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Intersectional Vulnerability in Post Natural Disasters on Women's Health

– Systematic literature review –

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Abstract

Natural disasters have been growing due to climate change, degradation of the environment, and globalisation. However, there is also a pattern of gender difference in vulnerability to and impact of natural disasters at all levels of the disaster process. Women's health status is, thus, violated in natural disasters. The purpose of this review study is to investigate how the effects of natural disasters on women's health are related to social categories, focusing on the intersection of conditions that creates vulnerabilities, and how the studies can help us understand women's vulnerability to natural disasters. As an approach to understanding vulnerability and situating the post-disaster experiences of women concerning health, the review study referred to the framework of Road map to hell by Wisner. This review study was a systematic review of English-language articles, having studied women's reproductive health and mental disorder after natural disasters, published in the last 15 years. The data stemmed from a systematic search of journal articles in the general computer databases.

Most studies in this review showed that females were more vulnerable to their health-wise post-natural disasters than males. In addition to gender, socio-economic status such as age, education, economic consequences, and pregnancy or having a child status and living environment made women more vulnerable when exposed to a natural disaster. Furthermore, my review study found that black women in the US and Haitian women with a history of traumatic events were more vulnerable to their health after natural disasters than other women.

Through my review study, we can understand that it does not mean that natural disasters cause significant damage directly and have an impact in the medium to long term. However, the more important we should understand is that the impacts of natural disasters are intersectional vulnerabilities of individuals' physical and psychological changes and changes in the environment. In addition, my review study showed that the difficulties in accessing multiple public and private resources, such as economic- and health facility resources and kinship networks, made it difficult to cope with post-disaster changes. Therefore, we can draw from

my review study that it is imperative to understand and prioritise intersectional vulnerabilities in natural disasters. Furthermore, disaster countermeasures need to consider individual situations such as the type of disaster, living environment, damage situation, one's life status and degree of social connection, and it is necessary to take measures to improve such vulnerabilities.

Keywords: natural disaster, women, reproductive health, mental health, depression, anxiety, post-traumatic stress disorders (PTSD)

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List of Abbreviations

BW: Birth Weight of under 2500g

CDC: Centres for Disease Control and Prevention

Early PTB: Preterm Birth: Gestation of under 34 completed weeks

EM-DAT: The International Disaster Database

LBW: Low Birth Weight of under 1500g

Mw: Moment magnitude

PNMS: Prenatal Maternal Stress

PTB: Preterm Birth: Gestation of under 37 completed weeks

PTSD: Post Traumatic Stress Disorders

PTSS: Post-Traumatic Stress Symptoms

SGA: Small for Gestational Age

UN: United Nations

UNDRR: United Nations Office for Disaster Risk Reduction

UNESCO: United Nations Educational Scientific and Cultural Organisation

UNISDR: United Nations Office for Disaster Risk Reduction

VLBW: Very Low Birth Weight of under 1000g

WDR: World Development Report

WHO: World Health Organization

Chapter 1

Introduction

A natural disaster is a sudden, significant adverse event of great magnitude resulting from the earth's natural processes. The World Health Organisation (WHO) defined natural disasters as follows: "Natural disasters are environmental events, not directly human-made, such as volcanic eruptions, earthquakes, floods, cyclones or more long term, epidemics, drought, famine by catastrophic food shortage" (WHO, 2002). The occurrence of natural disasters has been growing in recent years around the world. There are some reasons for climate change, degradation of the environment, massive urbanisation, social disparity, and globalisation. The United Nations International Strategy for Disaster Reduction (UNISDR) addressed that climate change and natural disasters are related, and the number and magnitude of natural disasters are prone to increase owing to more extreme weather events (UNICDR, 2008). In addition, the United Nations (UN) states that more than 5 billion people have been affected by natural disasters, which have affected approximately 2 million lives (UN, 2020). Furthermore, the International Disaster Database (EM-DAT) reports that more than 6,400 natural disasters occurred worldwide, with nearly one million people reported killed and 2.8 billion people affected between 2005 and 2020 (EM-DAT, 2021). In 2020, Statista (2020) reported approximately four hundred natural disasters events worldwide, and the Asian Pacific region came into contact with the highest number of natural disasters.

Natural disasters are, thus, drastic and typically occur without any warning. They can be characterised as geophysical, atmospheric, or hydrological events. For instance, we can describe severe chaotic winds in cyclones and the shaking of the earth in an earthquake. In addition, natural disasters interfere with our infrastructures, such as a functioning water and sewage system, the provision of gas and electricity, and food supplies. Consequently, natural disasters can bring catastrophic destruction and significant disruption to those who live in disaster-affected regions. Natural disasters, therefore, produce stressful environments, and they increase the risk to survivors' health problems.

Nevertheless, natural disasters do not affect people equally. WHO (2002) reported a pattern of gender difference in vulnerability to and impacts of natural disasters at all levels of the disaster process, such as exposure to risk, risk perception, response, physical and psychological impact,

recovery, and reconstruction (WHO, 2002). Women's health status has, in other words, a higher chance of being violated in natural disasters than that of men. Of the large number of studies conducted on the health effects of natural disasters, the majority of studies have revealed that women's stress levels after a natural disaster are higher than that of men's (Anwar, Mpofu, Matthews, Shadoul, & Brock, 2011; A. Lee, Khoshnood, & Humphries, 2018; Parida, 2015). In addition, Parida (2015) argues that there is a correlation between women's vulnerability and mental health problems. Furthermore, women's reproductive health is also significantly affected by natural disasters (Sohrabizadeh, Tourani, & Khankeh, 2016).

In my review study, I focus on the impacts of natural disasters on women's health. The purpose of my review study is to investigate how the effects of natural disasters on women's health are related to social categories, concentrating on the intersection of conditions that creates vulnerabilities. Moreover, I will seek how the studies can help us understand women's vulnerability to natural disasters.

Chapter 2 Background

2.1 Vulnerability in natural disasters

Natural disasters have severe consequences for many people bringing with them a host of issues. In total, natural disasters have long-term negative consequences beyond the immediate loss of life and demolition of infrastructure. UNISDR states that disaster risk consists of three factors: hazard, exposure, and vulnerability. Hazards are natural phenomena such as volcanic eruptions and avalanches. Hazard becomes a disaster when people or some resources exist in areas where the hazard occurs, and they cannot withstand it. In terms of vulnerability, Wisner, Gaillard, and Kelman (2012) and World Development Report (WDR) define vulnerability as the characteristics of a person or group and their susceptibility to loss from adverse shocks resulting from the impact of a natural hazard (WDR, 2013). Therefore, vulnerable in facing natural disasters is often those who struggle to recover in the aftermath of a disaster.

In the following four paragraphs, I will elaborate on various characteristics of vulnerability in natural disasters. In these paragraphs, in order to illustrate the different vulnerabilities in natural disasters, I am choosing literature from the event of natural disasters other than those selected for this review. Each time I mention a new case of a natural disaster, I add time, human casualties, and injuries in brackets to give the reader a sense of scale.

2.1.1 The destruction of buildings and business

There are severe effects on natural disasters, and natural disasters cause massive loss to life and property. For instance, earthquakes and floods severely damaged artificial structures like roads, bridges, electric poles, and housing. Another example is destructions caused by cyclones on the environment, which is widespread in the form of uprooted trees, blown-off rooftops, standing crops, injuries, and death to humans.

For instance, the Jiji earthquake in Taiwan (21 September 1999; more than 2,000 deaths; 10,000 injuries) reported that in Lugu Township, which is located in southwest Nantou County, more than one-third of its buildings were destroyed, including partially destroyed, accounting for 42% of the 649 in Lugu Village (Chang, 2012). In addition, in Taomi, which is located in the village of Puli Township in Nantou County, bamboo shoots were once the primary source of income. However, there was a significant decrease in the production of bamboo shoots for

the decade after the earthquake. The change in decrease was from exceeding one hundred tons per day to no more than five tons per day. (Chang, 2012).

In the Marmara earthquake in Turkey (17 August 1999; 17,127 deaths; 43,953 injured), 5,000 buildings collapsed, and 340,000 buildings were damaged due to the earthquake. As a result, 14,513 businesses closed, and 150,000 people became unemployed (Kasapoglu & Ecevit, 2003).

Regarding the devastation of buildings, they include important buildings such as hospitals or airports. Especially in health care facilities, the physical vulnerability of the health care facilities is of great concern as it can hinder or cease the delivery of critical health care services (WHO, 2011). For instance, in flood in Belkuchi, Bangladesh (25 July 2016; 42 deaths; 3.2 million affected), it was challenging to access primary health care facilities without transport and boat services, and a lack of services occurred. Therefore, many people who were exposed to the flood became more difficult to take health care services. In addition, there was a shortage of medicines and equipment due to infrastructural damage, including the roads (Ray-Bennett., Corsel., J., Goswami, & Ghosh, 2019).

2.1.2 Infrastructural damage and the lack of water

One of the most immediate devastating concerns with natural disasters is public and private service infrastructure damage. The damage to both of them is due to interruptions in infrastructure for living. Living infrastructure restoration is, in general, in order such as electricity, water and gas. Disruption in one of the infrastructure systems, such as functioning water and sewage system, energy supply, transport or communications, electricity, and food supplies, have severe consequences.

As mentioned above, living infrastructure restoration is in the order of electricity, water, and gas. The fact that the telecommunication system relies on an electric power system for its communications switches. In addition, the transportation system relies on electrical power for its signals and switches. Likewise, natural gas and petroleum infrastructures rely on electrical power to operate their storage, pumps, compression and control systems, and the water system relies on electrical power for its lift stations and control systems (Sarker & Lester, 2019, p. 1).

In the hurricane Irma (10 September 2017, the Caribbean Islands and the south-eastern US; 57 deaths; 6.8 million affected), Puerto Rico Electric Power Authority (PREPA) reported that the hurricane dealt severe damage to the energy system infrastructure of the island of Puerto Rico. In addition, before the power systems had fully recovered, hurricane Maria (20 September 2017, Puerto Rico; 64 deaths officially; 3.4 million affected) made landfall and knocked out the electric grid of the entire island of Puerto Rico, with severe damages to the other critical infrastructures. As a result, the National Weather Service and Centres for Disease Control and Prevention (CDC) reported that more than 12 million lost power, and over 6.5 million people were ordered to evacuate (CDC, 2017). Moreover, PREPA announced that service reached full system functionality, the same percentage as before this blackout, six months after Hurricane Maria (Sarker & Lester, 2019).

