Resilience of pregnant and postpartum women affected by the 2016 Kumamoto earthquake: A qualitative study

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Abstract
Aim: This study aimed to understand and discuss the support given to pregnant and postpartum women affected by disasters, by investigating the perspectives and resilience (the ability to cope, learn about, and overcome situations after a natural disaster) of women who experienced the 2016 Kumamoto earthquake.
Methods: Semi-structured interviews were used for data collection and qualitative analysis was performed using the qualitative method originally developed by Jiro Kawakita (KJ method). Participants were recruited from the affected area 1.5 years after the earthquake. Four pregnant women and three postpartum women who lived in the affected area were interviewed. Using the interview data, transcripts were created, themes were extracted, and themes with similar contents were combined and summarized.
Results: Five themes related to resilience were found: “supporting each other”; “confronting problems and afflictions”; “prioritizing children’s safety and security”; “taking care of any mental and physical health issues during pregnancy by myself”; and “connecting with others and sharing my experiences”. These resiliencies were affected by multiple adversities. Four themes related to adversity were found: “I experienced difficult days”; “I was afraid of large tremors and aftershocks”; “My child/children and I experienced something unusual”; and “I evacuated to a shelter, but it was terrible”. Resilience toward adversity was promoted by interaction and directed toward the future.
Conclusions: This study clarified the structure of resilience experienced by pregnant and postpartum women after a disaster. This knowledge can be used for the assessment and support of affected pregnant and postpartum women.
Key words: Kumamoto earthquake, mothers, pregnant women, qualitative study, resilience

INTRODUCTION
The 2016 Kumamoto earthquake was a large and destructive earthquake for the Kumamoto region in central Kyushu, Japan. It began with an M_JMA 6.5 shock at 21:26 on April 14, 2016. A second, more severe earthquake of M_JMA 7.3 occurred just 28 h later, at 01:25 on April 16. Moreover, following the aftershock, more than 4,200 earthquakes of varying scales were observed by the end of December that year (Kumamoto Prefectural Office, 2019). Therefore, many victims were afraid to stay inside buildings and houses and chose to hide in their cars instead. Reports stated that the number of direct casualties was 50, and the number of disaster-related deaths was 220, including newborns (Kumamoto Prefectural Office, 2019). More than 43,000 houses were damaged, and more than 155,000 houses were partially damaged (Kumamoto Prefectural Office, 2019). As of December 2020, nearly 604 people remained evacuated in temporary housing (Kumamoto Prefectural Office, 2020), and people were still in the process of recovery. In general, some people are likely to be severely affected by a disaster and be unable to recover without support. The special needs of such vulnerable populations...
need to be considered during disasters (National Center for Disaster Preparedness, 2021). Approximately 56,100 of the Kumamoto earthquake victims, including approximately 24,000 elderly people over the age of 65 years, 6,600 people with disabilities, and 16,600 patients with chronic diseases, required extra support. Among these victims, approximately 800 were pregnant and postpartum women (Institute for Human Diversity Japan, 2016). Pregnant and postpartum women at the time of the earthquake made up only a low percentage of victims, and it was difficult to locate them to provide the necessary support (MAMA-PLUG, 2016). Adverse effects in a woman’s life during pregnancy affect childbirth and childcare (Koike et al., 2018); the burden of childcare in the first year after childbirth is significant, and the need for physical and emotional support is high (Muto et al., 2010). Previous studies of disasters have shown that pregnant and postpartum women suffer from physical problems such as premature birth, premature rupture, and poor nutrition (Harville & Do, 2016; Oyarzo et al., 2012); mental problems such as depression, lack of confidence for childcare, and fetal health state anxiety (Yao et al., 2014; Ishii et al., 2017); and social problems such as deterioration of the living environment, decline in health service functions, and change in medical costs (Bloem & Miller, 2013; Zotti et al., 2015).

