

Figure 2. ASD 群における RBS-R の下位因子と IQ の散布図

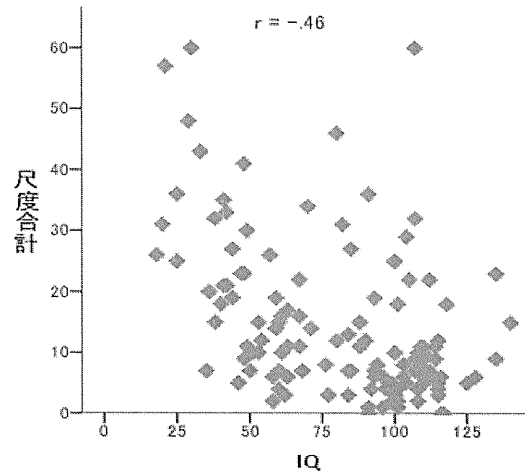


Figure 3. ASD 群における RBS-R の合計得点と IQ の散布図

Table 7. RBS-R の各セクションと PARS との相関

RBS-R	PARSピーク評定					PARS現在評定	
	社会性	過敏性	常同行動	こだわり	総得点	児童期	成人期
常同	.441 ***	.291 **	.467 ***	-.027	.383 ***	.097	.266 **
自傷	.262 **	.335 ***	.357 ***	.047	.300 **	.266 *	.244 **
強迫的	.380 ***	.365 ***	.275 **	.273 **	.412 **	.341 **	.460 ***
儀式的	.373 ***	.423 ***	.411 ***	.419 ***	.498 ***	.583 ***	.487 ***
同一性	.418 ***	.405 ***	.345 ***	.433 ***	.511 ***	.557 ***	.493 ***
限局	.296 **	.266 **	.369 ***	.395 ***	.417 ***	.458 ***	.317 ***
総得点	.489 ***	.477 ***	.493 ***	.409 ***	.593 ***	.536 ***	.541 ***

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

Table 8. RBS-R の各因子と PARS との相関

RBS-R	PARSピーク評定					PARS現在評定	
	社会性	過敏性	常同行動	こだわり	総得点	児童期	成人期
儀式的・同一性	.395 ***	.400 ***	.365 ***	.456 ***	.527 ***	.571 ***	.488 ***
自傷	.262 **	.335 ***	.357 ***	.047	.300 **	.266 *	.244 **
常同	.473 ***	.307 ***	.513 ***	.063	.442 ***	.174	.331 ***
強迫的	.378 ***	.375 ***	.267 **	.291 **	.418 ***	.343 **	.429 ***
限局	.314 ***	.333 ***	.307 ***	.475 ***	.454 ***	.538 ***	.409 ***
総得点	.489 ***	.477 ***	.493 ***	.409 ***	.593 ***	.536 ***	.541 ***

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

Table 9. RBS-R の各セクションと VABS-II との相関

RBS-R	Vineland適応行動					Vineland不適応行動		総得点
	コミュニ ケーション	日常生活 スキル	社会性	運動 スキル	適応 行動	不適応 内在化	不適応 外在化	
常同	-.366 ***	-.365 ***	-.359 ***	-.284 ***	-.385 ***	.340 ***	.269 ***	.392 ***
自傷	-.318 ***	-.242 ***	-.279 ***	-.128	-.271 ***	.342 ***	.293 ***	.400 ***
強迫的	-.298 ***	-.308 ***	-.354 ***	-.193 **	-.321 ***	.393 ***	.300 ***	.387 ***
儀式的	-.310 ***	-.296 ***	-.341 **	-.233 ***	-.326 ***	.496 ***	.396 ***	.504 ***
同一性	-.311 ***	-.298 ***	-.372 ***	-.262 ***	-.344 **	.560 ***	.370 ***	.520 ***
限局	-.167 **	-.135 *	-.189 **	-.129	-.169 *	.314 ***	.281 ***	.343 ***
総得点	-.421 ***	-.401 ***	-.470 ***	-.297 ***	-.444 ***	.578 ***	.410 ***	.562 ***