Water is an essential resource in natural disasters as well as for our life. There are two main explanations why water is needed in the event of a disaster as follows, 1) Maintenance to the hygienic environment and 2) Drinking water. CDC (2020) states that Floods and tsunami damage wells for drinking water and result in contamination in aquifers and wells. Floodwater contaminated water with livestock waste, human sewage, chemicals, and other contaminants that lead to illness when used for drinking, bathing, and other hygiene activities. The crucial effect on the health of disaster victims is the deterioration of the hygienic environments due to lack of water. CDC (2020) has been revealed to keep a body clean to prevent illness and infections and wash hands after the toilet to prevent food poisoning. In addition, a stressor for affected people under the environment where water cannot be used is included lack of water for the toilet for maintenance to hygienic environments. For drinking water, it is vital to take safe water and food. As exemplified, drinking contaminated water leads to increasing diarrheal infections such as cholera and Shigella (WHO, 2020). Furthermore, hydration is essential for good health. WHO (2020) also state that inadequate water supply cause illness such as urinary stones, infections, myocardial infarction, and economic syndrome resulting from blood flow deterioration.

2.1.3 Displaced population.

Another immediate effect of natural disasters is a displaced population. When countries, regions or areas are devastated by natural disasters, many affected people are forced to abandon their homes and seek temporary- or evacuees' shelters in other regions (Child Fund, 2021).

Due to natural disasters, people lose almost all of their belongings, including their houses and livelihood. For instance, droughts lead to a migration of many people who can no longer make their living in their home countries since there is not enough water left to grow plants or raise cattle. Another example is that, in the Niigata–Chuetsu earthquake (23rd October 2004, Japan; 49 deaths; 4,794 injured), the Ministry of Agriculture, Forestry, and fisheries (MAFF) reported that around 100,000 people took refuge, approximately 3,185 houses were destroyed, and the damage amounted to more than $ 26 billion (as of 16 September 2005). Nine thousand one hundred sixty people who lost their houses were still living in temporary shelters as long as a year after the earthquake due to the sustained occurrence of aftershocks and delayed reconstruction of community infrastructural (Kuwabara et al., 2008; MAFF, 2020).

In the Marmara earthquake (17 August 1999, Turkey; 17480 deaths; 45000 injured), the International Recovery Platform (IRP) reported 120,000 damaged and 50,000 heavily damaged housing. In addition, the government of Turkey and private companies had built prefabricated temporary houses. Nevertheless, only owners have the right to claim a permanent house from the State, not tenants according to the legal laws. Therefore, those survivors whose houses were marginally damaged or people who had been tenants before the earthquake was not legally eligible to have a new house. Consequently, 129,338 people were forced to live in 39,928 prefabricated houses in five provinces of the hard-hit areas a year after the earthquake (Kasapoglu & Ecevit, 2003).

Furthermore, Riyad Fatema, Islam, East, and Usher (2019b) argue that displacement due to natural disasters leads to more extraordinary women's mortality rates than men and, as well as higher rates of malnutrition and sexual abuse or sexual violence in temporally housing and shelters.

2.1.4 Emotional aftershocks.

All these effects above lead to Post Traumatic Stress Disorder (PTSD). Natural disasters are traumatic events that many survivors encounter and cause various psychological or physical health problems (Kuwabara et al., 2008). Confronted with accidents of destruction and the deaths of friends, family members and loved ones, people develop PTSD as a severe psychological condition resulting from severe trauma (Petrucci, 2012). Moreover, many survivors from natural disasters have psychological health problems, such as depression, fear,

or anxiety since it is hard to handle the consequences of natural disasters. Some victim's onset severe depression and PTSD, and they continue to suffer from these mental disorders for the long term. It, therefore, takes a long term for them to recover from these terrible events. Kuwabara et al. (2008) presented that 59.3% of the participants in the study had psychological distress immediately after the earthquake in the Niigata - Chuetsu Earthquake, Japan. Kuwabara et al. (2008) also addressed, as being with unfamiliar members during the night after the earthquake and living in temporary shelter or at a relative's home were the most substantial risk factors impairing psychological recovery five months after the earthquake. (Kuwabara et al., 2008).

2.2 Gender in Natural disaster

Natural disasters do not discriminate, but their impacts do. A vulnerability to disasters is due to inequalities in exposure and sensitivity to risk, such as access to resources and opportunities (Bahmanjanbeh, Kohan, Yarmohammadian, & Haghshenas, 2016; Sohrabizadeh et al., 2016). The vulnerability systematically disadvantages certain groups of people, and natural disasters make them more vulnerable to their health. Furthermore, vulnerability creates stress and anxiety, affecting physical, psychological, or social health; personal, situational, and environmental (Riyad Fatema, Islam, East, & Usher, 2019a). In my review study, I focus on women as specific groups of people.

There is some evidence indicating that females and males suffer from different consequences after natural disasters. Firstly, there are social and economic effects (WHO, 2002). For instance, loss of the ability to take care of the family due to unemployment cause adjustment difficulties for men with respect to the more traditional gender role norms. By contrast, women, who lose their husbands, are burdened with greater unprepared responsibility. For instance, they have to become the breadwinner of the household instead of their husband.

Secondly, women become more vulnerable to sexual abuse and domestic violence due to natural disasters' social and economic effects. For instance, women are put up in refugee camps that lack security and privacy, threatening their survival after a natural disaster (WHO, 2002). Similarly, the safety of women experiencing domestic violence is multiplied in disaster situations, and those women do not have access to disaster relief and recovery resources due to narrow social networks.

Thirdly, some evidence indicates gender differences concerning psychological consequences after natural disasters. For instance, WHO (2002) reported that several studies have found that a higher proportion of females reports suffering from emotional disorders and distress as compared to males. Furthermore, adverse reproductive outcomes, such as early pregnancy loss, preterm birth (PTB), stillbirths, delivery-related complications, and infertility, were found following natural disasters. WHO (2002) also stated that social taboos around menstruation and norms about appropriate behaviour for women and girls are related to women's health problems in disaster situations.

The following three paragraphs focus on women's health consequences regarding reproductive health and mental disorders and pregnant women and mothers' mental disorders.

2.2.1 Reproductive health.

Women's physical health vulnerabilities impact reproductive outcomes, such as abortion, stillbirth, PTB, and urinary tract infections (Mallett & Etzel, 2018; Riyad Fatema et al., 2019a; Zahran, Peek, Snodgrass, Weiler, & Hempel, 2013). The terms of reproductive hazards include mediators that affect reproductive or sexual function (Cordero, 1993). As exemplified, it specifies outcomes resulting from reproductive hazards include irregular menstrual cycles and infertility. Women's health vulnerabilities derived from being exposed to natural disasters are, thus, an adverse reproductive outcome. In addition, natural disasters lead to psychological disorders such as depression and PTSD. Therefore, stressful life events, such as exposure to natural disasters and pregnancy-related stress, are associated with birth outcomes.

A study regarding the impact of flooding on pregnancy and child health by Mallett and Etzel (2018) concluded that women with prenatal affected by flood indicated an association between high levels of prenatal stress and poor pregnancy outcomes, such as PTB and Low Birth Weight (LBW). Similarly, in the Chilean earthquake (27 February 2010 in Chile; 525 deaths), a study showed a reduction in birth rate and late deliveries after 42 weeks, whereas there was an increase in early preterm deliveries within 34 weeks or PTB. Mainly, women exposed to the earthquake in the first trimester of pregnancy were diagnosed with early preterm delivery of preterm delivery and delivered small for Small Gestational Age (SGA) (Oyarzo et al., 2012).

In Hurricane Andrew (24 August 1992, US; 38 deaths; more than 250,000 affected), there was a significant increase in the number of preterm deliveries for women living in the hurricane-

affected area for nearly all months in the year following the hurricane (Antipova & Curtis, 2015). In another study regarding hurricane Andrew, Zahran et al. (2013) addressed that pregnant women exposed to the hurricane resulted in more stress-induced abnormal labour and Caesarean delivery outcomes compared to statistically matched groups. A study on the event of the tornado outbreak in Alabama counties in April 2011 and of Tornado Missouri on 22 May 2011 indicated that there was no significant difference between women who were exposed and those who were not exposed to tornados regarding perinatal outcomes, such as PTB, LBW infants and infant mortality. However, a higher number of women exposed to tornados underwent a Caesarean section (Christopher, Kitsantas, Spooner, Robare, & Hanfling, 2019).

Sanguanklin et al. (2014) indicated that displacement was a predictor of prenatal maternal stress for pregnant mothers exposed to Thailand floods (summer season 2011, Thailand; 800 deaths; 13.6 million affected). In addition, the study reported that 70 % of pregnant women who experienced displacement during the flooding had infant birth weight more than that of infants born to non-displaced women (Sanguanklin et al., 2014). Zahran et al. (2013) also suggested flood-related displacement due to hurricane Andrew affected access to prenatal care in the US.

2.2.2 Mental disorders.

Psychological health vulnerabilities due to natural disasters lead to emotional disorders, ongoing distress, and PTSD in addition to shock, anxiety, and sleep disturbance. PTSD is the most commonly occurring psychological health problem among survivors of natural disasters. Gerard (2002) identified that depressive disorder and anxiety disorder were commonly mental health problems. The severity of psychological symptoms and modified behaviour after natural disasters are affected by various factors, such as age, gender, marital status, loss of loved ones, personal health condition, and personal injuries. However, these factors are superimposed on lack of resources, good infrastructure, and better social support systems (Farooqui et al., 2017).

In general, among all victims of traumatic events such as natural disasters, women are more vulnerable than men to mental disorders (Angela Lo, Su, & Chou, 2012; Farooqui et al., 2017; E. Lee & Lee, 2019; Riyad Fatema et al., 2019b). Especially in more gender unequal societies, there is significant evidence that women suffer from mental disorders more than men. Under this circumstance, Parida (2015) argues that women struggle with loss, hopelessness and

feelings of helplessness to enhance their condition. In addition, as a reason why women are more vulnerable than men, Parida (2015) stated that women are more dependent interpersonally and more emotionally reliant on others than men.

A survey among college students in Korea regarding the impact of disaster awareness and coping on stress, anxiety, and depression, highlighted that female students reported more stress and higher levels of depression symptoms than male students (E. Lee & Lee, 2019). Similarly, a review by Farooqui et al. (2017) suggested that females appeared to be the most widely affected group on psychological health problems, and they have a higher risk as compared to males.

2.2.3 Pregnant and postpartum women's mental health.

Pregnant and postpartum women, and their infants, are particularly vulnerable to natural disasters, and the health and well-being of pregnant women post-natural disasters are of international concern (Giarratano, Barcelona, Savage, & Harville, 2019; E. Harville, Xiong, & Buekens, 2010). This review study looks at how pregnant and postpartum women are vulnerable to psychological health problems due to natural disasters.

