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Paper:

Factors Affecting Behavior and Behavioral Intentions of Expectant and Nursing Mothers Regarding Disaster Preparation

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Expectant and nursing mothers need to prepare for natural disasters to protect their lives and their children's lives and to maintain their health and daily life after the disaster. This study aimed to clarify the actual conditions of disaster preparedness behaviors of expectant and nursing mothers and to identify factors promoting disaster preparation behavior and behavioral intentions that lead to disaster preparation behavior among expectant and nursing mothers. We conducted a cross-sectional survey involving 1,000 expectants and nursing mothers between October 2020 and January 2021 using an anonymous self-administered questionnaire. We received 135 valid responses. The questionnaire included items about the actual status of disaster preparation, attitudes toward preparation behavior based on Ajzen's theory of planned behavior, subjective norms on disaster preparation determined by perceived expectations from others, descriptive norms on disaster preparation that refer to the perceptions of others' engagement in disaster preparation behavior, perceptions of behavioral control that refer to views regarding how easy or difficult it is to perform a given behavior, and social support sources that are required for disaster preparation behavior. Correlations among variables were analyzed. A structural equation modeling technique was used to test a model to explain factors encouraging expectant and nursing mothers to prepare for disaster.

Keywords: expectant and nursing mothers, preparation for disaster, theory of planned behavior

1. Introduction

In the Maternal and Child Health Law, expectant and nursing mothers are defined as the women who are pregnant or gave birth to baby within a year. Expectant and nursing mothers and infants are considered as "persons requiring special care and consideration" [1] who need support and protection during evacuation in the time of disaster. However, in a large-scale disaster it is expected that "public assistance" by the administrative organizations could not be available easily. And it is important to promote "self-help" to protect themselves by themselves and "mutual aid" to help one another in region in the future.

Expectant and nursing mothers live in a period with special hormone balance and their physical and mental changes are large and easy to deviate from the normal condition [2]. Infants need generally the protection from their protectors during their growth and have high individuality and vulnerability such as child age and allergy. And expectant and nursing mothers seem healthy at first sight and are easily overlooked. In the environment after disaster, their health conditions become easily serious, which could endanger the life of not only unborn baby and infants but also expectant and nursing mothers themselves. For this reason, it is pointed out that expectant and nursing mothers need the characteristic preparedness for disaster considering the physical and mental changes during the period of pregnancy, birth, and after childbirth in addition to the general preparedness for disaster [3].

According to the actual condition survey on the preparedness for disaster by expectant mothers, it is indicated that more than half of them have no awareness of disaster prevention and such expectant mothers have not taken disaster preparation behavior yet [4]. And according to the actual condition survey on the mothers who care their infants, it is indicated that although they have interest on disaster management measures and understand the necessity, they have not prepared for such measures [5]. As the reasons why they have not prepared for the measures, "there is no time," "cannot afford," "not useful," "drill has no effectiveness," and "administrative organs should prepare for disaster management" are given [6]. Furthermore, it is pointed out that the preparation taking time and cost such as preparation of emergency bag and the preparation necessary to coordinate with others such as arrangement on how to contact one another are not realized easily [7]. As mentioned above, the self-help by expectant and nursing mothers is not sufficient enough.

The studies on disaster management behavior cover the citizens in general in many cases but seldom expectant and nursing mothers. Therefore, to foster the self-help of

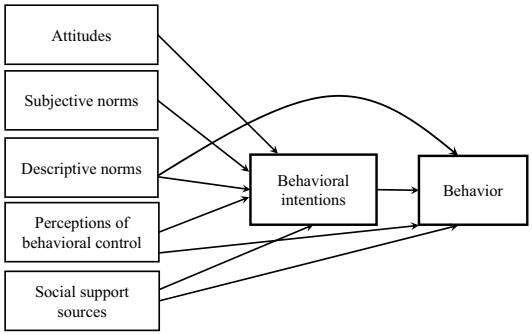

Fig. 1. Hypothetical model of this study.

expectant and nursing mothers it is required to examine the factors determining their disaster management behavior using an empirical model.

In the previous studies on social behavior such as health behavior [8,9] and disaster management behavior [10,11], as a main theoretical framework to explain the psychological process leading to behavior "theory of planned behavior" of Ajzen [12] is applied. The theory of planned behavior supposes a psychological process that the attitudes evaluating comprehensively whether it is good or bad for individuals to take behavior, the subjective norms indicating the approval of behavior by the important others nearby, and the perceptions of behavioral control evaluating whether it is easy or difficult to take behavior would determine the behavioral intentions, with other words, intentional decision making on behavior based on individual will, which would lead to the behavior. The perceptions of behavioral control are thought to influence directly on behavior [13,14]. The theory of planned behavior is a framework quoted widely as behavior prediction model [15,16].

Accordingly, in this study a model based on the framework of the theory of planned behavior is supposed. And based on the previous studies on disaster management behavior, two factors of the descriptive norms and the social support sources are added to the framework of the theory of planned behavior of Ajzen (**Fig. 1**). First, the descriptive norms mean the perception that the behavior taken by others nearby is considered as an appropriate standard of behavior under the circumstances [17]. It is pointed out that by adding the descriptive norms the influences of the social norms could be examined from many different aspects [18]. Especially, in the previous studies on disaster management, behavior the descriptive norms are regarded as a factor to promote the behavioral intentions and encourage the disaster management behavior directly [11, 19]. Thus, in this study the descriptive norms are supposed as a factor to promote the behavioral intentions and behavior and examined.

