

Original Article

## Childcare and Child Development in Japan

Akiko Murata<sup>a,b\*</sup>, Naomi Matsumoto<sup>c</sup>, Chikara Miyaji<sup>a</sup>, Soshi Takao<sup>c</sup>, and Takashi Yorifuji<sup>c</sup>

<sup>a</sup>Department of Epidemiology, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences,

<sup>c</sup>Faculty of Medicine, Dentistry and Pharmaceutical Sciences, Okayama University, Okayama 700-8558, Japan,

<sup>b</sup>Family Practice Center of Okayama, Nagi Family Clinic, Nagi-cho, Okayama 708-1323, Japan

For decades, the notion has persisted in developed countries that exclusive care by the mothers is best for the development of children up to 3 years of age. To examine the veracity of this “myth of the first three years” in Japan, we examined the effects of childcare facility use for children younger than 3 years on their development using the cohorts of the Longitudinal Survey of Newborns in the 21st Century conducted in Japan. Of the 47,015 respondents to the survey, we studied the children of 5,508 mothers with university/professional education to evaluate the relationships between primary early (<2.5 years) childcare providers during weekday daytime hours and specific development indices for the ages of 2.5, 5.5, and 8 years. At the age of 2.5 and 5.5 years, children attending childcare facilities were judged as having more advanced developmental behaviors by their parents, such as being able to compose a two-word sentence (adjusted odds ratio [aOR]: 0.22) or to express emotions (aOR: 0.81), compared with those cared for by mothers. However, at the age of 8 years, children who attended childcare facilities as infants <2.5 years showed more aggressive behavior in interrupting people (aOR: 1.20) and causing disturbances in public (aOR: 1.26) than those cared for by mothers (after adjustment for numerous child and parental factors). Although these results are generally consistent with previous studies, issues potentially involved with problem behavior such as quality of childcare require further investigation, as does the case of children of mothers with more modest educational attainment.

**Key words:** “myth of the first three years”, childcare, child development, problem behavior, educational attainment

As the number of working women has increased worldwide over the past decades, the effects of childcare and preschool education practices on child development continue to be a topic of keen interest [1]. Many questions remain unanswered regarding who should take care of young children (age <3 years), and what effects this choice has on their development [1]. Moreover, diverse factors influence child development, including differences in national characteristics and cultural environments [2]. Therefore, in answering these questions it is believed that research should be conducted country by country [3,4] in order to take

into account differences in childcare systems [3,5], cultural views on education, economic and political factors, and other qualitative factors [6].

Since the start of the modern era in Japan, the mother has handled most of the parenting responsibilities alone [7]. The “myth of motherhood”, which uplifted the woman’s role as mother, was emphasized beginning in the 1910s [7,8]. The adjunct “myth of the first three years” was touted starting in the 1960s, emphasizing that when a child is small, especially in the period up to 3 years when much of its neurological development occurs, the mother should be dedicated to child-rearing within the home [8,9]. A counter-move-

Received September 1, 2022; accepted April 17, 2023.

\*Corresponding author. Phone: +81-86-235-7173; Fax: +81-86-235-7178  
E-mail: pu0u5tel@s.okayama-u.ac.jp (A. Murata)

Conflict of Interest Disclosures: No potential conflict of interest relevant to this article was reported.

ment discrediting this notion then occurred [8], and in 1998, the Japanese government went so far as to declare that no evidence existed for the myth of the first three years [10]. Nevertheless, in 2013, Prime Minister Abe's administration issued a plan to extend work leave for childcare to the age of 3 years [11]. This is one example that shows how deeply valued motherhood is in Japan, including the myth of the first three years [8]. Therefore, mothers, especially those with higher education levels, may face serious conflicts in performing dual roles of raising children and working, both of which may be essential for their self-realization [12].

In Japan and other countries, the proportion of working women in households with a child or children exceeds 50% and is trending upward [13]. In tandem, the number of users of childcare facilities has also been increasing [14]. Child development research since the 1970s has investigated the effects of the early use of childcare facilities (*i.e.*, for children younger than 3 years of age). These studies have focused on attachment, language development, personality, and sociability, but the evidence they have generated is inconsistent [15]. Moreover, few studies have taken into consideration potential confounders that can affect child development.

Therefore, we examined the effects of childcare facility use on the development of children of highly educated mothers using longitudinal data from a nationwide survey conducted in Japan.

## Materials and Methods

**Study design and participants.** In Japan, the Ministry of Health, Labour and Welfare (MHLW) has been performing regular surveys since 2001 under the title "Longitudinal Survey of Newborns in the 21st Century". The purpose of this survey is to obtain fundamental documentation for the countermeasures against declining birthrates in Japan by continuously observing the actual growth environment and development of children born in the first year of the 21st century. Data collected in this survey were used in the present study after receiving approval from the Research Ethics Committee of the Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama University (Approval No.: Research 1506-073).

Unlike Western countries, Japan uses a family registry to manage population data by family unit. When a

child is born, her/his birth certificate registration is submitted to the mayor of the municipality within 14 days, and the birth record data is registered in the Japanese Vital Statistics, linked to each child. The Longitudinal Survey of Newborns in the 21st Century included all children nationwide whose births were registered in two separate weeks of 2001: from 10 January to 17 January and 10 July to 17 July 2001. Birth record data include weight, gestational age, singleton vs. twin or other multiple-birth status, sex, birth order, and parental age. Beginning when each cohort was 6 months of age (*i.e.*, just the two cohorts, January and July births of 2001), the survey is performed via distribution of an annual postal questionnaire, focusing on environmental and socioeconomic factors for descriptive epidemiology. In the first survey in 2001/2002, forms were posted to 53,575 people, with a response from 47,015 people (response rate: 87.8%). Follow-up questionnaires were mailed annually to all initial respondents at child ages of 1.5, 2.5, 3.5, 4.5, 5.5, 7, and every year thereafter. In the present survey, data from the first survey (2001) through the eighth survey (2009) were used.

In the present study, of the 47,015 children whose parents responded, we excluded 2,382 who were born prematurely (<36 gestational weeks), 36 with an unknown number of gestational weeks, and 488 who were multiple-birth children because these factors can affect development. Furthermore, we excluded 3,866 children for whom it was not clear whether they were living with their mother and 115 who were definitely not living with their mother. These children were excluded because the topic of our research was the specific effects of the mother's involvement on child development. Finally, 40,128 children remained. Because we had a higher response rate from mothers who had graduated from a 4-year university degree than those who did not graduate from university, we chose to further restrict participants to children of mothers who graduated from university and higher education rather than claim generalizability despite the possibility of selection bias, thus leaving 5,508 children for the analysis.