In the Chilean earthquake (27 February 2010, Chilie; 525 deaths), a study addressed that pregnant women exposed to the earthquake had symptoms consistent with moderate depression. In addition, those exposed to the earthquake at the third trimester of pregnancy had the highest score in the traumatic experiences test (Oyarzo et al., 2012). Also, Oyarzo et al. (2012) concluded that the psychological responses of pregnant women to the earthquake had a negative impact on them and their babies, resulting in consequences such as suicide and PTB. Furthermore, as significant risk factors, the loss of loved ones and greater damage to property due to natural disasters directly affect the mental health conditions of pregnant women (Ren et al., 2014). Additionally, a higher rate of birth complications such as PTB, LBW, restricted intrauterine growth, and congenital disabilities after the earthquake serve as a secondary stressor for peripartum women and contribute to the pathophysiology of the peripartum mental illness disorders.

In the Noto Peninsula earthquake (25 March 2007, Japan; one death; 356 injuries), a study analysed postnatal depression among pregnant women during and after the earthquake. Hibino et al. (2009) indicated that the earthquake-related factor was existing anxiety about the

earthquake. Especially, women who were anxious about the earthquake during pregnancy and first-time mothers had an increased risk of depression after delivery. Moreover, the study suggested that social support positively affected psychological stress as a critical factor in buffering against peripartum depression after the earthquake (Hibino et al., 2009; Ren et al., 2014).

Chapter 3 Theory of vulnerability

3.1 Intersectionality and vulnerability

Understanding vulnerabilities in natural disasters need accumulated knowledge from many areas of experience and investigation. Phenomena that encompass the content of vulnerability, risk, and natural disasters are themselves complex, highly intersected.

"Intersectionality is a critical framework that provides the mindset and language to examine interconnections and interdependencies between social categories and systems" (Atewologun, 2018, p. 2). Social categories as various axes of discrimination include as follows:

1. Social identities such as gender identities, nationality, and physical ability.
2. Sociodemographic categories such as gender, class, economic and immigration status and ethnocultural.
3. Social processes such as gender and race.
4. Social systems such as policies, culture, and media.

Intersectionality refers to a situation in which various axes of discrimination, such as race, ethnicity, nation, gender, class, and sexuality, are combined and interact with each other to create unique repression. Therefore, we need to incorporate different individuals or communities' experiences with all discriminatory social structures.

More explicitly, intersectionality, a term first created by Professor Kimberle Williams Crenshaw in 1989, acknowledges that everyone faces multiple intersecting forms of structural discrimination. In addition, intersectionality recognises that power relations play an essential role in constructing thought, experience, and knowledge (Carbado, Crenshaw, Mays, & Tomlinson, 2013).

Moreover, the theoretical framework on intersectionality allows understanding and creating of "different interpretations of the same facts." (Clarke & McCall, 2013, p. 350). For example, Crenshaw focused on black women and pointed out how multidimensional their experiences are and how a single-category-based analysis distorts and marginalizes these experiences (Carbado et al., 2013). Another example is that due to poverty, many black women have been engaged in paid labour, such as housekeepers in white families in order to support their livelihoods and their household. However, racial and discrimination against women in the

labour market forces them to work in poor conditions. Another example is that, in South Africa, domestic servants, most of whom are black women, have long been excluded from society as the occupation without social security until 20 years.

These two examples show that even if we focus all women on one group as "women", the repression experienced by white women is different from that by black women. Therefore, the oppression they experience derives from the overlap of the two categories of gender and race, so that we must consider them together without dividing them.

Depending on the society or situation in prone natural disasters areas, social categories may have a bearing on potential loss, injury, or death in the face of disasters or resources made to be disasters and the prospects and processes for changing that situation. People are affected differently across their social categories, and in particular when categories intersect. In my review study, I review and look at how the effect of natural disasters are related to social categories, focusing on the intersection of conditions that creates vulnerabilities. These variations need to be understood theoretically and in practice.

3.2 Road map to hell

As mentioned above, UNISDR states that disaster risk consists of three factors: hazard, exposure, and vulnerability. Hazards are natural phenomena such as earthquakes and hurricanes. In addition, hazard becomes a disaster when they happen in areas where destruction interferes with societies, infrastructure, human life, and so on. The severity of the disasters is related to social and physical preparedness. For instance, in a situation where people are unprepared, or lack of resources are in a place where the hazard occurs, they cannot withstand it.

In terms of vulnerability, Wisner et al. (2012) and WDR (2013) define vulnerability as the characteristics of a person or group and their susceptibility to loss from adverse shocks resulting from the impact of a natural hazard. Therefore, vulnerabilities facing natural disasters is often ascribed to those who struggle to recover in the aftermath of a disaster. In my review study, I refer to the framework of Road map to hell by Wisner et al. (2012, p. 29) as an approach in order to understand vulnerability and situate the post-disaster experiences of women with respect to health (see **Figure. 1**.).

Figure. 1. shows that people affected in the aftermath of a natural disaster have needs indicated by the central arrows, and failure to satisfy these needs results in lengthy delays or unsatisfactory recovery and further marginalisation (Wisner et al., 2012). In addition, there are six characteristics of vulnerability in facing natural disasters: natural-, human-, social-, physical-, economic-, and political resources. Natural disasters increase the needs of resource-less victims.

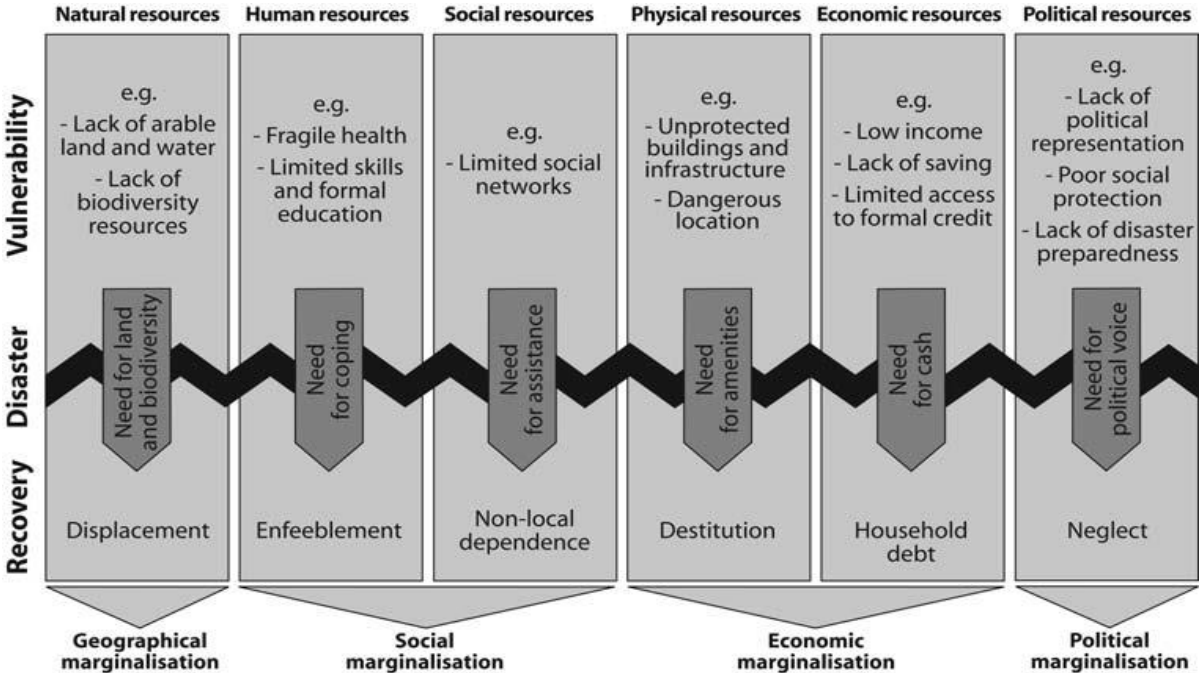

Figure.1. Road map to hell: from pre-disaster vulnerability to failed recovery (Wisner et al., 2012, p. 29)

Wisner et al. (2012) argue that humans are neither equally able to access the resources nor equally exposed to natural disasters. Natural disasters are of serious risk to people's livelihoods; thus, these six categories of resources are essential to dealing with natural disasters and are vital to sustainable livelihoods. Vulnerability, in other words, includes the ability to whether people are either able to use or access needed resources (Wisner et al., 2012).

For instance, residents in affected regions by natural disasters require displacement to which they can relocate, although depending on the social categories or situation, this is brought with a painful experience. Victims have a possibility to encounter psychological or physical health problems as well as those with limited skills and fragile health become more debilitated due to changing social and economic environments. Survivors with limited social networks need external assistance. Those with economic consequences owing to unemployment lose their physical assets resulting in leading to further destitution.

Furthermore, access to natural resources upon which to build a livelihood is inequitably distributed, as well as is access to physical resources such as secure locations, infrastructure that enables mobility, communications, and marketing, and political resources such as means of protection.

Regarding political resources, Wisner et al. (2012) reveal that people who are isolated or poor in terms of financial and livelihood resources tend to have little voice or limited access to political resources. They are also spatially, socially, economically, and politically marginalised. Therefore, in order to strengthen people's strategies to face natural disasters and cope with the interruption of life in the aftermath of disasters, political preparing resources, such as agreeing on warning signals, infrastructure and livestock protection, and planning evacuation routes and temporary shelters, are essential.

Chapter 4 The studies 2005 to 2020

4.1 Research questions

In sum, women's health vulnerability impacts reproductive outcomes and mental disorders due to natural disasters. However, it is uncertain how the effects of natural disasters on women's health are related to social categories with the intersection of conditions that creates vulnerabilities and how the studies can help us understand women's vulnerability to natural disasters.

In addressing these, what I would like to investigate in my review study are as follows:

1. How does research describe the impact of natural disasters on women's health?
    - What kind of factors that women's health problems caused by natural disasters are addressed in studies?
2. How can the studies help us understand women's vulnerability to natural disasters?

4.2 Methods

4.2.1 Study Design.

The review study was conducted based on the preferred reporting items for systematic reviews and meta-analysis (PRISMA) guidelines (Moher et al., 2015). The data stemmed from a systematic search of academic journal articles in the general computer databases, those available through my academic library.

4.2.2 Search Strategy and Inclusion/Exclusion Criteria.

The keywords used for my review study were as follows:

1. Natural disasters; terms including tsunamis, floods, drought, wildfire, earthquake, tornado, hurricane and snowstorm, reproductive health, and women or female or woman or females.
2. Natural disasters; include tsunamis, floods, drought, wildfire, earthquake, tornados, hurricane and snowstorm, women, and woman or female, and depression, anxiety, or PTSD.

In order to obtain authoritative information, this systematic review study included only full-text academic journals between 2005 and 2020 in the English language, having studied women's reproductive health and mental disorder after natural disasters. The articles with low quality and reliability, editorial articles, and academic journal articles conducted before 2005 were, thereby, excluded from my systematic review study. In addition, as my components, the countries for the review study were not limited in order to collect research data as much as possible, and I explored the impact of natural disasters on women's health regardless of the magnitude of natural disasters.

