

## Do the Integrated Health Posts Have Contextual Effect on Birth Weight? A Multilevel Evidence from Situbondo, East Java

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### ABSTRACT

**Background:** Low birth weight babies (LBW) are sensitive indicators of socioeconomic conditions and indirectly become a benchmark for maternal and child health. This study aimed to analyze contextual effect of integrated health post and socioeconomic determinants on LBW in Situbondo.

**Subjects and Method:** This was an observational analytic study with a case control design. The study was conducted at the integrated health posts in the Asembagus Health Center. The study population was all infants aged 0-1 years. A sample of 150 infants with normal birthweight and 50 LBW was selected by simple random sampling. The dependent variable was LBW. The independent variables were maternal age, maternal education, maternal occupation, maternal knowledge, family income, exposure to cigarette smoke, and integrated health post strata. Data were analyzed using multilevel multiple logistic regression analysis using STATA 13.

**Results:** The risk of LBW increased with maternal age <20 years or ≥35 years (b= 1.78; 95% CI= 0.83 to 2.73; p<0.001), low maternal education (b= 0.93; 95% CI <0.01 to 1.86; p= 0.049),

mother working outside the home (b= 1.24; 95% CI= 0.26 to 2.22; p= 0.013), low family income (b= 1.33; 95% CI= 0.42 to 2.24; p= 0.004), low maternal knowledge (b= 1.17; 95% CI= 0.13 to 2.21; p= 0.026), and high cigarette smoke exposure (b= 1.11; 95% CI= 0.08 to 2.13; p= 0.035). Integrated health post has not contextual effect on LBW with ICC= 0.01%.

**Conclusion:** The risk of LBW increases with maternal age <20 years or ≥35 years, low maternal education, low maternal education, mother working outside the home, low family income, low maternal knowledge, and high cigarette smoke exposure. Integrated health post has not contextual effect on LBW.

**Keywords:** low birthweight, socio-economic determinants, integrated health post

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### BACKGROUND

World Health Organization (WHO) in 2017 defines low birth weight (LBW) is the weight of the baby at birth is less than 2500 grams. Low birth weight is one of the problems that continues to occur globally and causes the long-term and short-term risks posed (WHO,

2014).

Low birth weight babies (LBW) are sensitive indicators of socioeconomic conditions and indirectly become a benchmark of maternal and child health (Joshi et al., 2011).

WHO recorded 4.2 million or 75% of all under-five deaths occurred in the first year of

life, recorded 30.5 deaths per 1000 live births in 2016 (WHO, 2017). According to WHO in 2015 in the world the occurrence of LBW is 15.5% which means that around 20.6 million babies are born every year (WHO, 2014).

The high incidence of babies born with low body weight has a significant contribution in neonatal and infant mortality rates, because babies with low birth weight (LBW) have a high risk of early growth retardation of infectious diseases, developmental delays and death during the period infancy and childhood (WHO, 2017).

Low Birth Weight (LBW) is one of the second leading causes of death in Indonesia after Intra Uterine Fetal Death (IUFD) which is as much as 11.2% (Ministry of Health, 2019). According to Pantiwati, (2010) the mortality rate that occurs in low birth weight (LBW) is 35 times higher compared to babies with normal birth weight.

Based on Basic Health Research data (2018), it shows that the percentage of low birth weight in Indonesia is 6.2%. East Java Province is one of the highest contributors to LBW, which is 6.9%. According to data from the East Java Health Office (2018), obtained from 4,753 where live birth rates. Situbondo Regency is the number one contributor to the LBW incidence rate of 695 or 7.7% of 4,753 live births.

According to Yuwono's (2015), it shows that socio-economic variables affecting the incidence of infants with LBW are maternal family income, maternal education level and maternal family status do not influence LBW incidents. Variable characteristics of pregnant women that affect the incidence of LBW infants are maternal length of pregnancy and maternal weight gain while maternal age parity and distance of delivery do not affect LBW incidence. Variables in the behavior of pregnant women that affect the incidence of infants with LBW are exercise, resting hours, frequency adjacent to smokers. Lots of Fe

(iron) consumed and nutritional conditions do not affect LBW events. The most influential factor on the incidence of babies with LBW is the maternal family income and the length of the mother's pregnancy.

