

**ORIGINAL****Development of Childcare Literacy Scale for Mothers with Infants and Children**

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**Abstract :** This study aimed to develop a Childcare Literacy Scale for Mothers with Infants and Children (CLMIC) and verify its reliability and validity. Using a 28-item childcare literacy measurement scale proposed after a preliminary survey, an anonymous self-administered questionnaire survey was conducted. Participants were mothers who came to the city's infant health checkups ; 211 people were included in the analysis. Cronbach's  $\alpha$  was used to verify reliability. To verify the validity, exploratory factor analysis was performed as construct validity. Following factor analysis of 28 items on the childcare literacy measurement scale, 4 factors and 24 items were adopted. For all factors, Cronbach's  $\alpha$  were greater than or equal to .80. CLMIC and Communicative and Critical Health Literacy, Health Literacy Scale for Women of Reproductive Age, and Japanese Short-Form-8-Item Health Survey showed significant positive correlations. CLMIC and Japanese Parenting Stress Index Short Form indicated a significant negative correlation. The reliability and validity of the developed CLMIC were confirmed. It was shown to be a useful scale that can contribute to health behaviors that protect against child-rearing stress and promote child safety and security, valuing the unique perspective of child-rearing that is appropriate for Japanese mothers. *J. Med. Invest.* 70:171-179, February, 2023

**Keywords :** childcare, health literacy, mothers, infants, children

**INTRODUCTION**

In recent years, mutual support functions in the home and community have been declining due to the shift to nuclear families and the weakening of people's ties in an aging society with a declining birthrate. As a result, many mothers have never been involved in child-rearing before giving birth to their children, and are struggling to raise them in the lack of a community setting, represented by "one-operator child-rearing." Traditionally, information on child-rearing was obtained mainly from parents, friends, and other close people with experience in child-rearing. However, online communities using Information and Communication Technology are now expanding (1), and people can obtain the latest child-rearing information regardless of time or location. Thus, the environment surrounding child-rearing is changing.

Ida *et al.* (2, 3) investigated social media usage by mothers with infants and children and their child-rearing information needs. They found that social media is functioning as a new community and that mothers are seeking the experiences of mothers with children of the same age. However, it has been reported that judgments about the reliability of Internet information are left to the mothers themselves and that there is a significant risk of being swayed by the information (4). In addition, a survey of public health nurses and midwives reported that the state of modern child-rearing information, while easier to obtain, is also confusing due to information overload and is one of the background factors behind the difficulty of raising first-time mothers (5). In 2017, a death from infant botulism occurred after a 6-month-old

infant was fed baby food containing honey (6). Although local governments have publicized the prohibition of giving honey to children under 1 year old through the Maternal and Child Health Handbook, several baby foods containing honey are listed on recipe websites. This clarifies that it was not a well-known fact and that misinformation can threaten children's health. Therefore, health literacy, which is the ability to obtain, understand, evaluate, and use information about health and medical care to make better decisions that lead to good health, is attracting attention as a health-determining ability (7, 8).

The concept of health literacy has been rapidly developing since the 1990s and has been positioned as an essential concept linked to health behavior. Berkman's systematic review found that people with low health literacy are less likely to recognize symptoms, express concerns to healthcare providers, and take medications appropriately ; have higher rates of hospitalization due to lack of disease control ; are less likely to receive checkups and vaccinations ; have more frequent use of emergency services and higher medical costs ; and higher mortality rates (9). In Japan, the concept of health literacy emerged in the 2000s. Many previous studies were conducted on socially vulnerable groups and questioned basic literacy skills, and there are limitations in their generalization to Japanese people, for whom a certain level of social security is ensured, and literacy rates are high, thus requiring accumulation of research.

While the fetal period through infancy is the most dynamic period of physical and mental development, it is also when adults must give due consideration to their surroundings because infants and children cannot change their environment or choose healthy behaviors (10). In Bowlby's attachment theory, stable attachment formation with the mother during this period is said to be the basis for later interpersonal relationships (11). Therefore, this study focused on health literacy related to child-rearing (childcare literacy), which focuses on information on health and medical care that contributes to children's healthy growth and development, and on child-rearing, which emphasizes the promotion of attachment formation between children and their

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mothers.

According to the 2016 Basic Survey of Social Life (12), Japanese mothers with children under 6 years of age spend more than three times as much time as fathers on childcare and housework-related activities. In addition, a survey on immunization reported that mothers are most often the immunization decision-makers and that information possessed by mothers is associated with the decision to receive voluntary immunizations (13). These findings suggest that mothers' childcare literacy strongly influences infants and children health in Japan. However, a 2016 survey conducted in prefecture A found that approximately 20% of all mothers could not select reliable child-rearing information, suggesting that there may be some mothers with low childcare literacy (14).