Following the 2016 Kumamoto earthquake, many lived in difficult situations, such as those in evacuation centers and even in cars and mothers had little or no space for breastfeeding or changing diapers at the evacuation centers (MAMA-PLUG, 2016). However, some mothers used social networks to obtain childcare needs immediately after the disaster (Nakamura, 2016) and created an advice booklet for affected mothers (Kumamoto Nichi-Nichi Shimbun, 2017). These behaviors by these mothers are thought to have been driven by resilience. Resilience leads to recovery, even in stressful situations and under negative experiences (Rutter, 1985), and it is enhanced by support from the surroundings. Resilience in general has been considered in a wide variety of research fields, such as psychology, sociology, medicine, and nursing (Garcia-Dia et al., 2013). In addition, the concept of resilience is also considered in studies of individuals, families, communities, and other groups and situations. The definition of resilience remains diverse, with no consensus on it. It has been argued that resilience demonstrates its nature during adversities (Rutter, 1985; Masten et al., 1990). Such adversities include those experienced outside the family, such as earthquakes, floods, and wars, and those experienced within the family, such as illness, accidents, and deaths in the family (Grotberg, 2003). Therefore, adversities emanating from outside the family, such as earthquakes, differs from adversities within the family, in that the former is affected by multiple factors. In large-scale earthquakes, the geographic environment and infrastructure systems are often destroyed and reconstruction takes time.

Grotberg (2003) argued that everyone can become resilient and external support can promote resilience. She defined resilience as “the human capacity to deal with, overcome, learn from, or even be transformed by the inevitable adversities of life” (Grotberg, 2003, p. 1). By this definition, resilience is distinct from stress defense and resistance, and it works to overcome inevitable damage in stressful situations (Obanawa, 2002). Grotberg further stated that resilience can be developed at any age, and includes acceptance of one’s experiences as a source of personal growth. Grotberg’s concept has been used not only for research on resilience in children, but also in research regarding the resilience of postpartum women (Miyano et al., 2014).

A study by García-León et al. (2019) indicated that women with high resilience had lower levels of perceived stress, including pregnancy-specific stress and psychopathological symptoms, during their last trimester. Their study also found that postpartum women with high resilience exhibited higher psychological wellbeing, lower psychopathological symptoms, and lower postpartum depression scores. This may be related to the fact that resilience is associated with reduced psychopathology and improved wellbeing for all mothers, and has been shown to have a buffering effect (Sexton et al., 2015).

Harville et al. (2010) investigated resilience from the perspective of recovery from post-traumatic stress disorder (PTSD) and depression using the Edinburgh Depression Scale and Post-traumatic Stress Checklist for pregnant and postpartum women who became pregnant after a disaster. The study reported that resilience was related to age, race, damage severity, educational level, partner support, and the process of recovery from PTSD and depression; however, there were no observations regarding pregnant and postpartum women at the time of the disaster. Resilience in affected women is a delicate subject, because insufficient understanding may lead to conflicting opinions about their experiences and needs. Therefore, investigating how resilience impacts affected women is essential when considering support and preparation for disasters.

The purpose of this study is to understand and discuss the support given to pregnant and postpartum women affected by disasters by investigating the perspectives and
resilience of these women at the time of the 2016 Kumamot earthquake. For this, two questions were formulated:

1. What types of adverse situations and events did pregnant and postpartum women face at the time of the earthquake?
2. How did pregnant and postpartum women show resilience at the time of the earthquake?

Definition
In this study, resilience is defined as the capacity of affected pregnant and postpartum women to deal with, overcome, and learn from the inevitable situations and events in their lives after the 2016 Kumamot earthquake.

METHODS
Design
A qualitative descriptive study was used to explore how pregnant and postpartum women deal with, overcome, and learn in the face of a disaster. Qualitative research can provide a general overview of the structure and function of problem awareness (Kawakita, 1986), and seeks to clarify how people perceive various events that occur during daily life based on their subjectivity (Pope & Mays, 2020). This approach was used in the present study to investigate relativity and complexity from the viewpoint of pregnant and postpartum women.

Setting and participants
The inclusion criteria were as follows: (1) All women who were pregnant regardless of their gestation age or postpartum women within 1 year of the birth of their children at the time of the Kumamot earthquake; (2) women who were living in the affected areas at the time of the Kumamot earthquake; and (3) women who were able to recall and talk about their experiences after the earthquake without difficulty. The period from pregnancy to <1 year after childbirth is considered the period when the child needs the most support after childbirth (Koike et al., 2018). Therefore, the present study examined scenarios ranging from pregnancy to childbirth and childcare.