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

Table 10. RBS-R の各因子と VABS-II との相関

RBS-R	Vineland適応行動					Vineland不適応行動		総得点
	コミュニ ケーション	日常生活 スキル	社会性	運動 スキル	適応 行動	不適応 内在化	不適応 外在化	
儀式的・同一性	-.320 ***	-.297 ***	-.376 ***	-.253 ***	-.345 ***	.527 ***	.399 ***	.526 ***
自傷	-.318 ***	-.242 ***	-.279 ***	-.128	-.271 ***	.342 ***	.293 ***	.400 ***
常同	-.389 ***	-.387 ***	-.392 ***	-.302 **	-.412 ***	.379 ***	.301 ***	.429 ***
強迫的	-.268 ***	-.265 ***	-.329 **	-.172 ***	-.287 ***	.326 ***	.281 ***	.329 ***
限局	-.199 ***	-.146 ***	-.195 ***	-.121 ***	-.180 ***	.398 ***	.284 ***	.377 ***
総得点	-.421 ***	-.401 ***	-.470 ***	-.297 ***	-.444 ***	.578 ***	.410 ***	.562 ***

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

III. 研究成果の刊行に関する一覧表

研究成果の刊行に関する一覧表(1/3)

書籍

著者氏名	論文タイトル名	書籍全体の編集者名	書籍名	出版社名	出版地	出版年	ページ
杉山登志朗・辻井正次		監修 杉山登志朗・辻井正次, 協力 NPO 法人アスペ・エルデの会	発達障害のある子どもができることとを伸ばす! 学童編-	日東書院	東京	2011-09	
杉山登志朗・辻井正次		監修 杉山登志朗・辻井正次, 協力 NPO 法人アスペ・エルデの会	発達障害のある子どもができることとを伸ばす! 幼児編	日東書院	東京	2011-09	

雑誌

発表者氏名	論文タイトル名	発表誌名	巻号	ページ	出版年
Nakai A, Miyachi T, Okada R, Tani I, Nakajima S, Onishi M, Fujita C, Tsujii M.	Evaluation of the Japanese version of the Developmental Coordination Disorder Questionnaire as a screening tool for clumsiness of Japanese children.	Res Dev Disabil	32	1615-1622	2011-5

研究成果の刊行に関する一覧表(2/3)

雑誌

発表者氏名	論文タイトル名	発表誌名	巻号	ページ	出版年
Kawakami, C., Ohnishi, M., Sugiyama, T., Someki, F., Nakamura, K., Tsuji, M	The risk factors for criminal behaviour in high-functioning autism spectrum disorders (HFASDs): A comparison of childhood adversities between individuals with HFASDs who exhibit criminal behaviour and those with HFASD and no criminal histories.	Research in Autism Spectrum Disorders	6(2)	949-957	2012-04
Ito H, Tani I, Yukihiro R, Adachi J, Hara K, Ogasawara M, Inoue M, Kamio Y, Nakamura K, Uchiyama T, Ichikawa H, Sugiyama T, Hagiwara T, Tsujii M	Validation of an Interview-Based Rating Scale Developed in Japan for Pervasive Developmental Disorders.	Research in Autism Spectrum Disorders			In press
明翫光宜・望月知世・内田裕之・辻井正次	広汎性発達障害児の人物画研究(1) : DAM 項目による身体部位表現の分析	小児の精神と神経	51(2)	157-168	2011-06
明翫光宜・飯田愛・森一晃・堀江奈央・稲生慧・中島俊思・辻井正次	広汎性発達障害児を対象とした「気分は変えられる」プログラム作成の試み	小児の精神と神経	51(4)	377-385	2011
原幸一・神谷美里・辻井正次	高機能広汎性発達障害児のバウムテストの発達特徴	発達障害研究	33(3)	314-321	2011-08

研究成果の刊行に関する一覧表(3/3)

雑誌

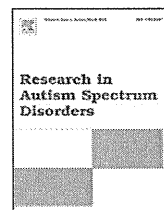
発表者氏名	論文タイトル名	発表誌名	巻号	ページ	出版年
井上雅彦・岡田涼・野村和代・上田暁史・安達潤・辻井正次・大塚晃・市川宏伸	知的障害者入所更生施設利用者における強度行動障害とその問題行動の特性に関する分析	精神医学	53(7)	639-645	2011-07
稲田尚子・黒田美保・井口英子・神尾陽子	日本語版反復的行動尺度修正版(RBS-R)の信頼性・妥当性に関する検討	発達心理学研究			印刷中

IV. 研究成果の刊行物・別刷り



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The risk factors for criminal behaviour in high-functioning autism spectrum disorders (HFASDs): A comparison of childhood adversities between individuals with HFASDs who exhibit criminal behaviour and those with HFASD and no criminal histories

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ABSTRACT

Most reports of the criminal behaviour of individuals with high-functioning autism spectrum disorder (HFASD) have been case studies, and few have empirically examined the risk factors of criminal behaviour among these individuals. This study examined 175 individuals with HFASD, including 36 individuals who had a prior history of criminal behaviours (the criminal group) and 139 individuals without a criminal history (the control group), with regard to 15 types of childhood adversities (CAs). The age of initial HFASD diagnosis and history of neglect and physical abuse were significantly correlated with an increased risk of criminal behaviour. These findings agreed with previous studies on general populations. The unique characteristics of individuals with HFASD and a history of criminal behaviour are discussed.