Next, it is pointed out that the social support sources would influence on the physical and mental growth of expectant and nursing mothers and infants, and the promotion of formation of new family [20,21]. Although expectant and nursing mothers and infants have generally a social aspect that they tend to be isolated from the region because of their poor relation with the community [22], they develop adaptation to role of mother, nursing behavior, their health, and new life during the period of pregnancy and childcare with the help of the social support sources. Therefore, in this study the social support sources related with expectant and nursing mothers are also supposed in the field of disaster management behavior and examined. Concretely, as in the cases of the previous studies [23–26] in addition of the familiar people such as husband, family, friends, and acquaintances, medical and health professionals who are regularly involved during the period of pregnancy and childcare are included in the social support sources.

The aim of this study is to clarify the actual situation of the disaster preparation behavior of expectant and nursing mothers and the factors determining such behavior by examining this hypothetical model.

2. Method of Study

2.1. Design of Study

A cross-sectional survey is conducted using anonymous self-administrated questionnaire.

2.2. Method

2.2.1. Survey Subjects

In this study the survey covers the women who are pregnant or gave birth to baby within a year. The survey area is located in Prefecture "A" including the area affected by the Great Hanshin-Awaji Earthquake in 1995, near the institute which an author belongs to and selected in the area with a similar value to the average total fertility rate (1.47) in the 2020 fiscal year in the prefecture. Survey cooperation is asked to the local governments and medical institutions in the survey area.

2.2.2. Implementation of Survey

The questionnaire is distributed at two comprehensive support centers for families with children of the local governments where the survey cooperation has been approved and a clinic for obstetrics and gynecology where women are assisted to give birth. As for the exemplar number of questionnaire, considering that the questionnaire is distributed under the spread of COVID-19 and the life of expectant and nursing mothers is generally busy, 1,000 exemplars are distributed, supposing the recovery rate of about 10%.

Regarding the method of distribution of the questionnaire, the staff of the collaborating institutions are asked to select an appropriate method with the least burden for them among the following methods. Those are the method to distribute the questionnaire when the staff have an interview with the survey subjects at the opportunities such as distribution of maternal and child health handbook, consultation with expectant and nursing mothers,

consultation on childcare, and regular medical examination, the method to distribute the questionnaire directly to the survey subjects at parents' class etc., and the method to send the questionnaire by enclosing it when a mail is sent to the survey subjects. Attention is paid not to distribute the questionnaire to the survey subjects redundantly.

The survey subjects are asked to send the questionnaire back by mail or answer it on internet. The data are collected during the period from the middle of October 2020 to the end of January 2021.

2.2.3. Definition of Term

Disaster preparation: The measures against disaster which can be conducted at home, for example provision of the goods such as water, food, necessaries of life, and medicines at home, confirmation of emergency contact method with family, and fall prevention of furniture are termed as "preparation at home for disaster." Apart from "preparation at home for disaster," the preparation for escape from danger at the time of disaster and the measures against disaster leading to evacuation behavior for saving life, for example the confirmation in advance of the evacuation route from home and supermarket commonly used and the shelter nearby, participation in emergency drill, and preparation of emergency bag for taking out in evacuation are termed "preparation for evacuation." Disaster preparation is divided into two, because in disaster management preparation there are two different kinds of preparation. One is the preparation which is made at home like preparation of emergency provisions and confirmation of contact method with family and the other is that which is preparations that lead to evacuation behavior and evacuation life in the event of a disaster, such as participation in a local area like participation in local emergency drill and cooperation with the activities of voluntary disaster prevention organization. A disaster exerts long-term influences on the citizens' health and life so that both of "preparation at home for disaster" and "preparation for evacuation" are indispensable. "Preparation of emergency bags that can be taken out at the time of evacuation" is mainly prepared by each individual and household at home. In this study, it is included in the preparation for evacuation because it is the preparation to be taken out at the time of evacuation, which leads to the evacuation life after the disaster.

2.2.4. Survey Contents

The survey contents consist of the basic attributes, the contents of disaster preparation behavior of expectant and nursing mothers, and the variables that are the framework of the theory of the planned behavior, namely attitudes, subjective norms and perceptions of behavioral control, and the additional variables of descriptive norms and social support sources. Four variables of attitudes, subjective norms, perceptions of behavioral control, and descriptive norms are measured in terms of both of "preparation at home for disaster" and "preparation for evacuation."

Basic attitudes: The following items are asked, weeks of gestation or age in month after birth, age, family member living together, address, and whether the survey subjects or their families have suffered disaster or not. Age is classified into "1. younger than 20 years old," "2. 20–24 years old," "3. 25–29 years old," "4. 30–34 years old," "5. 35–39 years old," and "6. 40 years old or older." In the analysis, judging from weeks of gestation and age in month after birth, the dummy variables of expectant mothers (51.9%) and nursing mothers (48.1%) (expectant mothers = 0, nursing mothers = 1) are used.

Behavior: The natural disaster preparation behavior taken by expectant and nursing mothers is measured. Referring to the social surveys on disaster management [27, 28], the measurable behaviors are selected among the behaviors which are generally recommended as disaster preparation behavior. Moreover, the behaviors recommended as preparation taken by nursing protector are selected from a pamphlet on measures against disaster for expectant and nursing mothers [29]. 17 items on "preparation at home for disaster," of which seven items are related with preparation taken by nursing protector and five items on "preparation for evacuation" are asked in the questionnaire. The behaviors are measured by selecting all the items the survey subjects implement. The disaster preparation behavior is scored by adding the number of answers. And it is shown that the higher the scores become, the more disaster preparation behavior is implemented.