Network sampling was adopted because it is useful when study participants are difficult to find, or otherwise impossible to obtain, and have not been previously identified (Gray et al., 2017). Network sampling was used to identify pregnant and postpartum women affected by the 2016 Kumamot earthquake given that they were a small, hard-to-find proportion of the affected population.

Data collection and measurement
This research was conducted in accordance with the Declaration of Helsinki and other nationally valid regulations and guidelines. The present study was approved by the Ethics Review Board of the Graduate School of Nursing Sciences, Chiba University (approval number: 30-25).

The data were collected through a semi-structured interview. The main content of the interview was obtained from the data of these two questions: (1) “What was the most memorable event or situation you experienced during the Kumamot earthquake?”; and (2) “How did you deal with, overcome, and learn from that situation or event?”. After the interview, participants’ background information, including age, household members, and their homes, were collected through a questionnaire. The guiding themes were given to the study participants in advance and an interview preparation period was set. The interview was conducted in one or two sessions of 60–90 min according to the participant’s convenience.

Data analysis method and procedure
In this research, data analysis was conducted based on the KJ method (Kawakita, 1986), a qualitative method originally developed by Jiro Kawakita. The KJ method is an approach that allows synthesis of large amounts of unordered information for better extrapolation of this information and the creation of new information by combining unfamiliar items (Kawakita, 1986). Furthermore, the KJ method is highly accurate and can guarantee credibility, clarity, and confirmability through a clear analytical method. By referring to the KJ method, the unordered information from the stories of the affected pregnant and postpartum women can be used to explain the data and clarify how resilience was promoted in these women.

A transcript was created from the data obtained during the interviews and analyzed according to the following procedures:

1. The responses for each interview question were extracted one by one, and one meaning was interpreted for each theme. Specifically, each theme focused on the behavior, emotions, and perceptions of “the types of maternal adversity situations and events” and “how the pregnant and postpartum women showed resilience,” and the content was extracted from each theme.
2. Themes were unified by similar contents and then summarized after distinguishing between adversity and resilience.
3. An affinity diagram for adversity and resilience of affected pregnant and postpartum women was created.

3
First, based on the results of the analysis, we examined the causal, ordinal, conflictual, dependent, symbiotic, and supportive relationships, direction of affect, and degree of affect for each final theme of adversity and resilience. Second, the content of the final themes was arranged to provide the most meaningful correlations with adversity and resilience. Finally, the results were reviewed and re-examined, and symbols and comments indicating the relationships were entered into the affinity diagram.

To ensure dependability, credibility, and transferability, the entire process was supervised by experienced qualitative researchers.

RESULTS

Seven women participated in this study, and their mean age was 32.7 years, with a range of 29–39 years. Two participants were having their first child, and five were multiparous. Four participants had moved more than once to their cars, parents’ houses, and/or shelters after the earthquake (Table 1).

**Adversity in affected pregnant and postpartum women**

An overall analysis of adversity that affected pregnant and postpartum women was performed after individual analyses. We collected themes, extracting them from the verbatim interviews, focusing on the behavior, emotions, and perceptions of the types of maternal adversity experienced. A repeated group formation was conducted until the final themes in the overall analysis were consolidated into four themes (Table 2).

Adversity was collected into four final themes: (i) “I experienced difficult days”; (ii) “I was afraid of large tremors and aftershocks”; (iii) “My child/children and I experienced something unusual”; and (iv) “I evacuated to the shelter, but it was terrible”.

**i) I experienced difficult days**

This theme covered how affected women were forced to live with inconveniences due to the destruction of their homes and social infrastructure. Destruction of housing included damage to their homes, lack of food and water, and a shortage of supplies for their children. Trouble with social infrastructure meant that they did not have access to information, moving was difficult, their nursery school was closed, thus hindering work, or they faced closure of companies and shops. Often, they faced hunger:

I was very careful about nutritious meals during my pregnancy, but I had no choice but to eat cup noodles or other instant food… (Case B)

When I went to get a rice ball for relief supplies, I lined up for one or two hours and returned empty-handed… (Case F)

**ii) I was afraid of large tremors and aftershocks**

This theme included experiences with constant tremors beyond the large earthquakes, and the tension was extended by unpredictable earthquakes. Participants mentioned fears of staying inside and being alone with their child/children, because there might be further earthquakes and tremors. Some participants had difficulties making up their mind and controlling themselves during the earthquake.