**Childcare facility use at the age of 2.5 years.** To examine the effects of childcare facility use on child development, we used the information regarding primary caregivers of the child at the age of 2.5 years (*i.e.*, the third survey). The survey asked who spent the lon-

gest time together with the child during weekday hours, and children were classified into one of three groups according to the answer: the mother (mother group), the father or grandparents (family group), or nurseries or daycare facilities (childcare facility group). Because 11 children lacked this information and 23 were cared for by a babysitter or other, we finally limited the anal-

ysis to 5,474 children (Fig. 1).

**Behavioral development outcomes.** To evaluate the effects of early (< 3 years of age) childcare facility use on development, we focused on age-appropriate behavioral development at the ages of 2.5, 5.5, and 8 years, and these behavioral outcomes were queried in each survey as follows.

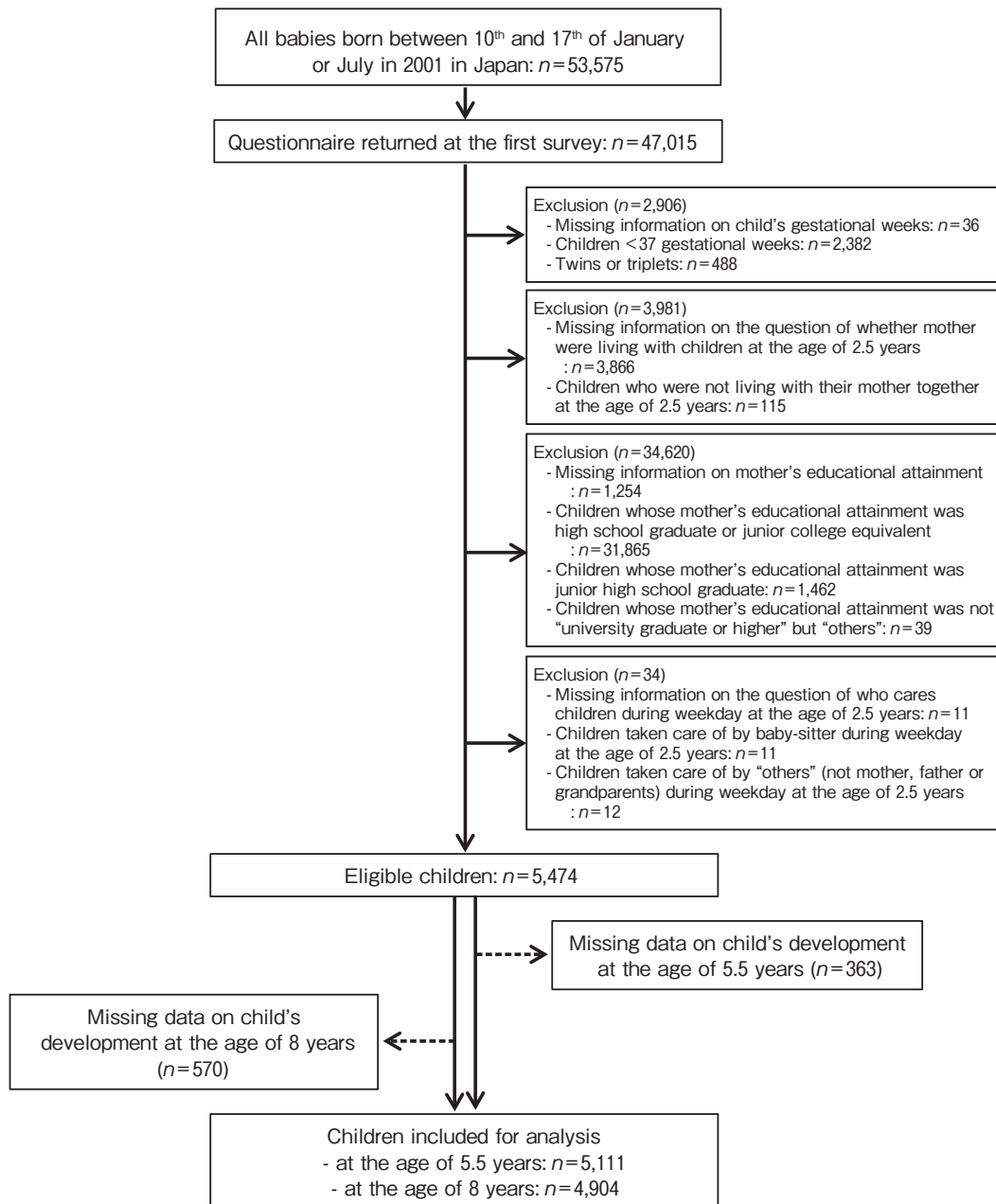


Fig. 1 Flowchart of the selection of the participants.

At the age of 2.5 years (the third survey), the following seven questions were asked: whether the child is able to (1) walk well by herself/himself, (2) run, (3) climb stairs by herself/himself, (4) say meaningful words, such as “mama” or “vroom-vroom”, (5) compose a two-word sentence, such as “doggie came” or “give me num-num”, (6) say her/his own name, and (7) use a spoon to eat. According to the MHLW, these questions regarding behavior originate from the Mother and Child Health Handbook, which is mandatorily distributed to every pregnant woman under Japanese law. These questions are also related to questions that healthcare specialists generally ask at the time of a medical examination at the age of 3 years [16-18].

At the age of 5.5 years (the sixth survey), the following six questions were asked: can the child (1) listen without fidgeting, (2) focus on one task, (3) remain patient, (4) express emotions, (5) act in a group, and (6) keep promises. According to the MHLW, these questions were established and have been used over the past several decades for early screening of potential behavioral development problems [16-18].

Finally, at the age of 8 years (the eighth survey), the following seven questions were asked: whether the child (1) interrupts people, (2) can wait her/his turn during play, (3) pays attention to the surrounding area when crossing a street, (4) tells lies, (5) destroys toys and/or books, (6) hurts other people, and (7) causes disturbances in public. We selected these seven questions because they are almost the same as those from a standardized and valid scale for problem behavior (*i.e.*, Child Behavior Checklist 4-18 for Japan) [19]. The first three questions deal with behavior that stems from concentration/attention-related problems, while the last four relate to delinquent/aggressive behavior (“extroversion” scale). We also defined an outcome of “all concentration/attention-related behaviors” as the existence of all three concentration/attention-related problems and an outcome of “all delinquent/aggressive problems” as the existence of all four delinquent/aggressive behaviors, according to the method of previous studies [20-22].

