



Modeling the Desire to have Children Post-Disaster Palu – Indonesian 2018

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Abstract

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BACKGROUND: The impact of a family death, especially on children, causes demographic changes, one of which is the mother's desire to have children. People in Palu City and its surroundings were shocked by the 7.4 Richter Scale earthquake on September 28, 2018, at 18:02 Central Indonesian Time. The earthquake accompanied by the tsunami gave rise to a new phenomenon, namely, liquefaction. This disaster caused 2227 people died, while 965 people were missing and 2537 people were injured.

AIM: The study aim is (1) to develop a model of the desire to have children based on a logistic regression approach by looking at the effect of the type of disaster and geographical location, and (2) to create spatial modeling using the overlay technique on the desire to have children.

METHODS: This research was conducted in Palu City. Participants in this study were 382. The data were analyzed using logistic and spatial regression with overlay technique.

RESULTS: The results of the odds ratio test show that the type of disaster and geographical location significantly affect the desire to have children. Mothers who experience disasters (earthquake, tsunami, and liquefaction) and mothers who live in disaster-prone zones each have 1674 times and 1293 times the opportunity to have children. The spatial modeling results show that the parameters of the disaster-affected area have a high priority for having children.

CONCLUSION: The type of disaster and geographical location affect the desire to have children in the city of Palu after the disaster. Most disaster-affected areas contributed to the desire to have children; the highest was Ulujadi and Mantikulore Districts.

Introduction

People in Palu City and its surroundings were shocked by the 7.4 Richter Scale earthquake on September 28, 2018, at 18:02 Central Indonesian Time [1]. The earthquake accompanied by the tsunami gave rise to a new phenomenon, namely liquefaction or land subsidence due to the compaction of the volume of the soil layer [2]. Liquefaction, also known as movable land, has buried many people and houses in Perumnas Balara and Petobo Village. Data and information reports for the Central Sulawesi Provincial Government in 2018, explained that around 2,227 people died, while 965 people were missing, 2,537 people were injured, and 223,751 people were displaced. For buildings affected by the disaster, as many as 68,451 houses were damaged, 265 schools were destroyed, 327 places of worship were damaged, and 45 health facilities were damaged [3].

The increasing threat of disasters that occur in Palu does not only reflect the emergence of events such as earthquakes, tsunamis, and liquefaction but also changes in the demographic and socioeconomic

characteristics of the population [4]. The disaster in Palu received a lot of world attention, especially the liquefaction phenomenon, which is still very rare based on data. However, no less important than disasters is the existence of people affected by disasters both at the time of the disaster and after it. In addition to the threat of loss of life, the condition also has an impact on socio-economic health, psychological which can cause greater harm, and this will affect recovery efforts [5], [6], [7].

Environmental changes can affect families in various ways, leading to survival and income-generating opportunities and access to nutrition, schools, and health services [8]. Changes in demographic behavior include decisions about when to have children and how many children to have, very likely to happen if the family experiences the death of a child [9]. The environmental situation is closely related to the process of population growth, much influenced by studies of mortality and migration. In the context of demography, apart from impacting casualties, infrastructure, and socio-economy, disasters also indirectly impact fertility and birth outcomes. The couple's intention and desire to have children is formed from death, where the family is concerned about their child's survival in the future.

A family will consider the decision to increase its fertility if a family member or child dies, intending to replace the child [10], [11], [12], [13].

The desire to have children due to the death of a child impacts the family or mother and their reproductive health, in this case, the process of pregnancy and birth outcomes. Natural disasters can have serious mental and physical health consequences. Mothers who experience stress disorders due to disasters have a risk of impaired health conditions for pregnant women, premature pregnancies, gestational hypertension, mothers with preeclampsia, and mental health disorders [14], [15], [16]. Disasters also impact the birth of babies with low birth weight, premature birth, and other disorders [17], [18], [19].