When I was shaken by the second large earthquake, I did not notice myself shouting at first. I was screaming and uttering a sound like “Ohhhhhhhhh!” but I did not notice it at all, and maybe my child was bothered by...
Table 2  Adversity of affected pregnant and postpartum women: final themes and themes determined in the preceding step

| Final theme                                      | Themes from the preceding step                                                                                                                                                                                                 |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I experienced difficult days                    | I had difficulties in my daily life including problems accessing clothes, food, and housing
|                                                | I had trouble accessing social infrastructure including networks and government and medical institutions                                                                                                                    |
| I was afraid of large tremors and aftershocks   | I was terrified by the quake and I didn’t know what to do                                                                                                                                                                |
|                                                | I was confused shortly after the large earthquake, and I wasn’t even aware of what I was doing                                                                                                                                 |
|                                                | I was afraid to enter the house or building during the aftershocks                                                                                                                                                      |
|                                                | I was scared when I was alone with my child                                                                                                                                                                               |
| My child/children and I experienced something unusual | I suffered from the disasters during pregnancy; I felt sick in my mind and body                                                                                                                                                     |
| I evacuated to a shelter, but it was terrible   | I had to withstand a long toilet queue at the shelter                                                                                                                                                                      |
|                                                | I felt uncomfortable with people around me in the shelter                                                                                                                                                                  |
|                                                | I was always just lying on the floor at the shelter, so I couldn’t rest well                                                                                                                                              |

my voice, and woke up and started crying. I wanted to leave the house, but my husband forced us to stay inside. Then I told my crying child, “I’m fine. I’m fine, all right, all right, all right…” I was calm during the first large quake, but I was surprised by the second large one… (Case F)

(iii) My child/children and I experienced something unusual

This theme applied to women who were pregnant during the earthquake and the physical, mental, and situational changes that they and their children (including unborn children) experienced. Pregnant women had physical symptoms such as lower leg oedema and stomach tightness. Mental symptoms included worrying about their family, being sheltered away from their husband and families, and the feeling of isolation from being unable to evacuate. Some of these symptoms were present not only in women, but also in their children. Problems that the children faced included shortages of diapers, unusual diaper rashes, vomiting of unfamiliar emergency food, digestive problems, and becoming sensitive to shaking due to frequent and large earthquakes. One woman stated:

The day after the large earthquake, I was scheduled for a prenatal check-up, so I called my hospital but was told that the electricity had not yet been restored. They could only accept births and could not carry out any check-ups for a while. I was worried because the earthquake struck during my pregnancy and the medical institution was closed, and I was concerned about what would happen to my developing baby.

Because I had been living in a small car, my feet became so swollen that I could no longer wear shoes… (Case C)

(iv) I evacuated to a shelter, but it was terrible

This theme indicated the severity of living in shelters. The affected women could not go to the bathroom whenever they needed to. Even if they needed to rest, they could only lie on the floor. Moreover, because relationships among people at the shelter were not positive, some participants chose to stay for only one day:

It was a pet-friendly shelter, but my grandmother’s dog seemed to dislike the people who were in there, and another person at the shelter seemed disgruntled. Therefore, we left the shelter. They used to turn the lights out in the room without any notice, it was just a mess, and I became sensitive to even small things. It took 30 minutes to line up for the toilet and I endured it even though I was pregnant… (Case A)

Resilience of affected pregnant and postpartum women

An overall analysis of resilience in affected pregnant and postpartum women was performed after individual analyses. We collected themes, extracting them from the verbatim interviews, focusing on the behavior, emotions, and perceptions of pregnant and postpartum women showing resilience. Eight steps were used to reduce the number of themes. After the overall analysis, five core themes were identified (Table 3): (i) “supporting each other”; (ii) “confronting problems and afflictions”;
Table 3  Resilience of affected pregnant and postpartum women: final theme and themes in the preceding step