**Statistical analysis.** We used a logistic regression analysis to evaluate the relationships between childcare facility use at the age of 2.5 years and behavioral development at the age of 2.5, 5.5, and 8 years. We first estimated crude odds ratios (ORs) with their 95% confidence intervals (CIs) (crude model), then adjusted for

children’s factors (model 1), and finally adjusted for both children’s and parental factors (model 2). We used children who were primarily cared for by their mothers as the reference.

Children’s factors were sex (dichotomous), birth month (dichotomous; January or July), birth order (dichotomous), number of siblings (dichotomous), and gestational age (continuous variable). Parental factors were the parental age at delivery (continuous variables), parental smoking status (dichotomous), paternal educational attainment (categorical variable), paternal income level (categorical variable), and the site of residence at delivery (categorical variable). We used the following four classifications for paternal educational attainment: university or higher, high school or junior college, junior high school, and unknown or others. We used the following seven classifications for paternal income:  $\geq 10$  million yen; 7-9.9 million yen; 5-6.9 million yen; 3-4.9 million yen;  $< 3$  million yen; no income; and unknown. Finally, we used three categories for the site of residence at delivery: ku (city ward)/cabinet-designated city, city, and town/village. We obtained data of sex, birth month, gestational age, birth order, parental age at delivery, and the site of residence at the time of birth from birth certificates, the smoking status of parents from the first survey, paternal educational attainment and income from the second survey, and the number of siblings from the third survey. We excluded missing cases and conducted our analyses with complete cases only.

We used Stata version 13.1/SE (StataCorp, College Station, TX, USA) for all statistical analyses.

## Results

The demographic characteristics of the respondents are shown in Table 1. The mother group tended to have more siblings and fathers who had a higher income than the other groups. The family group tended to have smoking fathers and to be born in a town/village.

A total of 363 and 570 children lacked information on behavioral development at the ages of 5.5 and 8 years, respectively (Table 2). Children who lacked this information at both ages were more likely to have smoking parents compared with those who had this information, but no significant differences were found based on childcare facility use.

At the age of 2.5 years, the childcare facility group

Table 1 Demographic characteristics of eligible 5,474 children by day-care of weekday in the daytime

	Total (n = 5,474)	Day-care of weekday in the daytime, n (%) <sup>d</sup>		
		Mother group (n = 3,841)	Family group (n = 255)	Childcare facility group (n = 1,378)
Characteristics of children				
Sex, n (%) <sup>a</sup>				
Boys	2,746 (50.2)	1,901 (49.5)	134 (52.5)	711 (51.6)
Girls	2,728 (49.8)	1,940 (50.5)	121 (47.5)	667 (48.4)
Birth month, n (%) <sup>a</sup>				
January	2,682 (49.0)	1,866 (48.6)	132 (51.8)	684 (49.6)
July	2,792 (51.0)	1,975 (51.4)	123 (48.2)	694 (50.4)
Number of siblings, n (%) <sup>a</sup>				
0	2,208 (40.3)	1,429 (37.2)	133 (52.2)	646 (46.9)
≥1	3,266 (59.7)	2,412 (62.8)	122 (47.8)	732 (53.1)
Birth Order, n (%) <sup>a</sup>				
1	3,036 (55.5)	2,118 (55.1)	151 (59.2)	767 (55.7)
≥2	2,438 (44.5)	1,723 (44.9)	104 (40.8)	611 (44.3)
Parental characteristics				
Mean maternal age at delivery, years (SD) <sup>a</sup>				
	31.3 ± 3.7	31.2 ± 3.6	31.4 ± 3.8	31.8 ± 4.0
Mean paternal age at delivery, years (SD) <sup>a</sup>				
	33.2 ± 4.9	33.0 ± 4.8	33.3 ± 5.1	33.6 ± 5.2
Maternal smoking status, n (%) <sup>b</sup>				
Non-smoker	5,244 (95.8)	3,678 (95.8)	244 (95.7)	1,322 (95.9)
Smoker	211 (3.9)	150 (3.9)	8 (3.1)	53 (3.8)
Unknown	19 (0.3)	13 (0.3)	3 (1.2)	3 (0.2)
Paternal smoking status, n (%) <sup>b</sup>				
Non-smoker	3,106 (56.7)	2,200 (57.3)	131 (51.4)	775 (56.2)
Smoker	2,300 (42.0)	1,606 (41.8)	114 (44.7)	580 (42.1)
Unknown	68 (1.2)	35 (0.9)	10 (3.9)	23 (1.7)
Paternal educational attainment, n (%) <sup>c</sup>				
University or higher	4,277 (78.1)	3,054 (79.5)	182 (71.4)	1,041 (75.5)
High school or Junior college	1,116 (20.4)	745 (19.4)	64 (25.1)	307 (22.3)
Junior high school	55 (1.0)	33 (0.9)	5 (2.0)	17 (1.2)
Unknown or others	26 (0.5)	9 (0.2)	4 (1.6)	13 (0.9)
Paternal income level (million yen), n (%) <sup>c</sup>				
≥10 million yen	378 (6.9)	306 (8.0)	9 (3.5)	63 (4.6)
7–9.9 million yen	1,017 (18.6)	776 (20.2)	22 (8.6)	219 (15.9)
5–6.9 million yen	1,740 (31.8)	1,267 (33.0)	79 (31.0)	394 (28.6)
3–4.9 million yen	1,584 (28.9)	1,037 (27.0)	99 (38.8)	448 (32.5)
<3 million yen	319 (5.8)	182 (4.7)	16 (6.3)	121 (8.8)
no income	34 (0.6)	16 (0.4)	4 (1.6)	14 (1.0)
Unknown	402 (7.3)	257 (6.7)	26 (10.2)	119 (8.6)
The site of residence at delivery, n (%) <sup>b</sup>				
<i>Ku</i> (city ward)/Cabinet-designated city	1,644 (30.0)	1,192 (31.0)	32 (12.5)	420 (30.5)
City	3,158 (57.7)	2,225 (57.9)	159 (62.4)	774 (56.2)
Town/Village	672 (12.3)	424 (11.0)	64 (25.1)	184 (13.4)

SD, standard deviation.

<sup>a</sup>Obtained from the birth record, <sup>b</sup>Obtained from the first survey (at the age of 0.5 years), <sup>c</sup>Obtained from the second survey (at the age of 1.5 years), <sup>d</sup>Obtained from the third survey (at the age of 2.5 years).

