Title

Experiences of perinatal women and public healthcare providers in a community affected by the Great East Japan Earthquake and Tsunami: Concerns that must be considered for the mental healthcare of perinatal women in postdisaster settings

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ABSTRACT

Particular support needs of perinatal women in a disaster have been difficult to grasp through preexisting quantitative epidemiological studies. This study aimed to extract concerns that must be considered for perinatal women's mental healthcare in postdisaster settings based on lessons from the Great East Japan Earthquake. Narrative messages regarding protective and risk factors for mothers' mental health from a representative population of mothers who had given birth and all official maternal caregivers, in a coastal town devastated by the catastrophe were subjected to qualitative analyses. Eight concerns were extracted as specific support needs: (1) improve information pathways, (2) maintain access to medical services, (3) sufficiently equip necessary items for perinatal women and children, (4) implement hygienic facilities, (5) prevent mothers from feeling diffidence, (6) encourage mothers to focus on positive aspects of being pregnant or taking care of their babies, (7) provide dedicated paths for relief supply distribution and dedicated rooms for mothers and children in shelters, and (8) resume usual healthcare activities as soon as possible. The comprehensive survey of the affected community presented concerns that needed to be considered for perinatal women's mental health in postdisaster settings.

Keywords

Perinatal women, disaster, mental health, healthcare provider, qualitative analysis

1. INTRODUCTION

The importance of postdisaster mental healthcare for perinatal women has been emphasized based on experiences and epidemiological studies conducted after previous disasters. These studies have indicated that being pregnant or postpartum could be risk factors for mental health problems in postdisaster settings, including increased posttraumatic stress symptomatology and depressive symptoms [1-7], which were shown to have a negative impact on birth outcomes and children's development [4, 8-11].

In Japan, each local government has a department of maternal and child health. Although the means of providing support for perinatal women and children are standardized in an ordinary setting in the nation, the means of support for perinatal women and children in postdisaster settings had not been standardized. After the Great East Japan Earthquake (GEJE) in 2011, healthcare providers such as public nurses in the department were urged but struggled, to respond. Although they conducted various duties, they were uncertain about what the perinatal women actually needed.

This study focused on the support needs of perinatal women and children from the aspect of how healthcare providers would better prepare or respond to a disaster by examining the experience of perinatal mothers and maternal and child healthcare providers. We conducted surveys to systematically collect qualitative narrative information from mothers and healthcare providers regarding the psychological experiences and needs of perinatal women in a town severely impacted by the GEJE. We expected that a qualitative study based on detailed information from personal experiences would provide a more extensive range of knowledge, which has been difficult to grasp through preexisting quantitative epidemiological

studies using pre-designed multiple-choice questionnaires. From the surveys, we extracted what perinatal mothers needed after the disaster as well as protective and risk factors of mental health from mothers' adaptation to postdisaster life and recovery from traumatic experiences.

2. METHODS

2. 1. Structure of the study

The study was comprised of 2 interview surveys targeting the total population who experienced the GEJE in the town of Shichigahama, Miyagi Prefecture, as perinatal women and public maternal healthcare providers (Figure 1). Shichigahama is a coastal town located in the area damaged by the GEJE and tsunami and has approximately 20,000 residents and approximately 100 births per year. The town was devastated by the massive earthquake and tsunami: 96 people died or were missing, and approximately 4,000 homes were damaged.

The interview survey for mothers was designed based on the results of the preliminary questionnaire survey to collect general information regarding the situation the mothers had faced during and after the disaster and their needs in those situations. In the preliminary survey, original questions were designed to understand the psychosocial conditions of the participants, including concerns regarding pregnancy, delivery, child rearing, general living conditions, house damage and evacuation due to the disaster, and the current needs for consultations on mothers' health condition or child rearing (Question: Table 1, Answer: Table 3). Participants were also requested to provide open-ended comments regarding their concerns and thoughts on what was lacking, what type of system or supports were needed, and what was encouraging in their pregnancy or child-rearing experience in the aftermath of the disaster.

The interview survey for mothers collected narrative information about the psychological conditions of their experience as perinatal mothers and was subjected to the content analyses to extract the needs of the perinatal women.