Previous studies on maternal health literacy have been mainly conducted in the U.S., with a limited number of participants, such as mothers with socioeconomic limitations, and the evaluation indicators were not specific to childcare literacy (15-17). In Japan, Ishikawa *et al.* (18) and Nakayama (19) have created assessment indicators for the public, but they are often used for adults, and Kawata (20) and Takaizumi *et al.* (21) have created assessment indicators specific to some groups and lifestyles, such as for mature women and dietary habits. However, no indicators specific to maternal childcare literacy have been found.

As information technology becomes increasingly widespread and online support becomes an option with the emergence of new infectious diseases, including new coronavirus infections, we believe that support that considers mothers' childcare literacy is essential. Currently, however, there is no indicator to assess mothers' childcare literacy. Since health in infancy is the foundation for lifelong health, we believe it is necessary to develop an evaluation index to appropriately assess mothers' childcare literacy and to consider support methods to enhance it.

Therefore, this study aimed to develop a Childcare Literacy Scale for Mothers with Infants and children (CLMIC) and to determine its reliability and validity.

## DEFINITION OF TERMS IN THIS STUDY

**Health literacy** : the ability to obtain, understand, evaluate, and effectively use information about health and health care (7, 8).

**Childcare literacy** : The ability to obtain, understand, evaluate, and effectively use information about child-rearing to promote the healthy growth and development of the child and the formation of attachment between the child and mother.

## MATERIALS AND METHODS

### *Participants*

The participants were mothers who came for infant health checkups, and so forth, conducted by the municipality. To ensure that the results did not differ depending on the size of the municipality in which the participants reside, the municipalities were selected based on the Basic Resident Ledger population by age group as of January 1, 2021 (by the municipality) from the Ministry of Internal Affairs and Communications. They were classified into those with populations aged 0 to 4 of less than 10,000 and those with populations of 10,000 or more. After classification, municipalities were randomly selected in each stratum. We then requested cooperation from 7 cities (6 with less than 10,000 residents and 1 with more than 10,000 residents) that agreed to cooperate in the study. We asked the heads of facilities to cooperate and mailed a total of 2,700 questionnaires addressed to the

section in charge of the local government.

### *Survey*

An unmarked self-administered questionnaire survey was conducted from May to July 2022. Questionnaires were distributed to participants by facility staff or researchers at infant health checkups in the 7 cities or were placed in a conspicuous location at the venue and taken home by the mothers. The questionnaires were collected by mail using the enclosed return envelope.

### *Questionnaire items*

#### (1) Main version of the CLMIC

After a pilot study, a main version of the CLMIC consisting of 28 items was used to conduct the survey.

##### i. Creation of the CLMIC draft version

Based on the authors' previous research on childcare literacy among mothers with infants and children (22) and existing literature, the authors developed a CLMIC draft version with 50 items for 6 factors : "Staying alert to parenting information," "Accessing multiple sources of child-rearing information," "Understanding child-rearing information," "Judging the reliability of child-rearing information," "Judging whether child-rearing information is necessary for oneself and one's children," and "Incorporating child-rearing information into one's child-rearing."

Content validity was examined based on the opinions of two researchers who developed the scale and three experts in the fields of community and maternal pediatric nursing and was based on the validity of the questionnaire items, the clarity of the questions, and the ease of answering the questions.

##### ii. Creation of the CLMIC main version (Pilot study)

The CLMIC draft version was used for the pilot study. The target population consisted of 239 mothers who came to infant health checkups, and so forth, conducted by 3 cities in prefecture A. 62 respondents were obtained, and 57 were selected for analysis (collection rate : 23.8%). Among the 62 questionnaire sheets collected, we excluded those containing missing values in items related to health behaviors, the CLMIC, the CCHL, the Health Literacy Scale for Women of Reproductive Age, the PSI-SF, or the SF-8. Further, we excluded those sheets in which the responses to all the scales were "3." Accordingly, 57 questionnaire sheets were considered valid responses and used in the analysis. The mean age (standard deviation) of the participants was 32.4 (4.8) years (Table 1).

After item analysis and factor analysis using the principal factor method and promax rotation, 28 items with 4 factors were extracted. The cumulative contribution rate before rotation was 69.09%, and the correlations among the 4 factors were significantly positively correlated with Spearman's rank correlation coefficient test  $\rho = 0.316$  to  $0.508$ . The criterion for item deletion was a factor loading of 0.40 or less. Cronbach's  $\alpha$  coefficients for each factor ranged from  $\alpha = 0.838$  to  $0.949$ .