**Table 2** Demographic characteristics of the children included in the analysis and those without information on behavioral development at the ages of 2.5, 5.5, and 8 years (n = 5,474)

	Included in the analysis at the age of 2.5 years (N = 5,440)	Without information on behavioral development at the age of 2.5 years (N = 34)	Included in the analysis at the age of 5.5 years (N = 5,111)	Without information on behavioral development at the age of 5.5 years (N = 363)	included in the analysis at the age of 8 years (N = 4,904)	Without information on behavioral development at the age of 8 years (N = 570)
Characteristics of children						
Sex, n (%) <sup>a</sup>						
Boys	2,727 (50.1)	19 (55.9)	2,565 (50.2)	181 (49.9)	2,471 (50.4)	275 (48.2)
Girls	2,713 (49.9)	15 (44.1)	2,546 (49.8)	182 (50.1)	2,433 (49.6)	295 (51.8)
Birth month, n (%) <sup>a</sup>						
January	2,660 (48.9)	22 (64.7)	2,493 (48.8)	189 (52.1)	2,399 (48.9)	283 (49.6)
July	2,780 (51.1)	12 (35.3)	2,618 (51.2)	174 (47.9)	2,505 (51.1)	287 (50.4)
Number of siblings, n (%) <sup>a</sup>						
0	2,196 (40.4)	12 (35.3)	2,057 (40.2)	151 (41.6)	1,971 (40.2)	237 (41.6)
≥1	3,244 (59.6)	22 (64.7)	3,054 (59.8)	212 (58.4)	2,933 (59.8)	333 (58.4)
Birth Order, n (%) <sup>a</sup>						
1	3,019 (55.5)	17 (50)	2,826 (55.3)	210 (57.9)	2,715 (55.4)	321 (56.3)
≥2	2,421 (44.5)	17 (50)	2,285 (44.7)	153 (42.1)	2,189 (44.6)	249 (43.7)
Parental characteristics						
Mean maternal age at delivery, years (SD) <sup>a</sup>	31.3 ± 3.7	31.4 ± 3.7	31.4 ± 3.7	30.8 ± 3.9	31.4 ± 3.7	31.1 ± 3.9
Mean paternal age at delivery, years (SD) <sup>a</sup>	33.2 ± 4.9	33.8 ± 5.3	33.2 ± 4.9	32.9 ± 5.4	33.2 ± 4.9	33.1 ± 5.5
Maternal smoking status, n (%) <sup>b</sup>						
Non-smoker	5,212 (95.8)	32 (94.1)	4,905 (96)	339 (93.4)	4,710 (96)	534 (93.7)
Smoker	209 (3.8)	2 (5.9)	190 (3.7)	21 (5.8)	178 (3.6)	33 (5.8)
Unknown	19 (0.3)	0 (0)	16 (0.3)	3 (0.8)	16 (0.3)	3 (0.5)
Paternal smoking status, n (%) <sup>b</sup>						
Non-smoker	3,083 (56.7)	23 (67.6)	2,927 (57.3)	179 (49.3)	2,823 (57.6)	283 (49.6)
Smoker	2,289 (42.1)	11 (32.4)	2,123 (41.5)	177 (48.8)	2,026 (41.3)	274 (48.1)
Unknown	68 (1.3)	0 (0)	61 (1.2)	7 (1.9)	55 (1.1)	13 (2.3)
Paternal educational attainment, n (%) <sup>c</sup>						
University or higher	4,254 (78.2)	23 (67.6)	4,007 (78.4)	270 (74.4)	3,862 (78.8)	415 (72.8)
High school or Junior college	1,106 (20.3)	10 (29.4)	1,033 (20.2)	83 (22.9)	978 (19.9)	138 (24.2)
Junior high school	54 (1)	1 (2.9)	49 (1)	6 (1.7)	45 (0.9)	10 (1.8)
Unknown	26 (0.5)	0 (0)	22 (0.4)	4 (1.1)	19 (0.4)	7 (1.2)
Paternal income level (million yen per one year), n (%) <sup>c</sup>						
≥10 million yen	376 (6.9)	2 (5.9)	359 (7)	19 (5.2)	339 (6.9)	39 (6.8)
7–9.9 million yen	1,006 (18.5)	11 (32.4)	960 (18.8)	57 (15.7)	935 (19.1)	82 (14.4)
5–6.9 million yen	1,732 (31.8)	8 (23.5)	1,635 (32)	105 (28.9)	1,580 (32.2)	160 (28.1)
3–4.9 million yen	1,578 (29)	6 (17.6)	1,466 (28.7)	118 (32.5)	1,388 (28.3)	196 (34.4)
<3 million yen	313 (5.8)	6 (17.6)	288 (5.6)	31 (8.5)	283 (5.8)	36 (6.3)
no income	34 (0.6)	0 (0)	30 (0.6)	4 (1.1)	30 (0.6)	4 (0.7)
Unknown	401 (7.4)	1 (2.9)	373 (7.3)	29 (8)	349 (7.1)	53 (9.3)
Childcare of weekday, n (%) <sup>d</sup>						
Mother group	3,592 (70.3)	249 (68.6)	3,592 (70.3)	249 (68.6)	3,447 (70.3)	394 (69.1)
Family group	239 (4.7)	16 (4.4)	239 (4.7)	16 (4.4)	227 (4.6)	28 (4.9)
Childcare facility group	1,280 (25)	98 (27)	1,280 (25)	98 (27)	1,230 (25.1)	148 (26)
The site of residence at delivery, n (%) <sup>b</sup>						
Ku (city ward)/Cabinet-designated city	1,636 (30.1)	8 (23.5)	1,526 (29.9)	118 (32.5)	1,470 (30)	174 (30.5)
City	3,137 (57.7)	21 (61.8)	2,963 (58)	195 (53.7)	2,841 (57.9)	317 (55.6)
Town/Village	667 (12.3)	5 (14.7)	622 (12.2)	50 (13.8)	593 (12.1)	79 (13.9)

SD, standard deviation. <sup>a</sup>Obtained from the birth record, <sup>b</sup>Obtained from the first survey (at the age of 0.5 years), <sup>c</sup>Obtained from the second survey (at the age of 1.5 years), <sup>d</sup>Obtained from the third survey (at the age of 2.5 years).