To collect narrative information from the caregivers' perspectives to complement the needs extracted from perinatal women, an additional group interview was conducted with the all public health nurses and a dietician of the maternal and child health section of the local government in Shichigahama, who played major roles in providing maternal healthcare during and after the disaster.

2. 2. Recruiting

Participants of mothers were recruited for our preliminary questionnaire survey at first during the public, medical/developmental check-ups for 18-month-old children that were held between October 2012 and March 2013. These are check-ups conducted by local governments and almost all mothers and children attend (national average participation rate = 93–94%, based on annual reports from Japanese Ministry of Health, Labour and Welfare). Forty-nine women had given birth in Shichigahama between 1 month before the earthquake and in the 6 months after (February 2, 2011–September 11, 2011); among them, 47 mothers participated in the check-up (participant rate = 95.9%), which is consistent with the national average. Maternal healthcare providers of the town briefly provided the outline of the survey, explained that participation was voluntary, and asked if they would like to know the details of the survey.

The first author explained the details of the survey to the mothers who showed interest in the questionnaire survey, and those who provided written informed consent participated in the survey. Counseling or medical mental healthcare services were provided to all of the mothers and children upon request or necessity regardless of participation in the survey. Thirty mothers (61.2%) completed the preliminary questionnaire survey. On the last page of the questionnaire, we asked whether they would be willing to participate in the interview survey. Eleven mothers (22.4%) expressed their willingness to participate and complete the additional interview surveys.

The interview surveys were conducted in the mother's home or in a private room in a local community center. All interviews were conducted by the first author, a psychiatrist who has been practicing in the perinatal mental healthcare unit of Tohoku University Hospital. Based on the key factors affecting the mothers' mental health extracted from the questionnaire survey, a semi-structured interview was designed to obtain more details about their situation around the time of the disaster, their psychological reaction during the perinatal period, how they perceived the experience of the disaster, their general personality, coping patterns in difficult situations, and history of psychiatric disorders (Table 1). In the interview, participants explained how they experienced the disaster and answered designed questions. The duration of most interviews was around 1 hour (mean = 65 minutes).

2. 3. Analysis

Participants' comments were deconstructed into minimum units comprising 1 or a few sentences conveying a single message and were subjected to thematic content analysis with the assistance of NVIVO 11 software [12-15]. A codebook was developed by the research team through a workshop conducted by 4 psychiatrists and a researcher with expertise in providing social support to disaster survivors. After each code was created as a node within the software, the total transcripts were imported to the software, and each transcript was aggregated into the nodes.

2. 4. Additional interview survey of healthcare providers

Six healthcare specialists (5 public health nurses and a dietician) in the maternal and child health section of the local government in Shichigahama who provided maternal healthcare during/after the earthquake were interviewed. All the healthcare specialists participated in the group interview to obtain information and opinions regarding the support needs of mothers and children in the disaster from the perspective of healthcare providers. The interview was conducted at a child health center in Shichigahama. The interview contained an open-ended discussion describing the process of the local government's official support for mothers in the postdisaster setting. Key questions were designed based on the mothers' questionnaire and interview survey responses (Table 1).

2. 5. Ethics

All the participants who participated in the surveys provided written informed consent. The protocols of the studies were approved by the Institutional Review Board of Tohoku University (No. 2012-1-287).

3. RESULTS

3. 1. Participants of mothers

Participants' characteristics are presented in Table 2. Approximately one-third of mothers who suffered house damage, and two-thirds of mothers were evacuated in the postdisaster setting acute phase.

3. 2. Interview survey of mothers

Based on the NVIVO 11-assisted thematic content analysis of comments throughout the interviews, needs of perinatal women regarding mental healthcare were classified into the following 6 categories.

(1) Improve information paths

Perinatal mothers desired information regarding supplies and medical services for delivery (obstetrics) and for babies and older children (pediatrics), as represented by comments such as "I wanted to know where I could get relief supplies from local governments and information about child rearing in the aftermath of the disaster. There was no way to know whether pediatric clinics were open unless we would actually visit there. I hoped that that information would have been accessible through either notice on a bulletin board in a community center, leaflets, mailing lists, or the website of the local government." "The local government should use already available networks such as the neighborhood association system. After the disasters, telephones were disconnected and messages posted through the community wireless systems were often difficult to catch. Web-based real-time updated information would be useful, although elderly people tend to be unfamiliar with the internet and might have some difficulty with access." "The local government could do better by letting us know how they will send us information or messages in case of emergency."