4.2.3 Study Selection Process.

Regarding women's reproductive health after natural disasters, the initial search using the proper combination of keywords and limitations among the available computer databases available through my academic library led to the identification of 19 studies. Then, the articles with identical titles as well as duplicate articles were deleted. After that, I evaluated the titles of these studies in a systematic screening and examined their abstracts in order to identify the studies related to women's reproductive health after natural disasters and select for full-text reading. As a result, only seven studies dealt with women's reproductive health after natural disasters.

For women's mental disorders after natural disasters, I conducted the process of article selection identically. The initial search led to the identification of 148 studies. As a result of evaluation and examination of eligibility regarding if these studies related to women's mental disorders after natural disasters, only 14 studies were found to deal with women's mental disorders after natural disasters. In addition, six studies were found to relate to pregnant women and mothers' mental health after natural disasters.

In total, 27 studies were found in order to deal with my review study.

4.3 Studies on the impact of natural disasters on women's health

4.3.1 Baseline characteristics.

The extracted academic journal articles concerning women's health in natural disasters have a different focus: reproductive health, mental disorders, and pregnant and postpartum women's health. **Table 1** and **Table 2** indicated the number of studies related to reproductive health,

mental disorders and pregnant women and mothers' mental health presented in academic journals (from 2005 to 2021) according to types of natural disasters (from 1997 to 2015) countries affected, respectively.

Table 1. The number of studies related to reproductive health, mental disorders and pregnant women and mothers' mental health presented in academic journals (from 2005 to 2021) according to types of natural disasters (from 1997 to 2015).

n=27

	Reproductive health	Mental disorders	Pregnant women and postpartum mother's mental health
Type of hazard			
Earthquake	4	6	2
Earthquake and flood	1	1	
Earthquakes and tsunami		3	2
Flood	1	1	
Hurricane	1	3	1
Cyclone			1
Total	7	14	6

Table 2. The number of studies related to reproductive health, mental disorders and pregnant women and mothers' mental health presented in academic journals (from 2005 to 2021) according to countries affected (from 1997 to 2015).

n=27

	Reproductive health	Mental disorders	Pregnant women and postpartum mother's mental health
Country			
China	3	3	1
Haiti		1	
Iran	2	2	
Japan		3	2
Nepal		2	
Pakistan			1
USA	2	3	1
Vanuatu			1
Total	7	14	6

The review identified five studies related to three earthquakes regarding women's reproductive health, including three studies about the Wenchuan earthquake (12 May 2008; China) and two studies about the Ahar earthquake (11 August 2012; Iran). The other two studies were about the Red River flood (25 April 1997; USA) and Hurricane Katrina (29 August 2005; USA). The studies analysed women's reproductive health between two months to eight years after the natural disasters.

For the women's mental disorders, ten studies were conducted after seven earthquakes, including three studies about the Great East Japan Earthquake (11 March 2011; Japan); two studies about the Wenchuan earthquake (12 May 2008; China); two studies about the Gorkha earthquake (25 April 2015, Nepal); one study about the Ahar earthquake (11 August 2012; Iran); one study about the Haiti earthquake (12 January 2010; Haiti); one study about the Bam earthquake (26 December 2003; Iran). The other four studies were as follows: two studies about Hurricane Katrina (29 August 2005; USA), one study about the Dongting Lake flood (7-25 September 1998; China**),** and one study about Hurricane Sandy (31 October 2012; USA). The studies evaluated the prevalence of the mental disorder between six months to 17 years after the natural disasters.

For pregnant and postpartum women's mental health, four studies were conducted after three earthquakes, including two studies about the Great East Japan Earthquake (11 March 2011; Japan); one study about the Wenchuan earthquake (12 May 2008; China); and one study about the Kashmir earthquake (8 October 2005; Pakistan). The other two studies were one study about The Super Cyclone (13 March 2015; Vanuatu); and one study about Hurricane Katrina (29 August 2005; USA). The studies analysed the prevalence of mental disorders on pregnant and postpartum women between three months to four years after the natural disasters.

4.3.2 The impact of natural disasters on women's health.

As described above, the extracted studies concerning women's health have a different focus. Therefore, in this paragraph, findings are demonstrated from the 12 events from 1997 to 2015.

The Red River flood in the US.

A study about reproductive health after the Red River flood in the US (25 April 1997; 60 deaths; 27,000 affected), using analysed data from 1994 to 2000 birth files and time-series, reported that an increase in births; LBW and PTB after adjusting for maternal characteristics and smoking, and decreases in the crude birth rate and fertility rate after the flood (Tong, Zotti, & Hsia, 2011). Furthermore, Tong et al. (2011) investigated differences in the changes in birth rates by race or ethnicity and socio-economic status regarding maternal characteristics. Tong et al. (2011) showed that there was an increase in the proportion of women giving birth who were non-white, unmarried, and had more remarkable than high school education.

The Dongting Lake flood in China.

A cross-sectional study about mental disorders after the Dongting Lake flood in China (7 - 25 September 1998; 223 million people affected, 3,004 deaths and 15 million made homeless) showed that the prevalence of PTSD and anxiety was higher in females than in males. In addition to gender, the most substantial factor for PTSD was to have experienced stressors derived from the flooding, and that for anxiety was insufficient social support (Dai et al., 2017).

The Bam earthquake in Iran.

A cross-sectional study about mental disorders after the Bam earthquake in Iran (26 December 2003; more than 70,000 deaths) showed that the prevalence of psychiatric disorders in women was slightly more prominent than in men (54.27% and 49.93%, respectively) (Baniasadi et al., 2019). Nevertheless, there was a significant difference between men and women concerning depression; 28.97% and 43.47%, respectively. In addition to gender, the study indicated that widows and divorcees, and women with postgraduate, illiterates or drop-outs and those 60 years and older had a higher average concerning the prevalence of mental disorders. The highest risk factor for suffering from mental disorders after the earthquake devastating was the death of one or more family members (Baniasadi et al., 2019).

The Kashmir earthquake in Pakistan.

A cross-sectional study four years after the Kashmir earthquake in Pakistan (8 October 2005; 79,000 people deaths; 3.5 million affected; more than 32,000 buildings collapsed) analysed women between 15-49 years in affected earthquake areas. Anwar et al. (2011) presented three factors for depression and anxiety. Those were the conflicts of socio-economic status, earthquake experiences, and limited access to health facilities. In addition, the study highlighted that the most substantial risk factor for depression and anxiety was limited access to health facilities.

Furthermore, Anwar et al. (2011) addressed that reproductive health events such as stillbirth and abnormal vaginal discharge or genital ulcers were made worse due to the limited access to health facilities. Another predictive factor that the study in my review raised was that the husband was unemployed and that being separated from a family member due to the earthquake (Anwar et al., 2011).

Hurricane Katrina in the US.

There were four studies regarding Hurricane Katrina in the US (29 August 2005; 1,833 deaths; 15 million affected). The first study was a comparative study of women in being exposed areas and women nationally in the US regarding women's reproductive health. The study indicated that there was an increase in giving birth to LBW infants and very low birth weight (VLBW) infants in women living in the affected areas, compared to births nationally in the US (Callaghan et al., 2007). Callaghan et al. (2007) also reported that women living in the hurricane-affected areas were not breastfeeding or had for a shorter duration of breastfeeding compared with women nationally. The reasons why the effects on breastfeeding occurred were interruptions in the supply of clean water for drinking and bathing, insufficient access to safe food, exposure to environmental toxins, disruption of health care, and crowded conditions in temporary shelters (Callaghan et al., 2007).

In two studies about mental disorders, women in affected hurricane areas had higher depression and psychological stress levels than men in those areas (LaJoie, Sprang, & McKinney, 2010; Steven Picou & Hudson, 2010). In addition, a telephone survey 2,5 years after hurricane Katrina by Steven Picou and Hudson (2010) found that women, especially African Americans, were the most vulnerable populations and that mental health problems are relatively widespread for these groups. Furthermore, the findings revealed that African Americans were characterised by higher personal depression and PTSD symptoms in terms of social structural vulnerability.

In addition, women with lower educated were characterized by a higher prevalence of depression symptoms, and married women were more depressed than those who were nonmarried. Moreover, Steven Picou and Hudson (2010) stated that social structural vulnerability continues to maintain negative mental health impacts the long-term after the hurricane, and the destruction of one's residence resulted in increased levels of personal depression and PTSD symptoms. Another study among evacuees, using telephone interviews, described that women and those with greater exposure to the hurricane had higher prevalence of depression symptoms. Those women also had a higher anxiety concerning returning to the Gulf Coast rather than staying in Louisville (LaJoie et al., 2010).

A study using interviews with women who had been pregnant during or shortly after the hurricane found that non-white women, especially African American women, were more likely

to have damage, have perceived or experienced danger post-hurricane, and suffer from depression and PTSD. In addition, E. W. Harville et al. (2009) revealed that race was a strong predictor of the prevalence of mental health problems. Concerning gender, women with the most educated group and higher income were the least likely to have had damage or experienced danger, whereas those with a high school diploma were most vulnerable to psychopathology, as well as women who did not live with a partner (E. W. Harville et al., 2009). Notably, women, who have given birth to two or more children, were more likely than primiparous women and first-time mothers to have had severe damage and to be depressed and have PTSD.

The Wenchuan earthquake in China.

There were six studies concerning the Wenchuan earthquake in China (12 May 2008; 90,000 people deaths; 470,000 affected; five million homeless overnight). The first study was a survey after seven and eight years following the earthquake. The study indicated that exposure to the earthquake was associated with a higher risk of PTB (Lian et al., 2020). Furthermore, Lian et al. (2020) identified that women who have given birth to two or more children, first-time mothers living in the local region, and those with lower education had a higher risk for PTB incidence.

In two of the studies concerning menstrual cycles after the earthquake, both two studies indicated that the percentage of women, who reported that menstrual cycles became irregular after the earthquake, increased considerably compared with before the earthquake (Li et al., 2011; Liu, Han, Xiao, Ma, & Chen, 2009). Liu et al. (2009) addressed that the stress derived from the disaster was significantly associated with menstrual disorders among women aged between 21 and 50 years. However, there was no difference in changes in the different levels of education and age groups. The main stressors were the poor living conditions in the temporary shelters, followed by insufficient access to clean water and post-traumatic psychological conditions.

Furthermore, for 8-10 weeks following the earthquake, gynaecological diseases, sexual problems, and a lack of fertility desire were widespread in the QingChuan district. Regarding fertility desire, “89.4% of participants reported that they would not pursue a plan to become pregnant, and 67.1% of them reported they would request pregnancy termination if they

became pregnant" (Liu et al., 2009, p. 165). The reasons for wanting to terminate a pregnancy were the bad environmental and economic conditions after the earthquake.