Behavioral intention: The following two items are asked, "I will prepare for occurrence of disaster" and "I would like to prepare for occurrence of disaster." Answer is selected among five stages of evaluation from "1. I don't think so at all" to "5. I think so very much." By calculating the scaled scores using arithmetic average, it is shown that the higher the scores become, the higher the will for behavior becomes (Cronbach's α for preparation at home for disaster = 0.728, α for preparation for evacuation = 0.776).

Attitudes: Three items of "good–bad," "useful–unuseful," and "necessary–unnecessary" in terms of disaster preparation behavior are asked using semantic differential method (hereafter "SD method") with five stages evaluation. By calculating the scaled scores using arithmetic average, it is shown that the higher the scores become, the more positive the attitude becomes (α for preparation at home for disaster = 0.889, α for preparation for evacuation = 0.922).

Subjective norms: The following two items are asked, "important persons for you expect you to prepare for disaster" and "important persons for you expect you to prepare for disaster so that you and your children would not suffer from it." Answer is selected among five stages of evaluation from "1. I don't think so at all" to "5. I think so very much." By calculating the scaled scores using arithmetic average it is shown that the higher the scores become, the stronger the subjective norms become (α for preparation at home for disaster = 0.934, α for preparation for evacuation = 0.934).

Descriptive norms: The following two items are asked, "how many your friends and acquaintances who are pregnant or care their babies like you have prepared for disaster?" and "how many your neighbors have prepared for disaster?". Answer is selected among five stages of evaluation from "1. no one" to "5. almost everyone." By calculating the scaled scores using arithmetic average it is shown that the higher the scores become, the stronger the descriptive norms become (α for preparation at home for disaster $= 0.821$, α for preparation for evacuation $= 0.832$).

Perceptions of behavioral control: Perceptions of behavioral control indicate the recognition on the factors to promote execution of behavior and those to prevent it, and the feeling on intensity of the influences of these factors [15, 16]. In this study the following five items are asked, "I have knowledge and information to prepare for disaster," "for me it is troublesome to prepare for disaster," "I cannot afford to prepare for disaster," "I have no time to prepare for disaster," and "I have no opportunity to learn preparation for disaster such as study meeting, lecture, distribution of pamphlet, and event." Answer is selected among five stages of evaluation from "1. I don't think so at all" to "5. I think so very much." In the analysis as for four items of "it is troublesome to prepare for disaster," "cannot afford to prepare for disaster," "no time to prepare for disaster," and "no opportunity to learn preparation for disaster," the scores are inverted as inverted items and it is shown that the higher the scores become, the stronger the perceptions of behavioral control norms become.

Social support sources: Because the social behavior of expectant and nursing mothers in health and life is influenced by presence or absence of social support sources, it is thought that presence or absence and degree of social support sources would exert the influences on their disaster preparation behavior. Accordingly, the question is asked, "during pregnancy and childcare to what extent you rely on the following persons?". In terms of social support sources referring to the previous studies, the following eight items are asked, "husband and partner," "biological parents, parents-in-law, and siblings," "neighbors," "medical staff of maternity clinic such as doctor, midwife, and nurse," "friends and acquaintances who are pregnant and care infants," "public health nurse and midwife at community health center and child rearing support center of local government," "colleagues," and "schoolteacher of day nursery, kindergarten, and elementary school." Answer is selected among five stages of evaluation from "1. I don't rely on that person at all" to "5. I rely on that person very much." By calculating the scaled scores using arithmetic average, it is shown that the higher the scores become, the more the social support sources exist ($\alpha = 0.691$).

In this study, expectant and nursing mothers are also asked about the social support sources which they want to rely on in preparing for disaster. About "the person whom you want to rely on to make 'preparation at home for disaster' and 'preparation for evacuation' so that you would not suffer from disaster," the following eight items are asked, "husband and partner," "biological parents, parents-in-law, and siblings," "neighbors," "medical staff of maternity clinic such as doctor, midwife, and nurse," "friends and acquaintances who are pregnant and care infants," "public health nurse and midwife at community health center and child rearing support center of local government," "colleagues," and "schoolteacher of day nursery, kindergarten, and elementary school." Answer is selected among five stages of evaluation from "1. I don't rely on that person at all" to "5. I want to rely on that person very much."

2.3. Construct Validity and Internal Consistency

Each variable of the theory of planned behavior that is the survey contents is measured by preparing the scales, referring to the previous studies [11–15, 30]. The validity of the survey contents is examined with a researcher who studies disaster management behavior using the theory of planned behavior. Before the questionnaire is distributed, a pretest is conducted to expectant and nursing mothers and the survey contents are sophisticated. The pretest was conducted on a 32-week pregnant woman, a nursing mother with a 3-month-old baby, and a nursing mother with a 9-month-old baby. We asked a total of three expectant and nursing mothers to answer the survey sheet, and asked for their opinions on the questions and wording. As for the internal consistency of the survey contents, the correlation matrix of each item is confirmed, it is confirmed that there is no item with overlapping semantic content and Cronbach's α is calculated.

2.4. Analysis Method

The correlations among the variables are analyzed and the hypothetical model to explain the behavior of "preparation at home for disaster" and that of "preparation for evacuation" is verified using the structural equation modeling technique. The suitability of the model is judged using the fit index of GFI, AGFI, CFI, and RMSEA [31,32]. In the correlation analysis and the verification of structural model, the statistical packages of SPSS Statics ver. 23 and SPSS Amos ver. 27 are used for statistical analysis. And the significance level is set as 5%.