(2) Maintain access to medical services

Mothers said they would not have been too worried about the condition of their pregnancy if they had had an opportunity to be examined by obstetricians or midwives at an earlier time, especially before starting fetal movement, as represented in the following comments, and information about how to reach a hospital for delivery was essential for pregnant mothers, as represented in the following comments: "I was relieved from worry about my pregnancy after I was able to access to an obstetrician and checked the heartbeats of my baby" and "I heard that an ambulance was probably not available because of the confused state and all the obstetric clinics were closed, even if I would have needed to reach doctors for a delivery." Some mothers also needed information about pediatrics for babies and older children, as represented by this comment: "Because we had difficulty in seeing doctors, unlike our usual setting, I was really upset when one of my daughters got sick at that time. I was concerned how to reach doctors for a check-up or medicine in case my children would have troubles in their health. The worst part was that we were not able to know when the unusual condition would end."

(3) Sufficiently equip necessary items for perinatal women and children

A wide range of items needed for perinatal mothers, neonates, infants, and children in various stages of development was in short supply during the emergency, as represented by these comments: "Most emergency stocks of diapers were exclusively for neonates, and the ones for older infants and toddlers tended to be sparse" and "After the disaster, fear of shortages of stocks tended to urge us to purchase too much of items, such as 10 cans of powdered milk or 10 packages of diapers."

(4) Implement hygienic facilities

Hygienic equipment and clean water were especially needed for perinatal women and children to prevent health problems, such as infections, as represented in the following comment: “Good hygiene was not kept at the time. Because of a limited amount of water, my baby was not cleaned enough, and blood remained on his body since the birth.”

(5) Prevent mothers from feeling diffidence

The participants expressed feelings of diffidence through comments such as the following: “If I was not pregnant at the time, I could have helped my family. I suspected that my parents had pain in their knees or lower backs after the disaster because they carried heavy items, such as water, instead of me” and “If I was not pregnant at the time, I could have done something for my husband when I had trouble contacting him. In fact, I just lay down.”

(6) Encourage mothers to focus on positive aspects of being pregnant or taking care of their babies

Many mothers made comments that they were encouraged by thoughts that they were in charge of protecting their fetuses or children, for example, “If I had not been pregnant, I would have got emotional. I was able to act cautiously probably because I was pregnant” and “What was on my mind at that time was that I had to protect my child.” Since we tend to focus on negative aspects in difficult conditions such as disasters, it can be helpful for mothers when healthcare providers encourage mothers to pay attention to positive aspects of being pregnant or taking care of their babies.

3. 3. Additional interview of the maternal and child healthcare providers

Lessons and opinions captured in healthcare providers’ interviews are summarized in Table 4. Providers learned from the difficulties and delays in postdisaster support for mothers and children; nevertheless, the local government had prepared their disaster response manual and disaster stockpiles before the tragedy. Two additional concerns were extracted from these providers’ perspective to complement the support needs extracted from the mothers’ opinions.

(7) Provide dedicated paths for relief supply distribution and dedicated rooms for mothers and children in shelters

Although mothers identified necessary items in an emergency, healthcare providers indicated the necessity for considerations of means of distributing the items, as represented in the comments: “In the beginning, pregnant women or mothers with young children had to wait in a long line to receive supplies; thus, we set up the dedicated pipelines to distribute items for mothers in the maternal and child center. Dedicated paths seemed to decrease their burden” and “Preparing packages of essential items for mothers and children ahead of the emergency would have been useful and would have sped up distributions.” These improvements will respond to the mothers’ concerns regarding their difficulty to move or to know where to go in to get supplies for babies or children. Additionally, healthcare providers commented, “Mothers in shelters were nervous because crying or noisy children tend to make other displaced people irritated” and “Shelter administrators would do better to prepare dedicated rooms for mothers and children to stay comfortably to support their mental health. Dedicated rooms also protect breastfeeding privacy.” Most of the mothers also responded that the relationship with their families was the most sufficient supportive factor for their psychosocial

conditions and made comments such as “The most encouraging thing was the time when we were together as a family” and “When I felt a uterine contraction frequently, I really appreciated that the shelter administrators prepared a dedicated room for my family.” Providing dedicated rooms for families with pregnant women or babies would be more proper for psychological support for mothers in some cases.

