pregnancy intervals than women with higher education. This is related to women with low incomes choosing not to use contraception so that unwanted pregnancies occur.[24]

The results of this study indicate that the most dominant factor influencing the occurrence of short birth intervals after controlling for other variables is the survival status of the previous child. The risk of short-distance births is 4 times for women who experience child death compared to women whose previous children are still alive. This is in line with research in Manipur, India[25] which showed that the child's previous survival status was the most important in determining the pattern of child spacing for social and biological reasons. Socially, couples who have experienced the loss of a child as an infant avoid contraception with the motivation to

have another child as a substitute. Biologically, infant mortality interferes with breastfeeding which contributes to the return of fertility, and the absence of contraception can increase the likelihood of subsequent early conception.[25] This study also provides evidence that child mortality will have an impact on shorter delivery intervals for subsequent children.

Child mortality also affects other factors, namely breastfeeding and contraceptive use. Women who will stop breastfeeding will be fertile again soon and are at risk of pregnancy if they do not use contraception. This is because lactational amenorrhea arising from breastfeeding can prolong the birth interval.[25] The relationship between child mortality and the birth interval is more related to maternal behavior, such as discontinuation of contraceptive use and cessation of breastfeeding. Mothers who stop breastfeeding result the mother fertility returning quickly.[22]

In general, the increase in infant mortality rate can be caused by babies born with short birth intervals, maternal age who are too young or too old, or babies born to mothers with high parity.[2] Maternal age and high parity are at risk of death in children. Due to the death of a previous child, couples tend to try to get pregnant again to replace immediately the child who has died. This results in a short birth interval with the occurrence of child deaths.[19]

A mother's education affects the occurrence of short birth spacing. Mothers without formal education tend to have a short birth interval with subsequent births.[19] When a child dies in a mother without formal education, the mother will likely try as soon as possible to be able to obtain a substitute child. This incident can be caused by the lack of understanding of mothers about reproductive health. In contrast, mothers with college graduates are likely to experience short birth intervals due to delays in marriage so that couples will shorten their reproductive period. This statement is in line with research that states that study-oriented factors are one of the causes of women getting married late.[26] When a baby or child dies, it is very likely that mothers with college graduates will immediately plan to have another child due to their limited reproductive age.

This study has several limitatations, since the study used secondary data, researchers had limited direct access to respondents, and researchers can only process existing data. The sample in this study were married women who had at least 2 children, and did not exclude women who had abortions or miscarriages, so there might be an underrepresentation of birth interval.

In conclusion, the largest percentage of short birth interval is in the 2012 IDHS data (12.1%). In the 2007 IDHS, the factors that significantly influence birth interval are the woman's age, duration of breastfeeding, contraceptive use, previous child's life status, education level, and household wealth index. In contrast to the 2012 IDHS, factors that have a significant effect on birth spacing are duration of breastfeeding, contraceptive use, previous child's life status, education level, place of residence, and household wealth index. Meanwhile, in the 2017 IDHS, the factors that significantly affect birth interval are the woman's age, duration of breastfeeding, contraceptive use, previous child's life status, education level, place of residence, and household wealth index.

Optimal birth interval has the potential to improve maternal, neonatal, and infant health. Birth interval is expected to be a basic priority for policymakers to improve maternal and child health. Child mortality is the most dominant factor influencing the occurrence of short birth intervals after being controlled by other variables. Efforts that can be made to improve maternal and child health are to develope strategies to reduce neonatal, infant, child, and perinatal mortality. This study recommends increasing awareness about optimal birth interval and increasing the use of modern contraception, improving maternal and child health services, and providing health education to mothers regarding the care of babies to toddlers who are still very susceptible to illness.

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