

Table 2
Descriptive statistics of the Japanese version of Developmental Coordination Disorder Questionnaire.

Grade (age)	Control during movement				Fine motor				General coordination				DCDQ total			
	Male		Female		Male		Female		Male		Female		Male		Female	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Middle (4–5)	19.46	5.40	19.04	5.35	12.44	4.17	14.78	4.02	16.09	4.76	17.19	4.79	47.99	12.84	50.97	12.69
Senior (5–6)	21.31	5.46	19.99	5.26	13.63	4.20	15.59	3.76	17.23	4.27	17.73	4.59	52.51	12.11	53.38	12.50
1 (6–7)	21.22	5.48	20.38	5.32	14.53	3.72	16.12	3.63	16.75	4.57	17.99	4.59	52.55	12.24	54.56	12.03
2 (7–8)	21.51	5.22	20.45	5.12	13.82	3.63	15.70	3.39	16.27	4.39	17.66	4.34	51.73	11.58	53.81	11.31
3 (8–9)	22.29	5.38	20.76	5.01	14.17	3.56	15.60	3.50	16.98	4.26	17.53	4.16	53.44	11.71	53.94	11.00
4 (9–10)	22.94	5.43	21.27	5.38	14.91	3.51	16.02	3.44	17.76	4.33	17.77	4.20	55.79	11.67	55.18	11.51
5 (10–11)	23.29	5.21	21.86	5.64	14.98	3.74	16.58	3.47	17.83	4.46	18.41	4.44	56.10	11.96	56.99	12.00
6 (11–12)	23.39	5.77	22.09	5.21	14.88	4.00	16.71	3.35	17.72	4.75	18.30	4.15	55.99	13.29	57.12	11.34
7 (12–13)	23.64	5.26	22.39	5.41	14.88	3.93	16.45	3.53	17.78	4.50	18.35	4.40	56.39	12.33	57.16	12.01
8 (13–14)	24.62	5.10	23.03	5.52	15.97	3.77	17.05	3.26	19.07	4.46	18.62	4.55	59.72	12.19	58.59	12.08
9 (14–15)	25.11	4.92	23.73	5.55	16.00	3.70	17.39	3.44	19.04	4.61	18.96	4.64	60.36	12.00	60.04	12.22
Sex	78.88***				284.13***				21.44**				6.86**			
Grade	36.70***				25.35***				13.33***				29.67***			
Sex × grade	0.54				1.20				2.26*				1.30			

* $p < 0.05$.
 ** $p < 0.01$.
 *** $p < 0.001$.

during movement subclass. In addition, the main effect of gender was higher in boys than in girls, and the main effect of school grade tended to increase as the grade level increased. The main effects of gender ($F(1, 6251) = 284.13, p < 0.001$) and school grade ($F(10, 6251) = 25.35, p < 0.001$) were significant in the fine motor subclass, while the interaction effect ($F(10, 6251) = 1.20$) was not significant. The main effect of gender was higher in girls than in boys, and the main effect of school grade tended to increase as the grade level increased. The main effects of gender ($F(1, 6231) = 21.44, p < 0.001$) and school grade ($F(10, 6231) = 13.33, p < 0.001$) and the interaction effect ($F(10, 6231) = 2.26, p < 0.001$) were significant in the general coordination subclass. The simple main effect by school grade was significant in the middle class students of the nursery school ($F(1, 6231) = 5.07, p < 0.001$), the elementary Year 1 schoolchildren ($F(1, 6231) = 14.60, p < 0.001$), and the Year 2 children ($F(1, 6231) = 17.14, p < 0.001$), and was higher in girls than in boys. The simple main effect of school grade was significant in both genders, boys ($F(10, 6231) = 11.86, p < 0.001$) and girls ($F(10, 6231) = 3.50, p < 0.001$), but the difference in school grade tended to be greater in boys than in girls. When the total scores of the DCDQ-J were analyzed using two-way ANOVA, the main effect of gender ($F(1, 6150) = 6.86, p < 0.01$) and that of school grade ($F(10, 6150) = 29.67, p < 0.001$) were significant, while the interaction effect ($F(10, 6150) = 1.30$) was not significant. The main effect of gender was greater in girls than in boys, and the main effect of school grade tended to increase as the grade level increased.

A main effect of school grade was observed at the subscale level and the total scores of the DCDQ-J; thus, the tendency of their developmental changes was evaluated using multiple regression analysis. The 1st to the 10th items were prepared by assigning a value of 1–11 to the middle class students of the nursery school through to Year 9 students. The influence of gender against each subscale and the total score were controlled at Step 1, and the items regarding their school grade from the 1st to the 10th were input by using a forward selection method at Step 2. The first item was significant in the control during movement subclass ($\beta = 0.23, p < 0.001$), and it tended to increase as the grade level increased. In the fine motor subclass, the first item was significant ($\beta = 0.17, p < 0.001$), and it tended to increase as the grade level increased. In the overall coordination subclass, an interaction of gender and school grade was observed, so that multiple regression analysis by gender was performed. The 2nd item was significant in boys ($\beta = 0.17, p < 0.001$), and in girls ($\beta = 0.09, p < 0.001$), and it increased as the grade level increased. In the total scores of DCDQ-J, the first item was significant ($\beta = 0.21, p < 0.001$), and it tended to increase as the grade level increased. Fig. 1 shows the plot of scores by school grade and the approximation curve.

3.3. Subgroups of coordination

Using the standard scores of the 3 subscales of the DCDQ-J, *k*-means clustering was performed to study the subgroups of coordination by changing the number of clusters from 2 to 4. In consideration of the interpretive potentiality, a 4-cluster analysis was used. Fig. 2 shows the subscale scores of the DCDQ-J by cluster. All of the subscale scores of Cluster 1 ($n = 1414, 22.87\%$) were lower than the mean value; especially, the subscale score of the fine motor subclass was low. Therefore, Cluster 1 was defined as a “poor fine motor group.” Cluster 2 ($n = 2307, 37.31\%$) was characterized as having high subscale scores, and it was defined as an “excellent coordination group.” The subscale score of fine motor alone in Cluster 3 ($n = 1377, 22.27\%$) was greater than the mean value, and other 2 subscale scores were lower than the mean value, and it was defined as an “excellent fine motor group.” All of the subscale scores of Cluster 4 ($n = 1086, 17.56\%$) were far lower than the mean values, and it was defined as a “poor coordination group.”

The frequency of cluster occurrence was studied when school grade and gender were different. The bias between the cluster and school grade was significant ($\chi^2(30) = 294.66, p < 0.001$). As the grade level increased, the number of participants

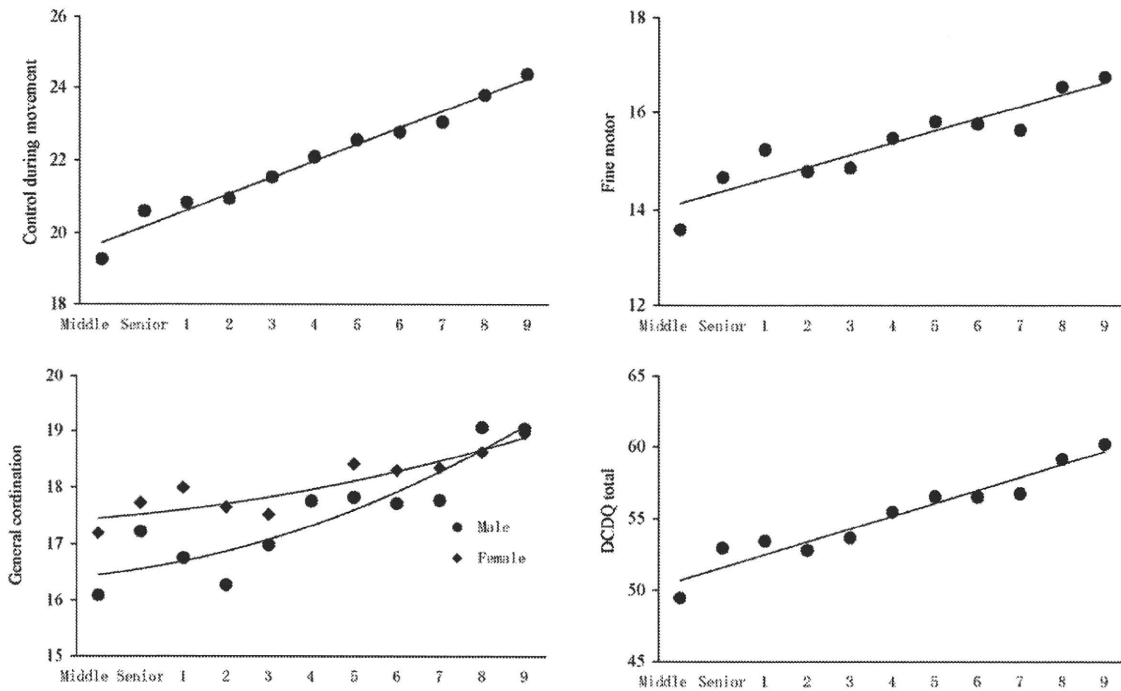


Fig. 1. The score of Japanese version of Developmental Coordination Disorder Questionnaire by grade.