Problems that occur in babies with low birth weight (LBW), especially those premature, occur because of inattention of the organ systems in these babies. Problems with LBW that often occur are disorders of the respiratory system, central nervous system, cardiovascular, hematological, gastrointestinal, kidney, thermo-regulation (Maryunani, 2009).

LBW can be prevented by increasing periodic pregnancy checks at least 4 times during the pregnancy period and starting at a young gestational age, health education about the growth and development of the fetus in the womb, danger signs during pregnancy and self-care during pregnancy so that they can maintain their health and the fetus in the womb properly, mothers should be able to plan their deliveries in the period of healthy reproduction (20 years - 34 years). Support from other related sectors to play a role in improving maternal education and family economic status so that they can increase access to the use of antenatal services and the nutritional status of mothers during pregnancy (Proverawati, 2010).

Health service performance is one of the important factors in efforts to improve the quality of population health. To monitor the health and growth of children under five, the community can use integrated health post. At present there are an estimated 240,000 integrated health posts throughout Indonesia, both urban and rural. Efforts to reduce the health problems of infants and toddlers can be sought by utilizing access to health services such as Integrated Health Posts, which is managed by the community themselves. Integrated health posts activities include immunization, weighing, supplemen-

tary feeding and nutrition and health counseling (Hidayat and Jahari, 2011).

The results of a preliminary study showed that the number of LBW cases in 2017 was 695 cases (7.72%). In 2018 the number of LBW cases were 706 cases (7.7%) and resulted in 53 cases (43.8%) cases of infant mortality. Low birth weight is one of the causes of infant mortality in Situbondo District (Situbondo Health Office, 2019).

Based on the above problems, the authors are interested in conducting research with the title "Integrated health posts contextual influence and socioeconomic determinants of the incidence of low birth weight (LBW) in Situbondo Regency".

## SUBJECTS AND METHOD

### 1. Study Design

This was a case control study conducted at integrated health posts in Asembagus Health Center, East Java, Indonesia, from January to February 2020.

### 2. Population and Sample

The source population was infants who live in the work area of the Asembagus Health Center. A sample of 200 infants consisted of 50 low birthweight babies and 150 normal birthweight was selected randomly.

### 3. Study Variables

The dependent variable was LBW. The independent variables were maternal age, maternal education, maternal occupation, family income, maternal knowledge, exposure to cigarette smoke, health personnel support, and, and integrated health posts strata.

### 4. Operational Definition of Variables

**Birth weight** was the baby's weight at birth measured in grams. The measurement scale was continuous and transformed into dichotomous.

**Maternal age** was the age of the mother at the time of delivery. The measurement scale was continuous and transformed into dichotomous, coded 0= <20 years or ≥35 years

and 1= 20-35 years.

**Maternal education** was the status of formal education (elementary, junior high, high school, college) that is taken by mothers based on the last diploma obtained. The measurement scale was categorical, code 0 <Senior high school and 1≥ Senior high school.

**Maternal occupation** was the work of mothers inside or outside the house both formal and informal which is done in the amount of time spent during the day. The measurement scale was categorical, coded 0= work inside the home, 1= work outside the home.

**Family income** was the amount of family income received in one month as a family economic source. Revenues can be measured by Regency or City Minimum Wages. The measurement scale was continuous and transformed into dichotomous, coded 0= <minimum wage (Rp 1,763,000), 1= ≥minimum wage (Rp 1,763,000).

**Exposure to cigarette smoke** was a situation where mothers are often exposed to cigarette smoke caused by members of the house who smoke, work colleagues, and public places. The measurement scale was continuous and transformed into dichotomous, coded 0= rarely exposed, 1= often exposed.

**Maternal knowledge** was the mother's knowledge of low birth weight (LBW) in terms of understanding, characteristics, prevention, and care of babies with low birth weight. The measurement scale was continuous and transformed into dichotomous, coded 0= low (score <5), 1= good (score ≥5).

**Integrated health post** was the level of integrated health posts development that has been determined by special criteria and special assessments set by the Indonesian Ministry of Health. The measurement scale was categorical, 1= *madya*, 2= *purnama*, 3= *mandiri*.

**5. Study Instruments**

The research instrument used for data collection was a questionnaire that had been tested for validity and reliability. The questionnaire was used to measure maternal age, maternal education, maternal occupation, maternal knowledge, exposure to cigarette smoke, family income, health workers support, and strata of integrated health posts.