**Table 3** The associations between weekday childcare facility use at the age of 2.5 years and behavioral development at the age of 2.5 years (n=5,440)

	Cases with behavioral problem			Crude model	Model 1	Model 2
	N Case	Total N	(%)	OR (95%CI)	aOR (95%CI)	aOR (95%CI)
Unable to walk						
Mother group	9 /	3,819	(0.2)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	0 /	254	(0.0)	( )	( )	( )
Childcare facility group	3 /	1,367	(0.2)	0.93 (0.25–3.44)	0.94 (0.25–3.49)	0.91 (0.24–3.44)
Unable to run						
Mother group	23 /	3,818	(0.6)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	0 /	254	(0.0)	( )	( )	( )
Childcare facility group	6 /	1,367	(0.4)	0.73 (0.30–1.79)	0.73 (0.30–1.80)	0.76 (0.30–1.92)
Unable to climb stairs						
Mother group	80 /	3,816	(2.1)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	1 /	254	(0.4)	0.18 (0.03–1.33)	0.18 (0.02–1.30)	0.20 (0.03–1.46)
Childcare facility group	28 /	1,365	(2.1)	0.98 (0.63–1.51)	0.98 (0.63–1.51)	0.99 (0.62–1.58)
Unable to say meaningful words						
Mother group	24 /	3,819	(0.6)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	0 /	254	(0.0)	( )	( )	( )
Childcare facility group	3 /	1,367	(0.2)	0.35 (0.10–1.16)	0.34 (0.10–1.14)	0.32 (0.09–1.08)
Unable to compose a two-word sentence						
Mother group	163 /	3,818	(4.3)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	4 /	254	(1.6)	0.36 (0.13–0.98)	0.35 (0.13–0.96)	0.34 (0.12–0.95)
Childcare facility group	16 /	1,366	(1.2)	0.27 (0.16–0.45)	0.26 (0.15–0.43)	0.22 (0.12–0.40)
Unable to say her/his own name						
Mother group	483 /	3,816	(12.7)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	28 /	254	(11.0)	0.85 (0.57–1.28)	0.83 (0.55–1.26)	0.78 (0.50–1.21)
Childcare facility group	71 /	1,363	(5.2)	0.38 (0.29–0.49)	0.36 (0.28–0.47)	0.35 (0.27–0.47)
Unable to use a spoon to eat						
Mother group	91 /	3,818	(2.4)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	10 /	254	(3.9)	1.68 (0.86–3.27)	1.58 (0.80–3.08)	1.47 (0.71–3.03)
Childcare facility group	11 /	1,366	(0.8)	0.33 (0.18–0.62)	0.32 (0.17–0.60)	0.26 (0.13–0.53)

OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval.

There were 1,621 cases missing on unable to walk, 1,622 cases missing on unable to run, 1,624 cases missing on unable to climb stairs, 1,621 cases missing on unable to say meaningful words, 1,622 cases missing on unable to compose a two-word sentence, 1,624 cases missing on unable to say her/his own name, 1,622 cases missing on unable to use a spoon to eat.

Model 1: Adjusted for children’s factors (sex, number of siblings, birth order, birth month, and gestational age). Model 2: Adjusted for children’s factors (sex, number of siblings, birth order, birth month, and gestational age) as well as parental factors (parental age at delivery, parental smoking status, paternal educational attainment, paternal income level at the age of 1.5 years, and the site of residence at delivery).

had more advanced developmental behaviors as judged by their parents than the mother group (Table 3). An example of these outcomes is that the adjusted ORs (aORs) for being unable to compose a two-word sentence and use a spoon to eat in the childcare facility group were 0.22 (95%CI: 0.12-0.40) and 0.26 (95%CI: 0.13-0.53) compared with the mother group, respectively.

In contrast, no differences in behavioral outcomes

were observed at the age of 5.5 years, except for being unable to remain patient and express emotions (Table 4). The family group had a higher aOR for being unable to remain patient (aOR: 1.72; 95%CI: 1.25-2.36) and the childcare facility group had a lower aOR for being unable to express emotions (aOR: 0.81; 95%CI: 0.68-0.96) compared with the mother group.

Finally, at the age of 8 years, the childcare facility group had more unfavorable behavioral outcomes than

**Table 4** The associations between weekday childcare facility use at the age of 2.5 years and behavioral development at the age of 5.5 years (n=5,111)

	Cases with behavioral problem			Crude model	Model 1	Model 2
	N Case	Total N	(%)	OR (95%CI)	aOR (95%CI)	aOR (95%CI)
Unable to listen without fidgeting						
Mother group	452	3,575	(12.6)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	42	239	(17.6)	1.47 (1.04–2.08)	1.42 (1.00–2.03)	1.17 (0.79–1.74)
Childcare facility group	189	1,277	(14.8)	1.20 (1.00–1.44)	1.19 (0.99–1.43)	1.09 (0.90–1.34)
Unable to focus on one task						
Mother group	298	3,581	(8.3)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	23	239	(9.6)	1.17 (0.75–1.83)	1.14 (0.73–1.79)	0.99 (0.60–1.63)
Childcare facility group	112	1,277	(8.8)	1.06 (0.84–1.33)	1.06 (0.84–1.33)	1.01 (0.79–1.29)
Unable to remain patient						
Mother group	665	3,563	(18.7)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	73	238	(30.7)	1.93 (1.45–2.57)	1.92 (1.44–2.56)	1.72 (1.25–2.36)
Childcare facility group	272	1,274	(21.4)	1.18 (1.01–1.39)	1.18 (1.00–1.38)	1.06 (0.89–1.25)
Unable to express emotions						
Mother group	795	3,564	(22.3)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	45	239	(18.8)	0.81 (0.58–1.13)	0.78 (0.56–1.09)	0.77 (0.53–1.10)
Childcare facility group	236	1,268	(18.6)	0.80 (0.68–0.94)	0.79 (0.67–0.93)	0.81 (0.68–0.96)
Unable to act in a group						
Mother group	215	3,580	(6.0)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	17	239	(7.1)	1.20 (0.72–2.00)	1.18 (0.70–1.97)	1.23 (0.72–2.10)
Childcare facility group	65	1,270	(5.1)	0.84 (0.63–1.12)	0.84 (0.63–1.11)	0.76 (0.55–1.03)
Unable to keep promises						
Mother group	518	3,552	(14.6)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	45	238	(18.9)	1.37 (0.97–1.91)	1.35 (0.96–1.89)	1.22 (0.84–1.76)
Childcare facility group	211	1,271	(16.6)	1.17 (0.98–1.39)	1.16 (0.97–1.38)	1.06 (0.87–1.28)

OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval.

There were 1,536 cases missing on unable to listen without fidgeting, 1,530 cases missing on unable to focus on one task, 1,548 cases missing on unable to remain patient, 1,547 cases missing on unable to express emotions, 1,531 cases missing on unable to act in a group, 1,559 cases missing on unable to keep promises.