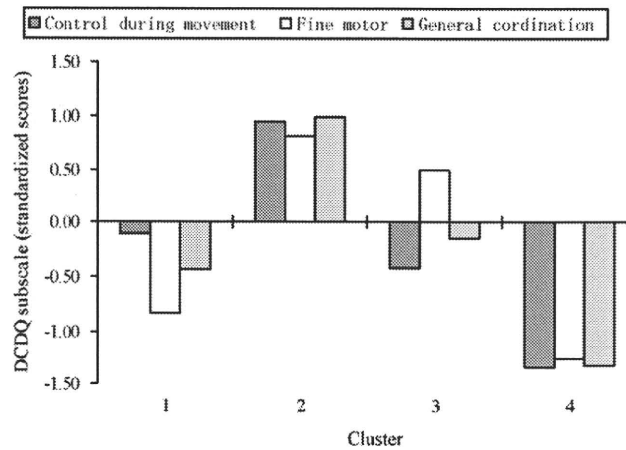


Fig. 2. The score of Japanese version of the Developmental Coordination Disorder Questionnaire subscales by cluster (standardized scores).

in the excellent coordination group increased, while those in the poor coordination group decreased (Fig. 3). The frequency of cluster occurrence of the other 2 groups was approximately 20% regardless of their school grade. In addition, there was a significant bias between the cluster and gender ($\chi^2(3) = 275.13, p < 0.001$), which indicated that the poor fine motor group had more boys than girls, while the excellent fine motor group had more girls (Fig. 4).

3.4. Relationship of the DCDQ-J with intelligence and ADHD-RS

In the Japanese version ADHD-RS, each subscale was averaged, and the resulting data was defined as inattentive ($\alpha = 0.90$) and hyperactive/impulsive ($\alpha = 0.86$); further, the total score of all items indicated ADHD tendencies ($\alpha = 0.93$). The correlation between the subscales was 0.75. The correlation coefficient between the DCDQ-J, the IQ, and the Japanese version ADHD-RS was calculated (Table 3). The 3 subscale scores and the total scores of the DCDQ-J were slightly positively associated with intelligence. Furthermore, a negative correlation of -0.2 to -0.5 was observed between the 3 subscale scores and the total scores of the DCDQ-J and the Japanese version ADHD-RS.

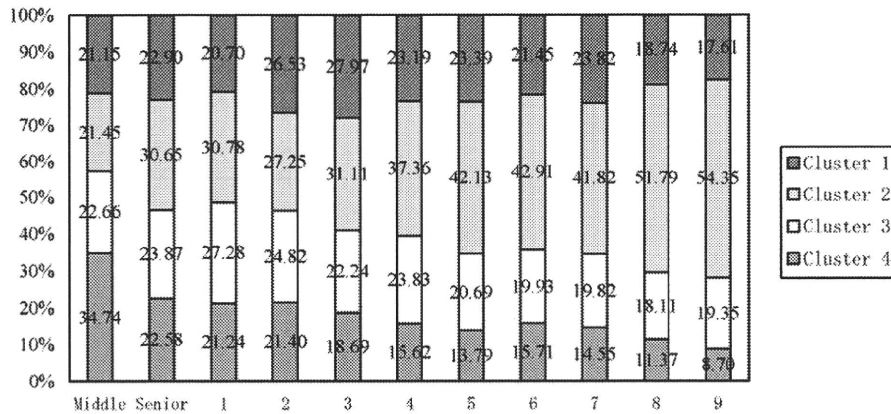


Fig. 3. The frequency ratio of each cluster by grade.

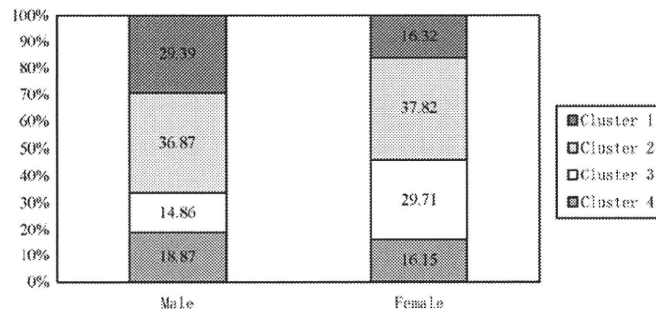


Fig. 4. The frequency ratio of each cluster by sex.

4. Discussion

This study was undertaken in a large sample of Japanese children by using DCDQ-J, ADHD-RS, and the New Kyoken Support to Intelligence Tests to establish relationships among coordination, ADHD tendencies, and intelligence. In this study, differences in development were evaluated, taking into consideration that motor skills increase with age and that the scores of control during movement and fine motor subclasses tend to increase linearly as the grade level increases. The general coordination changed non-linearly regardless of gender, and the scores tended to increase sharply as the grade level increased. The mean value and the development-related changes obtained in this study may be useful to study normal development of coordination and for screening of DCD in Japanese children.

When the subgroups of coordination were studied using the DCDQ-J, they were classified into 4 groups, including the poor fine motor group, the excellent coordination group, the excellent fine motor group, and the poor coordination group. Among these groups, the number of the participants in the excellent coordination group increased as the grade level increased, while those in the poor coordination group decreased. Furthermore, the poor fine motor group had more boys, while the excellent fine motor group had more girls. There were various patterns, for example, children with poor coordination were the weakest at fine motor or poor at all physical exercises, and the frequency of these patterns varied depending on their school grade and/or gender. Accordingly, special attention should be paid to children with clumsiness to determine the kind of movement that is their weak point, in consideration of their school grade and gender.

Table 3
 Relationship between Developmental Coordination Disorder Questionnaire and intelligence quotient or attention-deficit hyperactivity disorder-rating scale.

	DCDQ			
	Control during movement	Fine motor	General coordination	DCDQ total
IQ	.12***	.14***	.11***	.14***
ADHD-RS				
Inattention	-.26***	-.46***	-.48***	-.43***
Hyperactive-Impulsive	-.19***	-.36***	-.35***	-.33***
ADHD total	-.24***	-.45***	-.45***	-.41***

*** $p < 0.001$.

The DCDQ-J was related to the ADHD tendencies in children. Previous studies have mentioned that DCD is associated with ADHD, and that children with ADHD present clumsiness (Fox & Lent, 1996; Kopp et al., 2010; Lingam et al., 2010). In this study as well, all subscales and total scores of the DCDQ-J were significantly associated with the Japanese version ADHD-RS, which suggested that children with poor coordination more frequently showed inattention and hyperactivity in some situations. On the other hand, there was almost no relationship between scores of the DCDQ-J and the IQ. The correlation between the subscales and the total score of the DCDQ-J and their IQ ranged from 0.1 and 0.2, and children with poorer coordination tended to have lower IQs, but the relationship was very weak. Considering that the IQ should be within the normal limit in the diagnosis criteria of DCD by DSM-IV (2000), this study indicates that the DCDQ-J has some degree of validity and may be a useful screening tool for DCD in Japan.

5. Limitation and perspectives

Only the questionnaire survey was done in this study, which was not intended to provide a medical diagnosis of DCD. In countries other than Japan, the cutoff value of the DCDQ is set in terms of the medical diagnosis as well as other batteries of tests (Schoemaker et al., 2006; Tseng, Fu, Wilson, & Hu, 2010; Wilson et al., 2000, 2009). Therefore, the predictive validity of the DCDQ-J should be studied in Japan in the future.

Conflict of interests

The authors have no conflict of interests to declare.

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Research in Developmental Disabilities



Japanese version of home form of the ADHD-RS: An evaluation of its reliability and validity

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ABSTRACT

Using the Japanese version of home form of the ADHD-RS, this survey attempted to compare the scores between the US and Japan and examined the correlates of ADHD-RS. We collected responses from parents or rearers of 5977 children (3119 males and 2858 females) in nursery, elementary, and lower-secondary schools. A confirmed factor analysis of ADHD-RS confirmed the two-factor solution (Inattentive and Hyperactive-Impulsive) same as previous studies. ADHD-RS scores were not related to IQ, but were negatively associated with standardized achievement test scores. Males showed stronger ADHD tendencies than did the females, and the scores ended to decline as the children grew older. Japanese children scored lower than did their US children in Hyperactive-Impulsive among all of the sex-age groups. Japanese version of home form of the ADHD-RS was developed with good reliability and validity. More researches of ADHD in Japanese children are required.

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1. Introduction

The Developmental Disabilities Support Act, which was enforced in 2005, marked the start of individual supports to children with developmental disabilities in the Japanese educational system. Prior to it, in 2002, a research team of the Ministry of Education, Culture, Sports, Science and Technology conducted a survey of 41,579 school children in five regions of Japan. This survey, named “a nationwide survey of children and students going to regular classes in need of individual educational support,” interviewed classroom teachers about the following: students’ learning, which covered learning disorders; students’ interpersonal relationships, which covered pervasive developmental disorders; and behavior and attention, which covered ADHD. As a result, the survey found out that 6.3% of the children and students surveyed had some developmental disorders and were in need of educational help (The Ministry of Education, Culture, Sports, Science and Technology, 2003). This finding proved to be very persuasive and accelerated the shift of the emphasis in the Japanese educational system for the children with developmental disabilities towards education with special support education. The survey also found that 2.5% of the children surveyed showed obvious characteristics of ADHD, although this figure was smaller than that of the US. At that time, the concept of developmental disorders was yet to spread enough in Japan, thus this figure was surprising one.