**6. Data Analysis**

Univariate analysis was performed to see the frequency distribution and percentage characteristics of samples. Bivariate analysis was conducted to study the relationship between independent variables and low birthweight using the chi-square. Multivariate analysis was performed using multiple multilevel logistic regression analysis to determine the integrated health posts contextual influence

on the socioeconomic determinants of LBW.

**7. Research Ethics**

Ethical clearance in this study was obtained from the Health Research Ethics Commission of Moewardi Hospital Surakarta City with the number 1.342 / XII / HREC / 2019 published on December 13, 2019.

**RESULTS**

**1. Sample Characteristics**

Characteristics in this study include age, gender, education, occupation, and income. These characteristics are shown in Table 1 and 2.

**2. Bivariate analysis**

The analytical test used in the bivariate analysis is the chi square test. Bivariate analysis based on the results of this study can be seen in Table 3.

**Table 1. Sample Characteristics (Continuous Data)**

Variable	n	Mean	SD	Min.	Max.
Maternal age	200	24.38	5.67	15	45
Family Income (Rupiah)	200	1,948,500	6,520,919	1,000,000	5,000,000
Maternal Knowledge	200	3.24	1.38	1	5
Smoke exposure	200	6.6	1.60	3	11
Health personnel support	200	10.60	0.58	9	11

**Table 2 Sample Characteristics (Dichotomous Data)**

Characteristics		n	%
Maternal age	20-35 years old	151	75.5
	<20 years old and >35 years old	49	24.5
Maternal education	Higher education (≥ SHS)	151	75.5
	Primary School (<SHS)	49	24.5
Mother’s occupation	Working at home	115	57.5
	Working outside of home	85	42.5
Family Income	High (≥minimum wage)	115	57.5
	Rendah (<minimum wage)	85	42.5
Maternal knowledge	Good	172	86
	Poor	28	14
Smoke exposure	Low exposure	76	38
	High exposure	124	62
Health personnel support	Strong	200	100
	Weak	0	0

**3. Multiple multilevel analysis**

Multiple multilevel logistic regression analysis was carried out to explain the effects of more than one independent variables (mater-

nal age, maternal education, maternal occupation, family income, maternal knowledge, exposure to cigarette smoke, health workers support, and integrated health posts strata)

to the dependent variable (LBW). The results of multiple multilevel analysis can be seen in Table 4.

**Table 3 Bivariate analysis of determinants of LBW**

Independent Variable	Birth Weight				OR	p
	LBW		NBW			
	n	%	n	%		
<b>Maternal age</b>						
20-35 years old	22	14.5	129	85.4	7.81	<0.001
<20 years old and >35 years old	28	57.2	21	42.8		
<b>Maternal education</b>						
High (≥Senior high school)	22	14.5	130	85.5	7.81	<0.001
Low (<Senior high school)	28	58.4	20	41.6		
<b>Maternal Occupation</b>						
Working at home	28	19.7	114	10.3	4.12	0.007
Working outside of home	22	38	36	62		
<b>Family Income</b>						
high (≥minimum wage)	14	12.5	98	87.5	4.12	<0.001
low (<minimum wage)	36	41	52	59		
<b>Maternal Knowledge</b>						
Good	30	17.6	140	82.4	9.33	<0.001
Poor	20	66.7	10	33.3		
<b>Smoke exposure</b>						
Low	7	9.3	69	90.7	5.23	<0.001
High	43	34.6	81	65.4		

**Table 4 Multilevel Multiple Logistic Regression Analysis of Low Birth Weight Infants**

Independent Variable	Regression Coefficient (b)	SE	CI 95%		p
			Lower Limit	Upper Limit	
<b>Fixed Effect</b>					
Maternal age (<20 or >35 years)	1.78	0.48	0.83	2.73	<0.001
Maternal education (high or primary school (<SHS))	0.93	0.47	0.00	1.86	0.049
Maternal occupation Outside of house	1.24	0.50	0.26	2.22	0.013
Family Income Low (<minimum wage)	1.33	0.46	0.42	2.24	0.004
Maternal knowledge (Poor)	1.17	0.52	0.13	2.21	0.026
Exposure of smoke (High exposed)	1.11	0.52	0.08	2.13	0.035
Costanta	4.13	0.60	5.32	2.94	<0.001
<b>Random Effect</b>					
Var (Costanta)	3.61				
Var (Costanta)					
n observation= 200					
n grup= 25					
Log Likelihood= -71.27					
Average of group= 8 Min= 8 Max= 8					
p = <0.001					
ICC= 0.01%					