(8) Resume usual healthcare activities as soon as possible

A debate was that a new disaster postvention program would be needed for promoting the mental health of perinatal women. However, the maternal care providers concluded through their activities that “Mothers are familiar with the maternal and child health service for collecting information about child rearing or communicating with other mothers in normal circumstances. Resuming usual maternal and child health supports as soon as possible is more urgent than determining supports specific to the disaster settings, considering mothers’ strong needs for information in postdisaster settings.”

4. DISCUSSION

We conducted questionnaire and interview surveys with perinatal mothers and healthcare providers in a devastated town 18 to 24 months after the GEJE. We collected information during the “early phase” of long-term recovery and comprehensive quotes regarding experiences from community members.

Mothers highlighted support needs regarding receiving information, especially about access to medical services and supplies for mothers and children. They had urgent and persistent needs for access to medical services to protect their children's health, even if pregnant women or their children did not feel ill. However, mothers indicated that it was difficult to take an action without reliable, accurate information because they had difficulty moving due to being pregnant or being accompanied by babies, especially in the postdisaster setting in which many lost their modes of transportation. Because infectious diseases secondarily associated with disasters may occur during the postimpact phase of a disaster [16], the importance of hygiene to control infection in disasters has been highly prioritized by infection control professionals [17]. Similarly, the mothers emphasized the importance of good hygiene conditions to protect their children, who were one of the populations susceptible to infections in this study. There was also concern that a uterine infection might cause obstetric complications, such as preterm birth. Shelters should provide water for cleaning, bathing facilities, and sanitation, or alternative hygienic equipment to prevent infection.

Mothers responded in contrasting ways to their vulnerable positions that required others' help. Some mothers were encouraged and renewed a sense of gratitude for the care and a bit of help from their families or other surrounding people. Other mothers were suffered from feelings of diffidence because they could not care for themselves. It would be what healthcare providers should keep in mind regarding psychological support for perinatal women. In the acute phase of the postdisaster setting, many occasions required waiting in a long line and carrying heavy burdens or walking over a long distance. Mothers should be reassured to not feel diffidence about being restricted and possibly unable to respond to the disaster appropriately. Additionally, we should notice the positive aspects of the perinatal period and encourage mothers to reflect on the positive aspects of occasions in the period when they experience difficulty. Positive

feelings regarding the roles as mothers seemed to increase the mothers' resilience and self-esteem about their behavior in the disaster.

Healthcare providers felt the same way as mothers in many aspects and provided additional suggestions for improving the support of perinatal women in disasters. For example, they asserted that the necessity of a dedicated room for mothers would encourage breastfeeding, which is the best way of feeding under poor hygienic conditions and increases the mental stability of mothers and babies. Dedicated rooms for families with pregnant women or babies can be a good psychological support because most of the mothers renewed the importance of the families and cited the connection with their families as the most significant supportive factor for their psychosocial conditions. Studies have suggested that people tend to feel sympathy and appreciation for surrounding people after a disaster and conceptualized the phenomena to include aspects such as posttraumatic growth [18]. Posttraumatic growth has been reported as a closely related phenomenon. Posttraumatic growth refers to positive changes that result from coping with a major life crisis or a traumatic event and comprises an increased sense of connection with others or an increased sense of one's own strength. Healthcare providers resumed their usual support activities as soon as possible with intentions to contact and communicate with mothers in the aftermath of the disaster where information paths remained impaired at various levels. In Japan, healthcare providers of the maternal and child health section of the local governments visited all mothers and babies approximately 1 month after birth, and local governments covered the fee for mothers to visit clinicians for medical and developmental check-ups for their children at several developmental milestones. Through these opportunities, mothers obtained information regarding the availability of support as well as information helpful for child rearing, and healthcare providers also evaluated the conditions of mothers and their children on these occasions. These usual supports were familiar to mothers and providers; thus, resuming usual maternal health services as soon as possible may be helpful for mothers and care providers.