Model 1: Adjusted for children's factors (sex, number of siblings, birth order, birth month, and gestational age). Model 2: Adjusted for children's factors (sex, number of siblings, birth order, birth month, and gestational age) as well as parental factors (parental age at delivery, parental smoking status, paternal educational attainment, paternal income level at the age of 1.5 years, and the site of residence at delivery).

the mother group (Table 5). For example, aORs for interrupting people and causing disturbances in public in the childcare facility group were 1.20 (95%CI: 1.04–1.39) and 1.26 (95%CI: 1.06–1.5) compared with the mother group, respectively.

## Discussion

In the present study, we evaluated the effects of childcare facility use on the development of children using the Longitudinal Survey of Newborns in the 21st Century. We found that the relationships between childcare facility use and child development differed

depending on the age and type of development. The childcare facility group was judged by respondents to have more advanced developmental behaviors at the age of 2.5 years than the mother group, while it was the opposite at the age of 8 years.

The reasons for this inconsistency in our findings can be partly explained by the use of different behavioral indices for each age group. Our behavioral indices for the age of 2.5 and 5.5 years reflect the contents of the 3-year-old and 5-year-old health checkups, which are stipulated in the Maternal and Child Health Law, respectively. The former consisted of language development (3 items) and motor development (2 items for



**Table 5** The associations between weekday childcare facility use at the age of 2.5 years and behavioral development at the age of 8 years (n = 4,904)

	Cases with behavioral problem			Crude model	Model 1	Model 2
	N Case	Total N	(%)	OR (95%CI)	aOR (95%CI)	aOR (95%CI)
<b>Attention problems</b>						
Interrupting people						
Mother group	1,170	3,408	(34.3)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	73	226	(32.3)	0.91 (0.68–1.22)	0.88 (0.66–1.18)	0.85 (0.62–1.16)
Childcare facility group	480	1,216	(39.5)	1.25 (1.09–1.43)	1.23 (1.07–1.41)	1.20 (1.04–1.39)
Unable to wait her/his turn to play						
Mother group	129	3,432	(3.8)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	12	225	(5.3)	1.44 (0.79–2.65)	1.42 (0.77–2.61)	1.43 (0.74–2.74)
Childcare facility group	59	1,223	(4.8)	1.30 (0.95–1.78)	1.28 (0.93–1.75)	1.32 (0.94–1.85)
Unable to pay attention when crossing a street						
Mother group	666	3,424	(19.5)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	32	227	(14.1)	0.68 (0.46–1.00)	0.68 (0.46–0.99)	0.61 (0.40–0.93)
Childcare facility group	264	1,224	(21.6)	1.14 (0.97–1.34)	1.13 (0.96–1.33)	1.14 (0.96–1.35)
All attention problems <sup>a</sup>						
Mother group	32	3,443	(0.9)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	3	227	(1.3)	1.43 (0.43–4.70)	1.42 (0.43–4.70)	1.13 (0.26–4.99)
Childcare facility group	13	1,230	(1.1)	1.14 (0.60–2.18)	1.12 (0.58–2.14)	1.33 (0.67–2.62)
<b>Delinquent/aggressive behaviors</b>						
Telling lies						
Mother group	717	3,403	(21.1)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	43	226	(19.0)	0.88 (0.63–1.24)	0.87 (0.62–1.23)	0.80 (0.55–1.17)
Childcare facility group	273	1,216	(22.5)	1.08 (0.93–1.27)	1.08 (0.92–1.26)	1.08 (0.91–1.28)
Destroying toys and/or books						
Mother group	211	3,438	(6.1)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	19	227	(8.4)	1.40 (0.86–2.28)	1.37 (0.84–2.25)	1.10 (0.65–1.87)
Childcare facility group	104	1,223	(8.5)	1.42 (1.11–1.82)	1.39 (1.09–1.78)	1.25 (0.96–1.62)
Hurting other people						
Mother group	292	3,431	(8.5)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	29	226	(12.8)	1.58 (1.05–2.38)	1.55 (1.02–2.33)	1.44 (0.92–2.23)
Childcare facility group	139	1,222	(11.4)	1.38 (1.11–1.71)	1.35 (1.09–1.68)	1.38 (1.10–1.73)
Causing disturbances in public						
Mother group	628	3,424	(18.3)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	42	227	(18.5)	1.01 (0.72–1.43)	0.97 (0.69–1.38)	0.88 (0.60–1.28)
Childcare facility group	276	1,224	(22.5)	1.30 (1.11–1.52)	1.27 (1.08–1.49)	1.26 (1.06–1.50)
All delinquent/aggressive behaviors <sup>b</sup>						
Mother group	21	3,446	(0.6)	1.00 ( ref. )	1.00 ( ref. )	1.00 ( ref. )
Family group	4	227	(1.8)	2.93 (1.00–8.60)	2.88 (0.98–8.50)	2.83 (0.92–8.77)
Childcare facility group	15	1,230	(1.2)	2.01 (1.03–3.92)	1.96 (1.01–3.82)	1.95 (0.93–4.06)

OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval.

There were 1,496 cases missing on interrupting people, 1,472 cases missing on unable to wait her/his turn to play, 1,480 cases missing on unable to pay attention when crossing a street, 1,561 cases missing on all attention problems.

There were 1,501 cases missing on telling lies, 1,466 cases missing on destroying toys and/or books, 1,473 cases missing on hurting other people, 1,480 cases missing on causing disturbances in public, 1,458 cases missing on all delinquent/aggressive behaviors.

<sup>a</sup>N cases as number of children having all three attention problems. <sup>b</sup>N cases as number of children having all four delinquent/aggressive behaviors.

Model 1: Adjusted for children’s factors (sex, number of siblings, birth order, birth month, and gestational age). Model 2: Adjusted for children’s factors (sex, number of siblings, birth order, birth month, and gestational age) as well as parental factors (parental age at delivery, parental smoking status, paternal educational attainment, paternal income level at the age of 1.5 years, and the site of residence at delivery).

gross motor development and 1 item for fine motor development) [17]. However, the latter comprised social behavior skills, including self-control, concentration abilities, patience, self-assertion, and cooperativeness [17, 18, 23, 24]. The discrepancy in the indices is considered unavoidable, since the 3-year-old health checkup aims to check the child's physical and psychological development, detect illness in its early stages and provide parental guidance, while the purpose of the 5-year-old health checkup is to identify minor developmental delays, biases, and interpersonal problems that had not been identified by the 3-year-old health checkup. With regard to social behavioral indices for the age of 8 years, we only investigated seven items for external problem behavior (external problems) regarding attention and delinquent/aggressive behavior. We did not consider internal problem behaviors (internal problems), such as depression, anxiety, and social withdrawal, which may have resulted in an incomplete picture of behavior-related problems overall at the age of 8 years [22].