2.5. Ethical Considerations

The survey is conducted anonymously. On the cover of the questionnaire, the following is stated clearly as the survey explanation, the purpose of study, the method, voluntary participation, the advantages and disadvantages, the protection of personal information, the effect that you don't need answer the question which you don't want to answer, and the effect that you don't need answer or reply the questionnaire if you don't agree the study. The consent of participant is confirmed by selecting the item of "I agree" if participant agrees with the participation to the study. The survey is approved for implementation by the Ethical Review Board of Kobe Women's University (approval number 2020-18-1, approved on September 23, 2020).

Table 1. Attributes of survey subjects.

	Item	Frequency	[%]
Expectant and nursing mothers	Early pregnancy period	55	40.7
	Middle pregnancy period	4	3.0
	Latter pregnancy period	11	8.2
	0–4 months after birth	61	45.2
	5–8 months after birth	3	2.2
	9–12 months after birth	1	0.7
	Total	135	100.0
Age	Less than 20 years old	0	0.0
	20–24 years old	2	1.5
	25–29 years old	36	26.7
	30–34 years old	60	44.4
	35–39 years old	30	22.2
	40 years old or more	7	5.2
	Total	135	100.0

3. Survey Results

1,000 exemplars of the questionnaire are distributed and 147 are collected with the response rate of 14.7%. Among the collected exemplars, those in which all the items of behavioral intentions, attitudes, subjective norms, descriptive norms, perceptions of behavioral control, and social support are answered are analyzed. Number of the valid answers is 135 exemplars with the valid response rate of 91.8%.

3.1. Attributes of Survey Subjects

Table 1 shows the basic attributes of the survey subjects. Among the number of valid answers of 135 exemplars, the number of expectant mothers is 70 persons with 51.9% and that of nursing mothers is 65 persons with 48.1%. The age with the most respondents is 30–34 years old. And the respondents without "husband and partner" account for less than 10%.

3.2. Implementation Situation on Disaster Preparation Behaviors

Table 2 shows the implementation situation on disaster preparation behavior. The item with the highest implementation rate is "confirmation of prediction of degree of local damage caused by natural disaster, evacuation route, and evacuation site using hazard map" (91 persons, 67.4%). Four items of general preparation for disaster exceed 50% of implantation rate. The item of preparation for disaster made by nursing protector with the highest implementation rate is "when you spend a long time with your child or sleep with your child in room, you keep distance from the items which easily fall over such as furniture" (57 persons, 42.2%), but its implementation rate is less than 50%.

3.3. Structure of Variables Used in Model

In terms of the behavioral intentions, the attitudes, the subjective norm, the descriptive norms, and the social support sources related with the disaster preparation for expectant and nursing mothers the average of each item is set as the scaled scores, Cronbach's α is found and an appropriate internal consistency is confirmed. However, as for five items of the perceptions of behavioral control related with the disaster preparation for expectant and nursing mothers, sufficient α cannot be obtained. In previous research, it has been clarified that some negative thoughts such as "no time," "cannot afford," "useless," and "training is ineffective" as reasons for not preparing are obstacles to prepared behavior intentions and behaviors. Therefore, in this study, we decided to examine two items of "I have knowledge and information to prepare for disaster" and "I have no opportunity to learn preparation for disaster."

3.4. Distribution of Behavior and Behavioral Intentions

The mean and standard deviation of the variables of "preparation at home for disaster" and "preparation for evacuation" are shown in **Table 3**. In the case of "preparation at home for disaster," the mean of behavior is 5.70 ± 3.92 points (perfect score of 17 points) and the mean of behavioral intentions is 4.27 ± 0.65 points. In the case of "preparation for evacuation," the mean of behavior is 1.07 ± 0.86 points (perfect score of 5 points) and the mean of behavioral intentions is 4.20 ± 0.68 points.

3.5. Correlation Among Variables

The correlation coefficients of correlation among variables are shown in **Table 4**. The correlation with the behavior for "preparation at home for disaster" is recognized in three variables, behavioral intentions ($r = 0.243$, $p = 0.005$), subjective norms ($r = 0.298$, $p < 0.000$), and "I have knowledge and information to prepare for disaster" of perceptions of behavioral control ($r = 0.321$, $p < 0.000$). The correlation with the behavioral intentions for "preparation at home for disaster" is recognized in two variables, attitudes ($r = 0.624$, $p < 0.000$) and subjective norms ($r = 0.424$, $p < 0.000$).

The correlation with the behavior for "preparation for evacuation" is recognized in behavioral intentions ($r = 0.189$, $p = 0.028$). The correlation with the behavioral intentions for "preparation for evacuation" is recognized in in two variables, attitudes ($r = 0.445$, $p < 0.000$) and subjective norms ($r = 0.340$, $p < 0.000$).

The descriptive norms hypothesized in this study correlated with the perceptions of behavioral control "I have knowledge and information to prepare for disaster" ($r = 0.206$, $p < 0.05$) and the perceptions of behavioral control "I have no opportunity to learn preparation for disaster" ($r = 0.210$, $p < 0.05$) for only "preparation for evacuation."

Table 2. Implementation situation on disaster reparation behavior.