Notably, we observed discrepancies in cognitions between mothers and healthcare providers. For example, although mothers expected the local government to set up more outreach efforts, healthcare providers thought that more self-help efforts from residents were needed considering the severe shortage of assistance after the disaster. Thus, searching for common ground regarding support and self-help capacities in various situations is necessary.

A few previous qualitative studies have focused on the experience of perinatal mothers to extract the support needs of perinatal women and children in disasters. There is a study regarding needs and concerns among pregnant women during and after Typhoon Haiyan (Yolanda) [19]. However, it investigated only practical support needs, such as essential items, medical services, sanitation, and information, and not mental healthcare. A study in which mothers were interviewed regarding their childbearing experience during Hurricane Katrina has been published [20]. The study intended to analyze psychological responses, but only negative responses. Although there are differences in social infrastructure between countries, our study design might be unique because it contained perspectives regarding the delicate attention to the well-being of perinatal women in postdisaster settings. Additionally, we conducted a comprehensive study with support system users (mothers) and support providers (healthcare providers)

to examine the implementation of the support for mothers and children.

This study has several limitations. First, in addition to official supports, supports from families and friends are crucial for perinatal women. In this study, we focused on merely the public support from the local government for perinatal women due to the limitation of time and effort. Integrating the knowledge regarding supports from families and friends is necessary in further research. Second, systems to support perinatal women vary widely among countries. Local communities, including families, friends, and neighbors or private organizations, could be major supporting bodies for perinatal women. The recommendations extracted in this study can be further validated and modified to apply to other countries or regions that have different geographical characteristics and cultural backgrounds. Third, because the surveys were conducted approximately one and a half years after the onset of the disaster, the needs which the participants recalled when answering the questions may be different from what the participants actually needed. Because it is not recommended to conduct systematic studies of survivors in the acute phase of postdisaster settings from an ethical perspective, it may be realistic to reconstruct afterward what was needed in the aftermath of a disaster. Fourth, the participants who participated in the interview survey were those who expressed their willingness to participate in the additional interview. Therefore, there might have been potential selection bias, for example, only the mothers who might be supported by others to manage time might have tended to participate in the interview survey. However, at least 22.4% of the total perinatal women participated in the interview survey, and the representative thoughts among the perinatal mothers may have been collected to some extent.

5. CONCLUSION

The comprehensive survey of the affected community provided 8 recommendations to improve disaster preparedness in relation to the psychosocial aspects of perinatal mothers' health: (1) improve information paths, (2) maintain access to medical services, (3) sufficiently equip them with necessary items for perinatal women and children, (4) implement hygienic facilities, (5) prevent mothers from feeling diffidence, (6) facilitate positive cognition of mothers, (7) dedicate rooms for mothers and children in shelters and paths for relief supply distribution, and (8) resume usual healthcare activities as soon as possible.

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Table 1: Items used in the questionnaire survey, and the key questions used in the interview surveys

Questions used in the preliminary questionnaire survey for mothers	
	Questions regarding pregnancy and delivery
Q-1	Date pregnancy was determined
Q-2	Expected date of birth
Q-3	Obstetrical hospital or clinic you attended
Q-4	Any problem in maternal or fetal conditions during early or medium-term pregnancy
Q-5	Any complication during the last month of pregnancy and/or delivery
Q-6	Nutrition in infants
Q-7	Timing of weaning off breastfeeding
	Questions regarding general living conditions
Q-8	Number of family members living together
Q-9	Whom among your family members are involved in childcare?
Q-10	Who supports your childcare besides your family members?
Q-11	Employment condition
Q-12	Education level
	Questions regarding pregnancy and delivery after the disaster
Q-13	The last date when you saw your obstetrician before the disaster
Q-14	The first date when you contacted your obstetric hospital/clinic after the disaster
Q-15	The first date when you saw your obstetrician after the disaster
Q-16	When did you start to attend the obstetric hospital/clinic where you delivered?
Q-17	Is there any organization that you ask for consultation regarding pregnancy or delivery besides the above obstetric hospitals/clinics?
Q-18	What were you concerned about when experiencing pregnancy in the aftermath of the disaster? (Free comments)
Q-19	What was lacking in your pregnancy experience in the aftermath of the disaster? (Free comments)
Q-20	What type of system or support did you wish you had for your pregnancy experience in the aftermath of the disaster? (Free comments)
Q-21	What encouraged your pregnancy experience in the aftermath of the disaster? (Free comments)
	Questions regarding living conditions and child rearing after the disaster
Q-22	Did you have any house damage due to the disaster?
Q-23	How did you evacuate after the disaster?
Q-24	What were you concerned about when experiencing child rearing in the aftermath of the disaster? (Free comments)
Q-25	What was lacking in your child-rearing experience in the aftermath of the disaster? (Free comments)