From the pilot study results, a draft version of the CLMIC was prepared with 28 items instead of the original 50 items. The questionnaire required responses using a 5-point scale (very easy, somewhat easy, undecided, somewhat difficult, and very difficult), and scores were assigned in order from 5 to 1, where higher scores indicate higher childcare literacy.

#### (2) Scales for determining criterion-related validity and convergent validity

The developer's prior consent was obtained for the use of the scale.

##### i. Communicative and Critical Health Literacy (CCHL) (18)

This is a widely used health literacy scale in Japan that can measure interactional and critical literacy further than

functional literacy, which assesses reading and writing ; it is a 5-item scale consisting of 5 items. Cronbach's  $\alpha$  in this study was 0.882.

ii. Health Literacy Scale for Women of Reproductive Age (20)

This scale was designed for women of reproductive age in their 20s and 30s to measure health literacy regarding women's health and illness ; it is a 4-item scale consisting of 21 items. Cronbach's  $\alpha$  in this study was 0.905.

iii. Japanese version Parenting Stress Index Short Form (PSI-SF) (23)

This scale measures parenting stress from child and parental aspects ; it is a 5-item scale consisting of 19 items. Cronbach's  $\alpha$  in this study was 0.886.

iv. Japanese version Short-Form-8-Item Health Survey (SF-8) (24)

This is a shortened version of the Health-Related Quality of Life (HRQOL) scale widely used in Japan, which measures eight domains of health. A physical component score (PCS) and a mental component score (MCS) are calculated. Cronbach's  $\alpha$  in this study was 0.864.

(3) Others

i. Basic attributes : age, occupation, education, family structure

ii. Child-rearing environment : Availability of child-rearing counselors, social resources, and Internet environment ; economic situation

iii. Health Behaviors : infant health checkups visits, mumps vaccination, awareness of pediatric emergency telephone counseling (#8000), awareness of shaken baby syndrome, awareness of contents of an emergency kit needed for infants and children, brushing teeth, accident prevention, and family doctor.

*Analytical methods*

The following analyses were performed using the statistical software SPSS Ver. 24.0. The significance level was set at 5% bilaterally.

(1) Item analysis : analysis of the ceiling and floor effects, item-to-total analysis

(2) Testing of reliability : calculating the Cronbach's  $\alpha$  coefficients of each factor and the whole scale

(3) Testing of validity

i. Construct validity

We employed exploratory factor analysis (principal factor method, promax rotation). The criteria for determining the number of factors were an eigenvalue of 1.0 or more and a cumulative contribution ratio of 50.0% or more. The criterion for determining subscale items was a factor loading of 0.40. We compared the adopted factor structure with the 6 categories extracted during the creation of the CLMIC proposal.

ii. Convergent validity

We calculated and examined the correlation coefficients of the CLMIC with the CCHL with the Health Literacy Scale for Women of Reproductive Age (by employing the Spearman's rank correlation coefficients). We set the total of the item scores in each of the CLMIC subscales as a subscale score and examined correlations between the total CLMIC score and the total score of each of the above scales.

iii. Criterion-related validation

We calculated and examined the correlation coefficients of the CLMIC with the PSI-SF with the SF-8 (by employing the Spearman's rank correlation coefficients). We set the total of the item scores in each of the CLMIC subscales as a subscale score and examined correlations between the total CLMIC score and the total score of each of the above scales. In addition, the

Mann-Whitney U test was used to compare CLMIC by health behaviors.

*Ethical considerations*

This study was approved by the Ethics Committee of Tokushima University Hospital (approval no. 3884-1). The participants were informed in writing of the purpose and methods of the study, as well as that participation was voluntary, that they would not be disadvantaged if they declined, that the data and personal information obtained would not be used for any purpose other than the study, and that the results of the study would be presented at academic conferences, and so forth, taking care not to identify any individuals. Participants were deemed to have consented to this study when they filled out and submitted the consent check-boxes on the questionnaire.

## RESULTS

Of the 2,700 questionnaires mailed to the local government departments where the participants resided, only approximately half could be distributed to the participants.

Among the 225 questionnaire sheets collected, we excluded those containing missing values in items related to health behaviors, the CLMIC, the CCHL, the Health Literacy Scale for Women of Reproductive Age, the PSI-SF, or the SF-8. Further, we excluded those sheets in which the responses to all the scales were "3." Accordingly, 211 questionnaire sheets were considered valid responses and used in the analysis.

*Characteristics of the participants*

The mean age of the participants (standard deviation) was 35.4 (4.9) years. The occupations were 108 (51.2%) full-time, 36 (17.1%) part-time, 9 (4.3%) self-employed, 54 (25.6%) housewife, and 4 (1.9%) others (students, etc.). Education included 38 (18.0%) high school graduates, 54 (25.6%) vocational school or junior college graduates, 104 (49.3%) university graduates, and 10 (4.7%) with postgraduate degrees. 84 (39.8%) had one child, 99 (46.9%) had two children, and 28 (13.3%) had three or more children (Table 1).