	(Multiple answers allowed) $n = 135$	Frequency	[%]
Preparation at home for disaster			
1	Preparation of food and drinking water	78	57.8
2	Portable radio and flashlight	68	50.4
3	Preparation of items you think necessary in daily life	75	55.6
4	Preparation of medicines you use usually	40	29.6
5	Preparation of infection prevention such as mask and hand sanitizer	81	60.0
6	Discussion with family and close friends on what to do if disaster occurs	44	32.6
7	Confirmation with family and close friends of emergency contact method	39	28.9
8	Fall prevention and layout of furniture, home appliances, and fragile items in room	41	30.4
9	When you spend a long time with your child or sleep with your child in room, you keep distance from the items which easily fall over such as furniture*	57	42.2
10	Registration of mail delivery service of disaster management information	34	25.2
11	Registration and use of social media for information collection at time of disaster	38	28.1
12	Preparation of maternal and child health handbook and medicines for infants*	36	26.7
13	Diaper, baby wipes, and garbage bags for infants*	36	26.7
14	Preparation of nutrition for infants such as milk, baby's feeding bottle, water for milk powder, baby food, and breastfeeding apron*	26	19.3
15	Preparation of clothes and shoes for infants*	23	17.0
16	Baby carrier necessary to move infants*	31	23.0
17	Preparation of items you consider as necessary to care infants*	23	17.0
Preparation for evacuation			
1	Confirmation of prediction of degree of local damage caused by natural disaster, evacuation route, and evacuation site using hazard map	91	67.4
2	Always carrying of portable bag for disaster management assuming that disaster occurs when you go out	7	5.2
3	Preparation of "emergency bag" for carrying out in emergency	34	25.2
4	Confirmation of evacuation route and evacuation site from the locations you visit daily	9	6.7
5	Participation to events related with disaster such as disaster drill and evacuation drill	3	2.2

*Preparation for nursing protector, 7 items

3.6. Verification of Hypothetical Model

3.6.1. Model of "Preparation at Home for Disaster" for Expectant and Nursing Mothers

To verify the model of "preparation at home for disaster" hypothesized in this study, a cause-and-effect relation is hypothesized and analyzed using the path analysis by structural equation modeling (method of maximum likelihood is used for the estimation). A model is corrected by deleting the nonsignificant passes and the model in shown in **Fig. 2** is finally adopted. GFI, AGFI, CFI, and RMSEA are relatively commonly used as typical goodness-of-fit indicators. GFI and AGFI are 0.9 or higher (ideally 0.95 or higher for GFI), CFI is 0.95 or higher, and RMSEA is 0.05 or lower [31, 32]. All the indices of suitability of the model, $\chi^2(8) = 22.710$, $p = 0.360$, GFI $= 0.967$, AGFI $= 0.915$, CFI $= 0.989$, and RMSEA $= 0.025$, satisfy the statistical tolerable level.

Regarding the factors affecting behavioral intentions, the path coefficient from attitudes to behavioral intentions is $\beta = 0.532$ ($p < .000$) and the path coefficient from subjective norms to behavioral intentions is $\beta = 0.204$ ($p = 0.004$).

Regarding the factors affecting behavior, the path coefficient from behavioral intentions to behavior is $\beta = 0.151$ ($p = 0.081$). The path coefficient from perceptions of behavioral control "I have knowledge and information to prepare for disaster" to behavior is $\beta = 0.256$ ($p = 0.002$) and the path coefficient from "expectant and nursing mothers" of basic attributes to behavior is $\beta = 0.185$ ($p = 0.015$). Furthermore, the path coefficient from subjective norms to behavior is $\beta = 0.165$ ($p = 0.053$) and the path coefficient from "age" to behavior is $\beta = 0.134$ ($p = 0.097$).

In "preparation at home for disaster" hypothesized in this study, the passes from descriptive norms and social support sources are not indicated.

3.6.2. Model of "Preparation for Evacuation" for Expectant and Nursing Mothers

To verify the model of "preparation for evacuation" hypothesized in this study, a cause-and-effect relation is hypothesized and analyzed using the path analysis by struc-

Table 3. Mean and SD of variables.

		Mean	*SD*
1	Behavior (preparation at home for disaster)	5.70	3.92
2	Behavior (preparation for evacuation)	1.07	0.86
3	Behavioral intentions (preparation at home for disaster)	4.27	0.65
4	Behavioral intentions (preparation for evacuation)	4.20	0.68
5	Attitudes (preparation at home for disaster)	4.58	0.64
6	Attitudes (preparation for evacuation)	4.61	0.59
7	Subjective norms (preparation at home for disaster)	3.68	0.96
8	Subjective norms (preparation for evacuation)	3.67	0.96
9	Descriptive norms (preparation at home for disaster)	2.73	0.68
10	Descriptive norms (preparation for evacuation)	2.64	0.63
11	Perceptions of behavioral control "I have knowledge and information to prepare for disaster" (preparation at home for disaster)	2.83	0.93
12	Perceptions of behavioral control "I have knowledge and information to prepare for disaster" (preparation for evacuation)	2.76	0.93
13	Perceptions of behavioral control "I have no opportunity to learn preparation for disaster" (preparation at home for disaster)	2.64	1.04
14	Perceptions of behavioral control "I have no opportunity to learn preparation for disaster" (preparation for evacuation)	2.67	1.06
15	Social support sources	3.16	0.75
16	Age	4.03	0.87

Table 4. Correlation among variables.