Q-26	What type of system or support did you wish in experiencing child rearing in the aftermath of the disaster? (Free comments)
Q-27	What encouraged your child-rearing experience in the aftermath of the disaster? (Free comments)
Q-28	What child-rearing difficulties are you currently experiencing? (Free comments)
Q-29	Do you want a private consultation about child rearing?
Q-30	Do you want a private consultation about mental problems you are having?
Key questions used in the interview survey for mothers	
Q-1	What was the most difficult mentally aspect about pregnancy or child rearing you experienced during the postdisaster setting?
Q-2	What was the most thankful or encouraging thing about pregnancy or child rearing that you experienced during the postdisaster setting?
Q-3	What support did you want regarding pregnancy or child rearing if possible during the postdisaster setting, and what will be needed for pregnancy or child rearing during a postdisaster setting?
Q-4	How do you feel about the fact that you experienced such a disaster and your pregnancy/childbirth at the same time?
Q-5	If the disaster did not occur at the time of your pregnancy/childbirth, would you feel differently about pregnancy and childbirth?
Q-6	Through experiences in the disaster, have you had any psychological change?
Q-7	Through experiences in the disaster, have you had any change in your way of viewing others?
Q-8	How do you want to tell your child about the disaster some day?
Q-9	What period do you feel was the hardest time after the earthquake?
Q-10	What period do you feel was a turning point in which conditions were getting better after the earthquake?
Q-11	How had you coped with psychological problems before the earthquake?
Q-12	Do you have any mental problem now? (providing specific examples of depression, PTSD, anxiety disorders, and other non-specific symptoms)
Key questions used in the interview survey for healthcare providers	
Q-1	How did you support mothers and babies who had already been born before the earthquake? (when, what, order of priority, trigger, existence or non-existence of request)
Q-2	How did you support expectant mothers?
Q-3	How did you support mothers and babies in shelters? (consideration for mothers or expectant mothers, effective support, difficulties, future tasks)
Q-4	How did you manage the mother and child center of the local government at the postdisaster settings?
Q-5	How did you gather and provide information necessary for mothers? (about what, how, how long, reaction of users, about supplies of maternity and nursery items, about

	availability of medical service)
Q-6	How did you prepare the disaster prevention manual before the earthquake? How did you revise it thereafter? (contents about maternal and child health, revised content after the disaster)
Q-7	What do you think about the results of the survey for mothers?
Q-8	What would your messages be for other local governments about support in disasters?

Table 2: Participants' characteristics

	Preliminary questionnaire survey	Interview survey
Mean age (range) at delivery	31.7 (24–43)	31.5 (24-39)
History of delivery	Primipara: 11, Multipara: 19	5 6
Trimester or after child birth at the earthquake	First trimester: 1 Second trimester: 11 Third trimester: 14 After child birth: 4	0 5 5 1
Perinatal complication	Normal: 15 Abnormal: 15 ・Threatened abortion/premature labor: 9 ・Preterm birth: 3 ・Low birth weight: 2 ・Pregnancy-induced hypertension syndrome: 5 ・Placenta previa: 1 ・Intrauterine growth retardation: 1	6 5 2 2 2 1 1 1
Nutrition	Mother's milk: 14 Combination: 12 Artificial milk: 4	6 4 1
Switch of gynecologists due to the disaster	No change: 23 Switched: 3 No answer: 4	9 1 1
Whether being supported by family members or professionals for child rearing	Supported: 27 No support: 3	9 2
Degree of house damage due to the disaster	No or little damage: 19 Partially destroyed: 2 Completely destroyed: 6 No answer: 3	8 0 2 1
Place of life in the first week after the disaster	Own house: 8 House of relatives: 14 Shelter: 4	3 5 3