*Child-rearing environment*

Regarding the child-rearing environment, 199 (94.3%) respondents had someone close by with whom they could discuss child-rearing ; 134 (63.8%) had a professional (doctor, public health nurse, midwife, etc.) with whom they could discuss child-rearing ; 179 (84.8%) had child-rearing friends such as mothers with children in the same age group close by ; 199 (94.3%) had a place to go out with their children (park, playground, etc.) ; 192 (91.0%) had child-rearing support facilities (child-rearing support center, children's hall, etc.) close by ; 204 (96.7%) had a hospital where they gave birth or a pediatrician with whom they had a family doctor close by ; 130 (61.6%) moved to their current residence after getting married or giving birth ; 161 (76.7%) thought their current place of residence was easy to raise children ; 208 (98.6%) had a good Internet environment at home, and 49 (23.4%) felt difficulties regarding their household's financial situation.

*Sources of child care information and use of child care support services*

The Internet (websites, blogs, apps, SNS) was the most common source of child-rearing information for 193 respondents (91.5%), followed by friends with 110 (52.1%), and family members/relatives with 77 (36.5%). Childcare support services that they used so far were nursery schools, kindergartens, and

**Table 1.** Characteristics of the participants

Characteristics	Pilot Study (N = 57)	Main Survey (N = 211)
	mean (SD)	
Age (years)	(N = 56) 32.4(4.8)	(N = 208) 35.4(4.9)
Age of the eldest child (years)	3.3(3.4)	(N = 210) 4.4(2.9)
Age of the youngest child (years)	1.0(1.1)	(N = 210) 2.1(1.1)
	n (%)	
Occupation		
Full-time	30 (52.6)	108 (51.2)
Part-time	8 (14.0)	36 (17.1)
Self-employed	4 (7.0)	9 (4.3)
Housewife	15 (26.3)	54 (25.6)
Other (student etc.)	0 (0.0)	4 (1.9)
Education		(N = 206)
High school graduate	7 (12.3)	38 (18.4)
Vocational school and junior college graduates	23 (40.4)	54 (25.6)
University graduate	24 (42.1)	104 (49.3)
Postgraduate degrees	3 (5.3)	10 (4.7)
Family type		
Nuclear family	42 (73.7)	188 (89.1)
Extended family	15 (26.3)	23 (10.9)
Number of children		
One child	26 (45.6)	84 (39.8)
Two children	17 (29.8)	99 (46.9)
Three children or more	14 (24.6)	28 (13.3)

certified childcare centers (including temporary care), with the highest number of respondents at 176 (83.4%), followed by community childcare support centers with 136 (64.5%), and events held by prefectural and municipal governments (such as baby food cooking classes) with 108 (51.2%).

### CLMIC

#### (1) Item analysis

The ceiling effect was found for “listening to child-rearing wisdom from those who have experienced child-rearing” and “exchanging information on child-rearing with mothers who have children of the same age,” therefore, these items were deleted. No item showed a floor effect, and no item showed a correlation coefficient of less than 0.40 in the item-total correlation.

#### (2) Exploratory factor analysis (Table 2)

We conducted a factor analysis on 28 question items and determined the number of factors as 4 based on comparisons with scree plots and factor interpretations of the 4 factors from the preliminary investigation. After the second factor analysis, we excluded the subscale items of “If I have a question about the content of child-rearing information, I will research until I understand it” (factor loading of 0.359), which had a low factor loading, and “Tell me what I want to discuss with a professional (doctor, public health nurse, midwife, etc.),” which had a high factor loading for multiple items. After these processes, we selected

24 items with 4 factors, for which a proper factor structure was obtained in terms of contents and created the final version of the CLMIC. The CLMIC consisted of 10 items for Factor 1 [Searching for local child-rearing information], 6 items for Factor 2 [Decision-making for personalized child-rearing], 6 items for Factor 3 [Examining the reliability of information], and 2 items for Factor 4 [Pursuing questions for convincing].

The cumulative contribution ratio before rotation was 64.36%, and the Spearman's correlation coefficients between the 4 factors were within the range of  $\rho = 0.350$  to  $0.503$ , showing significant, positive correlations between the factors ( $P < 0.01$ ).

#### (3) Testing of reliability

##### i. Internal consistency

Cronbach's  $\alpha$  coefficient of all 24 items of the final version of the CLMIC was 0.934, and the Cronbach's  $\alpha$  coefficients of the 4 factors were in the range of 0.863 to 0.945.