Previous studies that examined potential effects of childcare facility use on early language, cognitive, and motor developments showed that childcare facility use had favorable effects, consistent with the present study. A long-term follow-up study by the National Institute of Child Health and Human Development (in the US) found that children who were mostly taken care of at a childcare facility showed better language development up to the age of 3 years than those cared for at home [25, 26]; similar results were found at the age of 4.5 years [26, 27]. These findings were confirmed in subsequent studies conducted in the US, UK, Sweden, and Northern Ireland [1]. Studies in Japan also showed that childcare facility groups had better development in the language, cognitive, and exercise/motor domains than those cared for at home [28-32].

Previous studies conducted in various countries, including the US, UK, Northern Ireland, and Japan, also showed potential beneficial effects of early childcare facility use on social development compared with care at home [1, 15, 25-27, 30, 31]. This finding is partly consistent with our findings at the age of 5 years, but not at the age of 8 years. These inconsistent findings between studies may be explained by the fact that the previous studies did not adjust for family and other potential confounders [1]. Furthermore, other explanations could be related to difference in the quality of

childcare as suggested by numerous reports from the US, Canada, the UK, Germany, and the Netherlands [1, 33]. Although high-quality preschool education can be considered to lower physical aggressiveness [1], the difficulty of evaluating and factoring in the quality of care may hinder the interpretation of these studies' findings.

Strengths of the present study include the geographic representativeness of the Japanese survey and the high response and follow-up rates. Moreover, we adjusted for several potential confounding factors, such as the paternal educational status and household income status, which previous studies did not adjust for. Finally, we reduced the selection bias by restricting the respondents to a group of mothers with high academic attainment.

There are several limitations to this study. First, there is concern regarding the validity of the behavioral development outcomes, especially indices at the ages of 2.5 and 5.5 years, because these outcomes were self-reported by the guardians of the children and not by validated cognitive or behavioral function tests (*e.g.*, the Bayley Scales of Infant Development-II). However, the developmental problems assessed by the questions we used were related to shorter gestational age or restricted fetal growth, as anticipated based on our previous studies [16, 17, 20, 22]. Moreover, previous studies demonstrated that the behavioral development milestones queried by the Mother and Child Health Handbook were moderately-correlated with the validated cognitive function test [34] and predicted behavioral problems such as autism spectrum disorder [35]. Due to the subjective nature of these questions, we could not exclude the possibility of misclassification of behavioral outcomes, but such non-differential misclassification could have biased effect estimates toward the null hypothesis. We thus considered the results obtained from the self-report on developmental developments in our study to be valuable. Second, we did not know the quality or size of the childcare facilities that the participants used, and this might partly explain the negative effects of institutional childcare on development at the age of 8 years. Therefore, when conducting similar surveys in the future, it is necessary to deepen the understanding of child development issues, including their support systems. The third issue could be residual confounding because we could not adjust for maternal mental conditions, parental involvement in childcare, or local

socioeconomic environments. Finally, it is not possible to generalize based on the study results because we only included children from mothers with high educational attainment [36].

In conclusion in this study, we evaluated the effects of childcare facility use on the development of children using the Longitudinal Survey of Newborns in the 21st Century. The relationships between childcare facility use and child development differed depending on the age and type of development. At the age of 2.5 years, those who were cared for at nurseries or daycare facilities tended to have better language and motor behavioral outcomes as judged by their parents than those who were cared for by their mothers. However, this finding was the opposite for social behavioral development at the age of 8 years, when problem behavior was more evident in those with early childcare facility experience. Because of the increase in nuclearization of the family and families in which both parents work, the use of childcare facilities is unavoidable under contemporary circumstances. While the current findings do not support the myth of the first three years, they clarify some important issues to examine regarding the effect of childhood facility care on later social behavior.

**Acknowledgments.** We thank Saori Irie and Yoko Oka for their helpful support in collecting the data. We thank Ellen Knapp, PhD, from Edanz (<https://jp.edanz.com/ac>) for editing a draft of this manuscript.

**Source of funding.** This work was supported by a JSPS KAKENHI Grant (Number: JP20K10498). The sponsors had no involvement in the study design, the collection, analysis, or interpretation of data, the writing of the report, or the decision to submit the paper for publication. The authors declare no conflicts of interest associated with this manuscript.