Purpose of Study

Problems and consequences that arise when a mother decides to have children, the family will try to regulate her fertility, including removing contraceptives. Furthermore, mothers who want to have children need to consider the risks that arise, such as a history of pregnancy and childbirth at risk related to age during pregnancy, history of illness, pregnancy complications, etc. Based on these problems, this study aims to: (1) Develop a model of the desire to have children based on a logistic regression approach by looking at the effect of the type of disaster and geographical location and (2) create spatial modeling using the overlay technique on the desire to have children.

Based on the above research objectives, the hypothesis in this study is (1) the type of disaster and geographical location affect the desire to have children with a significance value of 0.05. The bigger the disaster and the higher the geographical vulnerability, the higher the desire to have children after the disaster in Palu. (2) Spatially, mothers who experience the disaster's severity and live in vulnerable areas have a high desire to have more children.

Methods

This survey research with a cross-sectional study method was conducted in Palu City. The research ethics committee approved the Graduate School of Gadjah Mada University research under 2183/UN1.SPs.1.1/AKM/KM/2020. Furthermore, the recommendation for a research license in the research area of Palu City was issued by the Central Sulawesi Provincial Government through the Investment Service and One-Stop Integrated Service number 070/0322/REK-PL/DPMPTSP/2020.

Participants in this study amounted to 382 mothers included in the inclusion criteria, namely, Couples of Childbearing Age (PUS) affected by natural disasters. This sample was taken from five sub-districts in Palu, the area's most severely affected by natural disasters such as earthquakes, tsunamis, and liquefaction. Samples were taken randomly using the proportional stratified random sampling technique.

The data collection method was conducted by interviewing through filling out questionnaires related to the desire to have children, namely, the type of disaster (earthquake, tsunami, and liquefaction) experienced by the respondent and the respondent's location at the time of the disaster (geographical location) and the desire to have children. Then conduct observations and documentation to determine the coordinates of the respondent when the disaster occurs. An open camera is the determination of the coordinates using a GPS (Global Positioning System) mobile phone with an application to determine the coordinates. Mark Harman developed an open Camera; this application can be used on almost all mobile phones with Android ICS and above. There were two places where the respondents lived during the observation. Some of them lived in temporary housing and permanent housing provided by the government because their houses were destroyed, and some lived in their own homes. The variables used in this study are the type of disaster (earthquake, tsunami, and liquefaction), geographical location (less vulnerable, vulnerable, very vulnerable, and very vulnerable), assessment of the classification of disaster vulnerability locations based on a joint determination of the government of Palu City and Central Sulawesi Province and other agencies. Next is the variable of desire to have children.

Data analysis uses logistic regression modeling to measure the effect of the type of disaster and geographical location simultaneously on the desire to have children and calculate the probability of each variable (odds ratio). They are, furthermore, modeling with a spatial approach. This model is done by mapping the mother's desire to have children, namely, by mapping the desire to have children. This approach is carried out using the overlay method. The overlay is the overlap between several layers to generate new information in a modeling study of the desire to have children using layers or parameters of five elements: Child mortality, population density, number of couples of childbearing age, disaster vulnerability, and affected area of disaster.

Results

Table 1 showed that the age in this study is the mother's age who is included in the group of couples

Table 1: Characteristics of respondents

Characteristics	f	%
Age		
<20 Years	5	1,3
20–30 Years	185	48,4
>35 years	192	50,3
Education		
Did not pass elementary school	4	1
Elementary school graduate	78	20,4
Middle School graduate	87	22,8
High school graduate	164	43
College	49	12,8
Profession		
Does not work	287	75,1
Work	95	24,9
Income		
Not following the district minimum wage	304	79,6
According to the district minimum wage	78	20,4
Desire to have children		
Want	234	61,3
Not	148	38,7
Type of disaster		
Earthquake	283	74,1
Tsunami	60	15,7
Liquefaction	39	10,2
Geographical location		
Less vulnerable	95	24,9
Vulnerable	95	24,9
Very vulnerable	96	25,1
Very high vulnerable	96	25,1