Currently, Attention Deficit-Hyperactivity Disorder (ADHD) is defined as follows: (a) some signs of inattention or hyperactivity-impulsivity have been present for at least 6 months to a point that is disruptive and inappropriate for

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developmental level; (b) some signs that cause impairment were present before age 7 years; (c) some impairment from the signs is present in two or more settings; (d) there must be clear evidence of significant impairment in social, school, or work functioning; (e) the signs do not happen only during the course of a pervasive developmental disorder, schizophrenia, or other psychiatric disorder (American Psychiatric Association, 1994). In particular, the evaluation of children's behaviors with ADHD at school has come to be more important, especially after early childhood. After entering the elementary school, more children become to express maladaptive behaviors in their classroom, and educational supports for the behaviors are required. In addition, children with ADHD often have some academic problems. They tend to show problems of continuing poor academic performance inadequate to their intelligence compared to other mental disorders (McConaughy, Achenbach, & Gent, 1988). This is a major problem with the ADHD (Barkley, 1998).

In another study, we paid attention to school settings where ADHD syndromes tend to emerge and attempted to standardize the Japanese version of home form of the ADHD-Rating Scale-IV (ADHD-RS: DuPaul, Power, Anastopoulos, & Reid, 1998). The effectiveness of ADHD-RS as a tool of initial screening was confirmed (DuPaul, Power, McGoey, Ikeda, & Anastopoulos, 1998).

There are some hypotheses about the links between ADHD and poor academic performance. Silver (1990) pointed out that while ADHD children have no problem with their intelligence itself, they lose their opportunities of learning because of the major ADHD behaviors (inattention, impulsiveness, and hyperactivity) they have, which results in their poor performance. On the other hand, McGee and Share (1988) claimed that children with ADHD have some academic skill problems and their lowered academic self-concept causes the behavior problems such as inattention and impulsiveness. Because there are different groups of children with ADHD and learning disorders, it is possible that different causes related to the problematic behaviors in each group, rather than just one hypothesis is generally true (Hinshaw, 1992).

Children with ADHD have the propensity to be easily affected by environmental factors. Thus, their behaviors need to be evaluated from different viewpoints in different situations, and, it is very important to assess children's ADHD tendencies at home as well as school setting. As known, any intervention with children with ADHD should begin with appropriate assessment. For a child to be diagnosed with ADHD, symptoms must be observable in him/her at least in two different situations, as stated in the definition above. In addition, for diagnosis by a child psychiatrist, he/she needs some other providers of relevant information (DuPaul & Stoner, 2003). If children show different ADHD-like symptoms in different situations, for instance at school and at home, some specific environmental factors might affect their problematic behaviors. One of a good measuring scales for evaluation by parents is Conners' Parent Rating Scales – Revised developed by Conners, Sitarenios, Parker, and Epstein (1998). It contains 80 items of seven factors (27 items in the shorter version), and is thus believed to be good for detailed evaluation of children's behaviors. Still, it has too many items to be used for screening of children. Another scale of this type, the ADHD-Rating Scale-IV (ADHD-RS) developed by DuPaul, Power, Anastopoulos, et al. (1998) and DuPaul, Power, McGoey, et al. (1998), complies with the diagnostic criteria of DSM-IV and is standardized based on abundance of data. This ADHD-RS is relatively easy to use, and is suitable for screening (DuPaul, Power, Anastopoulos, et al., 1998; DuPaul, Power, McGoey, et al., 1998).

In this study, we attempted to standardize the Japanese version of home form of the ADHD-RS. We have examined reliability and validity of this scale. For the validation, we confirmed the factor structure and examined the relationships with a children's intelligence quotient (IQ), standardized achievement scores, and school teacher ratings of needs for special care. In addition we examined the relationships with child-rearing style of the parents.

2. Method

2.1. Participants

Our survey was conducted in a city X, Aichi Prefecture, located in central Japan. This city is a residential area adjacent to the central city of the region, accommodating some 80,000 residents. The city's residents consist of many different types of households, with some commuting to the adjacent central city and others working for local offices and plants within the residential city. This city, therefore, provides appropriate data that represent the demography of Japan. We conducted a questionnaire survey with the parents or rearers of all the children going to the public nursery schools (middle [4–5] and senior [5–6] ages), elementary, and lower-secondary schools. Final data set comprised of 5977 children (3119 males and 2858 females). Our data included no children going to special education classes. Table 1 shows a breakdown of the children by their sex and school grade. There was no significant difference in the male–female ratio across the school grades covered ($\chi^2(8) = 14.22, n.s.$). Note that the number of participants differs from one variable to another.

2.2. Measures

2.2.1. ADHD-RS

We employed the Japanese version of the ADHD-Rating Scale translated by DuPaul, Power, Anastopoulos, and Reid (2008). On the basis of the ADHD criteria of DSM-IV, this scale consists of two subscales to measure the two major characteristics of ADHD, Inattentive (9 items) and Hyperactive-Impulsive (9 items). Both school and home form of the ADHD-RS have been confirmed to have sufficient reliability and validity (DuPaul, Power, Anastopoulos, et al., 1998). Our survey employed ADHD-RS and asked the parents or rearers to respond to all the items for their children, as DuPaul, Power, Anastopoulos, et al. (1998) and

Table 1
Detail of grade and sex of participants of this survey.

Grade (age)	Male	Female	Total
Nursery school			
Middle (4–5)	142	137	279
Senior (5–6)	134	137	271
Elementary school			
1 (6–7)	398	315	713
2 (7–8)	358	363	721
3 (8–9)	388	336	724
4 (9–10)	336	300	636
5 (10–11)	343	315	658
6 (11–12)	301	252	553
Lower-secondary school			
7 (12–13)	294	250	544
8 (13–14)	220	236	456
9 (14–15)	205	217	422
Total	3119	2858	5977

DuPaul, Power, McGoey, et al. (1998) did. As in the prior surveys, parents or rearer rated each item on a 4-point Likert scale ranging from “Not at all, rarely (0)” to “Sometimes (1)” to “Often (2)” and “Very often (3).” Therefore, the higher a child’s score is, the more ADHD tendency he/she has.

2.2.2. Parental rearing styles scale for parent training (PSPT)

We employed the scale to measure a parents’ or rearers’ style of rearing a child developed by Tsujii (2009). This scale consists of five subscales, Praising, Scolding, Easiness in bringing up, Social support, and Difficulty in bringing up. The reliability and validity of this scale was verified (Tsujii, 2009). Parents or rearer rated each item on a 4-point Likert scale ranging from “Does not apply at all (1)” to “Does not (usually) apply (2)” to “Hard to judge (3),” “Applies (4),” and “Applies very well (5).”

2.2.3. New Kyoken support to intelligence tests for each school grade

For elementary school children and lower-secondary school children, we measured their intelligence using New Kyoken Support to Intelligence Tests for Each School Grade, developed by Okamoto, Shibuya, Ishida, and Sakano (1993). This is a collective intelligence test conducted at the beginning of a school year to obtain each child’s intelligence quotient.

2.2.4. Kyoken norm referenced test of academic performance

For elementary school children and lower-secondary school children, we measured their academic performance. This scale is a standardized achievement test frequently used in Japan developed by Tatsuno, Ishida, Hattori, and Teachers of at Tsukuba University’s Elementary and Junior High Schools (2002). It evaluates children’s performance on a scale of 100 points in each subject. Our survey employed the children’s scores in Japanese and math. The test was conducted at the beginning of the school year.

2.2.5. Teacher ratings of needs for special care

For the first and second graders in elementary school, we asked their classroom teachers to evaluate whether or not each student needs special care in a daily class.

2.3. Procedure

For the parents or rearers, we prepared a questionnaire consisting of ADHD-RS and the PSPT, and distributed to the parents or rearers through the children’s classroom teachers in September. The survey required almost a month to complete, from September to October 2009. For the IQ and scores of the standardized achievement tests of the children as well as the ratings of children’s needs for special care, we used the teachers’ evaluations. This survey was conducted in accordance with an agreement signed by and between the city and Hamamatsu University School of Medicine. For protection of personal data, we adhered to the city’s information security policies. Thus, we paid due attention to the ethical issues related to the survey.

3. Results

3.1. Confirmatory factor analysis and reliability of ADHD-RS

We performed confirmatory factor analysis to examine the factor structure of Japanese version of ADHD-RS. Two models were compared: One presumed two factors, Inattentive and Hyperactive-Impulsive, following the prior studies (DuPaul,

Table 2
The result of confirmatory factor analysis of ADHD-RS and mean (SD) of items.

Item	F1	F2	M (SD)
<i>Inattentive</i> ($\alpha = .88$)			
Fails to give close attention to details or makes careless mistakes in schoolwork.	.55		1.06 (.69)
Has difficulty sustaining attention in tasks or play activities.	.74		.56 (.72)
Does not seem to listen when spoken to directly.	.60		.48 (.68)
Does not follow through on instructions and fails to finish work.	.71		.32 (.58)
Has difficulty organizing tasks and activities.	.72		.61 (.75)
Avoids tasks (e.g., schoolwork, homework) that require sustained mental effort.	.69		.64 (.80)
Loses things necessary for tasks or activities.	.64		.63 (.73)
Is easily distracted.	.74		.79 (.79)
Is forgetful in daily activities.	.66		.62 (.76)
<i>Hyperactive-Impulsive</i> ($\alpha = .85$)			
Fidgets with hands or feet or squirms in seat.		.62	.59 (.77)
Leaves seat in classroom or in other situations in which remaining seated is expected.		.64	.16 (.46)
Runs about or climbs excessively in situations in which it is inappropriate.		.67	.16 (.48)
Has difficulty playing or engaging in leisure activities quietly.		.72	.25 (.55)
Is "on the go" or acts as if "driven by a motor."		.70	.27 (.61)
Talks excessively.		.55	.59 (.80)
Blurts out answers before questions have been completed.		.60	.43 (.64)
Has difficulty awaiting turn.		.65	.22 (.51)
Interrupts or intrudes on others.		.64	.24 (.54)

Note. Factor correlation is .82.