| Final theme                        | Themes in the preceding step                                                                 |
|------------------------------------|-----------------------------------------------------------------------------------------------|
| Supporting each other              | People around me provided what I needed to live and for childcare                              |
|                                    | People around me (including myself) helped each other in unexpected events                     |
|                                    | People around me were concerned about my being pregnant and having children                    |
|                                    | My parents listened to me when I was depressed and nervous                                      |
|                                    | My husband took the initiative to move for my family                                           |
| Confronting problems and afflictions| I solved living problems using goods at home and the information I knew                       |
|                                    | I used a positive mindset against hard situations                                              |
| Prioritizing children’s safety and security | I took evacuation measures in consideration of my children’s safety                         |
|                                    | I focused on protecting my children                                                          |
|                                    | I tried to make my child feel reassured                                                       |
|                                    | It was tough to take care of my children after the disaster, but they gave me energy to endure|
| Taking care of any mental and physical health issues during pregnancy by myself            | I cared for my swelling and stomach tension during pregnancy                                 |
|                                    | I was encouraged by talking with a woman in the same situation about physical conditions, medical institutions, and preparations for childbirth |
| Connecting with others and sharing my experiences | I learned about the importance of disaster response by myself                                |
|                                    | I have had an extensive relationship with people around me since the earthquake disaster      |
|                                    | I share my earthquake experiences with my children for the future                            |

(iii) “prioritizing children’s safety and security”; (iv) “taking care of any mental and physical health issues during pregnancy by myself”; and (v) “connecting with others and sharing my experiences”.

(i) Supporting each other
This theme referred to affected women who received and gave support to family, friends, neighbors, and others after the earthquake. The parents of affected women listened to them because they were depressed and nervous, and their husbands took the initiative to get what their families needed. Having also established relationships with strangers, this support not only provided physical goods for their disaster-stricken life, but also social contact:

When I was staying in the car, older people whom I met for the first time often asked me “Are you okay? Are you all right? Is your stomach (baby) okay?” Usually, I would not speak too much to strangers. I did not think that so many strangers would be concerned... (Case C)

(ii) Confronting problems and afflictions
This theme included how women managed, on their own, the shortage of resources, including water, food, and information, and adopted a positive attitude in their thinking during difficult situations:

I am glad I was pregnant during the earthquake. Since this is my first child, if my baby had been born before the disaster, I would have been worried about raising my child, especially in a disaster-affected environment. If the quake had occurred sooner after the child’s birth, then I would not have had the privacy I needed for breastfeeding, and I would have needed nutritious food and fluids... (Case A)

(iii) Prioritizing children’s safety and security
This theme explained how affected women prioritized the safety of their babies over themselves and tried to keep their children calm. One woman described the difficulties she faced for her child’s sake saying:

I thought that breast milk was better for reassuring my child at the shelter. I would save milk for when I was not lactating, or my child cried a lot. I was wearing pajamas in the shelter, which were loose clothes that allowed me to breastfeed discreetly with my baby under my clothes... (Case G)

It was often difficult for these women to live with their children post-earthquake, even though the children provided encouragement. Thus, sometimes even when a woman wanted to stay in the disaster-stricken area with her husband and family, she had to move to a parent’s home outside of the prefecture, giving priority to her child’s health and safety.
(iv) Taking care of any mental and physical health issues during pregnancy by myself

This theme implied that women dealt with their pregnancy symptoms and anxiety on their own. Physical symptoms included swelling of the legs and bloated stomachs, and massage and exercises were used to relieve the legs. The women would lie down, relax, and take medicine for their bloated stomachs. They were also encouraged to meet and talk to other people who experienced the earthquake after pregnancy or childbirth. One participant described her anxiety and how she dealt with it as follows:

I was so anxious that I had a bloated stomach and it was quite painful. My friend recommended listening to a relaxing music collection, which helped my children and me to calm down. When I started having issues, I would tell my family that I needed to lie down because my stomach hurt… (Case D)

(v) Connecting with others and sharing my experiences

This theme captured how the women learned from their experiences. After experiencing the disaster and having practiced disaster preparation since then, these women had learned the importance of disaster prevention. In addition, they established face-to-face relationships with their neighbors. This theme also indicated that women wanted to share their experiences with their children so that they could connect with future generations:

I do not want to let the memory of the earthquake fade away. I want to tell my children what they experienced in the earthquake. Even if another earthquake never occurs while my child is alive, one could strike in his children or grandchildren’s generations. My child has to know about this if he lives here… (Case F)

Affinity diagram for adversity and resilience of affected pregnant and postpartum women

An affinity diagram of the adversity and resilience of the affected pregnant and postpartum women was developed so that the content of the final themes would provide meaningful correlations (Figure 1). Multiple adversities affected resilience. There were three components to promoting resilience in the affected women. These three components emerged when we repeated the bottom-up conception and reconstruction of the affinity diagram until the structure was most clearly expressed with well-defined symbolic meanings. The first component, the basis of resilience, promoted interaction, mutual support, and confrontation of problems and afflictions. The next component prioritized children’s safety and security and independently taking care of any mental and physical health issues during pregnancy. In the final component, after experiencing the disaster, affected women developed relationships with people around them, learned from their disaster experiences, and communicated their stories to their children for their future knowledge.

DISCUSSION

The aim of this qualitative study was to explore the adversities that pregnant and postpartum women experienced during and after the 2016 Kumamoto earthquake, and how they showed resilience in their response. In our study, we characterized the structure of resilience of the affected pregnant and postpartum women. Here, we will discuss the perspectives of adversity and resilience of these women, and the implications for nursing derived from our study.

Characteristics of adversity faced by affected pregnant and postpartum women

The factors affecting the adversities experienced by the affected women were two-fold. The first was the type of disaster, the Kumamoto earthquake. This factor meant that repeated large-scale earthquakes and aftershocks continued for a long period, causing sudden and major damage to the community. Therefore, this event differed from adversities that can be predicted in advance such as storms, flood damage, and diseases. The second factor was the characteristics of the participants: the pregnant and postpartum women. We found that affected women were desperate to protect their children from the earthquake and the chaos of daily life. In addition, participants and their children experienced physical and mental health problems, and it was not easy to live in the evacuation centers. Some of these adversities affected their resilience, including fear of earthquakes, the inconveniences of daily life, and physical and mental health problems. Resilience behavior has to be flexible because adversity changes over time (Grotberg, 2003). Thus, it is necessary to continuously and accurately assess adversity in order to promote the resilience of affected pregnant and postpartum women.

Characteristics of resilience of affected pregnant and postpartum women

From this study, we constructed five final categories for the resilience of affected pregnant and postpartum women. The affinity diagram created based on the results (Figure 1) showed that there are three components to these women developing resilience. The first component is the promotion of resilience through interaction,
The women were encouraged by their children and acquaintances, received support from their peers, and sometimes extended a helping hand to others. Previous research did not report any resilience associated with helping others; the fact that the affected women performed a supportive role is a new finding from the present study, although it has been reported that mutual help between residents during a disaster is essential for recovery (Yagazaki, 2017). Therefore, resilience may also be necessary during disasters. Furthermore, a previous study on children found a dynamic interaction among resilience factors (Grotberg, 1995), and that interaction between women promoted resilience. Once the foundation of resilience is established, the next component is to promote the prioritization of children’s needs and individual self-care during pregnancy. The women in our study did not display their negative feelings to their children and, instead, positively transformed difficult situations. The affected pregnant women felt that they could protect their children.

Figure 1 Affinity diagram of adversity and resilience of affected pregnant and postpartum women.
fetuses by focusing on their pregnancies, which may be considered as prioritizing their child. The safety and security of children during and after disasters has not been well explored to date because studies on the resilience of disaster-affected pregnant and postpartum women are limited. In the present study, the interaction between women protecting their children and taking care of themselves was shown to promote resilience. Previous research has also reported the need of affected mothers to protect their children’s health (Brunson, 2017), and protecting children may be an important concept in the resilience of affected mothers.

Ultimately, through the disaster, the affected women developed relationships with people around them, learned from their experiences, and communicated those experiences to their children. Pregnant and postpartum women who participated in this study had limited interactions with their neighbors and relatives before the earthquake, but the disaster strengthened their relations with others. In concordance with our study, close relations with familiar people after a disaster (Harville et al., 2010), thinking about the future of their children (Santoso et al., 2015), and learning from the experience (Grotberg, 2003) have been identified as by-products of disasters in previous studies.