#### (4) Testing of validity

##### i. Testing of construct validity

The 4 factors adopted through exploratory factor analysis and the 6 categories extracted during the creation of the draft CLMIC consisted of similar items. The results compared to the subscale items of the 4 preliminary survey factors resulted in a 4-factor structure, although the cohesion of the items differed from that of the preliminary investigation.

##### ii. Testing of convergent validity ( $p < 0.01$ ) (Table 3)

The correlation coefficient between the total CLMIC score and the CCHL was  $\rho = 0.552$ . Regarding the correlations of the CCHL with the CLMIC subscales, the correlation with [Searching for local child-rearing information] was  $\rho = 0.375$ , that with [Decision-making for personalized child-rearing] was  $\rho = 0.538$ , that with [Examining the reliability of information] was  $\rho = 0.559$ , and that with [Pursuing questions for convincing] was  $\rho = 0.411$ .

The correlation coefficient between the total CLMIC score and the Health Literacy Scale for Women of Reproductive Age was  $\rho = 0.436$ . Regarding the correlations of the Health Literacy Scale for Women of Reproductive Age with the CLMIC subscales, the correlation with [Searching for local child-rearing information] was  $\rho = 0.304$ , that with [Decision-making for personalized child-rearing] was  $\rho = 0.412$ , that with [Examining the reliability of information] was  $\rho = 0.490$ , and that with [Pursuing questions for convincing] was  $\rho = 0.403$ .

##### iii. Criterion-related validation ( $p < 0.01$ ) (Table 3)

The correlation coefficient between the total CLMIC score and the PSI-SF was  $\rho = -0.530$ . Concerning the correlations of the PSI-SF with the CLMIC subscales, the correlation with [Searching for local child-rearing information] was  $\rho = -0.411$ , that with [Decision-making for personalized child-rearing] was  $\rho = -0.517$ , that with [Examining the reliability of information] was  $\rho = -0.439$ , and that with [Pursuing questions for convincing] was  $\rho = -0.399$ .

The correlation coefficient between the total CLMIC score and the SF-8 (MCS) was  $\rho = 0.366$ . Regarding the correlations of the SF-8 (MCS) with the CLMIC subscales, the correlation with [Searching for local child-rearing information] was  $\rho = 0.262$ , that with [Decision-making for personalized child-rearing] was  $\rho = 0.362$ , that with [Examining the reliability of information] was  $\rho = 0.302$ , and that with [Pursuing questions for convincing] was  $\rho = 0.345$ . There was almost no correlation between the SF-8 (PCS) and the CLMIC.

Participants who knew about the health behavior [Contents of an emergency kit needed for infants and children] had a higher total score than those who did not know, and there was a significant difference ( $p = 0.004$ ).

Table 2. Exploratory factor analyses of the CLMIC (N = 211)

Factor/item	Factor loading			
	Factor 1	Factor 2	Factor 3	Factor 4
<i>Factor 1 : Searching for local childrearing information (α = 0.914)</i>				
7 Use administrative agencies (town halls, health centers) in your area to obtain information on childcare	0.869	0.164	-0.2	-0.094
4 Know the contact point for childcare information in your area	0.822	-0.333	0.267	0.034
6 Read through child-rearing information distributed by administrative agencies (town halls, health centers, etc.) in your area	0.814	0.065	-0.156	-0.034
5 Receive child-rearing information distributed by administrative agencies (town halls, health centers, etc.) in your area	0.794	0.04	0.067	-0.099
3 Know the contact person to find child care information you are interested in	0.784	-0.256	0.29	0.012
8 Use child-rearing support facilities (child-rearing support centers, nursery schools, etc.) to obtain information on child-rearing	0.68	0.132	-0.221	-0.018
9 Access a variety of child care information sources to find child care information that you care about	0.592	0.1	0.076	-0.113
10 Go to a professional (doctor, public health nurse, midwife, etc.) for consultation	0.573	0.063	-0.088	0.158
13 Understand the content of child-rearing information provided by child-rearing support facilities (child-rearing support centers, nursery schools, etc.)	0.515	0.22	-0.035	0.164
12 Understand the content of childcare information provided by government agencies (town halls, health centers, etc.)	0.509	0.073	0.083	0.217
<i>Factor 2 : Decision-making for personalized child-rearing (α = 0.878)</i>				
26 Incorporate the information gained into your own parenting	0.071	0.749	0.023	-0.02
28 Based on the information obtained, raise children with an eye on their future growth and development	0.001	0.731	0.184	-0.097
25 Choose parenting information that is more tailored to the child's growth and development than manuals	0.084	0.693	0.051	0.042
27 Reflect on your own parenting to date based on the information you have obtained	0.077	0.661	0.02	0.017
23 Select information that will help you raise your child in a way that keeps you smiling in front of your child	0.019	0.564	0.286	-0.01
24 Choose the advice of someone who usually knows you and your children better than a manual	-0.065	0.55	0.059	0.045
<i>Factor 3 : Examining the reliability of information (α = 0.863)</i>				
18 Ensure that the source is a reliable source of parenting information	-0.001	-0.039	0.846	-0.004
19 Use multiple sources of information to determine reliable parenting information without immediately believing it	-0.062	0.148	0.791	-0.131
20 Explain the evidence that the information is reliable parenting information	-0.073	0.07	0.737	0.027
21 Check to see if parenting methods have changed since the grandparents' generation or the older children	0.074	0.169	0.501	-0.047
22 Choose parenting information that makes sense with your own view of parenting	-0.103	0.31	0.494	0.126
17 Understand that parenting information has its own fads from time to time	0.013	0.16	0.413	0.119
<i>Factor 4 : Pursuing questions for convincing (α = 0.945)</i>				
14 Ask questions about explanations and advice from professionals (doctors, public health nurses, midwives, etc.) that you don't understand	-0.014	-0.058	0.026	0.972
15 Ask questions about explanations and advice from non-professionals (doctors, public health nurses, midwives, etc.) that you do not understand	-0.01	0.075	-0.061	0.932