Self-report questionnaires were conducted 2-13 months after the earthquake in the town of Mianzhu. The study showed that there was no significant difference in social categories such as age, ethnicity, and education regarding irregular menstrual cycles. Instead, the risk factors of menstrual irregularity were losing children, large amounts of property, social resources and hormonal contraception use (Li et al., 2011).

A study using a randomized sampling cross-sectional survey 8-10 months after the earthquake analysed mental disorders among new mothers who had a delivery within a week after the earthquake. The study indicated no significant difference in changing social categories such as age, ethnicity, and education. However, new mothers with severe earthquake experience had a higher risk of PTSD and depression than women without earthquake experience (Qu et al., 2012). In addition, Qu et al. (2012) indicated that those with monthly family income lower than USD 150 had higher risks of PTSD and depression than those with monthly family income higher than USD 448. Regarding employment, a farmworker and unemployment were a predictor of having depression compared with nonfarm workers.

Two of the studies were regarding mental disorders after the earthquake. The result showed that the prevalence of anxiety and depression disorders were considerably higher in females than in males (Wu, Xu, & He, 2014; Xie, Xu, & Wu, 2017). In addition, a study conducting self-report questionnaires and interviews identified that females with a lower income level, those living in temporary accommodation or rented houses and those with lower social support were predictors of having anxiety, depression, and PTSD (Wu et al., 2014).

A population-based mental health survey, using self-report questionnaires, showed that females, the middle-aged, those of Tibetan nationality, and people who suffered from fear after the earthquake were characterised as risk factors of PTSD, anxiety, and depression disorders (Xie et al., 2017). In addition, people with a high school education level had a higher anxiety disorder level than those above university level.

The Haiti earthquake in Haiti.

A population-based survey analysed a comparison of reproductive health for five years before and two years after the Haiti earthquake in Haiti (12 January 2010; 316,000 people deaths; 3

million affected; more than 32,000 buildings collapsed). The study showed that women have a higher risk of psychological health problems than men. Furthermore, insufficient social support in post-earthquake increased the risk of PTSD and depression among women (Cerdá et al., 2013). Furthermore, Cerdá et al. (2013) indicated that a prior history of violent trauma was the most associated with the risk of PTSD and depression resulting from the earthquake.

The Great East Japan earthquake and tsunami in Japan.

Five studies were identified on the effects of the Great East Japan earthquake and tsunami in Japan (11 March 2011; 15,894 deaths; 99,700 affected). Three out of five studies were conducted concerning mental disorders. The first study analysed mental health problems in residents in one of the hardest-hit areas. The study found that females were more likely to have mental health problems than male participants, especially women who experienced relocation had a higher risk of mental health problems (Yokoyama et al., 2014). In addition to gender (female), Yokoyama et al. (2014) showed that people with health complaints, severe economic status, replacements, and insufficient social networks, were associated with mental health problems.

Kawakami et al. (2020) analysed mental disorders in long-term residents in the 13 temporary shelters and the community residents in the disaster area using face-to-face interviews. The study found that the proportion of anxiety disorder residents was higher in the temporary shelter group than in the community residents (Kawakami et al., 2020). In particular, being divorced or separated, personal injury and bereavement of both family or relative and friends were associated with the post-disaster prevalence of anxiety in the shelter group. Regarding the specific mental disorder, Kawakami et al. (2020) also indicated that females, personal injury, and bereavement of both family members or relatives and friends were associated with the prevalence of depression. Similarly, personal injury and bereavement of both family or relatives and friends were associated with PTSD. However, personal injury was the only disaster risk factor the prevalence of anxiety.

A cross-sectional survey concerning depressive symptoms in female college students in the hardest-hit area showed that there was no difference in changes in socio-demographic characteristics such as living arrangements, age, and residence prefecture (Ito, Sasaki, Okabe, Konno, & Goto, 2018). Ito et al. (2018) found that those college students were worried concerning caring for and giving birth to a baby in the affected areas in the future.

Two studies analysed pregnant and postpartum women's mental health. The first study was a cross-sectional study among postpartum women in a disaster prefecture 6-9 months after the earthquake. The study indicated that women, who had postpartum with a higher level of depression symptoms, were below 25 years, had a baby with a birth weight under 2500g and were exposed severely to the earthquake (Nishigori et al., 2014).

The second study analysed the psychological distress and the related factor among women who were either pregnant or in the early postnatal stage living in a disaster area, from month 10 to month 48 after the earthquake. At all periods, the study indicated that there was a higher prevalence of psychiatric distress. Furthermore, the prevalence was more widespread among the mothers being surveyed in the disaster areas than the proportion of Japanese adults (Kineko, Maki, Mai, Mari, & Nobuko, 2016). The factors associated with depression were house damage, and loss of employment suffered from the earthquake and tsunami (Kineko et al., 2016). Furthermore, Kineko et al. (2016) indicated that having babies under these situations worsened their general health over two years after the earthquake. The more substantial related factors of the prevalence of depression symptoms were dissatisfaction with one's marital life, financial worries and insufficient social support concerning childcare and mother's anxiety at months 48 after the earthquake (Kineko et al., 2016).

Hurricane Sandy in the US.

Self-report questionnaires analysed gender differences in psychological reactions to Hurricane Sandy that affected New York Metropolitan Area in the US (31 October 2012; 72 deaths; 650,000 houses damaged). The study presented that women had more recollections of Hurricane Katrina and Hurricane Irene in comparison to men. Furthermore, women had higher fear from future events such as terror attacks, nuclear disasters, personal accidents or illnesses, and fear of death from close family members or friends compared with men (Hamama-Raz et al., 2015).

In addition, Hamama-Raz et al. (2015) addressed that the risk factor for post-traumatic stress symptoms (PTSS) was heightened fear of future hurricanes, and using newspapers as a source of information about the hurricane Sandy was identified as the second highest factor.

The Ahar earthquake (including floods) in Iran.

Three studies were extracted from the event of the Ahar earthquake in Iran (11 August 2012; 306 deaths; more than 263,693 affected). One of these studies focused on women's reproductive health and infant. The study indicated a decrease in live birth rate, general marriage fertility rate, stillbirth rate, and prevalence of sexually transmitted diseases post-the earthquake. In addition, there was an increase in infant mortality rate, LBW and the rate of Caesarian delivery (Bahmanjanbeh et al., 2016). On the other hand, there was no difference in social categories such as living region and marital status changes. However, Bahmanjanbeh et al. (2016) indicated that exposure to the earthquake and mothers' malnutrition is accountable for these problems. Furthermore, Bahmanjanbeh et al. (2016) showed an increase in under 1-year formula milk-fed infants' percentages and a decrease in the duration of breast milk feeding during the year of a disaster compared to the years before and after the natural disaster.

Two of three studies were conducted in in-depth unstructured interviews. One of the studies was concerning psycho-physical effects and women's health status after the earthquake. Sohrabizadeh et al. (2016) found that women were more vulnerable than men, and all women who had interviews, confronted physical and psychological health consequences after the earthquake. Significantly, older women reported physical injuries and limitations, and they depended on their family members resulting from their mobility in order to carry out householding. In addition, depressive symptoms were observed among all affected women and fear of reoccurring earthquakes or floods was increased. The most substantial risk factor of distress and anxiety of all women was that the changes post-disasters were affected their health conditions (Sohrabizadeh et al., 2016).

In addition, Sohrabizadeh et al. (2016) found that an increase in unwanted or unplanned pregnancies had been another challenge for some women. An increase in sexual relationships after disasters and insufficient birth control tools have resulted in unplanned pregnancies. Sohrabizadeh et al. (2016) pointed out insufficient information and support concerning women's reproductive health as the reasons for these problems.

Furthermore, living in unhealthy conditions, such as inadequate shower rooms and unequal and unfair distribution of portable bathrooms, influenced women negatively more than others. In addition, a single water pipe was unsuitably placed in some destructed areas, and no suitable drainage was available around this washing location, creating unhygienic conditions. This

situation affected daily tasks such as cooking and washing dishes and clothes. Finally, Sohrabizadeh et al. (2016) indicated inadequate knowledge on environmental health standards and insufficient educational programs in relation to pre-and post-disaster periods for these environmental health issues.

Another of the two studies focused on residents in affected earthquake regions. The study showed that women with lower education were more vulnerable in affected earthquake areas than others. In addition, Sohrabizadeh et al. (2018) indicated three categories of management issues: cultural factors, lack of preparedness, and a monitoring system. These issues were identified from the facts that 1) women kept women from sharing their reproductive health problems such as menstruation disorders, pregnancy, contraceptive methods, and sexually transmitted diseases due to that health workers are men, 2) there was no pre-disaster planning for providing post-disaster health services at rural and urban regions, and 3) monitoring functions were limited to pregnancy care for women who lived in the devastated regions (Sohrabizadeh et al., 2018).

The Super Cyclone in Vanuatu.

A study analysed patterns and predictors of distress among pregnant and non-pregnant women 3–4 and 15–16 months after the super cyclone in Vanuatu (13 March 2015; there were a smaller number of deaths at 11, however about 188,000 people were affected out of a total population of 270,000). 3-4 months after the cyclone, the study showed that women were equally vulnerable to distress regardless of pregnancy or non-pregnant. Predictor for distress was devastating to the village and house. There was no difference in changes in social categories such as age, education, and number of children 3-4 months after the cyclone (Pomer et al., 2019). However, Pomer et al. (2019) found that pregnancy and education were predictors for distress 15-16 months after the cyclone.

The Gorkha earthquake in Nepal.

Two studies in my review analysed mental disorders after the Gorkha earthquake in Nepal (25 April 2015; 8,970 deaths; 910,000 affected). Both studies presented that females who experienced more severe earthquake damage more significant psychological health problems in relation to PTSD than males (Adhikari Baral & K.C, 2019; Dahal, Kumar, & Thapa, 2018). Furthermore, Dahal et al. (2018), carrying out a cross-sectional study, found that gender; female and 60 years and above age group as the social category were the significant predictors

for PTSD. In addition to social category, difficulty in communication, death of family members, relatives and friends, loss of job or finance worries, and insufficient social support increased the prevalence of PTSD, and insufficient social support was the most substantial factor for PTSD.

Adhikari Baral and K.C (2019), conducting a cross-sectional descriptive study, indicated that females, the elderly, lower education and injured due to the earthquake had a higher risk for the prevalence of PTSD.

Chapter 5 What does the literature say?

