Analysis and evaluation of the sense of security and awareness of children and their parents regarding Children's emergency houses

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Abstract: In order to obtain basic knowledge for the dissemination and improvement of Children's emergency houses around school routes, we analyzed and compared the awareness of elementary school students and their parents regarding the recognition of shelters, the design of sign plates, and safety measures. Furthermore, we quantitatively analyzed the relationship between awareness and installation status. As a result of the analysis, we found that there were differences in awareness and evaluation of the design of the sign plates and safety measures between children and their guardians. Children tended to place more importance on psychological and emotional factors, while guardians tended to place more importance on practical and functional factors. As a result of analyzing the relationship between awareness of evacuation sites and installation status, we found that the degree of impact on awareness differed between children and guardians, particularly with regard to the height of the sign plates.

Keywords: Children's emergency house, Safety and Security in School Districts, School Route Planning

1. INTRODUCTION

1.1 Background of Study

Crimes targeting children are one of the major social issues in Japan. According to the statistics of the National Police Agency (2019), the number of physical crimes on the road has been decreasing from 2014 to 2018, but the number of cases in which children under 13 years old are victims has remained unchanged. In particular, as for the crimes and suspicious behaviors targeting children, it has been pointed out that crimes tend to be concentrated during the school commute on weekdays, and, it has been confirmed that many crimes and

suspicious behaviors occur during the school commute and after school between 3pm and 6pm.

This trend can be attributed to the way children commute to school. In many countries, including developed nations, children are prohibited from going out alone, but in Japan, many children commute to and from school either alone or in groups. According to a survey of elementary school students' commuting habits conducted by Hino et al. (2024), 82% of students walked to school every day, and 67% walked home every day, with higher percentages in larger cities. Additionally, it is not uncommon for children to go out alone after school to play or attend extracurricular activities. In other words, one of the causes can be attributed to the fact that the “appropriate targets” mentioned in the Routine Activity Theory (Cohen & Felson, 1979) are concentrated during commuting hours or in the vicinity of school routes and school districts after school.

Due to safety concerns such as those mentioned above and the impact of school consolidation resulting from the declining birthrate, commuting methods such as school buses, bicycles, and parent-provided transportation are becoming increasingly diverse (Setou et al., 2019). However, from a global perspective, the importance of children's independent mobility (Hillman et al., 1990), active school travel (Hino et al., 2024), and child-friendly cities is being emphasized from the standpoint of physical and mental development and children's rights. Furthermore, in Japan as well, initiatives such as the Road Vision 2040 (MLIT, 2020) and related policies promoting walkable cities have placed a strong emphasis on pedestrian spaces in urban and transportation planning.

From the above, it is clear that ensuring the safety of children on their way to and from school is a priority. Furthermore, it can be said that this is also an important issue in urban and transportation planning for the creation of safe, secure, and walkable urban spaces. In order to address this issue, there is an initiative called Children’s emergency house promoted by the police and local governments. These are emergency evacuation sites set up and operated where children can take refuge when they encounter dangerous situations. Children's evacuation shelters were first established in Chiba Prefecture in 1974 (Furukawa, 2023). Subsequently, in the 1990s, there were a series of incidents in which children were kidnapped or sexually abused on their way to school, raising awareness of the need to protect children throughout the region and leading to the establishment of shelters nationwide (Hiroshima Prefecture, 2021). One of the main features of Children’s emergency houses is that they are a volunteer activity in which local residents and shops cooperate to provide existing shops, residences, etc. as evacuation sites. Facilities and residences registered as shelters have stickers or plates displayed on them, and various measures have been taken to make them easy for children to recognize as landmarks. In some areas, diverse forms have been introduced, such as using cars as shelters or using flags instead of plates. Through activities such as these, the Children’s emergency house is not only a physical evacuation site, but also a symbolic presence that ensures the safety of children through the cooperation of the entire local community.

On the other hand, there has been insufficient verification of the actual use of the “Children's Emergency” system, including its effectiveness in ensuring the safety of children and providing a sense of security, which is the system's original purpose. It is necessary to clarify the effectiveness and issues of the system through analysis of the attitudes and actual use of the system by children and their guardians.

1.2 Related Previous Studies and Purpose of the Study

There are not many previous studies or survey reports on Children’s emergency houses, but

the following can be mentioned.

In the survey by Terada et al. (2010), it was pointed out that while shelters are an essential presence for children, the most common opinion was that “the display plates should be changed to a more eye-catching color”. In addition, Tategami et al. (2016) reported that the number of shelters installed did not match the size of elementary schools, and that stores were mainly registered as shelters in urban areas, while private houses were mainly registered as shelters in suburban areas. Furukawa (2023) pointed out that the placement of Children’s emergency house plates should be considered in terms of children's height, field of vision, and information processing ability. In particular, it is suggested that if the plates are not installed in a position that is easy for children to find, it may have a negative impact on the recognition and use of the shelters.

Local governments have conducted surveys of registrants for Children’s emergency houses in Ikoma City (2023) and Ome City (2024). In the survey by Ikoma City, 94% of registrants responded that they had not actually protected children in both FY2021 and FY2015. While it is thought that children are not encountering danger, the possibility of children's psychological resistance is pointed out as a reason for the low use of shelters. In the survey by Ome City, some respondents said that the announcements were insufficient, but the registrants showed a strong desire to look after children. There were also opinions that the flags and plates of the Children’s emergency house themselves contributed to crime prevention, and it was pointed out that the system itself played a certain role in raising awareness of crime prevention in the local community.

From these, while the Children’s emergency house is necessary in the local community, issues have been pointed out regarding its effectiveness and usage situation. In particular, many of the registrants pointed out that “the system is not well known”, and there is a lack of information about children's awareness and willingness to use the system. In addition, the visibility and design of the plates and stickers indicating the existence of the shelter, as well as the optimization of the installation location, are also important issues.