of childbearing age ranging from 15 to 49 years where the partner (male and female) is quite mature in all respects where the reproductive organs are functioning properly [20]. Respondents' age was grouped into three groups, namely, <20 years, 20–35 years, and >35 years. Of the 382 respondents studied, the highest age group of respondents was aged >35 years by 50.3%, while respondents with the lowest age group were aged <20 years, namely, 1.3%. The age grouping of respondents is based on the age group at risk and not at risk of having children; the risk age group is <20 years and >35 years, while the recommended age group is the age of 20–35 years. Education is divided into five categories: Did not pass elementary school, elementary school graduate, middle school graduate, high school graduate, and college. The results showed that most of the respondents with education graduated high school, namely 43%, and the lowest was did not pass elementary school. The work was divided into two groups, namely, working and not working. The results showed that most respondents did not work as much as 75.1% and worked 24.9%. The respondent's income is based on the Average Minimum Wage of Palu City, which is Rp. 2,620,989 [21]. Ethnic groups are divided into two groups, namely, the original ethnic Kaili and ethnic immigrants (Bugis, Javanese, Gorontalo, Buol, Tolitoli, Arab, Chinese, and others). The study found that the most ethnic groups were indigenous people at 55%, while immigrants amounted to 45%.

The variable type of disaster in this study is the type of natural disaster experienced by the mother, both earthquake, tsunami, and liquefaction. Of the 382 respondents studied, 283 respondents (74.1%), experienced a tsunami 60 respondents (15.7%) and liquefaction 39 respondents (10.2%). Respondents who live in less vulnerable locations are 95 (24.9%) respondents, and vulnerable are 95 (24.9%), very

vulnerable locations are 96 (25.1%), and 96 (26.1) respondents who live in a very vulnerable location. The measurement of the desire to have children includes all mothers (15–49 years old) who want to have children because they experience child death, mothers who want to have children but do not experience child death, and mothers who do not want to have the children. Based on the study results, 234 respondents wanted to have children during the disaster in Palu City, while those who did not want to have any more children were 148 respondents.

Logistic regression analysis was conducted to model the effect of the type of disaster and geographical location on the desire to have children in post-disaster mothers by analyzing the simultaneous test (G test). This test is to see whether all variables (type of disaster and geographical location) simultaneously affect the desire to have children. Then the odds ratio test (opportunity test) was carried out to see the probability of each variable on the desire to have children.

The results in Table 2 showed that the significance value of the G test is 0.007, which means it is smaller than the 0.05 level of significance. Hence, the decision taken is to reject H₀. These results indicate that the type of disaster and geographical location simultaneously has a significant effect on the desire to have children in post-disaster mothers in Palu. Meanwhile, the odds ratio test results showed that the type of disaster and geographical location had a very significant affected the desire to have children. These results show that mothers who experience disasters (earthquake, tsunami, and liquefaction) are 1.674 times more likely to desire to have children than mothers who do not experience disasters. Likewise, the geographical location shows that mothers who live in disaster-prone zones have a 1,293 times risk of having a desire to have children compared to mothers who do not live in disaster-prone zones.

Table 2: Results odds ratio test results and simultaneous test

Variable	Odds ratio test			Simultaneous test (G-test)	
	Sig	Exp B	95% CI for Exp B Lower-Upper	Che-square	Sig
Type of disaster	0.004	1.674	1.179–2.377	9.843	0.007
Geographical location	0.007	1.293	1.072–1.559		

The overlay model compares characters from the same location in each layer and produces the required information. The manufacturer determines the specific results, who can load calculations, or other requirements applied to the area or location. In short, the overlay process aims to show the scope of compatibility between two or more data. The parameters of the five elements (layers) used are: Child mortality, population density, number of couples of childbearing age, disaster vulnerability, and areas affected by natural disasters.

The modeling process results of the desire to have children are then carried out by overlaying using the Geographic Information System (GIS) method. There are three widely used overlay methods: Binary

overlays, tiered overlays, and weighted tiered overlays. Making the model of the desire to have children using the weighted tiered overlay method means that each parameter has a level of value and weight to the final result. Figure 1 shows the model of the desire to have children due to a weighted tiered overlay with five parameters. The areas where the desire to have children is very high in Palu City after the disaster are Ulujadi and Mantikulore Districts.