Table 4 showed the effect of maternal age on the risk of LBW. Maternal age <20 years old or ≥35 years old are (logodd) likely to deliver infants with LBW 1.78 units higher

than mothers aged 20-35 years (b= 1.78; 95% CI 0.83 to 2.73; p<0.001).

There was an effect of maternal education on the risk of LBW. Mothers with low

education (<Senior high school) have the possibility (logod) to deliver infants with LBW 1.50 units greater than those with higher education (b= 0.93; 95% CI 0.00 to 1.86; p= 0.049).

There was an effect of maternal occupation on the risk of LBW. Mothers who have work outside the home have the possibility (logod) for delivery infants with LBW 1.24 units higher than mothers who work at home (b= 1.24; 95% CI= 0.26 to 2.22; p= 0.013).

There was an effect of family income on the risk of LBW. Low family income increased (logod) the likelihood of LBW 1.33 units higher than high family income (b= 1.33; 95% CI 0.42 to 2.24; p= 0.004).

There was an effect of maternal knowledge on the risk of LBW. Mothers with low knowledge had the possibility (logod) to deliver LBW infants 1.17 units higher than those with good knowledge (b= 1.17; 95% CI= 0.13 to 2.21; p= 0.026).

There was an effect of high exposure to cigarette smoke on the risk of LBW. Mothers who are exposed to high cigarette smoke have logod to deliver LBW infants 1.11 higher than those with low exposure to cigarette smoke (b= 1.11; 95% CI= 0.08 to 2.13; p= 0.035).

There was no contextual effect of integrated health posts on the incidence of low birth weight (ICC = 0.01%). That was because the support of health workers provides good support in every integrated health posts available.

## DISCUSSION

### 1. The effect of maternal age on the incidence of low birth weight

The results of this study indicate that maternal age over 35 years tends to be more at risk of experiencing health problems and complications in pregnancy, thereby increasing the risk of premature birth. Advanced maternal age is also associated with a decrease in fetal

growth potential caused by aging of maternal biological tissue and the cumulative effect of the disease which can cause low birth weight (Fukuda et al., 2017).

Other study also mentions if mothers aged <20 years and > 35 years have the risk of giving birth to babies with low birth weight compared to mothers who have the age of 20-30 years. Mothers who are <20 years old tend to have physical and emotional immature and lack of knowledge to care for themselves during pregnancy so that LBW can occur (Ngwira and Stanley, 2015).

Paramitasari et al. (2018) stated that there is a direct influence between maternal age during pregnancy and the incidence of low birth weight. Mothers who are <20 years old or > 35 years old increase the risk of babies born with low birth weight. The same results was reported by Agorinya et al. (2018), which showed that maternal age was a determinant factor for low birth weight.

Maternal age <20 years and  $\geq 35$  years increases the incidence of low birth weight, so the government makes efforts to prevent this by preventing sexual education for adolescents to reduce the incidence of pregnancy outside of marriage and reduce the number of marriages impact on pregnancy at the age of <20 years. In addition, the government should also increase socialization on family planning programs in order to reduce the incidence of pregnant women  $\geq 35$  years old. Pregnant women who are <20 years old and  $\geq 35$  years old should routinely check their pregnancy to the nearest health facility so that the pregnancy is well monitored and detect early if the mother and baby experience complications of pregnancy.

### 2. The effect of maternal education on the incidence of low birth weight

The results of this study indicate there is an influence between maternal education and the incidence of low birth weight. Mothers who have primary education (<high school)

are more at risk than mothers who have high education ( $\geq$ Senior high school).

Maternal education is an initial health capital that can be associated with educational associations with available resources related to maternal health. Mothers who are highly educated will tend to have good health input compared to mothers with low education so that it can have an impact on the baby to be born by the mother (Kim and Wickrama, 2016).

A study by Trisnawati et al. (2018) reported that education has an indirect and significant influence on the incidence of low birth weight. High maternal education affects high family income, and low maternal education influences low income.