5.1 Increase preterm birth (PTB) and infant birth weight (BW)

There were four studies about an increase in births such in my review study, as PTB, BW and small for gestational age (SGA). These four studies hold the exposure to natural disasters and mother's malnutrition partially accountable for these problems. Furthermore, the arguments support that severe psychosocial stressors such as exposure to natural disasters, especially during early-pregnancy to mid-pregnancy, result in PTB and infant BW so that pregnant women are more sensitive in those periods. In addition, the studies in my review found that exposure to earthquakes resulted in a long-term effect on PTB. Thus, all four studies support that distress during pregnancy has long-term adverse effects, and prenatal maternal stress from natural disasters strongly influences on birth and child development.

Another issue that the studies in my review raise are the problem of mother's malnutrition post-natural disaster and the influence of this malnutrition on infant development. WHO (2015) states that pregnant women need more nutrition in order to accommodate the increased basal metabolism. However, under circumstances where there is a shortage of food in a disaster area, and the fact that emergency meals are higher in salt content, make it challenging for those who are affected by a disaster to get adequate nutrition and pay attention to changes in dietary balance, amount, and weight.

These are vulnerabilities that can depend on political resources (Wisner et al., 2012). It is problematic for pregnant women exposed to natural disasters and malnourished to stabilise the pregnancy process by themselves. Natural disasters make them more vulnerable concerning their health. Ideally, policymakers should acknowledge the long-term adverse effects of natural disasters on pregnant women's health in post-disaster recovery and plan for the provision of both psychological and prenatal care support in disaster-prone areas.

In two studies regarding PTB and infant BW, namely on the event of the Ahar earthquake in Iran and Hurricane Katrina in the US, there was no discussion concerning differences in social resources or socio-economic status of the victims. However, on the Wenchuan earthquake in China, women, who were given birth for the first time, living in a rural region and had lower education, also had a higher risk of PTB. This study demonstrates that women with lower

education also have insufficient information concerning women's reproductive health, and first-time mothers are more likely to have maternal trait- and pregnancy-specific anxiety than women who have given birth to two or more children. In addition, women living in rural areas may have less access to information and care. Therefore, these women are vulnerable to human- and political resources (Wisner et al., 2012), as being a first-time mother makes you more vulnerable if you have lower education and live in a rural area. At least, that is what we can draw from the Chinese study. Nevertheless, we can draw from these studies is that disaster-prone areas need local plans with respect to the reproductive health needs of people in case of natural disasters. It is also likely that general education programs on reproductive health can serve to make women less vulnerable during and after natural disasters.

5.2 Increase under 1-year formula milk-fed infant's rate

In my review study, two studies were concerned with the increased formula milk-fed infant's rate for children under one-year-old and a decrease in infants breast-feeding rate after natural disasters. These were found both after hurricane Katrina in the US and the Ahar earthquake in Iran. The studies subscribe these changes to unhealthy conditions and environmental problems in temporary shelters.

Unhealthy conditions in natural disasters, such as interruptions in the supply of clean water for drinking and insufficient access to safe food, have adverse effects on infant development. WHO (2015) suggests that breastfeeding is the better source of nutrition for infants in natural disasters. This is because breast-feeding infants are protected from physical and mental health problems by ingredients in the milk. However, under unhealthy conditions, the water and nutrition qualities of the milk are likely to be deteriorating. Nevertheless, despite increased nutrition, formula milk-fed and using baby bottles carries a great deal of risk. For instance, if it is difficult to clean and sterilise milk preparation products, there is also a risk of infections and diseases and losing the general health benefits of breast milk. Therefore, the studies showed that an increase in formula milk-fed infant's rate for children under one year old and a decrease in infant breastfeeding rates are of real concern. Thus, the provision of safe water for drinking and washing products, hot water or baby bottles is a crucial post-disaster concern.

However, unsanitary conditions in post-disaster temporary shelters are not only vulnerabilities of infants and lactating women. They are also vulnerable to physical and psychological stress

and difficult clean of milk replacement. Gribble and Berry (2011) state that breastfeeding helps reduce the physiological reaction to stress in both the infant and its mother, helping to cope with the stress of being involved in a disaster. This is a double jeopardy vulnerability, as what would, indeed, have alleviated stress has become difficult because of stress. The studies of my review show that infants and lactating mothers share a double vulnerability due to natural resources (Wisner et al., 2012), and providing safe foods to mothers and adequate knowledge in order to sustain breastfeeding in a disaster should be of a higher priority.

The studies also argue that environmental problems in temporary shelters lead to increase under 1-year formula milk-fed infant's rate. Crowded unhygienic conditions and privacy issues were found. Both the clean water supply and shower rooms and bathrooms hygiene are vital to suppress environmental issues. Especially, lactating women are more likely to get infection diseases such as mastitis, and under such conditions, they need a clean water supply in order to sustain breastfeeding. In addition, there are no breastfeeding rooms or changing rooms with partitions in many temporary shelters, which are essential to protect privacy. My review study did not extract details concerning the conditions of the temporary shelters. Nevertheless, the review study implicitly shows that lactating women in temporary shelters experienced challenges finding breastfeeding spaces to nurse their infants safely and privately.

These are vulnerable due to political resources (Wisner et al., 2012), where lactating women, who displaced from their homes to temporary shelters following a disaster, are more vulnerable to environmental issues in shelters, in addition to physical and psychological stress and the difficulty of finding clean milk replacement. From these studies, we understand how the environment, where it is managed safe, comfortable, and with dignity, is an essential feature in the temporary shelters in order to decrease the vulnerability of infants and lactating women. In addition, there should be sufficient space in the temporary shelters in order to place breastfeeding rooms and to have separate changing rooms for men and women.

5.3 Change in menstrual cycles

In my review study, there were two studies regarding the increase of irregular menstrual cycles. Both studies were found after the Wenchuan earthquake in China. There was no discussion concerning differences in social resources such as age group and the ethnic or socio-economic status of the victims in the studies. However, the factors that menstrual cycles became irregular

were the stress derived from the disaster, which was poor living conditions in the temporary shelters and post-traumatic psychological conditions.

The poor living conditions in the temporary shelters have adverse effects on menstrual cycles. For example, in terms of unhygienic toilets and insufficient access to clean water, Schmitt et al. (2017) state that the shared latrines in temporary shelters were unsafe, uncomfortable, and dirty. Under these circumstances, menstrual hygiene management is a challenge facing displaced women. For instance, in temporary shelters, women are more difficult likely to find spaces to clean themselves and dispose of menstrual waste. In addition, if it is challenging to keep cleaning the body themselves due to unsanitary conditions, there is also a risk that women get infectious diseases and gynaecological illnesses.

This is the vulnerability that can depend on physical- and political resources (Wisner et al., 2012). It is problematic for reproductive-age women living in temporary shelters due to being exposed to natural disasters. Natural disasters make them more vulnerable concerning menstrual cycles. At least, that is what we can draw from Chinese studies. Nevertheless, my review study did not deny the importance of clean water and hygiene for reproductive-age women in temporary shelters. Hence, we can draw from these studies that temporary shelters should be placed in line with the international environmental sanitation standards and policies of reproductive health in order to make reproductive age women less vulnerable during and after natural disasters.

Another issue that the studies in my review raise are post-traumatic psychological conditions. Most studies concerning menstrual cycles have drawn attention to that stressors have long been related to menstrual cycles abnormalities (Albert, Pruessner, & Newhouse, 2015; Edozien, 2006; Sanders & Bruce, 1999; Yamamoto, Okazaki, Sakamoto, & Funatsu, 2009). The studies of my review demonstrate that consequences of the post-traumatic psychological conditions that caused the menstrual irregular were loss of children, property, social resources, and hormonal contraceptive use. Thus, reproductive-age women have stress, such as losing a significant quantity of properties exposed to the earthquake. This is vulnerability due to physical resources (Wisner et al., 2012), where reproductive-age women, who experienced the loss of significant amount resources, including their children, are more vulnerable health-wise, especially during menstrual cycles.

From these, my review shows that reproductive-age women are more vulnerable to the menstrual cycle if they experience loss of significant amount resources, including their children and have to move to temporary shelters under adverse environmental conditions. In addition, what we can draw from these is that disaster-prone areas need health support concerning the menstrual cycle and psychological care.

5.4 Fertility responses and desire

In my review study, there was one study concerning an association between fertility desire and natural disasters. The study was found on the event of the Wenchuan earthquake in China. The study showed that most women, who took part in the study, reported that they would not have a plan to become pregnant, and even if they became pregnant, they would apply for termination. In addition, the study holds bad economic - and environmental conditions accountable for this problem. The argument is supported by Boberg-Fazlic, Ivets, Karlsson, and Nilsson (2021), that there are three aspects that affect fertility in a crisis, such as natural disasters: physical-, psychological-, and economic aspects.

Economic consequences due to natural disasters have adverse effects on fertility desire. According to the UN, In China, family and fertility policy measures has been carried out since1979 (UN, 2020). Furthermore, Yu et al. (2015) indicated that In China, the critical perception concerning having children is if a married couple has a higher income or not. Therefore, for Chinese women disaster-affected, their poverty and financial challenges are of a real concern more than becoming pregnant. Furthermore, due to an impaired quality of life resulting from economic consequences from the disaster, women prioritise the improvement of a better quality of life before becoming pregnant. These are vulnerabilities that can depend on economic resources (Wisner et al., 2012). Therefore, it is problematic for married women who have economic consequences due to natural disasters. Thus, natural disasters make them more vulnerable concerning women's fertility desire.

Another issue that the study in my review raises is environmental conditions for a safe childbirth and pregnancy process. Specifically, the study in my review demonstrates that environmental conditions were worsened due to a dearth of clean water. Furthermore, the argument is supported that the environmental conditions of whether or not a child can be delivered under a safe environment and whether or not a mother can remain healthy during the

pregnancy period are prone to relate with the psychological aspect (WHO, 2015). This is the vulnerability to physical resources (Wisner et al., 2012), as the poor environmental conditions after a disaster make women more vulnerable to becoming pregnant. This highlights the robust association between an impaired quality of environmental conditions aftermath the disaster and fertility desire as public health concerns.

At least, that is what we can draw from only the one Chinese study. However, the review study implicitly shows that psychological aspects caused by environment unhealthy conditions and economic consequences were interdependent that affect fertility among reproductive-age women disaster-affected. Changes in women's feelings and behaviour toward pregnancy due to exposure to natural disasters resulted in decreased infertility. Furthermore, we can draw from these that disaster-prone areas need plans for financial support and improvement of environmental conditions with respect to fertility desire.