The purpose of this study is to obtain basic knowledge about the requirements for an effective and reassuring Children’s emergency house. To this end, we focused on awareness and feelings of security, and analyzed the factors that affect the actual operation of the system and the intention to use it. Specifically, we conducted a questionnaire survey targeting elementary school students and their parents, and analyzed and compared the actual use of the shelter, awareness, and recognition, as well as the evaluation of the design. In addition, we conducted a multivariate analysis of the relationship between the recognition of the shelter and the situation of its setup. Based on these results, we considered the setup and operation of an effective Children’s emergency house.

2. OVERVIEW OF THE RESEARCH APPROACH

This section describes the process and methods used to achieve the objectives of this study.

First, to understand the current status and effectiveness of Children's Emergency Houses, a questionnaire survey was conducted targeting children and their guardians. The responses were analyzed, focusing on perceptions of shelters, actual usage, perceived necessity and intention to use shelters, feelings of safety provided by shelters and other crime prevention measures, and evaluations of the plate designs in their residential areas and other municipalities. The responses were quantified, and statistical analysis and quantitative analysis were conducted to gain an understanding of the results. To clarify the differences in awareness between children and their guardians, a cross-tabulation analysis was performed to

test for independence.

Subsequently, an analysis was conducted to quantitatively clarify the relationship between shelter setup conditions and awareness. The location information of shelters known to respondents from the previous survey was utilized. Additionally, field surveys were conducted to understand shelter setup conditions. Quantitative analysis of Type II was adopted for the analysis. In this process, to consider the differing effects of setup conditions on shelter awareness between children and parents, analyses were conducted separately for each group.

3. QUESTIONNAIRE SURVEY OVERVIEW

3.1 Outlines of Surveyed City and Children's emergency houses

Fukuoka City, the subject of this study, is located in the Kyushu region and is one of Japan's government-designated cities. It is made up of seven administrative districts and 148 elementary school districts, and as of February 2025, the population was 1.66 million. In each school district in the city, advanced school district safety and security measures have been introduced, such as a child monitoring system using IC tags, as well as Children's emergency houses, safety and security maps, and monitoring and patrol activities by PTAs and community associations. The PTA referred to here is an abbreviation for "Parent Teacher Association". It is a formal organization composed of parents, teachers, and sometimes students, that is intended to facilitate parental participation in a school.

Figure 1. Plate design and display example of Children's emergency house in Fukuoka City (photo by author)

Children's emergency shelters are emergency facilities where children can take refuge when they encounter dangerous situations. They are part of a community-wide system aimed at protecting children. In the 1990s, there were a series of cases where children were abducted or subjected to sexual violence while commuting to school or returning home, leading to a heightened awareness of the need for child protection across communities. As a result, the initiative spread nationwide (Hiroshima Prefecture (2021)). The National Police Agency has created a manual for shelter operators, but Children's Emergency House is run as a volunteer activity by the local community. There are no official standards or guidelines for the design or operation of shelters nationwide. Local governments, police, school officials, and local residents set standards and guidelines according to the circumstances of their area. Children's

emergency houses are generally existing facilities that are registered and utilized for this purpose, and new facilities are not built for this purpose. Facilities registered with the shelter must display signs such as plates, stickers, or flags in locations visible to passersby, especially children.

In Fukuoka City, the PTA takes the initiative in each elementary school district. Shelter registrations are on a volunteer basis and are recruited by the PTA of each school district. Generally, the shelters are registered in residences, stores, hospitals, and other facilities in the school district. The plate design indicating shelters is decided by each municipality, and Fukuoka City also uses its own plates. Figure 1 shows the plate design and examples of actual installations in Fukuoka City.

3.2 School Districts Surveyed

In this study, in order to clarify the effectiveness and sense of security of Children's emergency houses, we surveyed three elementary school districts in Fukuoka City. The reason for selecting these districts was that the PTA of each elementary school district is mainly responsible for operating the shelters, and there are sufficient numbers of shelters. Figure 2 shows the location of the three target school districts on a map of Fukuoka City (Fukuoka City, 2024).

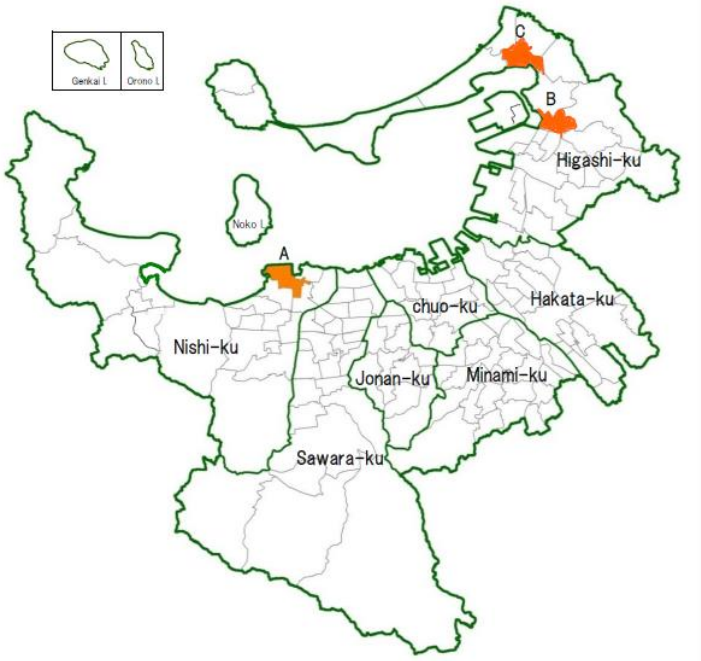

Figure 2. Location of the target school districts
(extracted from Fukuoka City School District Data Collection)

1) School district A was created in 2010 through the separation and merger of two school districts due to land reclamation and population growth. This area has a long history even within Fukuoka City, and is one of the bases of Fukuoka City's west area, which has commercial facilities and a station where the subway and JR lines connect.
2) School district B is located approximately 8km northeast of the city center of Fukuoka and has convenient access to public transportation with both JR and

private railway stations. The area around the station is a commercial district with around 600 stores and is a major hub for eastern Fukuoka. The land readjustment project around the station that started in 1999 was completed in 2021, and the area was renewed.

3) School district C is located in Higashi Ward, like school district B, and there are two train lines running through it, dividing the school district in two, with JR and private railway stations located there. From 1999 to 2005, the construction of apartment buildings by private companies progressed, and the number of young households is on the rise.