An exploratory factor analyses was conducted the principal factor method and promax rotation. The KMO was 0.878 and Bartlett's test of sphericity was significant (p < 0.01). Cronbach's α for the total score was 0.934. CLMIC=Childcare Literacy Scale for Mothers with Infants and Children

**Table 3.** Correlations among the CLMIC and all variables (N=211)

(a)	CLMIC total score	[Searching for local child-rearing information]	[Decision-making for personalized child-rearing]	[Examining the reliability of information]	[Pursuing questions for convincing]
CCHL	.552**	.375**	.538**	.559**	.411**
Health Literacy Scale for Women of Reproductive Age	.436**	.304**	.412**	.490**	.403**
PSI-SF	-.530**	-.411**	-.517**	-.439**	-.399**
SF-8(PCS)	.136*	.136*	.137*	.102	.076
SF-8(MCS)	.366**	.262**	.362**	.302**	.345*
(b)	mean(SD)				
Contents of an emergency kit for infants and children					
I know (N = 109)	94.5(14.3)	38.7(7.6)	24.1(4.2)	23.6(4.6)	8.1(1.8)
I don't know (N = 102)	88.8(14.2)	36.5(7.7)	23.0(4.0)	21.8(3.8)	7.5(1.8)

(a) Spearman's rank correlation coefficient test : \*\*  $p < 0.01$ , \*  $p < 0.05$

(b) Mann-Whitney U-test : \*\*  $p < 0.01$ , \*  $p < 0.05$

CCHL = Communicative and Critical Health Literacy, PSI-SF = Japanese version Parenting Stress Index Short Form, SF-8 = Japanese version Short-Form-8-Item Health Survey : PCS(physical component score), MCS(mental component score), CLMIC = Childcare Literacy Scale for Mothers with Infants and Children

## DISCUSSION

The final scale of the CLMIC consisted of 24 items comprising 4 factors : [Searching for local child-rearing information], [Decision-making for personalized child-rearing], [Examining the reliability of information], and [Pursuing questions for convincing].

Although several scales measuring health literacy (18, 19) and more specific population- and lifestyle-specific scales (20, 21) have been developed in previous studies, no health literacy scale specific to childcare for mothers with infants and children was found (15). This scale is the first to measure childcare literacy among mothers with infants and children. Nutbeam proposes a health literacy model that is hierarchically structured with functional literacy (basic reading, writing, and computing skills) as its foundation ; interactional literacy (the ability to actively obtain information through communication and use it in daily life) ; and critical literacy (the ability to critically analyze information and use that information to manage life and circumstances) (25). As Japan has a high literacy rate, there is a need for a scale that emphasizes interactional and critical literacy, which is more advanced than functional literacy (21). This scale can assess all three levels of literacy and emphasizes interactional and critical literacy, which is more necessary in today's information society.

In addition, health literacy comprises 4 elements : obtaining, understanding, evaluating, and utilizing information, and this scale consists of the same elements. However, this is a novel and original scale that can be evaluated by focusing on one's unique childcare rather than generalities in child-rearing, which emphasizes the child's healthy growth and development and the promotion of attachment formation between the child and the mother.

### (1) Reliability of the CLMIC

Cronbach's  $\alpha$  for the overall scale was 0.934, with a range of 0.863 to 0.945 for each of the 4 subscales. Cronbach's  $\alpha$  of 0.70 or

higher is the minimum acceptable range for scale development (26). Therefore, the internal consistency of this scale overall and its subscales was maintained ; the factor 4, consisting of 2 items, was not deleted because it is an important item for childcare literacy. Nonetheless, it is small compared to the number of items required for the subscales.