	Item	1	2	3	4	5	6	7	8	9
Preparation at home for disaster										
1	Behavior	1	**.243****	.128	**.298****	.011	**.321****	.095	.090	.164
2	Behavioral intentions		1	**.624****	**.424****	.042	.151	−.034	.155	−.134
3	Attitudes			1	**.368****	.149	.067	−.083	**.181***	−.098
4	Subjective norms				1	.089	**.229****	.002	.047	−.024
5	Descriptive norms					1	.116	.113	.109	**.197****
6	Perceptions of behavioral control "I have knowledge and information to prepare for disaster"						1	**.244****	.025	**.180***
7	Perceptions of behavioral control "I have no opportunity to learn preparation for disaster"							1	**.218***	**.209***
8	Social support sources								1	.113
9	Age									1
Preparation for evacuation										
1	Behavior	1	**.189***	.047	.113	.107	.124	.049	−.006	.057
2	Behavioral intentions		1	**.445****	**.340****	−.025	−.106	−.065	.137	−.067
3	Attitudes			1	**.344****	.037	−.086	−.095	−.010	−.108
4	Subjective norms				1	.020	.082	−.065	.036	−.069
5	Descriptive norms					1	.061	**.206***	**.210***	**.230****
6	Perceptions of behavioral control "I have knowledge and information to prepare for disaster"						1	**.307****	−.057	.138
7	Perceptions of behavioral control "I have no opportunity to learn preparation for disaster"							1	.164	**.254****
8	Social support sources								1	.113
9	Age									1

$^{*}p < .05$, $^{**}p < .01$.

tural equation modeling (method of maximum likelihood is used for estimation). A model is corrected by deleting the nonsignificant passes and the model in shown in **Fig. 3** is finally adopted. All the indices of suitability of the model, $\chi^2(23) = 25.625$, $p = 0.319$, GFI $= 0.964$, AGFI $= 0.913$, CFI $= 0.969$, and RMSEA $= 0.029$, satisfy the statistical tolerable level.

Regarding the factors affecting behavioral intentions, the path coefficient from attitudes to behavioral intentions is $\beta = 0.366$ ($p < .000$), the path coefficient from

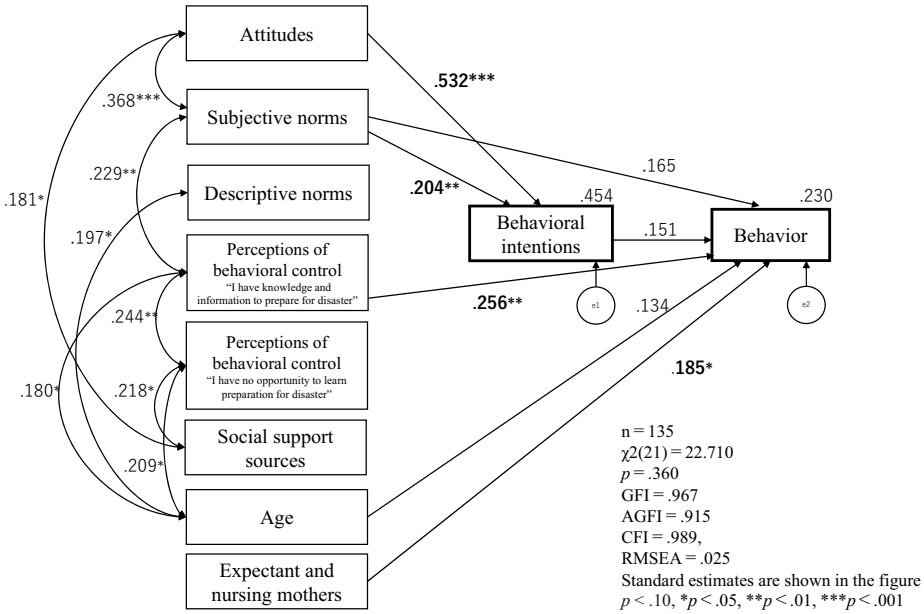

Fig. 2. Factors affecting behavioral intentions and behavior for "preparation at home for disaster."

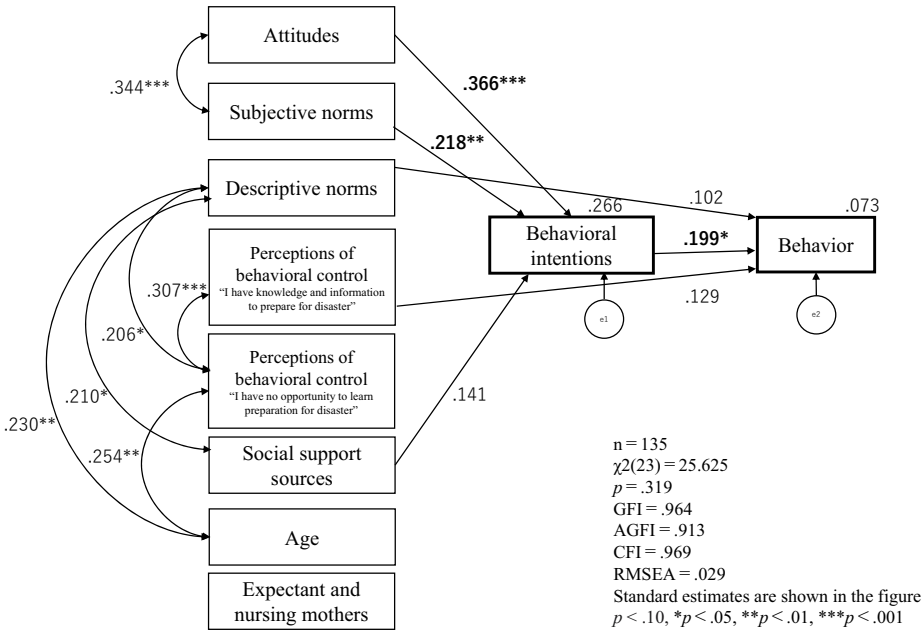

Fig. 3. Factors affecting behavioral intentions and behavior for "preparation for evacuation."

subjective norms to behavioral intentions is $\beta = 0.218$ ($p = 0.006$), and the path coefficient from social support sources to behavioral intentions is $\beta = 0.141$ ($p = 0.068$).