On the other hand, in my review study, there was one study about an increase in unwanted or unplanned pregnancies due to insufficient reproductive health support, such as the distribution of birth control tools and information services. This study was found in the event of the Ahar earthquake in Iran. In addition, the study in my review indicated that insufficient health care supports make women decrease knowledge concerning contraception use and opportunities to speak openly about their reproductive health. Furthermore, the most population in Iran are Muslim, and discrimination against women in Islamic countries such as Iran has not yet been eliminated (UN, 2020). Under such cultural issues in Iran, the needs of disaster-affected women may remain with unacceptable solutions in the absence of women in the national and local institutions (Sohrabizadeh et al., 2016).

This is the vulnerability that can depend on political resources (Wisner et al., 2012). It is problematic for reproductive-age women who are exposed to natural disasters to prevent unwanted or unplanned pregnancies. Natural disasters make them more vulnerable health-wise, especially fertility responses if it is difficult to access health facilities in order to obtain birth control tools and information, and they have cultural issues. In addition, reproductive health services likely play an essential role in the fertility responses in natural disasters. Ideally, the nation and local government should identify highly prioritize disaster-affected reproductive-age women's needs and solve poor reproductive health services for upcoming disasters.

5.5 Prevalence of mental disorders

In my review study, 14 studies were concerned with mental disorders following natural disasters. These studies were found from the ten events of natural disasters. Most studies of my review hold that women in affected natural disasters areas have a higher risk of psychological health problems than men in those areas. In addition to gender as a social source, in these studies of my review, the four significant factors being identified regarding the prevalence of mental disorders due to natural disasters are 1) Lower education, 2) Economic consequences, 3) Relocation and fear from future disasters and 4) History of traumatic events. Each of these factors will be illustrated on in the paragraph below.

5.5.1 Lower education

Three studies of my review hold lower education partially accountable for a greater risk of mental disorders prevalence due to natural disasters. Many studies indicate the association between prevalence rate of mental disorders and education, and prevalence rates for mental health problems become higher when one's education is low (Gagn & Ghenadenik, 2018; Groot & Maassen van den Brink, 2007; IPH, 2008; Niemeyer, Bieda, Michalak, Schneider, & Margraf, 2019). The United Nations educational scientific and cultural Organisation (UNESCO) supports that health inequality at the education level negatively affects our psychological health problems (UNESCO, 2021). In my review, the study by Sohrabizadeh et al. (2016) also supports that women with lower education have insufficient knowledge on environmental health standards in relation to pre-and post-disaster we can learn through educational programs. Thus, women with lower educated have fewer opportunities to gain knowledge concerning health and natural disasters than those with higher educated.

Therefore, these women are vulnerable to human- and political resources (Wisner et al., 2012). In addition, natural disasters make women more vulnerable to psychological health problems if they are lower educated. Thus, it is likely that the provision of general education programs on natural disasters for all people, especially those living in disaster-prone areas, can serve to make them less vulnerable to psychological health problems. Ideally, policymakers should plan in order for access to have education for all. In addition, the introduction of systematic disaster education for risk reduction is necessary from the stage of primary education.

5.5.2 Economic consequences

Another more robust risk that the studies in my review raise is economic consequences due to natural disasters and the impact of economic concerns on mental health. In addition, WHO (2011) states that the economic consequences are likely to develop secondary mental health effects that may increase suicidal rates. Thus, being unemployed due to a natural disaster make people in the disaster-prone area more worried about their lives. This circumstance is of a real concern.

This is the vulnerability that can depend on economic resources (Wisner et al., 2012). It is problematic for women exposed to natural disasters to maintain their lives the same as before a disaster. Natural disasters make them more vulnerable concerning psychological health if they had economic consequences due to a natural disaster. My review study implicitly shows that psychological health problems affect the economic consequences of a natural disaster and that social welfare and policy measures are needed in order to counteract these problems.

5.5.3 Relocation and fear from future disasters.

In three studies of my review regarding mental disorders prevalence, namely on the event of the hurricane Katrina in the US, the Wenchuan earthquake in China and the Great East Japan earthquake and tsunami in Japan, women, who experienced relocation and living temporary house, also had a higher risk of mental disorders prevalence. Thus, vulnerability to devastating housing have effects on psychological health. Furthermore, due to relocation and living in temporary shelters, women may have possibly experienced unhealthy environments, unsanitary conditions, less security and privacy. These circumstances cause exhaustion, stress, anxiety, and fear (Woodhall-Melnik & Grogan, 2019).

Therefore, mental disorders such as depression and anxiety may occur as a stress reaction caused by sadness and feeling of loss caused by devastating housing and the difficulties in life by living in temporary housing. This is the vulnerability that can depend on physical resources (Wisner et al., 2012). Therefore, housing damage due to natural disasters makes women more vulnerable to mental disorders if they need to relocate or live-in temporary housing.

Interestingly, in Hurricane Katrina in the US, there was a concern about returning to the Gulf Coast rather than staying in Louisville, where is relocation. According to the UN, Hurricanes are the most devastating natural disasters in the US (UN, 2020). Major hurricanes occur along

the coast from the southern part of the US to the east coast, especially in the Florida Peninsula and the Mississippi Delta. Hurricane Katrina was one of the worst disasters in US history. The participants in the study were evacuees who have their own house on Gulf Coast. Those who returned to the Gulf Coast were more likely to have higher psychological symptoms than evacuees who remained relocated. That is, many evacuees who live in coastal areas are vulnerable to hurricanes. Therefore, these evacuees are vulnerable to physical resources (Wisner et al., 2012), as living in coastal areas after the hurricane make them more vulnerable to psychological health, especially fear. Ideally, policymakers and governments should build access to positive interactions with social institutions and social networks in order to buffer evacuees' real concern to return to the Gulf Coast.

In addition, on Hurricane Sandy in the US, women had more recollections of the hurricane Katrina and Irene than men, and women had a higher level of fear from future events of disasters. As I demonstrated above, hurricanes are the most devastating natural disasters in the US. Furthermore, the fact that the number of hurricanes that occur in the US is increasing year by year, and the hurricanes become more severe damage to the US (UN, 2020). At least, what the study showed is among only residents in New York Metropolitan area. However, we can draw from the study that women in disaster-prone areas such as the US are vulnerable to physical resources (Wisner et al., 2012). Therefore, living in disaster-prone areas makes them more vulnerable concerning recollections of disasters history and fears of reoccurring in the future. As in the Gulf Coast case, access to active interactions with social institutions and social networks can play an important role.

5.5.4 History of traumatic events: Haiti

In one of the studies regarding psychiatric health problems, namely on the event of the Haiti earthquake, women who have a history of traumatic events have a higher risk of psychological disorders. The history of traumatic events is a crucial issue in Haiti. The fact is that Haiti is an undeveloped country, and there is the highest level of gender inequality and gendered social roles (UN, 2020; UNESCO, 2021). UNESCO (2021) subscribe that women with a mental health problem have experienced being exposed to sexual violence, kidnapping, rape, or gang-related violence prior to natural disasters occurring. Such violence and human rights abuses have contributed to the vulnerability of Haitian people, especially women and children. In addition, these circumstances lead to higher psychopathology prevalence due to natural

disasters since these cases cause trauma and flashbacks. Furthermore, due to the devastation of houses by natural disasters, women living in temporary housing are further exposed to sexual violence and rape, owing to a lack of security and safety.

These are vulnerable to physical- and political resources (Wisner et al., 2012). Haitian women with a history of traumatic events prior to natural disasters occur become more vulnerable to the onset of mental disorders to natural disasters. In my review, I could find from the only Haitian study. At least, what we can draw from this is that women with a history of traumatic events such as rape and sexual violence may be more vulnerable to developing mental disorders after natural disasters. Ideally, in order to stop the prevalence of sexual violence after a natural disaster, the government and policymakers should acknowledge the risks of violence in women and children and prioritize to plan for the protection of women and girls.

5.6 Psychological condition of pregnant women and mothers

In my review study, there were six studies about pregnant women and postpartum mothers' mental disorders after natural disasters. These studies were found in the five events of natural disasters.

In three of the studies regarding the psychological condition of pregnant women and mothers, namely on the Wenchuan earthquake in China and the Great East Japan earthquake and tsunami in Japan, those women who had financial worries due to the earthquake had a higher prevalence of psychiatric distress than those without disaster experience. As the Chinese study on the part of fertility desire subscribed, for women disaster-affected, their poverty and financial challenges are priorities as a real concern. Furthermore, loss of employment suffered from the disaster is more likely to be deteriorating their psychological condition. The studies of my review show that women who were either pregnant or in the postnatal stage have a higher risk share of vulnerability due to economic resources (Wisner et al., 2012) and having babies under these circumstances worsened their psychological health.

The studies also argued that severe disaster experience leads to increase mental disorders prevalence such as PTSD and depression. Thus, the argument supports that natural disasters are traumatic events that many victims face severe psychological health problems (Kuwabara et al., 2008). In particular, in these two earthquake disasters, the magnitude and damage of the earthquake were enormous as moment magnitude (Mw) 7.9 on the Wenchuan earthquake in

China and Mw 9 on the Great East Japan earthquake. Therefore, stress derived from the disaster has a more substantial influence on psychological health. Furthermore, the studies in my review found that the prevalence of psychological disorders such as PTSD and depression was widespread among mothers who had a delivery post-disaster. Thus, we can draw from these that women who were either pregnant or in the postnatal stage during disasters are more vulnerable if exposed to severe natural disasters and have economic consequences.

In one of the studies about the psychological condition of pregnant women and mothers, namely on the event of the super Cyclone in Vanuatu, there was no discussion concerning differences in social resources of the victims. In addition, women had an equal risk of distress regardless of pregnancy. However, 3-4 months after the cyclone, women who got house damage had a higher risk of distress. According to the UN and the UNESCO, more than half of the population was affected due to the super cyclone, and more than 80% of houses and buildings were partially or entirely devastated (UN, 2020; UNESCO, 2021). As Vanuatu is the least developed country, as Vanuatu National Statistics Office (VNSO) subscribes, most of the population is small-scale farmers (VNSO, 2021). Thu, since people do not have sufficient cash income, it is difficult to repair and rebuild a house if the house is collapsed due to a cyclone or other natural disaster, even if International Development Association (IDA) or other fund institution aid funding.

This is the vulnerability that can depend on physical- and economic resources (Wisner et al., 2012). For instance, home damage due to the cyclone made women more vulnerable if it was difficult to repair and rebuild. At least, what we can draw from the Vanuatu study, which is the least developed country. However, we can draw that housing damage makes women and mothers more vulnerable to natural disasters if they are challenged to repair and rebuild their houses. Therefore, women are vulnerable to housing damage.

5.7 Black women in the US

In my review study, there were three studies regarding racism in the US. In one of the studies, namely on the Red River flood in North Dakoda in the US, there was an increase in the proportion of women giving birth who were non-white and unmarried. It is problematic between disasters and sex crimes, especially for unmarried and racially minority women. Jenkins and Phillips (2008) state that race is a factor in post-disaster rape crimes. That is,

African American women are most likely to be targeted. In addition, the fact that correspondences to sexual damage by government officials were significantly delayed depending on the victim's race was pointed out (Jenkins & Phillips, 2008; Jones, Cross, & DeFour, 2007).