### (2) Validity of the CLMIC

#### i. Construct Validity

Exploratory factor analysis resulted in a 4-factor structure. These were composed of items that were similar to the 6 categories extracted during the creation of the draft CLMIC.

Factor 1 was [Searching for local child-rearing information], which consisted of 10 items (Table 2). This factor comprised items representing the ability to gain knowledge about child-rearing by accessing contact points that disseminate information about child-rearing in the area of residence and obtaining and understanding the necessary information for one's own needs. We consider this item to correspond to functional and interactional literacy in health literacy. The S-TOFHLA (27) and NVS (28), which were the most used measures of maternal health literacy in previous studies (15), are both measures of functional literacy only. It has been reported that low levels on this measure make it more difficult to read and understand pamphlets distributed at health care facilities (29), less knowledgeable about health matters (30), and more challenging to gather information about health care services such as checkups and immunizations (31). In addition, the items [use local administrative agencies (town hall, health center, etc.) in my area to obtain information on child-rearing] ; [use child-rearing support facilities (child-rearing support centers, nursery schools, etc.) to obtain information on child-rearing] ; and [go to specialists (doctors, public health nurses, midwives, etc.) for consultation] are interactional literacy items, in which respondents actively obtain information through communication, for example by providing information they require. Factor 1 includes items unique to child-rearing

literacy, such as child-rearing in the community, as nearly 90% of mothers use the Internet to obtain child-rearing information (32), along with mothers' positive attitude toward obtaining information from various sources, such as specialized organizations, and their strong desire for child-rearing information in their residential areas.

Factor 2 is [Decision-making for personalized child-rearing], which consists of 6 items (Table 2). This factor consists of items that represent the ability to evaluate information from two perspectives, not only the reliability of general information, but also which information is better for oneself and one's children, and to make decisions toward one's child-rearing and enact them based on these decisions. We believe that this is the critical literacy component of health literacy. Child-rearing in one's way means continuing to raise one's children while making self-determinations without being misled by the ideas of others (33). As most child-rearing books and magazines describe the growth and development of the average child, they are only a guide and not an object of comparison, and it is important to consider one's child carefully. In addition, the item [Select information that leads to parenting that makes me smile in front of my child] is a selection of information that can lead to positive parenting that is unique to oneself. It has been reported that such positive psychological factors are influential in enhancing self-esteem leading to mother-child attachment formation and promoting the mother's role (34). Additionally, the item [Based on the information obtained, raise the child with a view to their future growth and development] indicates that the participant of the practice and the result of the practice are usually the same person; however, the participant of the practice in child rearing is the mother, and the result of the practice is also manifested in the child. Therefore, we believe that this perspective of being able to imagine the child's future and make one's unique self-determination is unique to parenting literacy. Factor 2 is a factor unique to this scale, and we believe that it leads to an understanding of the mother's view of child-rearing and an examination of individualized support by enhancing positive thinking about child-rearing.

Factor 3 is [Examining the reliability of information], which consists of 6 items (Table 2). This factor comprised items representing the ability to examine the reliability of information from multiple perspectives, such as the reliability of the information source and whether the information is new and relevant to the times. We believe that this is the critical literacy component of health literacy. As some child-rearing information on the Internet and elsewhere contains unsubstantiated or manipulated information for commercial purposes, and not all information is necessarily reliable, there are reports that professionals are concerned about the image of mothers who rely on online information (35). A survey of men and women in their 20s and older (36) also reported that the percentage of those who can identify information sources and judge their reliability is lower in Japan than in other countries. Increasing the ability to identify the reliability of information sources is an important issue, and this factor includes items that can assess this. The item [Check to see if child-rearing methods have changed since the grandparents' generation or older children] is easily overlooked by mothers who have experience in child-rearing and who are familiar with the grandparents' generation because the knowledge gained from experience is easy to put into practice even if there is no available evidence. Factor 3 includes items that reevaluate the knowledge gained from previous child-rearing experiences in examining reliability.

Factor 4 is [Pursuing questions for convincing] which consists of 2 items (Table 2). This factor comprised items representing the ability to pursue questions and inadequate understanding of the information obtained until one is satisfied with it. This is

considered the interactional literacy component of health literacy. It has been reported that child-rearing anxiety and difficulty in child-rearing, which are also risk factors for child abuse, can be reduced by the presence of people with whom one can casually discuss child-rearing, in other words, emotional support (37, 38). However, while mothers want professionals to teach them, they report anxiety when they receive advice that differs from their base ideas and thoughts and feel apprehensive that they will be laughed at if they ask such questions (39). Factor 4 is the understanding of information through communication, especially to determine whether the mother can explain the consultation in her own words to the professionals and gain their understanding, and should be helpful for professionals in considering how to relate to the mother.