Table 1 shows the main indicators of the three target school districts.

Table 1. Main indicators of the target school districts
(extracted from Fukuoka City School District Data Collection)

Item		School district		
		A	B	C
Population		11,090	12,739	11,088
Number of households		6,202	7,089	5,663
Number of elementary school students		501	655	586
Aging population ratio [%]	≥65 y/o	19.8	21.8	22.9
	≥75 y/o	10.2	11.0	10.7

3.3 School Districts Surveyed

We conducted a questionnaire survey of children and their parents in the three elementary school districts in Fukuoka City mentioned above. Prior to the survey, we obtained confirmation and permission from the school directors and approval from the Fukuoka Women's University Ethical Review Committee for Epidemiological Research (approval number: 2024-31). The survey was conducted by enclosing a survey form for children (Form A), a questionnaire form for parents (Form B), and a request letter explaining the purpose of the survey and the protection of personal information in an envelope, and distributed to the children at school. The survey forms were answered by each child/guardian at home and collected via the school.

Table 2. Summary of the survey

Item	School district		
	A	B	C
Number of distribution (approximate)	520	670	600
Number of collections (children/parents)	154/135	230/193	140/123
Return ratio (children/parents) [%]	29.6/26.0	34.3/28.8	23.3/20.5
Survey period	October - November 2024		
Question items (response method: a. multiple choice, b. descriptive, c. 4- or 5-point rating scales (Likert scale), d. map-based responses)	1) Personal attributes (a, b) 2) Awareness and necessity for shelters (a, c) 3) Experience and intention to use shelters (a) 4) Sense of security and its requirements around the school route (a, c) 5) Evaluation of the plates and flag design (c) 6) Known shelter location (d)		

Table 2 shows a summary of the survey. The number of questionnaires distributed was 520 (School A), 670 (School B), and 600 (School C), and the number of questionnaires

returned was 154/135 (School A), 230/193 (School B), and 140/123 (School C). The response rate (%) was 29.6/26.0 (School A), 34.3/28.8 (School B), and 23.3/20.5 (School C). For parents with multiple children, they were instructed to complete Form B for one child only to avoid duplicate responses. The survey items consist of 1) Personal attributes, 2) Awareness and necessity for shelters, 3) Experience and intention to use shelters, 4) Sense of security and its requirements around the school route, 5) Evaluation of the plates and flag design, and 6) Location of the shelter. The response methods used were a. multiple choice, b. descriptive, c. 4- or 5-point rating scales (Likert scale), and d. map-based responses, depending on the content of the questions.

4. SURVEY AND ANALYSIS RESULTS

The aggregate and analysis results of the questionnaire survey are described below. As there were no differences in the trends of the responses between the school districts, the results are shown for the three school districts combined.

4.1 Personal Attributes

Regarding the children, 267 (47.1%) were boys and 247 (51.0%) were girls, and 10 (1.9%) did not want to answer, so the ratio of boys to girls was found to be almost equal. The breakdown by grade was as follows: 80 (15.3%) in first grade, 96 (18.3%) in second grade, 107 (20.4%) in third grade, 89 (17.0%) in fourth grade, 74 (14.1%) in fifth grade, 76 (14.5%) in sixth grade, and 2 (0.4%) with no response. There was no significant bias in the grades of the respondents.

The gender of the parents was male for 221 (49.0%), female for 221 (49.0%), and no response for 9 (2.0%).

4.2 Awareness and Necessity for Shelters

The results of the survey on awareness for shelters were as follows: 86.8% of the children said “yes” and 13.1% said “no”. On the other hand, 98.4% of the parents said “yes” and 1.6% said “no” (Figure 3). The test of independence (chi-square test) between the respondent’s type and awareness for shelters was rejected at the 1% level of significance. When asked about the

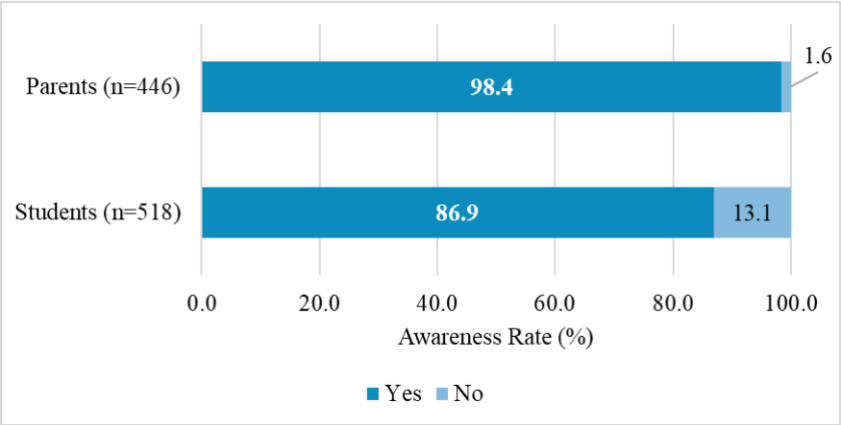

Figure 3. Awareness for shelters

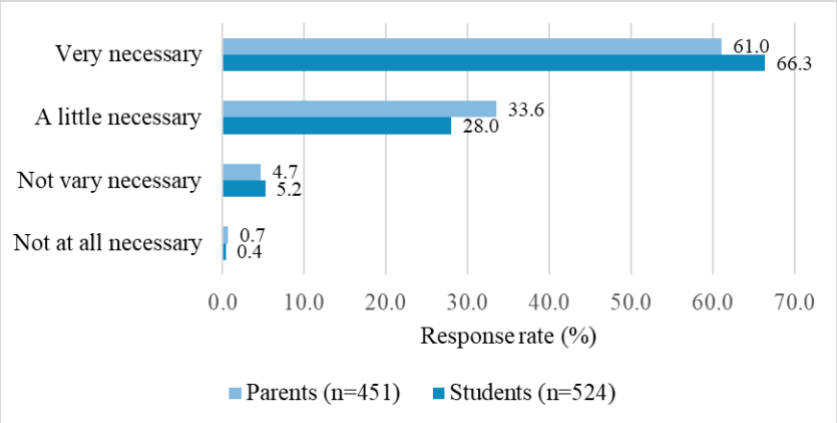

Figure 4. Necessity for shelters

necessity of shelters, over 90% of both children and parents said that they were "very necessary" or "necessary" (Figure 4). The results regarding children's awareness and perceived necessity of children's evacuation shelters were similar to those reported by Terada et al. (2010) and Furukawa (2023). The test of independence between the respondent's type and necessity for shelters was rejected at the 5% level of significance. The independence test showed that there were significant differences between children and their parents in terms of their awareness and perceived necessity of shelters. In particular, with regard to awareness, the influence of PTA activities and announcements may be considered a factor for parents.