Other study states that low maternal education will be related to the use of prenatal care services due to lack of awareness to check for pregnancy and low nutritional intake due to low socioeconomic status which also influences purchasing power (Archarya et al., 2018).

Mothers who have further education (high school, university) will reduce the incidence of low birth weight than mothers who have basic knowledge (elementary and junior high school or equivalent). Pregnant women who have basic education ( $<$ high school) are expected to be more active in seeking information about pregnancy and diligently checking their pregnancy at the nearest health worker.

### **3. The effect of maternal occupation on the incidence of low birth weight**

The results showed that there was a relationship between maternal work and the incidence of low birth weight. Mothers who have work outside the home are more likely to give birth to low birth weight than mothers who work at home. Maternal physical work during pregnancy has a significant relationship with the incidence of low birth weight babies. The proportion of babies born with LBW is gre-

ater in mothers who have heavy physical work. One effect arising from heavy physical work is placental hypoxia that leads to low birth weight babies, especially occurs in mothers who also experience nutritional deficiencies in pregnancy. The frequency and duration of rest performed by pregnant women is an important role in determining the birth weight of babies (Sharma et al, 2015).

Work is an activity or activities carried out every day during pregnancy. Work performed by pregnant women plays an important role in the development of the baby conceived. Heavy work can endanger the mother and her womb. The occurrence of premature rupture of membranes often occurs as a result of heavy work, thus making low birth weight babies born to low birth weight babies due to work fatigue (Abdul, 2010).

Mothers who work outside the home have a greater risk of giving birth to low birth weight compared to mothers who work inside the home. It is expected that mothers who work outside the home pay more attention to the frequency and duration of rest during pregnancy because it determines the baby's birth weight.

### **4. The effect of family income on the incidence of low birth weight**

The results showed that there was an influence between family income and the incidence of low birth weight. Babies born to low income families will tend to give birth to babies who have low birth weight than babies born to high income families this is because families who have low incomes will be associated with the provision of nutrients less in pregnant women, causing low nutritional status. Family income indirectly influences and is statistically significant on low birth weight babies through gestational age, nutritional status, psychological stress, and environmental sanitation. So that high income will reduce the incidence of low birth weight babies through good nutritional status, ade-

quate gestational age, and good environmental sanitation and low prenatal stress (Trisnawati et al., 2018).

The results of other studies mention that babies born in families with high incomes have a lower risk of giving birth to low birth weight babies compared to babies born to families that have low family income (Rahayu et al., 2019).

Other supporting research states that family income has an indirect effect on the incidence of low birth weight babies through nutrition in pregnancy. Low family income causes low maternal nutrition in pregnancy (Paramitasari et al., 2018). The low socioeconomic level reduces the purchasing power of good food in terms of quality and quantity (Mergawati and Widjanarko, 2016).

The government is expected to provide assistance to pregnant women who have low incomes such as registration on national health insurance, supplementary feeding of pregnant women and other food assistance so that the nutrition and nutritional status of pregnant women can be fulfilled. It is also expected that pregnant women who have low family income continue to diligently check their pregnancy to the nearest health worker and find information about what foods can meet nutrition during pregnancy.

#### **5. The effects of maternal knowledge on the incidence of low birth weight**

The results of this study indicate that there is a relationship between maternal knowledge and the incidence of low birth weight. Mothers who have good knowledge tend not to give birth to babies who have low birth weight compared to mothers who have bad knowledge, this is related to the level of education of the mother and mother's age. So that high maternal knowledge will reduce the incidence of low birth weight through high maternal education and age who are not at risk for pregnancy. Low public knowledge about high risk babies of low birth weight

also becomes an obstacle to reducing the incidence of low birth weight (Situbondo Health Office, 2018).

Low knowledge tends to have bad habit or lifestyle such as eating non-nutritious foods, checking the pregnancy if there are only complaints, choosing and looking for cheap birth attendants such as traditional birth attendants without knowing the consequences of labor that uses unsterile tools. Knowledge is needed in all respects, especially health because knowledge is a process in achieving a health behavior. This shows that the importance of one's knowledge about health issues, especially LBW (Hartiningrum and Fitriyah, 2019).