#### ii. Convergent validity

Childcare literacy is a concept based on health literacy. Therefore, for convergent validity, we used the CCHL which assesses interactional and critical literacy and is used in the maternal and child health field. It goes beyond the functional literacy of health literacy, and the Health Literacy Scale for Women of Reproductive Age was used.

The CLMIC showed a strong positive correlation ( $\rho = 0.552$ ,  $p < 0.01$ ) with CCHL. Similar positive correlations ( $\rho = 0.375$ - $0.559$ ,  $p < 0.01$ ) were found for all subscales. A strong positive correlation ( $\rho = 0.436$ ,  $p < 0.01$ ) was also found with the health literacy scale for sexually mature women. Similar positive correlations ( $\rho = 0.304$ - $0.490$ ,  $p < 0.01$ ) were found for all subscales.

From the above, we believe that this scale measures health literacy and has convergent validity.

#### iii. Criterion-related validation

Since health literacy is associated with health and health behaviors, childcare literacy is likely to influence mothers' and children's health and health behaviors. Therefore, to test criterion-related validity, we used the PSI-SF, which assesses parenting stress, and the SF-8, which assesses health-related quality of life, along with health behavior characteristics of mothers with infants and children.

The CLMIC showed a strong negative correlation ( $\rho = -0.530$ ,  $p < 0.01$ ) with PSI-SF. Similar negative correlations ( $\rho = -0.399$  to  $-0.517$ ,  $p < 0.01$ ) were found for all subscales. The observed correlation between parenting literacy and parenting stress suggests that parenting literacy may contribute to the alleviation of parenting stress. A weak positive correlation ( $\rho = 0.366$ ,  $p < 0.01$ ) was also found with SF-8 mental health. Similar weak positive correlations ( $\rho = 0.262$ - $0.362$ ,  $p < 0.01$ ) were found for all subscales. However, few correlations were found with physical health, suggesting that parenting literacy is primarily related to the quality of mental health.

In addition, those who recognized the contents of an emergency kit needed for infants and children had higher CLMIC total scores than those who did not ( $p = 0.004$ ,  $p < 0.01$ ). This is a health behavior characteristic of mothers with infants and children, suggesting that childcare literacy may contribute to health behaviors that keep children safe and secure. However, no association was found with other health behaviors. We believe that this was not a significant difference because most mothers in Japan receive infant health checkups and mumps vaccinations. Further verification of awareness of pediatric emergency telephone counseling (#8000) and awareness of shaken baby syndrome is needed since people may be aware of the term, but not of its contents and responses.

#### Significance of this study

In this study, we developed a CLMIC and examined its reliability and validity. The results indicated that the scale is a highly useful instrument that can contribute to child-rearing

stress and health behaviors that protect the safety and security of children, valuing the unique perspective of child-rearing that is appropriate for Japanese mothers. In Japan, postpartum support by public health nurses and other professionals focuses on high-risk families after home visits. However, we believe that many mothers are not high-risk, such as those with postpartum depression or child abuse, but instead “do not know what to do” or feel “a bit overwhelmed.” This scale can be used to screen such mothers during all home visits and through the infant health checkups. By understanding the childcare literacy of mothers in advance, professionals can consider tailored support content. If the mother’s childcare literacy is low, it is necessary to provide support to increase it; if it is high, it is necessary to consider it as a strength and support it. This will lead to the improvement of mothers’ childcare literacy, which will lead to the healthy growth and development of their children and the promotion of attachment between children and their mothers. It is also expected to reduce the risk of postpartum depression and child abuse, leading to better health for both mothers and children, as well as for future generations.

#### *Limitations of the study and future challenges*

In developing this scale, we believe that the number of questionnaires distributed and collected was lower than planned due to the cancellation or postponement of infant health checkups in the municipalities where the target mothers visited due to COVID-19 and the immense workload of public health nurses in the municipalities. However, the survey covered the entire country, and the population of 0–4-year-olds, infants and children, were stratified into two groups (less than 10,000 and more than 10,000), and municipalities were randomly selected, which may have less effect on regional bias.

In the future, we would like to establish a cutoff value for good childcare literacy based on theoretical evidence and develop health guidance intervention methods using this scale. In addition, we would like to expand the target to include mothers, fathers, and other guardians who care for infants and children. Furthermore, we would like to develop the scale into a childcare literacy scale that can be used not only in Japan, but also in the field of maternal and child health care in other countries while considering the cultural background of each country.

#### CONFLICT OF INTEREST

The authors declare no conflict of interest.

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