4.3 Experience and Intention to Use Shelters

When students were asked about their experience using shelters, only 5.2% answered "yes," indicating that very few students have used shelters. These results were similar to those of previous studies. In particular, as pointed out by Terada et al. (2010) and Tategami et al. (2016), the use included cases other than incidents or accidents, such as when children wanted to drink water or use the restroom. On the other hand, 87.6% of the students responded that they "would like to use" them, confirming their high intention to use them. The most common reason given for wanting to use the service was "I can get help quickly" (55.3%), followed by "I feel safe" (46.6%). Other responses included "my family or school taught me" (19.3%), "it is nearby" (18.7%), and "I have seen the plates" (15.5%) (Figure 5).

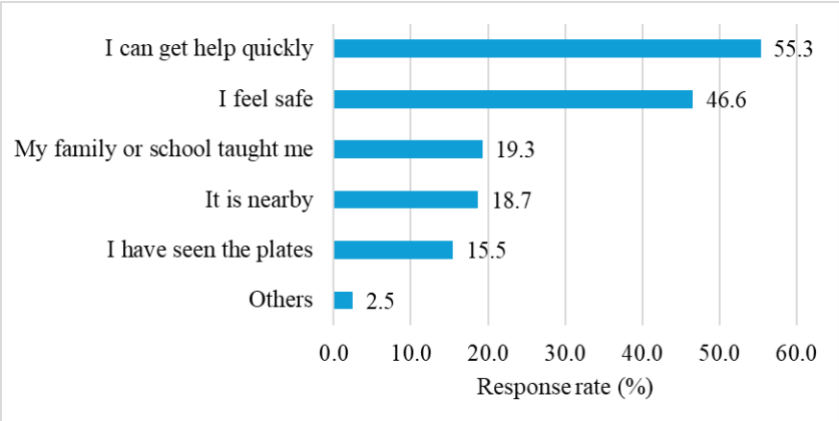

Figure 5. Reasons for intention to use shelter (n=524)

On the other hand, "I am afraid to enter an unknown house or store" and "I don't know if it is really safe" were the most common reasons given for "not wanting to use", and these

results showed a similar trend to that reported by Tategami et al. (2016). These results suggest that children's resistance to unfamiliar places and concerns about safety may hinder their intention to use shelters.

4.4 Factors for The Sense of Security around School Districts

The role of Children's Emergency Houses is to prevent crime and accidents in the school district, as well as to support children in safely commuting to and from school and participating in after-school activities. This is based on concepts from environmental criminology, such as CPTED (Crime Prevention Through Environmental Design) and the broken windows theory. In other words, it is not only the actual use of the facilities that is important, but also the presence of the facilities themselves, which serves as a deterrent to potential offenders, raises awareness among children, and provides a sense of security.

As shown in Section 3.3, while actual usage is low, there is a high perceived need and intention to use the facility. Therefore, this study conducted a survey to assess the effectiveness of crime prevention measures such as shelters by investigating children's and parents' sense of safety and the factors influencing it. The selection of factors was based on concepts from environmental criminology, the authors' previous research findings (Matsunaga et al. (2017, 2012 and 2009)), and the environmental conditions and crime prevention measures of the target school districts.

4.4.1 Sense of security about the Children's emergency house

A four-point scale questionnaire was administered to students and their parents to ask "whether they would feel safer if there were children's emergency houses in the vicinity of their commuting routes". As a result, students were most likely to respond "very" (51.2%), followed by "a little" (34.5%). Parents were most likely to respond "a little" (49.1%), followed by "very" (36.4%). A cross-tabulation analysis of the children's and parents' sense of security revealed significant differences at 5% level (Table 3). Furthermore, a residual analysis revealed significant differences in the "very" and "a little" ($p<0.001$). Both children and parents feel secure about the existence of children's emergency shelters, but there are significant differences in the degree of security they feel.

Table 3. Sense of security about the shelter

	Very	A little	Not very	Not at all	p-value
Students	264**	201**	39	12	0.0265
Parents	190**	216**	27	7	

Residual analysis: **Significant at 1% level; *Significant at 5% level.

Furthermore, when parents were asked whether they were worried about their children using a shelter, 47.7% said yes and 52.3% said no, so about half of them felt worried. Approximately half of parents feel uneasy about their children using shelters, which can be said to influence the fact that the necessity and sense of security of shelters are lower than those of children. Figure 6 shows the reasons of their worries. The reasons for parents' worries were similar to those given by children for not wanting to use shelters. From these results, it can be said that in order to reduce parents' worries about shelters, it is necessary to improve the reliability of shelters.