Regarding the factors affecting behavior, the path coefficient from behavioral intentions to behavior is $\beta = 0.199$ ($p = 0.027$), the path coefficient from perceptions of behavioral control "I have knowledge and information to prepare for disaster" to behavior is $\beta = 0.129$ ($p = 0.090$), and the path coefficient from descriptive norms to behavior is $\beta = 0.102$ ($p = 0.095$).

In "preparation for evacuation" hypothesized in this study, the passes from "age" and "expectant and nursing mothers" of the basic attributes are not indicated.

3.7. Social Support Sources Necessary for Preparation for Disaster

Table 5 shows the social support sources necessary for the preparation for disaster made by expectant and nursing mothers. Those who are involved continuously during the period of pregnancy and care of infant such as "husband and partner," "biological parents, parents-in-law, and siblings," "public health nurse and midwife at community health center and child rearing support center of local government," "medical staff of maternity clinic," and "friends and acquaintances who are pregnant and care infants" account for high percentage.

Table 5. Social support sources necessary for preparation for disaster.

	Item	*Mean*	*SD*
1	Husband and partner	4.16	1.07
2	Biological parents, parents-in-law, and siblings	3.78	1.29
3	Neighbors	2.44	1.37
4	Medical staff of maternity clinic such as doctor, midwife, and nurse	2.98	1.28
5	Friends and acquaintances who are pregnant and care infants	2.90	1.48
6	Public health nurse and midwife at community health center and child rearing support center of local government	3.04	1.42
7	Colleagues	2.20	1.51
8	Schoolteacher of day nursery, kindergarten, and elementary school	2.21	1.70

4. Considerations

4.1. Disaster Preparation Behavior of Expectant and Nursing Mothers

As a result of this study, it is found out that expectant and nursing mothers have made the general disaster preparation, while the implementation rate of the disaster preparation recommended for protectors of infants is low. As the reasons of such result, it is considered that there is a problem in calling attention to the recent natural disasters and Nankai Trough earthquakes. It is guessed that expectant and nursing mothers would have the general knowledge on disaster preparation, but their knowledge on the disaster preparation necessary for expectant and nursing mothers and infants would not be sufficient. It is pointed out that the preparation for disaster taking time and cost such as preparation of emergency bag and the preparation necessary to coordinate with others such as arrangement on how to contact one another are not materialized easily [5]. In this study, the implementation rate of the preparation for disaster taking time and cost such as consultation with family, confirmation of contact method, and provision of the necessaries for infants is low, which coincides with the knowledge of the previous studies.

The item with the highest implementation rate is "confirmation of prediction of degree of local damage caused by natural disaster, evacuation route, and evacuation site using hazard map." As the reasons of high recognition of hazard map, the circumstances are mentioned that the survey area suffered from Great Hanshin-Awaji Earthquake in 1995 and a windstorm and flood damage in 2019, the local governments distribute the hazard map to all the households regularly, and the 2020 Kyushu floods are still fresh in their minds. On the other hand, the implementation rates of confirmation of evacuation route and evacuation site, disaster drill, and evacuation drill are considerably low compared with "public opinion survey on disaster management" [27] and the survey on "awareness on and preparation for disaster and evacuation behavior" conducted by Yoshizawa et al. [33]. As the reason of such low rate, the social aspect of expectant and nursing mothers and infants is considered that they tend to be isolated from the region because of their poor relation with the community [19]. Furthermore, expectant and nursing mothers are thought to have a feeling to disaster drill and evacuation drill of "it is difficult to participate in it" and "it is not useful" [4].

The disaster management education has been conducted so far in terms of provision at home such as saving for emergency. Thus, in examining disaster management enlightenment and education for expectant and nursing mothers, it is necessary in the future to develop the contents of the evacuation behavior for expectant and nursing mothers taking their infants together.

4.2. Factors to Promote Disaster Preparation Behavior of Expectant and Nursing Mother

As a result of this study, it can be confirmed that the factors to promote the disaster preparation behavior of expectant and nursing mothers generally coincide with the theory of planned behavior of Ajzen.

The behavioral intentions to cause expectant and nursing mothers to take disaster preparation behavior, "motivation," are the factor determining the disaster preparation behavior of expectant and nursing mothers. It is indicated that to promote the disaster preparation behavior of expectant and nursing mothers it is important to enhance the behavioral intentions to the disaster preparation behavior of expectant and nursing mothers.

As for expectant and nursing mothers, the more positive the attitudes that they consider disaster preparation as valuable they have, the higher their behavioral intentions become. And the higher the subjective norms that they think the important persons for them expect them to prepare for disaster become, the higher their behavioral intentions become. That is to say, the factors to promote the behavioral intentions of expectant and nursing mothers to disaster preparation behavior, "motivation," are the attitudes toward disaster preparation and the subjective norms. Such result coincides with the knowledge of the previous studies dealing with the theory of planned behavior and disaster management behavior [10, 11]. It is generally said that women are more aware that having a pregnant child will protect the lives of their families and children, and that they will play a role in maintaining the health and livelihood of themselves and their families, and that it is timely for appropriate behavior change [22]. Therefore, it is speculated that expectant and nursing mothers who are strongly aware that they are expected to protect their families and children by experiencing life cycles such as pregnancy, childbirth, and childcare may become more aware of disaster prevention.