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1. Introduction

Over the past two decades, an increasing amount of attention has been given to high-functioning autism spectrum disorders (HFASDs). This diagnosis includes high-functioning autism (HFA) and Asperger's syndrome (AS). High-functioning pervasive developmental disorder (HFPDD) is generally defined as a pervasive developmental disorder (PDD) in individuals with normal or above-average intelligence (i.e., either $IQ \leq 70$; Howlin, 2003, or $IQ \leq 85$; Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999). In England, the estimated prevalence of PDD in preschool children is 0.626%, and 74.2% of this group do not have intellectual disabilities (IDs; Chakrabarti & Fombonne, 2001). The estimated prevalence of HFASD in the general preschool population is 0.464%. Similarly, Kadesjö, Gillberg, and Hagberg (1999) reported that the estimated prevalence for ASD is 1.2%, and approximately 70% of those with this condition do not have IDs. The prevalence of HFASD is approximately 0.84%.

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Although individuals with HFASD often have average or above-average intellectual abilities, they exhibit impairment in social, communication and imagination areas. These impairments often result in difficulties with interpersonal relationships (Frith, 1991; Wing, 1996). Moreover, individuals with HFASD often have comorbid psychiatric disorders, such as anxiety disorder and depression, or display problematic behaviours, such as violence and/or other antisocial behaviours (Tantam, 1991). Although research on the violent, antisocial or criminal behaviours committed by individuals with HFASD was scarce until the 1980s, it has increased since 1990 (Bjørkly, 2009; Newman & Ghaziuddin, 2008). Bjørkly (2009) conducted a systematic review on violence in people with AS that included 11 published case studies of 22 patients and 29 violent incidents. Many of these patients made threats or committed physical assaults, and others attacked or made threats with weapons such as screwdrivers (Mawson, Grounds, & Tantam, 1985) or knives (Murrie, Warren, Kristiansson, & Dietz, 2002; Raja & Azzoni, 2001). Other incidents included homicide (Schwartz-Watts, 2005; Scragg & Shah, 1994), attempted rape (Kohn, Fahum, Ratzoni, & Apter, 1998), and arson (Murrie et al., 2002). Additional studies of individuals with HFASD reported theft (Chen et al., 2003; Sugiyama, 2003), vandalism (Simblett & Wilson, 1993; Tantam, 1988), sexual offence (Silva, Ferrari, & Leong, 2002; Sugiyama, 2003), and arson (Everall & Lecouteur, 1990; Tantam, 1991).

Based on the definition used in the studies listed above, we define criminal behaviour as an illegal act for which an individual can be punished by law. This definition includes juvenile delinquencies such as running away from home as well as underage drinking or smoking.

Many of the studies on the criminal behaviour of individuals with HFASD are case studies, and empirical studies are scarce. Ghaziuddin, Tsai, and Ghaziuddin (1991) made the first attempt to examine the relationship between HFASD and criminal behaviour. These authors reviewed 21 peer-reviewed articles regarding people with AS that included 132 individuals. Of this group, only three (2.3%) had a history of violence.

Scragg and Shah (1994) found that the rate of AS among patients hospitalised in a high-security hospital was 1.5–2.3%. Note that the majority of admissions to this hospital were the result of criminal behaviour. However, some non-criminal patients were transferred because of their unmanageable behaviour at less secure psychiatric facilities. Siponmaa, Kristiansson, Jonson, Nydén, and Gillberg (2001) also found that 15% of 126 young (15–22-year-old) offenders in Stockholm, Sweden met the diagnostic criteria of PDD, including 12% with PDDNOS and 3% with AS. Therefore, their estimated prevalence of HFASD in the young forensic population was greater than 3%. These findings indicate that, although these studies regarding the rates of criminal behaviour among individuals with HFASD do not necessarily show a strong correlation between HFASD and criminal behaviour, it is apparently higher in individuals with HFASD compared with the general population (i.e., less than 1%; Chakrabarti & Fombonne, 2001; Kadesjö et al., 1999).