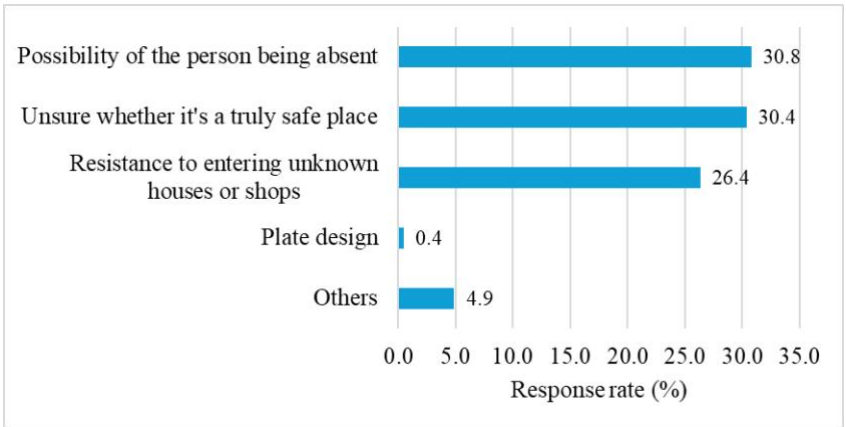

Figure 6. Reasons of parents' worries (n=451)

4.4.2 Factors for the sense of security about the Children's emergency house

In response to the question, "What factors influence the sense of security in children's emergency houses?", students and parents were asked to select the following six factors including "others" to increase the sense of security at a shelter (multiple selections allowed): "Clearly visible plates", "Busy traffic", "Bright place", "Shelter with permanent staffs (residents)", "Known place", and "Others".

The item "Known place" was selected the highest, with 57.6% of students and 82.0% of parents. "Shelter with permanent staffs (residents)" was selected by 42.4% of students and 54.3% of parents, "Busy traffic" was selected by 42.4% of students and 60.3% of parents, "Bright place" was selected by 39.7% of students and 44.8% by parents, and "Clearly visible plates" was selected by 32.4% of students and 42.1% of parents. Overall, parents tended to select each factor more than students.

Table 4. Factors for the sense of security about the shelter

Factors	Selection	Students (n=524)	Parents (n=451)	p-value
Known place	○	302**	370**	< 0.001
	×	222**	81**	
Shelter with permanent staffs (residents)	○	222**	245**	< 0.001
	×	302**	206**	
Busy traffic	○	262**	92**	< 0.001
	×	302**	179**	
Bright place	○	208	202	0.108
	×	316	249	
Clearly visible plates	○	170**	190**	0.008
	×	354**	261**	

Residual analysis: **Significant at 1% level; *Significant at 5% level.

A cross-tabulation analysis was performed on the student and parents' choice of the five factors excluding "others". The numbers of responses for each factor and analysis results are shown in Table 4. Significant differences were found between the choices of students and parents for the four factors other than "bright location." The reason for this may be that children are not allowed to go out alone after 6 p.m., and shelters are expected to be used during the day and before sunset. Furthermore, residual analysis showed that there was a significant difference in the sense of security between children and parents due to four factors excluding "bright place". Overall, it can be said that parents tend to place importance on the

reliability of the shelter and the presence of other people around them, while children tend to place importance on visual and easily understandable factors.

4.4.3 Other factors for the sense of security around school districts

In addition, students and their parents were asked if they felt secure about the following six factors including "others" other than shelter (multiple selections allowed): "Crossing guard", "Security camera", "Friends and siblings", "Personal alarm", and "GPS", "Others".

The item "Friends and siblings" was selected the highest, with 67.7% of students and 86.3% of parents. "Personal alarm" was selected by 59.4% of students and 62.5% of parents, "Security camera" was selected by 50.0% of students and 79.6% of parents, "Crossing guard" was selected by 48.9% of students and 67.6% by parents, and "GPS" was selected by 37.0% of students and 60.5% of parents. Overall, parents tended to select each factor more than students.

A cross-tabulation analysis was conducted to see if there were differences in choice between students and parents. The numbers of responses for each item excluding "Others" and analysis results are shown in Table 5. As a result, significant differences were found between the choices made by students and their parents in four factors, excluding "Personal alarm". Furthermore, based on the results of the residual analysis, it can be said that parents tend to feel secure about community activities and technology-based monitoring measures, while children tend to feel secure about factors related to people close to them.

Table 5. Other factors for the sense of security

Factors	Selection	Students (n=524)	Parents (n=451)	p-value
Crossing guard	○	256**	305**	< 0.001
	×	268**	146**	
Security camera	○	262**	359**	< 0.001
	×	262**	92**	
Friends and siblings	○	355**	389**	< 0.001
	×	169**	62**	
Personal alarm	○	311	282	0.311
	×	213	169	
GPS	○	194**	273**	< 0.001
	×	330**	178**	

Residual analysis: **Significant at 1% level; *Significant at 5% level.

4.4.4 Plates and flag design evaluation

As mentioned earlier, Children's emergency houses generally use existing homes or facilities and are marked with recognizable plates, stickers, or flags, etc. These have unique designs and specifications depending on the organization that operates and manages the shelter, such as a municipality or company. It is thought that these designs and methods of display will affect the sense of security and awareness of the shelter. In this questionnaire, we set up evaluation items related to the ease of use of the shelters, targeting multiple plates and flags of different designs and formats. Figure 7 shows the plates and flags used to evaluate the design. These have been introduced in municipalities other than Fukuoka City and Fukuoka Prefecture. Plate 5 is not disclosed in this paper due to copyright protection.

Figure 7. Plates and flag used in design evaluation

Figures 8 and 9 show the results of the five-level evaluation of the ease of use of the shelters for each plate and flag design. The evaluation for Fukuoka City is on a four-level scale, so it is for reference only. Overall, both children and parents gave Plate 5 the highest rating, followed by Plate 1. Individually, Plate 6 received high ratings from the children. It is thought that the reason for this is that Plate 5 features anime characters that are familiar to most generations in Japan. On the other hand, Plate 4 and 7 were rated as relatively difficult to use.

In order to confirm the differences in the evaluations of students and their parents towards design, we conducted a cross-tabulation analysis. The results are shown in Table 6 and 7. First, regarding the results for Fukuoka City, a significant difference was confirmed between students and parents in terms of the ease of use of the shelter ($p<0.001$). Residual analysis showed a significant difference, particularly in the evaluation of “very easy to use”. Next, for the designs of the other organizations, a significant difference in evaluation was confirmed between students and parents for all designs except for Plate 5. For Plate 5, it is thought that no significant difference occurred because both students and parents gave it a high evaluation. The results of the residual analysis revealed significant differences between children's and parents' evaluations of Plates 3 and 4. Plate 3 received more positive evaluations from children than from parents, while Plate 4 received significantly more negative evaluations from children than from parents. Regarding Plate 3, it is considered that the children perceived it favorably because it features the police mascot character of another municipality. Plate 4, on the other hand, may have given children an intimidating impression due to its background color of yellow—a safety color signifying caution—and the use of black text only.