Power, Anastopoulos, et al., 1998; DuPaul, Power, McGoey, et al., 1998). The other model supposed only a single factor of ADHD. We found the fit indices of the two-factor model as GFI = .91, AGFI = .89 and RMSEA = .08, all sufficient values. Although the correlation between the factors was rather high at $r = .82$, it was consistent with the value of the prior studies. Next, the single-factor model had the fit indices of GFI = .86, AGFI = .82, and RMSEA = .09, indicating poor fitness of the model. We can decide, therefore, that the two-factor structure is more appropriate. Table 2 shows the factor analysis results with the two-factor model as well as the mean and SD of the items. With all of the items, we recognized some floor effect.

We obtained Cronbach's alphas for the two subscales of ADHD-RS and found them sufficient, .88 for Inattentive and .85 for Hyperactive-Impulsive. These values show sufficient reliability of the scales.

3.2. The sex and grade differences of ADHD-RS

We conducted sex \times grade analyses of variance (ANOVA) with the two subscale scores and the total score of ADHD-RS as dependent variables (Table 3).

With Inattentive, the sex \times grade interaction effect was nonsignificant ($F(10, 5955) = 1.13, n.s.$). The main effect of sex was significant ($F(1, 5955) = 176.46, p < .001$), suggesting that males scored higher than did females. The main effect of grade was significant ($F(10, 5955) = 4.56, p < .001$). Second grader scored higher than first, sixth, and ninth graders did. Third graders scored higher than first and ninth graders did. And, fourth graders scored higher than did first graders.

With Hyperactive-Impulsive, the sex \times grade interaction effect was significant ($F(10, 5955) = 3.08, p < .01$). Simple main effects of the sex were significant on the middle nursery through seventh grade children, with the males scoring higher than the females across all those grades. The simple main effects of grade was significant both in males and females, suggesting that higher their grade is, lower they scored.

With the total score of ADHD-RS, the sex \times grade interaction effect was nonsignificant ($F(10, 5955) = 1.82, n.s.$). The main effect of sex was significant ($F(1, 5955) = 210.32, p < .001$), suggesting that males scored higher than did females. The main effect of grade was significant ($F(10, 5955) = 10.40, p < .001$). Middle nursery and second graders scored higher than first graders and fifth through ninth graders did. Senior nursery and fourth graders scored higher than eighth and ninth graders did. First graders scored higher than did ninth graders. And, fourth graders scored higher than sixth through ninth graders did.

3.3. Comparison between Japanese data and USA data of ADHD-RS

We compared the Japanese ADHD-RS scores obtained in our survey to those of the US collected by DuPaul, Power, Anastopoulos, et al. (1998) and DuPaul, Power, McGoey, et al. (1998). The scores are presented in Table 4. Note that we compared only three age groups, 5–7 years of age, 8–10 years of age, and 11–13 years of age, since our participants were limited in age. Also, it is a very common that children are grouped not by their physical age but by their school grades when examining the developmental differences in Japan. For this reason, our survey grouped the participants according to their school grades to match the age classifications of DuPaul, Power, Anastopoulos, et al. (1998) and DuPaul, Power, McGoey, et al. (1998) for this comparison.

Our analysis found no significant difference in the Inattentive in any of the boy groups between the two nations. Among the females, a significant difference was found only in the group aged 8 through 10 (second through fourth graders), with the

Table 3
Two-factor analyses of variance (ANOVA) of scale scores of ADHD-RS by sex and grade with Bonferroni multiple comparison ($p < .05$).

Grade (age)	Male	Female	Sex × Grade		Sex	Grade
	M (SD)	M (SD)	F		F	F
Inattention			1.13		176.46***	4.56***
Middle (4–5) ¹	6.51 (5.07)	4.94 (4.32)			M > F	4 > 3, 8, 11
Senior (5–6) ²	5.96 (3.88)	4.78 (3.99)				5 > 3, 11
1 (6–7) ³	5.71 (4.30)	4.53 (3.64)				6 > 3
2 (7–8) ⁴	7.41 (5.48)	5.17 (4.41)				
3 (8–9) ⁵	7.10 (5.20)	5.25 (4.42)				
4 (9–10) ⁶	7.01 (5.09)	5.01 (3.93)				
5 (10–11) ⁷	6.50 (5.21)	4.70 (3.99)				
6 (11–12) ⁸	6.58 (5.30)	4.27 (3.98)				
7 (12–13) ⁹	6.40 (4.86)	4.63 (4.16)				
8 (13–14) ¹⁰	6.08 (4.94)	4.68 (3.95)				
9 (14–15) ¹¹	5.75 (4.77)	4.64 (4.11)				
Hyperactive-Impulsivity			3.08**		188.60***	27.38***
Middle (4–5) ¹	5.43 (4.87)	3.68 (3.54)	16.95***	M > F	M > F	1 > 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Senior (5–6) ²	4.93 (4.71)	3.23 (3.60)	15.37***	M > F		2 > 6, 7, 8, 9, 10, 11
1 (6–7) ³	3.90 (3.82)	2.67 (3.02)	20.89***	M > F		3, 4, 5 > 7, 8, 9, 10, 11
2 (7–8) ⁴	4.55 (4.52)	2.41 (2.86)	65.61***	M > F		6 > 9, 10, 11
3 (8–9) ⁵	4.24 (4.42)	2.61 (3.71)	37.80***	M > F		7, 8 > 10, 11
4 (9–10) ⁶	3.65 (4.25)	2.09 (2.70)	30.64***	M > F		
5 (10–11) ⁷	3.16 (4.06)	1.99 (2.87)	17.64***	M > F		
6 (11–12) ⁸	3.33 (4.07)	1.62 (2.41)	31.68***	M > F		
7 (12–13) ⁹	2.70 (3.50)	1.62 (2.91)	12.34***	M > F		
8 (13–14) ¹⁰	1.95 (2.71)	1.47 (2.02)	2.12			
9 (14–15) ¹¹	1.80 (2.71)	1.49 (2.71)	.79			
			M: 22.32***	1 > 3, 5, 6, 7, 8, 9, 10, 11 2 > 6, 7, 8, 9, 10, 11 3 > 9, 10, 11 4 > 6, 7, 8, 9, 10, 11 5 > 7, 8, 9, 10, 11 6 > 9, 10, 11 7, 8 > 10, 11		
			F: 7.99***	1 > 3, 5, 6, 7, 8, 9, 10, 11 2 > 7, 8, 9, 10, 11 3, 5 > 8, 9, 10, 11		
ADHD-RS total			1.82		210.32***	10.40***
Middle (4–5) ¹	11.94 (9.41)	8.62 (7.31)			M > F	1, 4 > 3, 7, 8, 9, 10, 11
Senior (5–6) ²	10.88 (8.02)	8.01 (7.14)				2, 6 > 10, 11
1 (6–7) ³	9.61 (7.57)	7.20 (6.15)				3 > 11
2 (7–8) ⁴	11.96 (9.46)	7.58 (6.66)				5 > 7, 8, 9, 10, 11
3 (8–9) ⁵	11.34 (9.00)	7.86 (7.60)				
4 (9–10) ⁶	10.66 (8.79)	7.11 (6.01)				
5 (10–11) ⁷	9.66 (8.70)	6.70 (6.38)				
6 (11–12) ⁸	9.91 (8.79)	5.88 (5.92)				
7 (12–13) ⁹	9.10 (7.68)	6.25 (6.58)				
8 (13–14) ¹⁰	8.03 (7.17)	6.15 (5.46)				
9 (14–15) ¹¹	7.55 (6.88)	6.13 (6.36)				

** $p < .01$.
*** $p < .001$.

Japanese females scoring higher than their US counterparts. In Hyperactive-Impulsive, in all of the groups, both males and females, the Japanese children scored lower than did the children in the US. In total score, a significant difference was found in the males and females aged second through seventh (senior nursery through first graders) and the males of aged 11 through 13 (fifth through seventh graders). In any of these groups, the Japanese children scored below their US counterparts.

3.4. Correlations of ADHD-RS with study variables

Table 5 shows the correlations between ADHD-RS and the study variables. The correlations between ADHD-RS and IQ were nearly zero, while the correlations between ADHD-RS and standardized achievement test scores were significant and negative in all cases although the values were small. Totally, ADHD-RS shows significant relationships with PSRT. ADHD-RS was negatively related to Praising, Easiness in bringing up, and Social support, and positively related to Scolding and Difficulty in Bringing up.

Table 4
Descriptive statistics of home form of the ADHD-RS.