Good maternal knowledge will reduce the incidence of low birth weight compared to poor maternal knowledge. So that government support is needed to provide knowledge of mothers about low birth weight through classes of pregnant women or existing Integrated Health Posts. It is also expected for pregnant women who have low knowledge to seek information on low birth weight so as to prevent the occurrence of low birth weight.

#### **6. The effects of cigarette smoke exposure on low birth weight events**

The results of this study indicate that there is an influence of cigarette smoke exposure with the incidence of low birth weight. Mothers who are exposed to high cigarette smoke will tend to give birth to babies who have low birth weight compared to mothers who are exposed to low cigarette smoke. Cigarette smoke contains more than 4,000 different chemicals released into the air as particles and gases, including carbon monoxide, ammonia, dimethyl nitrosamine, formaldehyde, hydrogen cyanide and acrolein (WHO, 2014).

Nicotine is one of the main addictive compounds in cigarette smoke and is a key substance that contributes significantly to various health problems, because nicotine is inhaled and enters the respiratory system will



be flowed through the blood, very low levels of nicotine will cause transcriptomy modifications that can be detected in respiratory tract epithelium so that it easily crosses the placenta and binds to the nicotinic acetylcholine receptors (nAChRs) that regulate fetal brain development (Lewis et al., 2017).

Higher nicotine levels in amniotic fluid, fetal serum and placenta from maternal serum, nicotine content in cigarettes can damage placental function which causes aberrant placental metabolism, cell damage, apoptosis, abnormal heartbeat in labor and some oxidative damage that can cause severe baby weight to be born (Herman et al., 2016). Exposure to gestational cigarette smoke can affect lung function and gestational age thereby increasing the risk of premature birth (Balte et al., 2016).

Another study stated, mothers who smoked during conception and during pregnancy had an effect on the birth of low birth weight babies. Exposure to cigarette smoke obtained from outside such as cigarette smoke in the environment, cigarette smoke in the workplace and exposure to passive cigarette smoke from family members who smoke, also negatively impact pregnancy which is reported with low birth weight (Mine et al. , 2017). Smoking bans in public places can reduce the risk of premature birth (Díez-Izquierdo et al., 2017).

Mothers who are exposed to high cigarette smoke have a higher risk of giving birth to babies with low birth weight than mothers who are exposed to low cigarette smoke. Pregnant women should make efforts to prevent this by avoiding places where there are many people who smoke, giving understanding to husbands or family members who smoke not to smoke near the mother or in the house, and suggesting the husband to change clothes after smoking so that the mother is not exposed to residue (residue) from cigarette smoke. It is advisable for the govern-

ment to make regulations and emphasize these regulations so as not to smoke in public places.

### **7. Contextual effect of integrated health posts on the incidence of low birth weight**

The results showed there was no contextual influence at the second level, namely the integrated health posts between the variations in the incidence of LBW (ICC= <0.01%). ICC value in this study is smaller than the rule of thumb rule of 8-10%. The support of health workers in all integrated health posts strata examined has a good value.

Integrated health post is a variable that has an important role in accessing services provided by the community to health providers in the vicinity. Integrated health posts consist of several levels, namely pratama, madya, purnama and mandiri (Ministry of Health, 2011).

According to Suryandari (2016), the results of the study show that there are several factors that influence the Integrated health posts strata of age, old cadres and knowledge. There is no influence between work and integrated health posts strata. In conclusion, the influence of variables for integrated health posts strata is age, old cadres, and knowledge. In addition, there are also several other factors to assess integrated health posts strata such as frequency of weighing, average cadre of tasks, average D / S coverage, cumulative coverage of MCH, cumulative coverage of family planning, cumulative coverage of immunizations, additional programs, coverage of healthy funds.

So it can be concluded that not only the support of health workers can influence the integrated health posts strata but many other factors are interrelated so that other factors that support also need to be considered by the government and related health centers so that the quality of integrated health posts is better and in accordance with the scope and

target from each stratum.

#### AUTHOR CONTRIBUTION

Eti Kuswandari was the main author who plays a role in conducting study, collecting the data, wrote the articles, and processing data analysis. Harsono Salimo played a role in suggesting materials for discussion. Yulia Lanti Retno Dewi played a role in formulating of the framework of research thinking and data analysis.

#### CONFLICT OF INTEREST

There is no conflict of interest in this study.

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