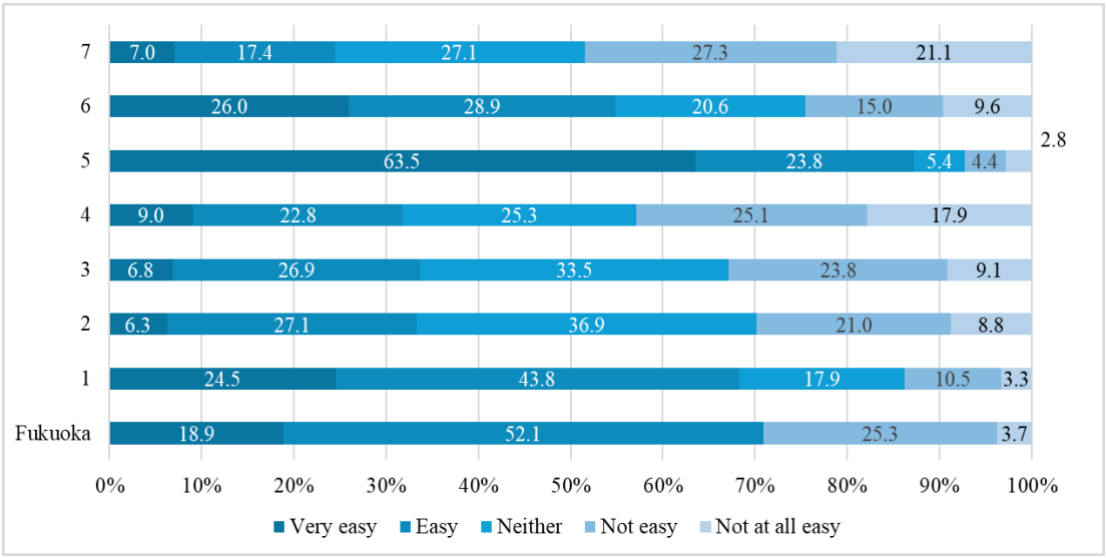

Figure 8. Plates and flag design evaluation (students, n=524)

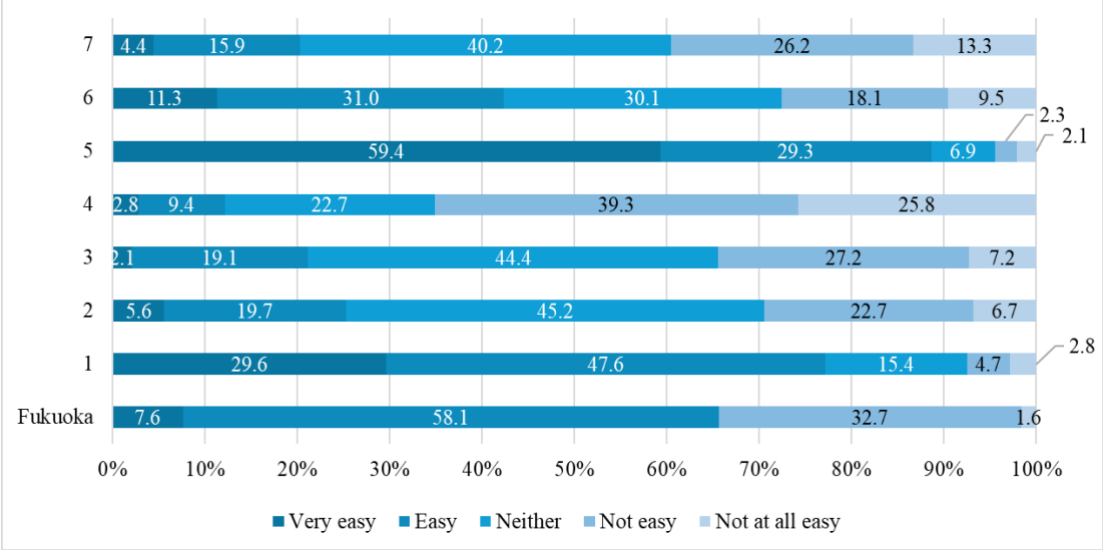

Figure 9. Plates and flag design evaluation (parents, n=451)

Table 6. Plate design evaluation (Fukuoka City)

Respondents	Very easy	Easy	Not easy	Not at all easy	p-value
Students	96**	265	129	19	< 0.001
Parents	33**	252	142	7	

Residual analysis: **Significant at 1% level; *Significant at 5% level.

Table 7. Plates and flag design evaluation (excluding Fukuoka City)

No.	Respondents	Very easy	Easy	Neither	Not easy	Not at all	p-value
1	Students	119*	213	87	51**	16	0.008
	Parents	127*	204	66	20**	12	
2	Students	30	130**	177**	101	42	0.029
	Parents	54	215**	195**	98	29	
3	Students	33**	130**	162**	115	44	< 0.001
	Parents	9**	82**	191**	117	31	
4	Students	44**	111**	123	122**	87**	< 0.001
	Parents	12**	40**	97	168**	110**	
5	Students	315	118*	27	22*	14	0.102
	Parents	257	127*	30	10*	9	
6	Students	125**	139	99**	72	46	< 0.001
	Parents	49**	134	130**	78	41	
7	Students	34*	84	131**	132	102**	< 0.001
	Parents	19*	68	172**	112	57**	

Residual analysis: **Significant at 1% level; *Significant at 5% level.

5. ANALYSIS OF THE RELATIONSHIP BETWEEN SHELTER AWARENESS AND SET-UP CONDITIONS

5.1 Overview of Analysis Subject

Of the three elementary school districts surveyed, School District A was selected for analysis in this study. The reason for this was that the locations of all shelters in the school district were known. Figure 10 shows a map with shelter locations and designated school routes (blue lines).