Discussion

Some theories explain that a part of the fertility rate occurs in response to deaths in society in general and in particular and the couple's own experiences of child mortality. The idea of this theory is rooted in demographic transition theory, psychology, sociology, and economics. Preston (1978) explains that child deaths that occur outside the family and fertility decisions are called the extrafamilial effect, also known as the concept of fertility insurance. These results indicate that women who give birth to more children is one way to anticipate if at any time their child dies, there are still other children in the family who can maintain the existence of the family. Several other studies have also measured the decrease in fertility time with regional child mortality [22]. Child insurance (having many children) is less relevant to disasters in

the short term. However, if a child dies, this condition can alter the family's expectations about the child's survival for a long time and cause the couple to seek to produce many children [23]. In theory, Freedman (1979) explains that the environment that influences mortality and socioeconomic factors play a major role in increasing fertility, which is also strongly influenced by extended family norms and intermediary variables [24].

Based on logistic regression modeling, the type of disaster and geographical location simultaneously affect the mother's desire to have children after the tragedy in Palu City. Freedman (1979) explains that in the concept of sociology, birth is influenced by the environment and death. One of the basic principles of sociology is that community members will face problems that arise repeatedly and carry important social consequences, such as natural disasters that can cause casualties, including children, so they tend to create a normative way of solving problems, namely, by wanting to have other children. Disasters can increase broad pronatalist sentiment and the desire to "rebuild" society. Women who are childless at a disaster are expected to be more prepared to respond to ideas such as pronatalism [25], [26], [27]. Indirectly, community members participate in accelerating family development to replace lost or deceased children by having more children [28].

In line with the research results obtained in Palu, the study explains that the impact of environmental shocks due to disasters such as climate change is often complex, varying within and between households, and