No answer: 4	0

Characteristics of mothers who participated in this survey (n = 30) are summarized in Table 2. Profile regarding age, history of delivery, perinatal and neonatal complications, whether participants experienced a switch of gynecologists due to the disaster, whether being supported by family members or professionals for child rearing, house damage due to the disaster, and place of life in the first week after the disaster are summarized.

Table 3: Mothers' experience in postdisaster setting based on the preliminary questionnaire survey

Inquiries	Category	(N)	Items	(N)
(1) What was lacking in the experience of pregnancy or child rearing in the aftermath of the disaster?	Supply of daily necessities	32	Water	11
			Food	9
			Gasoline	5
			Maternity wear, sanitary articles	4
			Heating	2
			General daily necessities	1
	Supply of nursery items	15	Milk	6
			Diapers	4
			Baby wipes	2
			Baby wear	1
			Feeding bottle	1
			General baby items	1
	Information (including consultation service)	17	Availability of medical services	7
			Availability of supplies	3
			Consultation service	2
			Others (unspecified)	5
	Bathing facilities	8		
	Economic support	2		
(2) What were you concerned about experiencing regarding pregnancy or child rearing in the aftermath of the disaster?	Pregnant condition	55	Cleanliness	19
			Fetal well-being	14
			Nutritional condition	11
			Miscarriage or preterm birth	6
			Mother's health condition	5
	Obstetrics attendance	21	Availability of hospitals/clinics	11
			Transportation	10
	Living condition	15	Residential condition	7
			Economic condition	8

	Circumstances around child rearing	14	Items for childbirth and child rearing	10
			Child support	4
	Effect of radiation	14		
(3) What encouraged your experiences regarding pregnancy or child rearing in the aftermath of the disaster?	Family (other than children)	17		
	Fetuses or children	5		
	Friends	10		
	Neighbors	5		
	Official support (Health nurses or maternal and child health center of the local government)	5		

Results of the questionnaire survey of 30 mothers regarding the 3 major inquiries are summarized in the Table 3. (1) Regarding the factors lacking in their experiences with pregnancy or child rearing in the aftermath of the disaster, the most frequently answered missed item was “water,” for drinking and washing/wiping children’s bodies or their bodies. (2) Regarding the factors that mothers were concerned about experiencing during pregnancy or child rearing in the aftermath of the disaster, the most frequently answers were pregnancy condition, especially regarding infection (“cleanliness”) and fetal health condition. A considerable number of mothers were concerned about the hazards of radioactivity with the atomic-power accident at Fukushima (Shichigahama is located approximately 100 km from the Fukushima nuclear power plant). (3) Regarding the factors that encouraged mothers regarding their experience with pregnancy or child rearing in the aftermath of the disaster, almost all the participants indicated a relationship with others, especially with family members, as a major encouraging factor. Many mothers also answered that being responsible for their children, including fetuses, was a strong encouraging factor.

Table 4: Lessons from the Great East Japan Earthquake based on the additional group interviews with the local government healthcare providers

Distribution of supplies	・Items for mothers and children should be distributed separately from other relief goods to avoid leaving pregnant and postpartum mothers in a long line. ・For convenience in sharing a limited amount of stocks in the emergent situation, milk should be stocked in small portions. ・Baby food should be stocked, as well as milk. Baby food can be applicable for elderly people with dysphasia in an emergent situation. ・Consider stocking large-sized diapers for older infants. ・Families with small children needed more daily life water other than drinking water (because children often need their bodies wiped or their belongings washed). ・Distribution of supplies can be good opportunities to contact mothers for provision of information (health management, basic childcare [especially for primipara], and availability of medical service), assessment and/or support for mothers and children. ・Multiple sections involved in the service of mothers and children in disaster settings, for example, sections in charge of disaster response, stocks, and healthcare, should share information and policies regarding disaster response.
Shelter administration consideration for mothers and children	・Dedicated rooms for mothers and children along with their family members to help mothers with small children (especially crying babies) to be relaxed, without other tired refugees. ・Shelters for pregnant mothers need special attention for heating ・Mothers with infants need hot water for milk formula, heating, items to maintain cleanliness (e.g., sanitizing wipes). ・Mothers requested play spaces for children because children were getting stressed from refugee life. ・Shelters should have functions to provide information about availability of medical services, general advice for pregnancy, and support for transportation to visit obstetrics.