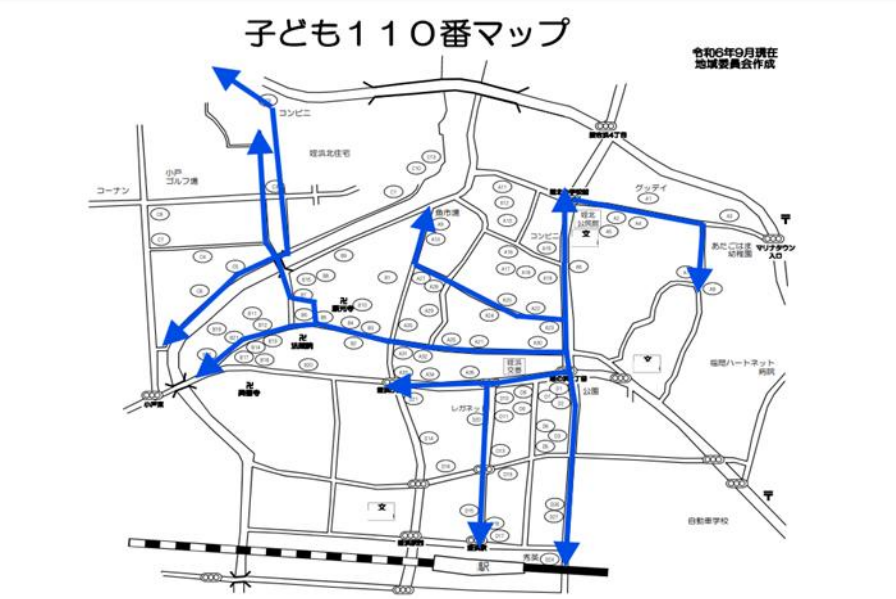

Figure 10. Map of school district A (Source: A Elementary School Website)

From the map, we identified 87 shelters in the school district. For each of these 87 shelters, the awareness rate was calculated by comparing it to the responses to the questionnaire. The awareness rate was calculated by dividing the number of respondents who were aware of each shelter by the total number of respondents and expressed as a percentage. Figure 11 shows the distribution of awareness rates. Of the 87 shelters, 10 for children and 13 for parents had an awareness rate of 5% or higher. On the other hand, 43 and 40 shelters had a 0%, accounting for about half of the total, and 34 shelters had a recognition rate of less than 5% for both children and parents. Even in the shelters with the highest awareness rate, 21.2% of the children and 22.5% of the parents had very low awareness rates.

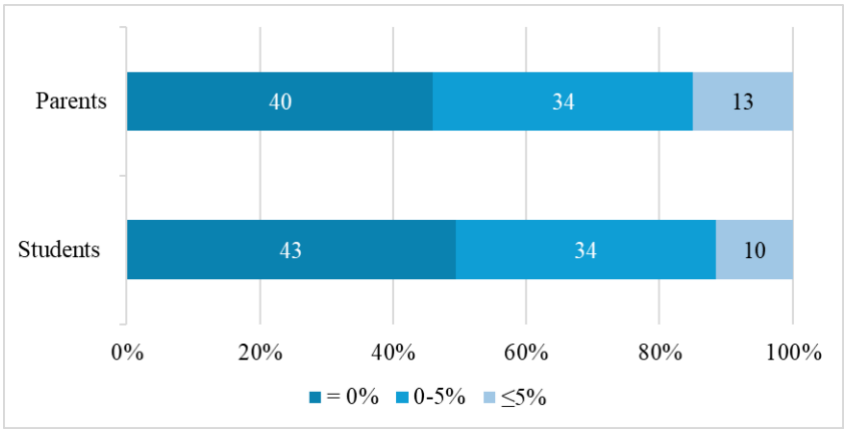

Figure 11. Shelter awareness rates

5.2 Analysis Method

We used Quantification II to analyze the factors that influence the awareness rate of Children's emergency houses. This method is suitable for cases where the objective and explanatory variables are categorical data, and allows quantification of the degree to which

each explanatory variable affects the objective variable. In this study, the awareness rate was set as the objective variable at two levels, “less than 5% (=0)” and “5% or more (=1)”. Furthermore, the explanatory variables were “building type,” “shelter location”, “plate height,” and “plate condition,” obtained from the field survey, among the items related to setup conditions that affect the recognition rate of shelters. Table 8 shows the explanatory variables and categorical classifications.

Table 8. Explanatory variables and categorical classifications

Explanatory variables	Categorical classifications
Building type	0=Shop 1=Residential 2=Medical and educational facilities
Shelter location	0=Around school routes 1=Outside school routes
Plate height	0=Higher than eye level 1=Eye level 2=Lower than eye level
Plate condition	0=Clean 1=Partially off display 2=Almost off display

5.3 Analysis Results

The objective and explanatory variables were analyzed separately for students and parents, respectively. Figure 12 shows the item ranges and Table 9 shows the category scores for each explanatory variable. The discriminant accuracy rate was 65.2% for both.

For item range, the results showed that the type of building and the location of the shelter contributed significantly to the discrimination for both students and parents. On the other hand, for plate status, the results showed that only students had a significant contribution.

Next, we discuss the impact of each item from the category scores. In terms of building type, medical facilities have a large positive effect on the recognition rate, while residential has a negative effect. Shops that were thought to have a positive effect on awareness had a negative effect on parents and a slight positive effect on children. Compared to medical and educational facilities, stores often display advertisements, making the plates relatively less noticeable. Regarding shelter location, shelters outside school routes had a greater positive effect on the recognition rate. The reason may be that, as pointed out in previous studies (Yoshiki et al., 2017), children are more likely to be concentrated on the conversations with friends and the movement itself on the way to school. And children may be traveling alone outside of school routes during school commute hours, and may consciously or unconsciously notice shelters. Regarding plate height, children were more likely to recognize plates that were lower than their eye level, while parents were more likely to recognize plates that were at eye level. This may be due to the fact that children are short in stature and naturally tend to pay attention to objects below their field of vision. Regarding plate condition, both children and parents perceived “Clean” as positive and “Almost off display” as negative. On the other hand, children perceived “Partially off display” as significantly positive. The reason for this is that the facilities where these plates are installed have been registered as shelters for many years and are familiar places for children, so their perception of the plates is influenced more by their image of the facilities where they are installed than by the condition of the plates themselves.