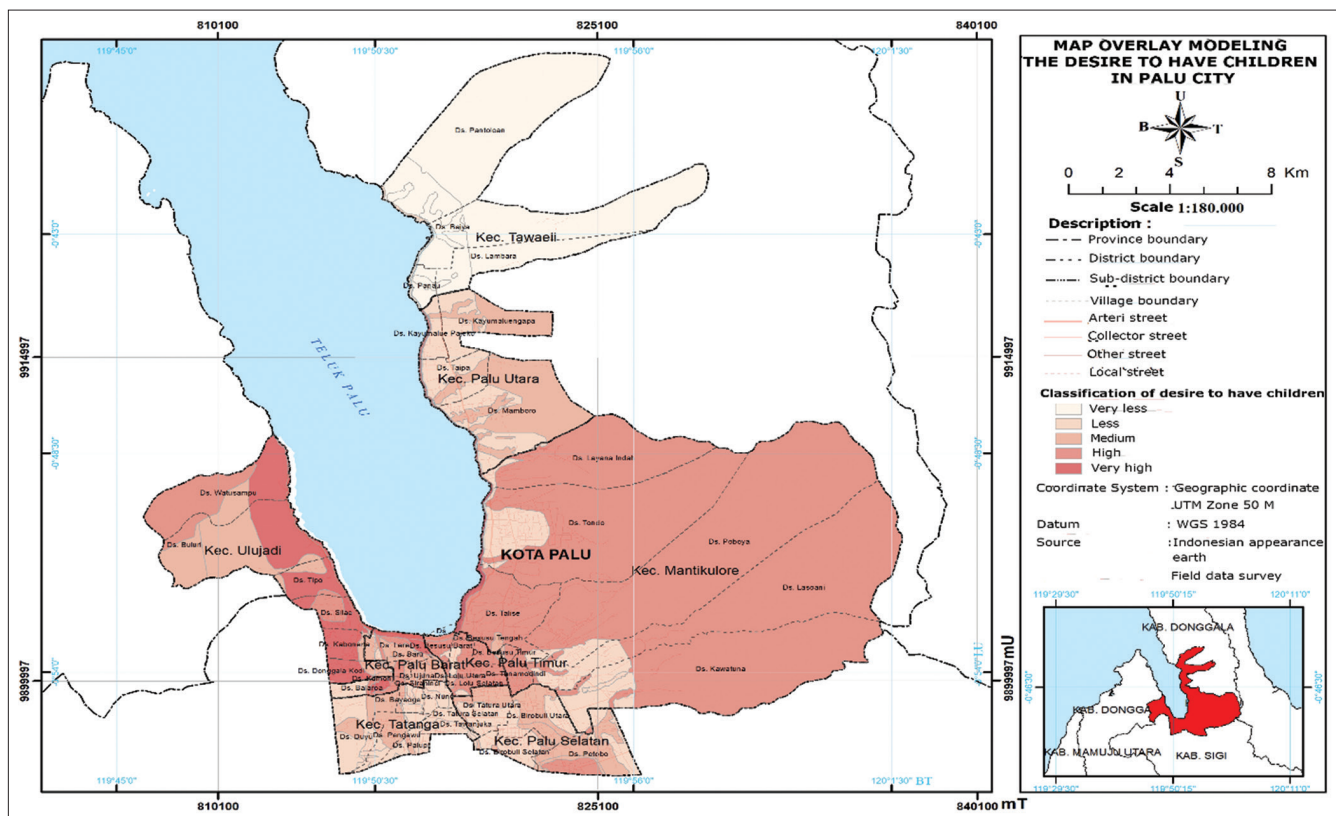


Figure 1: Map overlay modeling the desire to have children in Palu City

changes in demographic behavior, including fertility [13]. The birth response varies widely, increasing or decreasing reported births depending on local social conditions and environmental contexts. These changes also tend to be important implications for women's life satisfaction to having children [29]. In line with the research, it was found that part of the desire to have children and give birth is a response to child death. This explanation is rooted in demographic transition theory, psychology, sociology, and economic theory. Preston called it the "outside effect" of giving birth to the concept of "insurance," a couple who gave birth to more children in anticipation of children who would not survive. This understanding is that children can die due to illness, accident, or disaster, including what happened in Palu City. The number of deaths outside the family or death at the community level influences families, especially mothers, to decide whether they want to have children or not [22].

The analysis is that deaths that occur outside the family are thought to affect fertility in other ways. This mechanism can occur through risks at the community or ethnic group level. Suppose it is seen that children are members of society who are the successors of the next generation. In that case, collectively, an increase in births will appear to respond to child mortality at the community level. Although demographers have emphasized the relationship between child mortality and birth by approaching the concept of survival or survival in psychology, there are different motivations for the relationship between birth and death. In particular, goals related to a child's survival experience preferences are intrinsic goals. Children can be used as interpersonal connections (family happiness) and community development (to have a role and benefit society) rather than extrinsic goals such as accumulating wealth and family status [30]. Logically, it implies that new investment in the family (the presence of children) will emerge as a response to the weak awareness of the family that ignores the importance of children [31].

We are also fully aware that this study still has many shortcomings and limitations related to the cross-sectional method. Data collection is instantaneous and concurrent and calculated based on existing statistics. Respondents' responses and answers may be influenced by existing conditions and other factors affected by post-disaster trauma. A qualitative approach with in-depth interviews is highly recommended in this study. Involving husbands and families is very helpful in providing answers and responses to why they want and do not want to have children after the disaster in Palu city.

Conclusion

In general, the results of logistic regression modeling show a significant effect between the type

of disaster and geographical location on the desire to have children after the disaster in Palu City. Mothers who experience disasters (earthquake, tsunami, and liquefaction) and live in disaster-prone zones have the opportunity to have children. The results of spatial modeling using the overlay technique show that the parameters of the disaster-affected area have a high priority, indicating that the zone/area of these parameters tends to have children. The spatial modeling in the overlay analysis shows that most areas contribute to the desire to have children, and the highest are Ulujadi and Mantikulore Districts.

Recommendation

This research is expected to be a reference for population development in predicting the desire to have children and fertility rates in areas affected by natural disasters, especially those affected by the earthquake, tsunamis, and liquefaction, so that if it occurs in other regions with the same conditions they can know the description of mothers who have the desire to have more children. Likewise, mapping the vulnerability of geographical locations can be used as a reference to find out mothers who live in disaster-prone areas and the level of desire to have children.

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