In this study, all of the subjects surveyed were the expectant and nursing mothers, and a model analysis was conducted only for the expectant and nursing mothers. In order to improve the accuracy of the model, the effect controlled when it occurs between the expectant and nursing mothers. In "preparation for evacuation," the attributes of the expectant and nursing mothers, such as the expectant or the nursing mothers did not have any effect on the behavior and behavior intention of "preparation for evac-

uation." In "preparation for evacuation," the generality of the model was confirmed for both the expectant and nursing mothers.

In this study, the item of "I have knowledge and information to prepare for disaster" of the perceptions of behavioral control determines directly the disaster preparation behavior of expectant and nursing mothers. In a previous study on women's health promotion in terms of the behavior of breast cancer screening with mammography, it is pointed out that the perceptions of behavioral control influence the examination behavior [34], which coincides with the results of this study. In this way, in the disaster management behavior and the preventive behavior to maintain health, the perceptions of behavioral control such as information and knowledge function as a factor to promote the behavior directly. For this reason, regarding the disaster preparation behavior of expectant and nursing mothers, it is indicated that provision of the knowledge and information necessary to prepare for disaster to expectant and nursing mothers would encourage them to behave for disaster preparation. Moreover, it is also pointed out that there are the concrete needs of expectant and nursing mothers for disaster management education [35]. Therefore, it is necessary for the disaster management education for expectant and nursing mothers that the contents should be enriched by incorporating the knowledge and information especially for them. And because expectant and nursing mothers are defined as the women who are pregnant or gave birth to baby within a year, those who get the education change significantly in about one year. Thus, the disaster management education for expectant and nursing mothers should be conducted continuously and regularly.

The descriptive norms hypothesized in this study are the factor to affect the behavior for "preparation for evacuation." As the reason why the descriptive norms function as such factor, the circumstances are given that the social behavior such as evacuation behavior tends to be influenced by the behavior many other persons nearby take. Therefore, for the disaster management education it is thought that the disaster drill and evacuation drill where expectant and nursing mothers with the same situation gather together, understand their position and conditions one another and image the concrete measures for evacuation at the time of disaster would be effective for enhancement of the subjective norms and promotion of the behavior for "preparation for evacuation."

It was confirmed that the social support sources tend to be a facilitator for expectant and nursing mothers hypothesized in this study are a factor to promote the behavioral intentions of "preparation for evacuation." This coincides almost with the hypothesis. As the reason, it is guessed that expectant and nursing mothers think with the social support resources it would be easier for them to participate in evacuation drill and the social support resources would help their evacuation at the time of disaster. In the case of the evacuation of expectant and nursing mothers, the difficulties are expected that they could fall down and it would take more time for evacuation. In the case of expectant mothers especially during the middle and latter pregnancy periods, there is an additional risk of fall down because they would lose sight of their own footsteps due to baby bump and could not move well as they want. After birth, nursing mothers would carry their baby who cannot walk and additionally hold hands with an elder child so that they should take evacuation behavior without keeping their both hands free. For this reason, expectant and nursing mothers are likely to be anxious about evacuation. It is thought that in the future by conducting the evacuation drill and disaster drill which not only expectant and nursing mothers but also the social support sources such as their husband and family could easily participate to the evacuation behavior could be imagined concretely for them to encourage their behavior for preparation for evacuation.

The social support that expectant and nursing mothers expect to prepare for future disasters is their family, the friends and acquaintances of expectant and nursing mothers with the same position as their own, and the professionals of medical and health service. This coincides with the results of the previous studies [23–26]. It is reported that now the community health centers and child rearing support centers of a part of the local governments and some maternity clinics carry out the disaster management education for expectant and nursing mothers. And some local governments distribute the maternal and child health handbook in which the measures for disaster management necessary for expectant and nursing mothers are printed. From the above, it is thought that the maternity clinic, community health center, and child rearing support center which are familiar with expectant and nursing mothers are recommended as the location where the disaster management education for expectant and nursing mothers is carried out. And it is considered as useful as a tool for the disaster management education to use the maternal and child health handbook with which expectant and nursing mothers carry always.

As a result of this study, it was confirmed that the preparations for the individual disasters which are necessary for expectant and nursing mothers were not sufficiently prepared and the necessity was confirmed. Furthermore, the factors determining the behavioral intentions and behavior for the disaster preparation for expectant and nursing mothers could be different from the results of the disaster management studies targeting the citizens in general. As for the characteristics of the factors leading to the disaster preparation behavior of expectant and nursing mothers into "preparation at home," it was suggested that "subjective norms" and "perception of behavioral control" may directly affect the disaster preparation behavior of expectant and nursing mothers. Regarding "preparation for evacuation," "descriptive norms" may influence the disaster preparation behavior of expectant and nursing mothers, and it is suggested that the existence of "perception of behavioral control" may be the key to the behavioral intention of "preparation for evacuation" of expectant and nursing mothers. Therefore, in order to strengthen the disaster preparation for expectant and nursing mothers, it is

necessary to provide disaster prevention education and enlightenment based on the behavioral intentions and characteristics of the disaster preparation for expectant and nursing mothers.

4.3. Limits of This Study

Because in this study the expectant and nursing mothers living in the area which suffered from the Great Hanshin-Awaji Earthquake are examined and the sample size is small due to the survey conducted under the spread of COVID-19, this study has limits to generalize its results to the expectant and nursing mothers in general. This survey has also the limits because it is based on the cross-sectional survey at a specific point in time. In this study, the factors influencing on the behavioral intentions and behavior in the actual situation of the disaster preparation of expectant and nursing mothers are examined. But it is not examined to what extent the behavioral intentions would be related with the actual behavior. In the future, the influences on behavior should be examined by a cross-sectional study.

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