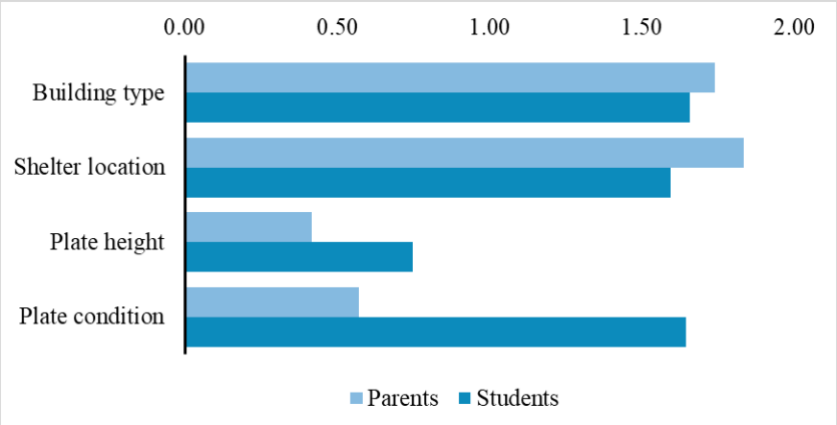

Figure 12. Item ranges

Table 9. Explanatory variables and category scores

Explanatory variables	Categorical classifications	Students	Parents
Building type	Shop	0.0274	-0.0735
	Residential	-0.3350	-0.2717
	Medical and educational facilities	1.3225	1.4687
Shelter location	Around school routes	-0.6526	-0.7508
	Outside school routes	0.9427	1.0844
Plate height	Higher than eye level	0.2127	-0.2740
	Eye level	-0.2553	0.1420
	Lower than eye level	0.4936	0.0369
Plate condition	Clean	0.0217	0.0611
	Partially off display	0.8593	-0.5088
	Almost off display	-0.7852	-0.0156

6. CONCLUSIONS

The purpose of this study is to obtain basic knowledge about the requirements for an effective and reassuring Children's emergency house. To this end, we focused on awareness and sense of security, and analyzed the factors that affect the actual operation of the system and the intention to use it. Specifically, we conducted a questionnaire survey targeting elementary school students and their parents, and analyzed and compared the actual use of the shelter, awareness, and recognition, as well as the evaluation of the plates and flag design. In addition, we conducted Quantification II to analyze the relationship between the recognition of the shelter and the situation of its setup.

Awareness and necessity of shelters were high among both children and parents. In particular, parents' awareness of shelters was significantly higher than that of children. Since parents' participation in PTA activities and announcements from the PTA may have served as opportunities to learn about shelters, it can be considered that information dissemination by schools and PTAs has a certain effect. Although children have little experience using shelters, they expressed a high level of interest in using them. The reasons for their interest suggest that children recognize shelters as places they can rely on in emergencies. On the other hand, the reasons for not wanting to use shelters included resistance and anxiety toward using unfamiliar places. These findings suggest the importance of raising awareness of shelters

through schools and PTAs.

The analysis results related to sense of security showed that children and parents differ in their needs for safety measures on the way to school. While the children felt more secure in their connection with familiar people, the parents highly valued specific elements that would deter crime and enable quick emergency response. In particular, the crossing guard was highly evaluated by parents as a symbol of cooperation with the local community, indicating that a system to protect children in the entire community contributes to fostering a sense of trust. In the evaluation of the design, there was a difference in the elements that children and their parents considered important. Children tended to emphasize intuitive features such as colors, shapes, and characters that are easy to understand visually, and to seek elements that help them feel a sense of psychological security. Parents, on the other hand, placed more importance on reliability and effectiveness in case of emergency, and on the design that clearly indicates security and cooperation with the local community. These results suggest that shelter planning and operation should take into account the differences between children (users) and parents (operators) in terms of their sense of security and preferences for plate designs.

Using Quantification II analysis, we analyzed the factors affecting the recognition rate of shelters, and found that medical facility has a particularly positive effect on awareness. It suggests that the high visibility of the shelters had an influence. In addition, shelters located around school routes tended to be less recognized by both students and parents. Furthermore, the results showed that children were most likely to recognize plates placed lower than their eye level. On the other hand, parents tended to recognize plates placed at eye level. In addition, plates that had been in place for a long time tended to be recognized more easily. These results suggest that the location and height of the plates and their long-term maintenance are important to improve the recognition rate of the plates.

In summary, Children's emergency houses play a role in providing both children and their guardians with a certain sense of security, but in order to maximize their effectiveness, improvements are required to increase awareness.

Regarding the establishment and operation of the facility, a visually intuitive design and a plate lower than eye level are effective for children, while providing information emphasizing reliability and regional cooperation is important for parents. In addition, it is necessary to raise awareness by utilizing easily visible installations. As mentioned earlier, when planning and setting up shelters, it is necessary to consider the differences in awareness and behavior between children (users) and their parents (operators). In addition to the existing manuals for shelter registrants, it is desirable to create guidelines for planning and setting up shelters. Furthermore, it is important to inform children and their parents about the shelter system.

In this study, we conducted surveys and analyses targeting children and their guardians. However, to further enhance the effectiveness of the system, it is also necessary to understand the actual conditions and awareness of cooperative stores, facilities, and households that serve as shelters. For example, by investigating and analyzing the awareness and behavior of cooperating parties—such as how they perceive the role of Children's emergency houses, the burden they feel regarding daily preparations and responses, or their motivation for participating in this activity—it may be possible to identify clues for improving the sustainability of the shelter system. Additionally, by analyzing the correlation between the establishment and operation of shelters and the number of criminal or suspicious incidents, it is considered possible to verify the effectiveness of Children's emergency houses.

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APPENDICES

In Japan, the emergency shelter for elementary school students is commonly called "Children's House of No. 110" (Kodomo Hyaku-to-ban no Ie). The No. 110 means the emergency call number to the police. In this study, to avoid confusion, the term Children's emergency house or "shelter" is used in consideration of its original function.

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