## References

- Burchinal M, Magnuson K, Powell D and Hong SS: Early child care and education; in *Handbook of child psychology and developmental science: Ecological settings and processes* vol. 4, Lerner MR, Bornstein HM and Leventhal T eds, 7th Ed, John Wiley & Sons, Inc., New Jersey (2015) pp223–267.
- Azuma H: A longitudinal comparative study of child development in Japan and the United States. *Kyouiku jouhou kenkyuu* (Japan Society of Educational Information, Osaka) (1985) 1: 10–19 (in Japanese).
- Amino T: Influence of nursing on children's development: 2002 research report. *Kousei roudou kagaku kenkyuu* (Health Labour Sciences Research, Tokyo) (2003): 705–776 (in Japanese).
- Fujisawa K and Nakamuro M: Does childcare "quality" affect child development?: Comparison between small and medium-sized nurseries. *RIETI discussion paper series 17-J-001* (2017): 1–23 (in Japanese).
- OECD: Formal child and out-of-school-hours care support; in *Babies and bosses: Reconciling work and family life: A synthesis of findings for OECD countries*, OECD publications, Paris (2007) pp127–168.
- OECD: Why countries invest in early childhood education and care; in *Starting strong II: Early childhood education and care*. OECD publications, Paris (2006) pp19–44.
- Otaï E: Have parents become useless?; in *Nisuisseiki kazokuhe: Kazoku no sengotaisei no mikata, koekata* (The Japanese Family System in Transition: A Sociological Analysis of Family Change in Postwar Japan), 3rd Ed, Yuhikaku, Tokyo (2007) pp169–196 (in Japanese).
- Ohinata M: Myth of the first three years: the main cause of mother-child adhesion; in *Zouho bosei-ai shinwa no wana* (A revised and enlarged edition of the trap of the myth of maternal love), 1st Ed, Nippon hyoron sha, Tokyo (2015) pp72–87 (in Japanese).
- Ohinata M: What is the myth of the first three years. *Josanpu zasshi* (The Japanese journal for midwives, Tokyo) (2001) 55: 749–753 (in Japanese).
- Ministry of Health, Labour and Welfare (MHLW): Mother and child; in *annual reports on Health and Welfare 1998*, MHLW, Tokyo (1998) pp54–59 (in Japanese).
- Ikemoto M: Thinking about companies and childcare: Can 3-year maternity leave be evaluated? *Bijinesu houmu* (Business law farms, Tokyo) (2013) 13: 53–57 (in Japanese).
- Inoue K: A modern mother's norm and attitude in Japan: Analysis of preceding papers about sociological studies since 1990. *Kawaguchi tandai kiyuu* (Kawaguchi Junior College Journal, Saitama) (2011) 25: 103–114 (in Japanese).
- Household Statistics Office, Director-General for Statistics and Information Policy, MHLW: Households with children. Summary report of comprehensive survey of living conditions 2019 (2020) 7–8 (in Japanese).
- Childcare Division, Child and Family Policy Bureau, MHLW: Number of children in daycare centers, etc. A report on the status related to day-care centers, etc. 2021 Apr 1 (2021) 2–4 (in Japanese).
- Matsunaga A, Shimizu S and Iizuka M: The influence on the social development of young children of participation in group-nursery under 3 years. *Gunma daigaku kyouiku gakubu kiyuu Jinbun shakai kagaku hen* (Annual report of the faculty of education, Gunma university. Cultural science series, Gunma) (2015) 64: 135–144 (in Japanese).
- Kato T, Yorifuji T, Inoue S, Yamakawa M, Doi H and Kawachi I: Associations of preterm births with child health and development: Japanese population-based study. *The Journal of Pediatrics* (2013) 163: 1578–1584. e4.
- Takeuchi A, Yorifuji T, Takahashi K, Nakamura M, Kageyama M, Kubo T, Ogino T and Doi H: Neurodevelopment in full-term small for gestational age infants: A nationwide Japanese population-based study. *Brain and Development* (2016) 38: 529–537.
- Yorifuji T, Kashima S, Diez HM, Kado Y, Sanada S and Doi H: Prenatal exposure to traffic-related air pollution and child behavioral development milestone delays in Japan. *Epidemiology* (2016) 27: 57–65.
- Itani T: An Introduction to the Child Behavior Checklist for Ages 4–18 Japanese version. *Jidou seinen seishin igaku to sono kinsetsu-ryouiki* (Japanese Journal of Child and Adolescent Psychiatry, Kyoto) (2012) 53: 271–275 (in Japanese).
- Diez HM, Yorifuji T, Kado Y, Sanada S and Doi H: Preterm birth and behavioural outcomes at 8 years of age: A nationwide survey

- in Japan. *Archives of Disease in Childhood* (2016) 101: 338–343.
21. Kobayashi K, Yorifuji T, Yamakawa M, Oka M, Inoue S, Yoshinaga H and Doi H: Poor toddler-age sleep schedules predict school-age behavioral disorders in a longitudinal survey. *Brain and Development* (2015) 37: 572–578.
  22. Takeuchi A, Yorifuji T, Takahashi K, Nakamura M, Kageyama M, Kubo T, Ogino T, Kobayashi K and Doi H: Behavioral outcomes of school-aged full-term small-for-gestational-age infants: A nationwide Japanese population-based study. *Brain and Development* (2017) 39: 101–106.
  23. Ikesako H and Miyamoto K: Which learning contents matter?; in *Fostering social and emotional skills through families, schools and communities: Summary of international evidence and implication for Japan's educational practices and research*; in OECD Education Working Papers No. 121, OECD Publishing, Paris (2015): 18–28.
  24. OECD: *The role of education and skills in today's world*; in *Skills for social progress: The power of social and emotional skills*, OECD publishing, Paris (2015): 17–30.
  25. National Institute of Child Health and Human Development (NICHD) Early Child Care Research Network: The relation of child care to cognitive and language development. *Child Development* (2000) 71: 960–980.
  26. NICHD: NICHD SECCYD findings: quantity of child care, NICHD SECCYD findings: child care type; *The NICHD study of early child care and youth development: findings for children up to age 4 1/2 years*, NIH Publications, Maryland (2006) pp16–21.
  27. NICHD Early Child Care Research Network: Type of child care and children's development at 54 months. *Early Childhood Research Quarterly* (2004) 19: 203–230.
  28. Anme T: Quantity of early child care and social competence, vocabulary and motor development: Two-year longitudinal study. *Shakai fukushi gaku* (Japanese Journal of Social services, Tokyo) (2002) 43: 125–134 (in Japanese).
  29. Anme T, Tanaka H, Sakai H, Shoji T, Miyazaki K, Fuchita E and Maruyama A: Quantity of early child care and social competence, vocabulary and motor development: 5-years longitudinal study of 1-year-old child. *Kousei no shiyou* (Journal of health and welfare statistic, Tokyo) (2004) 51: 20–26 (in Japanese).
  30. Takamatsu M: The follow-up study on the effects of group nursing: (1) 4 months follow-up study. *Shin-ai kiyou* (Annual report of Wakayama Shin-ai Women's Junior College, Wakayama) (1984) 24: 60–68 (in Japanese).
  31. Takamatsu M: The follow-up study on the effects of group nursing: (2) 16 months follow-up study. *Shin-ai kiyou* (Annual report of Wakayama Shin-ai Women's Junior College, Wakayama) (1985) 25: 47–54 (in Japanese).
  32. Uchida N: Revisiting the “till-3-year-old” myth: Is it really better for children to be reared at home until 3? *Gakujutu no doukou* (Trends in the sciences, Tokyo) (2010) 15: 76–86 (in Japanese).
  33. OECD: *Comparative child well-being across the OECD*; in *Doing better for families*, OECD publications, Paris (2011) pp21–64.
  34. Hashimoto K, Maezawa H, Takekoh M, Tamai S, Kato K and Kamikubo T: Clinical Validity of the Family-Rated Kinder Infant Development Scale (KIDS) in Pediatric Disabled Patients. *The journal of the Japan Pediatric Society* (2019) 123: 1505–1510 (in Japanese).
  35. Hirota T, Bishop S, Adachi M, Shui A, Takahashi M, Mori H and Nakamura K: Utilization of the Maternal and Child Health Handbook in Early Identification of Autism Spectrum Disorder and Other Neurodevelopmental Disorders. *Autism Research* (2020) 14: 551–559.
  36. Yamaguchi S, Asai Y and Kambayashi R: How does early child-care enrollment affect children, parents, and their interactions? *Labour Economics* (2018) 55: 56–71.