Age (grade in Japan)	This study				DuPaul, Power, Anastopoulos, et al. (1998) and DuPaul, Power, McGoey, et al. (1998)				Comparison between country	
	Male		Female		Male		Female		Male	Female
	N	M (SD)	N	M (SD)	N	M (SD)	N	M (SD)	t	t
Inattention										
5–7	532	5.77 (4.20)	452	4.60 (3.75)	353	5.94 (5.08)	314	4.51 (4.45)	.51	.31
8–10 (2–4)	1082	7.17 (5.26)	999	5.15 (4.28)	289	6.65 (5.33)	327	4.17 (4.36)	1.49	3.54**
11–13 (5–7)	938	6.49 (5.13)	817	4.54 (4.04)	149	6.70 (6.27)	173	4.61 (5.12)	.38	.16
14–18	–	–	–	–	133	5.70 (5.36)	225	4.07 (4.57)		
Hyperactive-Impulsive										
5–7	532	4.16 (4.09)	452	2.84 (3.22)	353	6.59 (5.56)	314	5.00 (4.53)	7.05**	7.25**
8–10 (2–4)	1082	4.16 (4.41)	999	2.38 (3.13)	289	5.53 (5.25)	327	3.39 (3.79)	4.06**	4.34**
11–13 (5–7)	938	3.07 (3.90)	817	1.76 (2.75)	149	4.79 (5.54)	173	2.88 (3.48)	3.64**	3.95**
14–18	–	–	–	–	133	3.68 (4.32)	225	3.29 (3.82)		
ADHD total										
5–7	532	9.93 (7.70)	452	7.45 (6.47)	353	12.54 (9.97)	314	9.51 (8.17)	4.16**	3.73**
8–10 (2–4)	1082	11.33 (9.09)	999	7.53 (6.81)	289	12.18 (9.81)	327	7.56 (7.51)	1.32	.06
11–13 (5–7)	938	9.56 (8.42)	817	6.31 (6.31)	149	11.50 (11.32)	173	7.49 (7.84)	2.00*	1.85
14–18	–	–	–	–	133	9.38 (8.96)	225	7.36 (7.74)		

* $p < .05$.** $p < .01$.**Table 5**
Correlations of ADHD-RS with study variables.

	Inattention	Hyperactive-Impulsive	ADHD total
IQ ($N = 4141$)	-.09*	-.08	-.09
Standard achievement test			
Japanese ($N = 4390$)	-.17**	-.13**	-.16***
Math ($N = 4390$)	-.16***	-.11***	-.15***
Parental rearing styles			
Praising ($N = 5354$)	-.36***	-.25***	-.34***
Scolding ($N = 5409$)	.42***	.38***	.43***
Easiness to bring up ($N = 5380$)	-.32***	-.28***	-.33***
Social support ($N = 5356$)	-.17***	-.12***	-.16***
Difficulty in bring up ($N = 5374$)	.32***	.24***	.31***

* $p < .05$.** $p < .01$.*** $p < .001$.

3.5. Comparison between students with and without needs for special care

We compared the ADHD-RS scores between children with needs for special care and those without the needs rated by their school teachers (Table 6). Students who need special care scored significantly higher in two subscale scores and total score. This suggests that intensity of the ADHD tendency evaluated by their parents or rearers was consistent with teachers' evaluation of needs for special care.

4. Discussion

4.1. Factor structure, reliability, and validity of ADHD-RS in Japan

We examined the factor structure of ADHD-RS by using a confirmatory factor analysis and found that a two-factor structure of Inattentive and Hyperactive-Impulsive fit the data, consistent with prior studies (DuPaul, Power, Anastopoulos,

Table 6
The comparison between students who need special care and who do not need special care in ADHD-RS scores.

	Children without needs for special care		Children with needs for special care		t
	N	M (SD)	N	M (SD)	
Inattention	1388	4.88 (4.57)	49	10.20 (6.66)	-5.55***
Hyperactive-Impulsive	1410	2.92 (3.62)	50	6.22 (5.75)	-4.03***
ADHD total	1386	7.75 (7.64)	48	16.46 (11.63)	-5.15***

*** $p < .001$.

et al., 1998; DuPaul, Power, McGoey, et al., 1998). With the reliability of the scale, we obtained sufficient alpha coefficients, indicating good reliability. Future studies should examine the reliability with the test–retest method.

We examined the validity of the scales in terms of the relationships with IQ and standardized achievement tests (Japanese and math). As a result, we found almost no relationships between the ADHD-RS scores and IQ, while there were significant negative relationships between the ADHD-RS scores and standardized achievement test scores. These results agree with DuPaul and Stoner (2003), who suggested that ADHD has nothing to do with IQ but negative relationships with academic achievements, thus suggesting the scale's validity.

We also compared the scores of the children with and without needs for special care evaluated by teachers, and found that the children with needs for special care scored significantly higher than the children without the needs. Since this result is agreement with DuPaul, Power, Anastopoulos, et al. (1998) and DuPaul, Power, McGoey, et al. (1998), it suggests the construct validity of the Japanese version of home form of the ADHD-RS. Parents may be capable of seeing their children's ADHD tendencies from multiple viewpoints to some extent.

4.2. Sex and grade differences of ADHD-RS scores in Japan

Our analyses of variance yield significant sex \times grade interaction effects for Hyperactive-Impulsive. Among both the females and males, the grade was found to have a significant simple main effect, with the score coming down as the grade went up. Also, among the middle nursery children through seventh graders, the sex had a significant simple main effect, with the males always scoring higher than their female children. This analysis in terms of interactions suggested that the difference between the two sexes, which was evident among lower-grade children, diminished as children grew older until it finally disappeared.

The sex had a significant simple main effect, with the males showing stronger ADHD tendencies than the females. This finding is in agreement with the results of DuPaul, Power, Anastopoulos, et al. (1998) and DuPaul, Power, McGoey, et al. (1998), which shows that males show stronger ADHD tendencies than females do in Japan as well. This also agrees with the common impression held at classrooms.

4.3. Difference between Japanese data and USA data of ADHD-RS scores

We compared the scores between the US and Japan and found that the Japanese children scored lower than their US children on Hyperactive-Impulsive in all the age groups, both males and females. In contrast, in Inattention, no significant difference was found between the two nations, in any age group of males. In addition, Japanese females aged 8 through 10 scored higher than US children. Because the results in Hyperactive-Impulsive were in line with the corresponding comparison results of teachers' evaluations, many Japanese children might have less hyperactive tendency than do the US ones. In Japanese culture characterized by collectivism, everyone is appreciated for reading the situation and not disturbing anyone else (Jonhson, 1993; Markus & Kitayama, 1991). This cultural norm is internalized into children by their parents' discipline and teachers' education. As they grow up in this Japanese culture, they might learn to suppress their hyperactivity. On this issue, Barkley (1998) compared the US and Japanese children in terms of introversion, a dimension of personality deeply related to hyperactivity, and found that many Japanese children are more introverted than their US children, which supports our understanding of our comparison result.

On the other hand, in inattention, no significant difference was found between the two nations among males, while the Japanese females of the 8 through 10 age groups scored higher than did their US children. This contradicts the comparison results of teachers' evaluations. Of this, we can have different interpretations: it might suggest some characteristics of many Japanese females of this age group, or it might reflect some characteristics of their parents' evaluation frameworks. Since no significant difference was found in any other age groups of females or in any age group of males, we can conclude that no significant difference exists between the US and Japan, as a whole. Currently, no clear-cut interpretation is available, and more researchers are required.

4.4. The relationships between ADHD-RS and PSPT

We had exploratory analysis of the correlation between ADHD-RS scores and the parental rearing styles. As a whole, ADHD-RS showed significant relationships with parental rearing styles. While Praising, Easiness in bringing up, and Social support were negatively associated with ADHD-RS, Scolding and Difficulty in bringing up were positively associated with ADHD-RS. These findings suggest that parents or rearers who consider their children as having high ADHD tendencies scold their children more often than praising them and find it difficult to bring up a child. At the same time, we saw a tendency among these parents or rearers that they do not enjoy bringing up a child. In Europe and North America, generally, researchers have pointed out that many of the parents or rearers of ADHD children scold their children very often and do not praise them often (Barkley, 1995). Our survey results agree with this, suggesting that similar tendencies exist in Europe, North America, and Japan. In Japan, parents or rearers often tell their children to consider other people's viewpoints and not to disturb others or make them unhappy. This is the way a child is expected to control his/her behaviors in Japan (Jonhson, 1993). In doing so, parents or rearers often tell the children to consider emotions and empathize with others, in order to make the children follow their instructions. This is in strong contrast to the Western way (Doi, 1971). Even many Japanese parents

or rearers become overstressed by some ADHD symptoms and scold the child more and praise them less. For the reason, parents or rearers found it hard to bring up their children. “Easiness in bringing up” is the scale for measuring behaviors in early childhood (Tsujii, 2009). We found a negative correlation between ADHD-RS and this subscale. This suggests that children with ADHD have some temperaments that made it hard for parents or rearers to bring up. There is the study reporting the relationships between ADHD and young children’s temperaments (Barkley, 1998). The results of this study agree with this study.

4.5. Limitation and perspectives

We conducted a large-scale survey using the home form of the ADHD-RS to compare the scores between the US and Japan and to examine the correlates of ADHD-RS and the sex and grade differences of ADHD tendency. We have found that ADHD-RS has sufficient reliability and validity, and provided a basic data of ADHD in Japanese children. However, some parts of our results did not agree with some prior studies and what we know from our experiences. For instance, while some researchers suggested the link between ADHD and academic problems (Barkley, 1998; McConaughy et al., 1988), parents or rearers’ rated inattention was not related to academic performance in this study. We consider that this difference reflects the different viewpoints of evaluators. Parents’ or rearers’ evaluations based on the children’s behaviors at home can separate inattention from academic performance. This suggests that it is important to use assessment from multiple viewpoints. Inattention evaluated by teachers comes from children’s behavior in their classroom, and it may differ from inattentive behavior evaluated by parents or rearers. In addition, in our survey results, the second graders scored higher than the first graders and middle or senior nursery children did. This result is in contradiction with research results outside Japan. This result suggests that standards of evaluation vary with children’s age in Japan. Thus, more researches are required in ADHD screening measurement by parents or rearers. It is needed to include more items tapping the behaviors that are hard to evaluate and to set up cutoff values for each age group. Moreover, though this surveyed covered only nursery, elementary and lower-secondary children, a future survey should cover a broader range of schools to reveal developmental differences.