Provision of information for residents	・Healthcare providers should pay attention to refugees at their home because they tend to lack necessary information and supplies, compared with refugees in shelters. ・Local governments should enlighten residents to facilitate self-help efforts to obtain information in disaster settings because official support could severely be short-handed immediately after the disaster. ・It is effective to resume usual maternal and child health supports as soon as possible, rather than designing new postdisaster interventions. These usual supports, familiar to mothers and providers, provide sufficient information and a sense of security and comfort. They can also be good opportunities for evaluating mothers' conditions and screening of mothers at high risk of mental health problems. ・Mothers requested a place to gather and talk with each other approximately 1 month after the earthquake. Attending to these opportunities is voluntary and can be psychologically beneficial.
Medical services	・Cooperation between medical experts and local public health nurses, who know about the area and residents, is desirable. ・Partnerships with multiple medical services to prepare for disasters is desirable. If some are damaged, others may provide medical services. ・The lists of local medical services and their availability at the time point prepared by a medical association and distributed by local government were very useful.
Disaster response manual	・Multiple sections involved in the service of mothers and children should cooperate to prepare disaster response manuals to be shared by those sections. ・It is effective to share detailed practical procedures rather than merely sharing disaster response manuals between sections.

Based on the group interview with local government healthcare providers regarding their experiences supporting perinatal women in the town during the disaster, the topics they felt were especially important, effective, or ineffective were extracted (listed in the second column) and classified into 5 categories (listed in the first column).

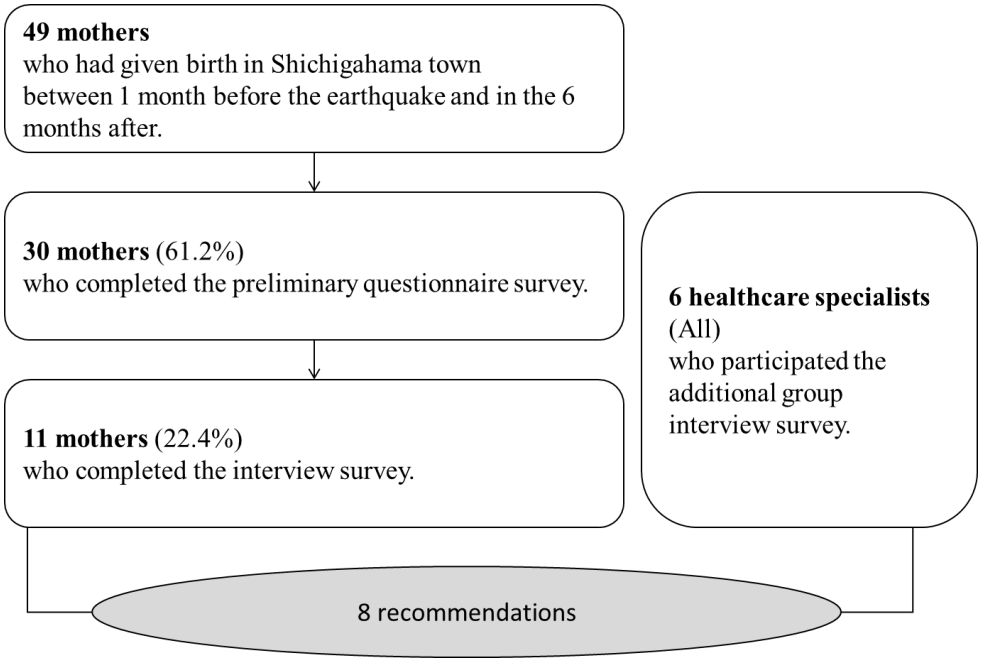

Figure 1: Participant flowchart