Based on the above, it is considered that the adversities experienced by and resilience of affected women were related in multiple ways. In other words, as shown in the affinity diagram, one type of adversity does not directly correspond to one form of resilience. The characteristics of resilience identified in this study were that these women had the support of those around them in protecting themselves and their children and in facing the future. A newly discovered characteristic in this study was that the resilience of pregnant and postpartum women has three components.

**Implications**

Our results suggest the importance of supporting pregnant and postpartum women effectively during and after a disaster. Implications for each of the three components should be considered.

First, it is necessary to conduct a predictive and continuous assessment, based on the fact that the resilience of disaster-affected women will change, as will the interaction between supporting each other and confronting problems, which is the basis of resilience. This study showed that pregnant and postpartum women could be active supporters, suggesting that encouragement is needed to prevent the loss of their resilience. Resilience can be promoted by external support (Grotberg, 1995); therefore, if relationships with others around them are weak, it is necessary to build connections between affected pregnant women and other residents. Women who experience a disaster may have the potential to become active supporters by building connections with other residents. Furthermore, when focusing on relationships with people, it is necessary to assess and provide resources to women, such as essential childcare products, a place where they can feel at ease in an evacuation center, and other necessary support. However, if a continuum of support is not available, then a system that can coordinate support may be necessary.

Second, promoting children’s safety and security and helping pregnant women to take care of their mental and physical issues is vital. During a disaster, pregnant and postpartum women tend to prioritize the safety and security of their children. Therefore, it is necessary to provide a safe and secure environment, as well as resources and support for both physical and mental health issues.

Third, encouraging the development of relationships and helping women learn from and communicate their disaster experiences, especially to their children, is essential. It is necessary to support affected women so that they can learn from adversity, understand the meaning of their experience, and prepare for future growth.

Currently, affected pregnant and postpartum women usually do not receive support unless they ask for it. Instead, affected mothers interact with each other socially and personally, supporting each other and caring not only for themselves, but also for their children. Therefore, support staff, including the midwives, obstetric nurses, public health nurses, and community nurses, must make assessments based on the characteristics of adversity and resilience of affected women. Understanding the affinity diagram shown in Figure 1 helps field nurses to predict both the adversities and resilience of affected pregnant and postpartum women. We believe it will help them provide the necessary support to encourage maternal resilience in future disaster events.

**Limitations**

In this study, the participants were pregnant and postpartum women who were affected by the 2016 Kumamoto earthquake. These women voluntarily agreed to be interviewed about their experiences and resilience at the time of the earthquake. Since some time had passed before our research project began, there was a chance of recall bias. In addition, because the interviews were conducted once or twice in the same period, it was not
possible to capture the transformative aspect of resilience. Therefore, future studies should investigate this aspect.

The period the women spent evacuated from their homes was relatively short, ranging from 3 days to 2 weeks. Moreover, three of the seven participants were evacuated outside of the affected area. Therefore, there is a possibility that our study was biased toward participants with relatively high resilience. In addition, the number of participants was low, and the background of participants was biased toward medical workers and housewives.

Nevertheless, this is the first study focusing on the resilience of affected pregnant and postpartum women affected by disasters. In order to help susceptible pregnant and postpartum women during a disaster, not to provide one-sided support, and to prepare for future disasters, it is crucial to consider the importance of resilience.

CONCLUSION

The results of this study clarified the structure of resilience shown by pregnant and postpartum women after a disaster. The resilience of these women was affected by multiple adversities and had a three-component structure, as well as interactions within each component. This information can be used for the assessment and support of disaster-affected pregnant and postpartum women. Affected pregnant and postpartum women tend to experience more adversity than usual to protect their newborns and other children. However, these women can promote resilience in themselves and others, and be active supporters during a disaster. In order to promote resilience in affected pregnant and postpartum women, it is necessary to understand and support them in the context of resilience based on their vulnerabilities.

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AUTHORS’ CONTRIBUTIONS

S.S. was responsible for the study conception and design, data collection, analysis, and drafting of the manuscript; N. S. and M. M. critically reviewed the manuscript and supervised the overall study process.

DISCLOSURES

The authors have no conflicts of interest to declare.

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