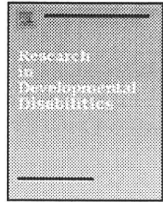
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Japanese version of school form of the ADHD-RS: An evaluation of its reliability and validity

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ABSTRACT

Using the Japanese version of school form of the ADHD-RS, this survey attempted to compare the scores between the US and Japan and examined the correlates of ADHD-RS. The classroom teachers of 7414 children (3842 males and 3572 females) evaluated all the children's behaviors. A confirmed factor analysis of ADHD-RS confirmed the two-factor solution (Inattentive and Hyperactive-Impulsive) same as previous studies. ADHD-RS scores were not related to IQ, but were associated with standardized achievement test scores. Males showed stronger ADHD tendencies than did the females, and the males tended to score lower as they grew older. Our comparison of the scores between the US and Japan found the Japanese children scored lower than did their US children. Japanese version of school form of the ADHD-RS with good reliability and validity was developed. More researches of ADHD in Japanese children are required.

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1. Introduction

The concept and definition of attention deficit-hyperactivity disorder (ADHD) have been debated. Currently, the debates are narrowing down to a definition set forth by the American Psychiatric Association (1994): (a) some signs of inattention or hyperactivity-impulsivity have been present for at least six months to a point that is disruptive and inappropriate for developmental level; (b) some signs that cause impairment were present before age 7 years; (c) some impairment form the signs is present in two or more settings; (d) there must be clear evidence of significant impairment in social, school, or work functioning; (e) the signs do not happen only during the course of a pervasive developmental disorder, schizophrenia, or other psychiatric disorder.

An epidemiological survey has found that around 3 to 7% of all the school children in the US can be diagnosed as ADHD (Barkley, 1998). In addition, according to this survey, about 80% of those children diagnosed as ADHD patients carry their symptoms into their adolescence, and about 30–65% into their adulthood. Furthermore, a significant difference in the prevalence rate is also confirmed between the two sexes, with the male–female ratio in the general population reported to be 2.5:1 to 5.1:1. The US and some other nations of Europe and North America have been accumulating basic data on the disorder.

In Japan, we have epidemiological data from a survey conducted by a research team of the Ministry of Education, Culture, Sports, Science and Technology in 2002 of 41,579 school children in five regions of the nation. This survey, named “a nationwide survey of children and students going to regular classes in need of individual educational support,” was conducted on the basis of the Developmental Disabilities Support Act enforced in 2005. The survey interviewed the school teachers about the following: students' learning, which covered learning disorders; students' interpersonal relationships,

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which covered pervasive developmental disorders; and students' behavior and attention, which covered ADHD. As a result, the survey found out that 6.3% of the students surveyed had some developmental disorders and were in need of special educational help (Ministry of Education, Culture, Sports, Science and Technology, 2003). This result was a sensational one, which accelerated the shift of the emphasis in the Japanese special educational system, which traditionally focused on special education to the children with mental retardation (1.4% of the nation's whole school children), towards education with special support education. The survey also found that 2.5% of the children surveyed showed obvious characteristics of ADHD, although this figure was smaller than that of the US at that time. This may be partly because the concept of developmental disorders had yet to recognize in Japanese school education, so teachers and parents did not have a good viewpoint or a framework for evaluating problematic behaviors. However, over the last several years, Japanese society has made remarkable progress improving its understanding of and support for developmental disorders. This would yield a major new trend radically different from the one found in 2002. Therefore, we have conducted another teacher-evaluated survey using a survey format, ADHD-RS, similar to the one employed in 2002 but more sophisticated.

An ADHD-RS survey conducted by classroom teachers of their own children can be helpful to the teachers themselves, as they can identify the children with ADHD who need support. Three types of rating scales of ADHD tendencies are currently available: those rated by parents, teachers, and children themselves. In general, in case an ADHD child works on a structured task one-on-one with an adult he/she meets for the first time, individual inspections are not essential in evaluating the child's ADHD tendency. They are only supplementary and provide some data on his/her intelligence and education. In assessing ADHD tendencies, it is necessary to collect data from multiple providers of information with different viewpoints. Many preschool and school education are using a multiple-gating procedure (Feil, Walker, & Severson, 1995). DuPaul (1992) proposed a five-stage assessment model. In the first stage, a child's teacher makes rough assessment of his/her ADHD symptoms. In the second stage, the teacher interviews the child's parents and watches his/her behaviors more closely. One common rating scale for teachers is Conners' Teacher Rating Scales-Revised (CTRS-R), developed by Conners, Sitarenois, Parker, and Epstein (1998). This scale consists of 59 evaluation items corresponding to six factors (28 items in the shorter version), and therefore is believed to suit the careful observation held in this second stage. Another rating scale, the ADHD-Rating Scale-IV (ADHD-RS) developed by DuPaul, Power, Anastopoulos, and Reid (1998) complies with the diagnostic criteria of DSM-IV and is standardized based on abundance of data. ADHD-RS is relatively easy to use and is believed to be helpful in the first stage of rating (DuPaul, Power, Anastopoulos, et al., 1998; DuPaul, Power, McGoey, Ikeda, & Anastopoulos, 1998).

Building upon those existing scales, our research has attempted to standardize the Japanese version of ADHD-RS, a scale of rating a child's ADHD tendencies from a teacher's perspective. In addition, we have examined reliability and validity of this scale. For the validation, we confirmed the factor structure and examined the relationships with a children's intelligence quotient (IQ), standardized achievement scores, and teacher ratings of needs for special care.

2. Method

2.1. Participants

Our survey covered all pupils and students of the public elementary and lower-secondary schools in a city X, Aichi Prefecture, located in central Japan. This city is a residential area adjacent to the central city of the region, accommodating some 80,000 residents. The city's residents consist of many different types of households, with some commuting to the adjacent central city and others working for local offices and plants within the residential city. This city, therefore, provides appropriate data that represent the demography of Japan. We conducted a questionnaire survey of the classroom teachers of all the children going to public elementary and lower-secondary schools of this city. Final sample consisted of 7414 of these children (3842 males and 3572 females). Our data did not include children going to special education classes. Table 1 shows a breakdown of the children by their sex and school grade. There was no significant difference in the male–female ratio across the school grades covered ($\chi^2(8) = 8.11, n.s.$). Note that the number of participants differs from one variable to another.

2.2. Measures

2.2.1. ADHD-RS

We employed the Japanese version of the ADHD-Rating Scale translated by DuPaul, Power, Anastopoulos, and Reid (2008). On the basis of the ADHD criteria of DSM-IV, this scale consists of two subscales to measure the two major characteristics of ADHD, Inattentive (9 items) and Hyperactive-Impulsive (9 items). There are two forms of teacher rating (school form) and rearers' ratings (home form). The reliability and validity of the scale have been confirmed (DuPaul, Power, McGoey, et al., 1998). Our survey employed the school form, and the classroom teachers were asked to evaluate their children. As in the prior surveys, teachers rated each item on a 4-point Likert Scale ranging from "Not at all, rarely (0)" to "Sometimes (1)" to "Often (2)" and "Very often (3)." Therefore, the higher a child's score is, the more ADHD tendency he/she has.

2.2.2. New Kyoken support to intelligence tests for each school grade

We measured intelligence of the elementary and lower-secondary school children using New Kyoken support to intelligence tests for each school grade, developed by Okamoto, Shibuya, Ishida, and Sakano (1993). This is a collective intelligence test conducted at the beginning of a school year to obtain each child's intelligence quotient.

Table 1
Details of grade and sex of participants of this survey.

Grade (age)	Male	Female	Total
1 (6–7)	490	403	893
2 (7–8)	450	428	878
3 (8–9)	478	441	919
4 (9–10)	419	392	811
5 (10–11)	421	431	852
6 (11–12)	417	361	778
7 (12–13)	416	374	790
8 (13–14)	387	377	764
9 (14–15)	364	365	729
Total	3842	3572	7414

2.2.3. *Kyoken norm referenced test of academic performance*

This is a standardized achievement test frequently used in Japan developed by Tatsuno, Ishida, Hattori, and Teachers at Tsukuba University's Elementary and Junior High Schools (2002). It evaluates children's performance on a scale of 100 points in each participant. Our survey employed the children's scores in Japanese and math. The test was conducted at the beginning of the school year.

2.2.4. *Teacher ratings of needs for special care*

For the first and second graders, we asked their classroom teachers to evaluate whether or not each student needs special care in a daily class.

2.3. *Procedure*

We prepared the questionnaire, containing the four types of scales above, and visited the schools covered to hand out the questionnaire to each teacher in early August, when the schools were in the middle of a summer off. The survey took almost a month to complete, till the end of the August. This survey was conducted in accordance with an agreement signed by and between the city of X and Hamamatsu University School of Medicine. For protection of personal data, we adhered to the city's information security policies. Thus, we paid due attention to the ethical issues related to the survey.