These are vulnerabilities that can depend on political resources (Wisner et al., 2012), as problems such as racial disparity, poverty, and discrimination that have existed before the natural disaster became more apparent due to the disaster. Natural disasters make women more vulnerable to sexual crimes if they are African American or unmarried. Ideally, government officials should plan to anticipate and prevent disaster-related sexual violence throughout the evacuation and sheltering process against minority groups such as African American women not given the benefit of victim status.

In two of the studies, namely on the event of hurricane Katrina in the US, there was concern about black women's vulnerability in the US. One study of them raised is that women and African Americans were the most vulnerable populations and that these groups' psychological health problems are relatively widespread. In addition, people with lower education also have a higher risk of personal depression and PTSD. Singhal, Tien, and Hsia (2016) argue that black women are likely to have ordinarily physiological health problems due to the chronic stress of racism they have experienced. These women are vulnerable to human- and political resources (Wisner et al., 2012), as women become more vulnerable if they are African American with lower education and chronic stress due to racism.

Another study demonstrates that black pregnant women had a higher risk of mental health. According to CDC, black women in the US are much more likely to die from childbirth or pregnancy-related causes than white women (CDC, 2020). This is not only due to poverty, lack of education, limited access to prenatal care, and poor physical and mental health. However, Singhal et al. (2016) also argue that chronic stress by the racism they have experienced affect physiological health during pregnancy and postpartum periods. These black pregnant women are vulnerable to chronic stress due to racism and distress derived from the disaster. Therefore, the study of my review shows that black pregnant women share a double vulnerability due to chronic stress by the racism and stress derived from natural disasters. Natural disasters make black women in the US more vulnerable to psychological health if they are pregnant.

In my review study, I was able to find only studies on events in the US regarding racism. At least, what we can draw from these studies is that disaster-prone areas, especially multi-ethnic nations like the US, are vulnerable to race. Ideally, governments and policymakers should plan for reforms in the health system and provide of psychological and prenatal support in order to protect black women.

5.8 Vulnerability of older women in natural disasters

In two studies of my review, namely on the event of the Bam earthquake in Iran and the Gorkha earthquake in Nepal, women who are 60 years and above age group have a higher risk of the prevalence of mental disorders due to natural disasters. Unfortunately, there was no discussion regarding the reasons or the details why they had a higher risk of it, in the studies,. However, another study of my review, namely on the event of the Ahar earthquake in Iran, indicated that older women reported physical injuries and limitations, and they depended on their family members resulting from their mobility in order to carry out householding (Sohrabizadeh et al., 2016). Thus, through my review study, we can understand the vulnerability to physical constraints of the elderly.

Recently, the ageing of the population has been accelerating due to the influence of demographic transitions (Reher, 2011). Therefore, in some areas, especially in rural areas, many victims of natural disasters can be the elderly in need of assistance (UNDRR, 2012). Furthermore, physical restrictions due to the ageing elderly cause delays in evacuation in the event of a disaster. Also, those with physical restrictions are likely to impact their physical and psychological health conditions in life after evacuation so that they are challenged to cope with the changes in their lives in a natural disaster and limited social networks etc. Moreover, the elderly likely have several physical or psychological health problems before exposure to a disaster (Maltais, 2019). Thus, the United Nations Office for Disaster Risk Reduction (UNDRR) argues that most disaster-related deaths are the elderly (UNDRR, 2012).

These women are vulnerable to human- and social resources (Wisner et al., 2012), as women in the elderly age group are likely to be among the most affected during a disaster. In addition, those are more vulnerable to natural disasters if they have physical restrictions in need of assistance and several physical or psychological health problems before a natural disaster occurs. We can draw from these that in order to reduce the elderly women's health risks after

a natural disaster, support their lives after the disaster, and provisions of social network and health care facilities are needed. In some cases, financial support will also be necessary.

5.9 Disaster preparedness

In three studies oy my review, women who lost family members, relatives or loved ones have a higher risk of mental disorders in natural disasters. In addition, in one of the studies, women experienced menstrual irregularity caused by facing the death of family members, relatives or friends. Bifulco (2010) argues that psychological disorders such as depression and PTSD appear when a traumatic event with significant loss occurs. Loss trauma is often an event associated with the death of another, such as close persons. This involves parents, partners, children, close relatives or friends and includes unpredictable and horrific situations. Therefore, bereavement due to a natural disaster is loss trauma. This is the vulnerability that can depend on human resources (Wisner et al., 2012). Therefore, it is problematic for women who experienced bereavement due to natural disasters. Bereavement of close persons due to a natural disaster makes them more vulnerable concerning their psychological health and menstrual cycle.

In the event of the super cyclone in Vanuatu, the death toll was low at only 11, although the fact that approximately 188,000 people were affected out of a total population of 270,000. The World Bank stated that the death toll was remarkably low because Vanuatu's early warning system was activated, so people were able to hunker down in shelters prior to Cyclone Pam's winds hitting the islands (n.d., 2015). In addition, having emergency preparation plans in many communities could serve to make fewer women who experience bereavement.

At least, that is what we can draw from the Vanuatu study. Nevertheless, we can draw from this that it is more likely to be less vulnerable to loss trauma due to natural disasters if the death toll can be reduced by implementing of emergency preparation plans for natural disasters. Ideally, there is no doubt that all governments and policymakers should implement appropriate and effective emergency preparedness plans. Therefore, it can be said that such plans will play a vital role in overcoming the vulnerabilities hidden in the risk of natural disasters.

5.10 Insufficient support

In my review study, most studies indicated that sufficient social support during and after natural disasters is vital, especially in maternal and child- and mental health areas. Social support comes from others and social networks. In natural disasters, social support can be obtained from specific individuals such as family members and friends and the community and facility (Thoits, 2011).

In two of the studies, namely on the event of the Bam earthquake in Iran and the Great East earthquake and tsunami in Japan, women, who face the death of both family members or relatives and friends due to a natural disaster, or who were or widow and divorced, had a higher risk factor of mental disorders. In addition, in the event of the Kashmir earthquake in Pakistan, some women had to be separated from family members due to the disaster. Under these circumstances, it is difficult for them to have support from their specific individuals, and this problem may lead to increase anxiety and fear. Moreover, this can draw the vulnerability to social resources (Wisner et al., 2012), as those women become more vulnerable due to insufficient support if they lose their family members or friends or are separated from their family after disasters.

Other issues that the studies in my review raise are limited access to health facilities and insufficient support concerning childcare and mothers' anxiety, psychological areas, and anxiety the changes post-disasters as their lives. Especially first-time mothers and women with psychological health problems or lost family members due to disaster have more negative effects by having less access to information and care. These are also vulnerabilities that can depend on social resources (Wisner et al., 2012). It is problematic for women who need special care and support from professionals. Difficulties in access to the community and health facilities due to natural disasters make women more vulnerable.

From these studies, my review demonstrates that many women who participated in studies had experienced insufficient support after natural disasters. However, the details were unclear, as if the insufficient social support was from individuals, the community or both. At least, we can draw from these that sufficient social support has positive effects on women's health, and adequate social support has the effect of buffering women's health problems during and after

natural disasters. Ideally, disaster-prone areas should build an organisational culture in order to get support whenever we need it in a natural disaster.

Chapter 6 Women's vulnerabilities to natural disasters

6.1 Limitation and an opening up for more research

WHO (2005) argue that there is a general lack of research on sex and gender differences in vulnerability to and impact of disasters. The fact that the empirical literature on women's health is limited. Because it is understandably difficult for women to agree with taking part in research if they must speak openly about their sensitive areas. Women affected by natural disasters could potentially become more sensitive. Thus, such aspects of stress in women are ethically challenging to conduct studies.

This review study aims to investigate how the effects of natural disasters on women's health are related to social categories, focusing on the intersection of conditions that create vulnerabilities. At least, what I can understand from my review study is that impacts of natural disasters are an intersection of vulnerabilities, and the physical and psychological changes of individuals, and changes in the environment. In addition, we can also draw that the difficulties to access multiple public and private resources, such as economic resources, health facility resources and kinship networks, made more vulnerable to coping with post-disaster changes.

From these, it will be a future task to clarify what kind of resources women affected by natural disasters use in order to cope with intersectional vulnerabilities and whether they could not cope with them. In addition, clarifying the challenges of disaster-related support and social security systems in order to improve women's intersectional vulnerabilities in the event of a disaster is also a future task. It will help build systems with continuity and inclusiveness for upcoming disasters. In addition, it is also necessary to pay more attention to positive aspects such as satisfaction of life after the disaster. As a further study, it is also crucial to focus on the women's satisfaction and physical and mental health in their post-disaster life based on 'Quality of Life'.

6.2 Conclusion

Through 27 studies of my review from the academic journals published between 2005 and 2020, I looked at how we can understand vulnerability and situate the post-disaster experiences of women with respect to health, referring to the framework of Road map to hell by Wisner. Most studies in this review showed that females were more vulnerable to their health-wise post-natural disasters than males. Furthermore, through my review study, we can understand that it does not mean that natural disasters cause significant damage directly and have an impact in the medium to long term. However, the more important we should understand is that the impacts of natural disasters are intersectional vulnerabilities of individuals' physical and psychological changes and changes in the environment. In other words, the extent of impacts in a natural disaster depends on the vulnerabilities of the individual to risk. In addition, the higher vulnerability makes the damage after a natural disaster more severe. In addition, it makes it more difficult to reconstruct and recover after a natural disaster. Such circumstances also make women more vulnerable to upcoming disasters.

As a framework, 'Road map to hell' (Wisner et al., 2012) was helpful to understand the dynamics of women's vulnerabilities in post-natural disasters. All six vulnerability resources came to light through the review study, and we could draw better intervention and provision through understanding women's vulnerabilities. Intersectional vulnerability helped bring forth women's health problems in natural disasters in more explicit terms. Without an intersectional approach to vulnerability, it was difficult to understand how natural disasters make women more vulnerable and how we could see priories in order to improve such vulnerabilities. To conceptualise vulnerability using the framework allowed an appreciation of the intersectional vulnerability of individuals affected by natural disasters.

In my review study, the difficulties in accessing multiple public and private resources, such as economic resources, health facility resources and kinship networks, made it more difficult to cope with post-disaster changes. Therefore, my review shows that it is imperative to understand and prioritise intersectional vulnerabilities in natural disasters. For instance, disaster countermeasures need to take into account individual situations such as the type of disaster, living environment, damage situation, one's life status and degree of social connection. Furthermore, it is necessary to take measures to improve such vulnerabilities.

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