3. Results

3.1. *Confirmatory factor analysis and reliability of ADHD-RS*

We performed confirmatory factor analysis to examine the factor structure of Japanese version of ADHD-RS. Two models were compared: One presumed two factors, Inattentive and Hyperactive-Impulsive, following the prior studies (DuPaul, Power, Anastopoulos, et al., 1998; DuPaul, Power, McGoey, et al., 1998). The other model supposed only a single factor of ADHD. We found the fit indices of the two-factor model as GFI = .90, AGFI = .87 and RMSEA = .08, all sufficient values. Although the correlation between the factors was rather high at $r = .78$, it was consistent with the

Table 2
The result of confirmatory factor analysis of Japanese version of school form of the ADHD-RS and mean (SD) of items.

Item	F1	F2	M (SD)
Inattentive ($\alpha = .91$)			
Fails to give close attention to details or makes careless mistakes in schoolwork	.73		0.34 (0.70)
Has difficulty sustaining attention in tasks or play activities	.84		0.24 (0.65)
Does not seem to listen when spoken to directly	.58		0.13 (0.47)
Does not follow through on instructions and fails to finish work	.73		0.13 (0.48)
Has difficulty organizing tasks and activities	.71		0.20 (0.59)
Avoids tasks (e.g., schoolwork, homework) that require sustained mental effort	.75		0.22 (0.65)
Loses things necessary for tasks or activities	.72		0.18 (0.58)
Is easily distracted	.81		0.27 (0.69)
Is forgetful in daily activities	.68		0.18(0.56)
Hyperactive-Impulsive ($\alpha = .88$)			
Fidgets with hands or feet or squirms in seat		.70	0.22 (0.64)
Leaves seat in classroom or in other situations in which remaining seated is expected		.70	0.09 (0.41)
Runs about or climbs excessively in situations in which it is inappropriate		.66	0.04 (0.25)
Has difficulty playing or engaging in leisure activities quietly		.75	0.10 (0.41)
Is "on the go" or acts as if "driven by a motor"		.73	0.05 (0.32)
Talks excessively		.65	0.14 (0.51)
Blurts out answers before questions have been completed		.63	0.10 (0.43)
Has difficulty awaiting turn		.71	0.06 (0.33)
Interrupts or intrudes on others		.71	0.09 (0.41)

Note: Factor correlation is .78.

value of the prior studies. Next, the single-factor model had the fit indices of GFI = .77, AGFI = .70, and RMSEA = .11, indicating poor fitness of the model. We can decide, therefore, that the two-factor structure is more appropriate. Table 2 shows the factor analysis results with the two-factor model as well as the mean and SD of the items. With all of the items, we recognized some floor effect.

We obtained Cronbach's alphas for the two subscales of ADHD-RS and found them sufficient, .91 for Inattentive and .88 for Hyperactive-Impulsive. These values show sufficient reliability of the scales.

3.2. The sex and grade differences of ADHD-RS

We conducted sex \times grade analyses of variance (ANOVA) with the two subscale scores and the total score of ADHD-RS as dependent variables (Table 3).

With Inattentive, the sex \times grade interaction effect was significant ($F(8, 7396) = 3.93, p < .001$). We had a simple main effect test and found that the sex had significant simple main effects in all the grades. In every grade, the males scored higher than the females. Another simple main effect was found with the grades in the males. For the second graders and above, the older they were, the lower their scores were. Among the females, the simple main effects of grade were nonsignificant.

With Hyperactive-Impulsive, the sex \times grade interaction effect was significant ($F(8, 7396) = 8.87, p < .001$). Simple main effects of the sex were significant on the second through seventh graders, with the males scoring higher than the females

Table 3
Two-factor analyses of variance (ANOVA) of scale scores of ADHD-RS by sex and grade with Bonferroni multiple comparison ($p < .05$).

Grade (Age)	Male	Female	Sex \times grade		Sex	Grade
	M (SD)	M (SD)	F		F	F
Inattentive			3.93***		378.69***	8.22***
1 (6–7)	2.26 (4.57)	0.83 (2.42)	28.13***		M > F	2 > 1, 5, 6, 8, 9
2 (7–8)	3.78 (5.67)	1.17 (2.97)	92.81***	M > F		3 > 1, 5, 6, 9
3 (8–9)	3.49 (5.97)	1.10 (2.69)	81.26***	M > F		4 > 5, 9
4 (9–10)	3.30 (5.46)	0.98 (2.53)	67.55***	M > F		7 > 9
5 (10–11)	2.27 (4.60)	0.67 (2.31)	34.03***	M > F		
6 (11–12)	2.77 (5.27)	0.56 (1.87)	58.36***	M > F		
7 (12–13)	2.61 (4.62)	1.36 (3.34)	19.01***	M > F		
8 (13–14)	2.42 (4.35)	0.99 (2.80)	24.37***	M > F		
9 (14–15)	1.90 (3.54)	0.74 (2.03)	15.03***	M > F		
			M: 10.80***	2 > 1, 5, 6, 7, 8, 9 3 > 1, 5, 7, 8, 9 4 > 1, 5, 9		
			F: 1.58			
Hyperactive-Impulsive			8.87***		367.54***	9.02***
1 (6–7)	1.36 (3.34)	0.35 (1.37)	32.55***	M > F	M > F	1 > 9
2 (7–8)	2.18 (4.21)	0.32 (1.25)	108.68***	M > F		2, 3 > 6, 7, 8, 9
3 (8–9)	2.12 (4.68)	0.23 (1.01)	117.71***	M > F		4, 5 > 9
4 (9–10)	1.74 (3.87)	0.23 (1.22)	66.36***	M > F		
5 (10–11)	1.57 (3.69)	0.14 (0.78)	62.24***	M > F		
6 (11–12)	1.29 (3.12)	0.13 (0.70)	37.81***	M > F		
7 (12–13)	1.24 (3.02)	0.29 (1.04)	25.54***	M > F		
8 (13–14)	0.87 (2.42)	0.39 (1.47)	6.39*	M > F		
9 (14–15)	0.50 (1.62)	0.18 (0.63)	2.69			
			M: 17.72***	1 > 9 2 > 1, 5, 6, 7, 8, 9 3 > 1, 6, 7, 8, 9 4, 5 > 8, 9 6, 7 > 9		
			F: 0.48			
ADHD-RS total			6.15***		440.29***	9.28***
1 (6–7)	3.62 (7.31)	1.18 (3.51)	35.11***	M > F	M > F	2 > 1, 5, 6, 7, 8, 9
2 (7–8)	5.96 (9.26)	1.50 (3.89)	116.40***	M > F		3 > 1, 5, 6, 8, 9
3 (8–9)	5.61 (10.12)	1.33 (3.42)	111.62***	M > F		4, 7 > 9
4 (9–10)	5.04 (8.71)	1.21 (3.31)	78.91***	M > F		
5 (10–11)	3.84 (7.68)	0.81 (2.79)	51.98***	M > F		
6 (11–12)	4.06 (7.70)	0.69 (2.40)	58.47***	M > F		
7 (12–13)	3.84 (6.94)	1.65 (4.07)	25.27***	M > F		
8 (13–14)	3.30 (6.19)	1.38 (3.91)	18.67***	M > F		
9 (14–15)	2.40 (4.63)	0.92 (2.47)	10.53***	M > F		
			M: 14.68***	2, 3 > 1, 5, 6, 7, 8, 9 4 > 1, 8, 9 5, 6, 7 > 9		
			F: 1.06			

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 4
Descriptive statistics of school form of the ADHD-RS.

Age (grade in Japan)	This study				DuPaul, Power, Anastopoulos, et al. (1998) and DuPaul, Power, McGoey, et al. (1998)				Comparison between country	
	Male		Female		Male		Female		Male	Female
	N	M (SD)	N	M (SD)	N	M (SD)	N	M (SD)	t	t
Inattentive										
5–7	–	–	–	–	243	8.75 (7.66)	211	6.59 (7.26)	–	–
8–10 (2–4)	1347	3.53 (5.71)	1261	1.09 (2.74)	307	10.33 (8.49)	258	6.04 (7.29)	13.34**	10.74**
11–13 (5–7)	1254	2.55 (4.84)	1166	0.86 (2.60)	221	9.33 (8.11)	222	5.97 (6.76)	12.03**	11.09**
14–18	–	–	–	–	223	8.25 (7.27)	223	4.09 (5.26)	–	–
Hyperactive-Impulsive										
5–7	–	–	–	–	243	8.12 (7.86)	211	5.66 (7.27)	–	–
8–10 (2–4)	1347	2.02 (4.29)	1261	0.26 (1.16)	307	8.43 (8.05)	258	3.81 (6.15)	13.50**	9.21**
11–13 (5–7)	1254	1.37 (3.29)	1166	0.19 (0.85)	221	5.96 (6.72)	222	3.62 (5.61)	9.93**	9.08**
14–18	–	–	–	–	223	4.37 (6.09)	223	1.97 (3.40)	–	–
ADHD total										
5–7	–	–	–	–	243	16.87 (14.61)	211	12.25 (13.61)	–	–
8–10 (2–4)	1347	5.55 (9.41)	1261	1.35 (3.55)	307	18.76 (15.51)	258	9.86 (12.63)	14.31**	10.71**
11–13 (5–7)	1254	3.91 (7.44)	1166	1.04 (3.18)	221	15.28 (13.55)	222	9.59 (11.42)	12.13**	11.05**
14–18	–	–	–	–	223	12.62 (12.16)	223	6.06 (7.94)	–	–

** $p < .01$.

across all those grades. Again, with the males, the grade had a significant simple main effect, with the higher-grade males scoring lower. The simple main effects of grade were nonsignificant among the females.

With the total score of ADHD-RS, the sex \times grade interaction effect was significant ($F(8, 7396) = 6.15, p < .001$). A simple main effects of sex were significant with all the grades, with the males scoring higher than the females. In addition, among the males the grade has a significant simple main effect, with the score tending to decline as the grade went up. The grade had no significant effect among the females.

3.3. Comparison between Japanese data and USA data of ADHD-RS

We compared the Japanese ADHD-RS scores obtained in our survey to those of the US collected by DuPaul, Power, Anastopoulos, et al. (1998) and DuPaul, Power, McGoey, et al. (1998). The scores are presented in Table 4. Note that we compared only two age groups, 8–10 years of age and 11–13 years of age, since our participants were limited in age. Also, it is a very common that children are grouped not by their physical age but by their school grades when examining the developmental differences in Japan. For this reason, our survey grouped the participants according to their school grades to match the age classifications of DuPaul, Power, Anastopoulos, et al. (1998) and DuPaul, Power, McGoey, et al. (1998) for this comparison. This comparison showed that the Japanese children scored lower than did their US equivalents in the two subscale scores and the total score.

3.4. Correlations of ADHD-RS-IV with study variables

Table 5 shows the correlations between ADHD-RS and the study variables. The correlations with IQ were nearly zero, while the standardized achievement test scores showed significant negative correlations in all cases. Totally, Inattentive showed relatively high correlation.

3.5. Comparison between students with and without needs for special care

We compared the ADHD-RS scores between children with needs for special care and those without the needs (Table 6). Students who need special care scored significantly higher in two subscale scores and total score. This suggests that intensity

Table 5
Correlations of ADHD-RS with study variables.

	Inattentive	Hyperactive-Impulsive	ADHD total
IQ ($N = 6115$)	-.03*	.01	-.01
Standardized achievement test			
Japanese ($N = 6376$)	-.29***	-.13***	-.25***
Math ($N = 6376$)	-.30***	-.12***	-.25***

* $p < .05$.*** $p < .001$.

Table 6

The comparison between students who need special care and who do not need special care in ADHD-RS scores.

	Children without needs for special care	Children with needs for special care	<i>t</i>
	<i>M (SD)</i>	<i>M (SD)</i>	
Inattentive	1.37 (3.21)	9.60 (6.95)	-14.27***
Hyperactive-Impulsive	0.66 (2.03)	5.79 (6.16)	-10.08***
ADHD total	2.03 (4.84)	15.39 (11.68)	-13.81***

*** $p < .001$.

of the ADHD tendency was a factor considered by the teachers as they decided whether or not a child was in need of such special care.

4. Discussion

4.1. Factor structure, reliability, and validity of ADHD-RS in Japan

We examined the factor structure of ADHD-RS using a confirmatory factor analysis and found that a two-factor structure of Inattentive and Hyperactive-Impulsive fit the data, consistent with prior studies (DuPaul, Power, Anastopoulos, et al., 1998; DuPaul, Power, McGoey, et al., 1998). With the reliability of the scale, we obtained sufficient alpha coefficients, indicating good reliability. Future studies should examine the reliability with the test-retest method.

4.2. The relationships between ADHD-RS and IQ and academic performance

We examined correlations between the ADHD-RS scores and the children's IQ and their standardized achievement tests scores of Japanese and math. The ADHD-RS scores showed no relationships with IQ. There are several hypotheses concerning complications of ADHD and mental retardation indicated by IQ. Our survey result agrees with another research reporting no significant difference in IQ between an ADHD group and a normal one (Kaplan, Crawford, Dewey, & Fisher, 2000). Some other researches indicate that while ADHD children with learning disorders are lower in IQ than normal children, ADHD children without learning disorders are no inferior in IQ (August & Garfinkel, 1989; Dykman & Ackerman, 1991). Future studies should examine the case of complications of learning disorders and ADHD in Japan. Meanwhile, we observed significant negative correlations between the ADHD-RS scores and the standardized achievement test scores. The correlation was especially high with inattentive. This finding agrees with the common understanding that many ADHD children also have chronic, poor academic performance inadequate to their intelligence (McConaughy, Achenbach, & Gent, 1988), which is a major problem with the disorder (Barkley, 1998). There are some hypotheses about the links between ADHD and poor academic performance. DuPaul and Stoner (2003), following Silver's (1990) hypothesis, pointed out that while ADHD children have no problem with their intelligence itself, they lose their opportunities of learning since they lose their attention and concentration easily, which results in their poor performance. McGee and Share (1988) argued that some disorders with academic skills eventually result in behavioral problems such as inattention and impulsiveness. Our survey finding supported the links between poor academic performance and ADHD tendencies, especially inattention.

4.3. Sex and grade differences of ADHD-RS scores in Japan

Our analyses of variance yield some significant sex \times grade interaction effects for two subscale scores and total scores of ADHD-RS. Among the males, we saw a simple main effect of the grade. For the second graders and older, the higher the grade was, the lower were the scores. This means males of the second grade or above, as they grew older, they became more able to control their behaviors and impulse and maintain their attention. This agrees with a report that the symptoms of ADHD reach their peak in childhood, diminish in degrees during later childhood, and the symptoms disappear during the period in 50% of the children who satisfied the criteria of ADHD (Campbell, 2002). As for the remaining 50% in whom some problems remain after they enter elementary school, 59–67% of them can continue with their destructive behavioral disorder into the later childhood or even early adolescence (Raggio & Pierce, 1999). Thus, we cannot disregard the importance of identifying ADHD children among third or fourth graders or older.

In our survey, the first graders scored lower than did the second graders. We ascribe this to two factors. First, the teachers of the first graders evaluated their children on criteria slacker than those used by the teachers of the other grades. First grade is a transitional period from the preschool years into school years. Then, at least in Japan, many first graders tend to feel nervous since they have yet to get accustomed to life in school, which quite different from what they experienced in their preschool years. Thus, we can expect teachers of first graders to evaluate their children on a slacker standard. The other factor is a possibility that the first graders covered by our survey, as a whole, were of a generation with less ADHD tendency. This issue requires more researches, taking into consideration evaluations by their parents or third parties.

We found the significant main effects of sex, with the males showing stronger ADHD tendency than did the females. This is consistent with DuPaul, Power, Anastopoulos, et al. (1998) and DuPaul, Power, McGoey, et al. (1998). Also, the grade had no

significant simple main effect among the females. It is because the females, across all the grades, scored quite low. These results are in agreement with international epidemiological reports, which also suggest that the Japanese version of school form of the ADHD-RS has constructive validity.

4.4. Difference between Japanese data and USA data of ADHD-RS scores

We compared the scores between the US and Japan and found that the Japanese children scored lower than did their US children on the subscale scores and total score of ADHD-RS, irrespective of sex and age group. This result suggests that the Japanese children have less ADHD tendency than did the children in the US. However, we have another interpretation of the result. Many of the Japanese teachers might be less strict with their children than are many US teachers. One cross-cultural difference in child rearing and classrooms between the West and Japan is that between individualism and collectivism (Triandis, 1995). In the US, where the culture tends to nurture individuality and uniqueness, we can expect many classroom teachers to be generally sensitive to individuality of each pupil. Thus, many US teachers can recognize individual differences of their pupils, in a test such as ADHD-RS, in which a teacher evaluates each child. On the contrary, in the Japanese culture, which prioritizes collective standards above individuality, many teachers can evaluate individual children in terms of deviation from the group's norm. Therefore, many teachers may tend to focus on those children who stand out in their evaluation, leaving many other children unaccounted for. In the US, more teachers consider each and every child, we can expect. We recognized some floor effect with all of the items (Table 2). Also, we asked the teachers to separate those children in need of special care and those who had no such need. We compared the scores the teachers gave for those two types of children and found that the scores given to children with needs for special care were drastically higher than those given to the children without needs for special care (Table 6). These findings reflect the point of view many Japanese teachers have of their children.

4.5. Limitation and perspectives

Employing Japanese version of school form of the ADHD-RS, our survey compared the scores between the US and Japan and examined correlations with several variables. It showed that ADHD-RS has sufficient reliability and validity, and provides a basic data of ADHD in Japanese children. With respect to reliability, however, we further need to examine agreement rates with evaluations by people other than teachers and test-retest reliability. Also, some parts of our results did not agree with some prior studies and what we know from our experiences. For instance, the first graders scored lower than did any other graders. We think this is ascribable to the evaluation criteria. As this example suggests, we need further consideration and examinations in measurements used for collective screening of children with ADHD in Japan. Attempts for improvement include, among others, having more items that are hard to evaluate relatively, adjusting the number of alternatives, and having less items to reduce the teachers' work. At the same time, however, each school has a considerably different culture and we suppose many things should be ascribed to different viewpoints held by different school cultures. In addition, though we consider that this survey's epidemiological significance lies in that it was a complete survey in the target city, not a sample survey, we still need compare the results to those of surveys conducted in other cities, for the sake of further generalization of the findings. In addition, although this survey included only elementary and lower-secondary schools, a future survey including a broader range of schools might reveal some more developmental differences. Thus, further surveys and analyses are necessary in the future.

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