Although the estimated prevalence of criminal behaviours among individuals with HFASD is higher than that of the general population, little is known about the risk factors for individuals with ASD, especially those with HFASD. In one of the few empirical studies on the subject, Mouridsen, Bente, Torben, and Niels (2008) investigated the prevalence rate and patterns of criminal behaviour in 313 former child psychiatric inpatients with PDD and compared them with 933 matched controls from the general population. These patients were divided into three groups: those with childhood autism ($n = 113$), those with AS ($n = 114$), and those with atypical autism ($n = 86$). They found that 9% of 113 individuals with childhood autism exhibited criminal behaviours; furthermore, 8.1% of 86 patients with atypical autism and 18.4% of 114 patients with AS were convicted of crimes. These results indicate that HFASD might be a risk factor for criminal behaviour. Långström, Grann, Ruchkin, Sjostedt, and Fazel (2009) also compared 31 individuals with ASD (including those with autism and AS) who committed violent, non-sexual crimes as well as two sexual offences with those with ASD and no history of violence. These authors reported that the violent offences among those with ASD were predicted by gender (i.e., males), sub-diagnosis (i.e., AS rather than autism), and comorbid psychiatric disorders (i.e., psychotic and substance use disorders). These results matched a previous study reporting the risk factors of criminal behaviour among individuals without ASD (Långström et al., 2009).

An awareness of criminal behaviour in individuals with HFASD is increasing, but how criminal behaviour risk factors interact with one another still remains unclear. Although several criminal behaviour risk factors and psychiatric disorders have been identified in the general population, most studies have examined only one or two factors (Green et al., 2010). However, risk factors are highly clustered with one another and should be examined using a multivariate model.

Based on this notion, a large-scale epidemiological study known as the National Comorbidity Survey Replication (NCS-R) was conducted in the US (Green et al., 2010). The NCS-R reported 12 risk factors, named “childhood adversities” (CAs), which were selected through a review of risk factor studies that influenced the development of psychiatric disorders. These CAs included maladaptive family functioning (i.e., parental mental illness, substance use, criminality, family violence, physical and sexual abuse, and neglect) and were significantly related to the initial age of onset of disruptive behaviours (Green et al., 2010). CAs may be risk factors for criminal behaviour in individuals with HFASD. In fact, some individuals with HFASD who exhibit violent behaviour were physically abused as children (Mandell, Walrath, Manteuffel, Sgro, & Pinto-Martin, 2005).

Other CAs that are related to criminal behaviour include a history of being bullied (Saito, Kobayashi, Tanaka, & Shimizu, 2003; Sugiyama, 2003; Tantam, 2000) and childhood hyperactivity (Biederman, Mick, Faraone, & Burback, 2001). Bullying and hyperactivity are risk factors for criminal behaviour according to community (Connor, 2002) and clinical samples (Barkley, 1998; Sugiyama, 2000). Similar to the general population, individuals with ASD often exhibit hyperactivity and become the target of bullying (Heinrichs, 2003; Wing, 1996).

In addition, three offenders who were victims of bullying received diagnoses of PDD later in life (Schwartz-Watts, 2005). These cases suggest that an early ASD diagnosis and proper intervention is important to decrease the risk of developing

Table 1
Demographic characteristics of participants.

	Criminal	Control	Total	$\chi^2(df)$
Sex				
Male	30	117	147	0.02 n.s. (1)
Female	6	22	28	
Total	36	139	175	
Diagnosis				
Autism	9	36	45	0.22 n.s. (2)
Asperger	11	47	58	
NOS	16	56	72	
Total	36	139	175	

criminal behaviours (Schwartz-Watts, 2005; Sugiyama, 2003). In fact, the age at which ASD was first diagnosed often affects early interventions and could thereby influence prognosis (Lord, 1995). Based on these reports, the timing of the initial ASD diagnosis and appropriate intervention might influence the later development of criminal behaviour in those with HFASD. A delay in the initial ASD diagnosis might be another risk factor of criminal behaviour in individuals with HFASD.

Thus, the purpose of this study was to examine the risk factors of criminal behaviour, including CAs and the age of initial diagnosis, in individuals with HFASD.

2. Methods

2.1. Participants

The participants included 175 individuals (147 males, 28 females) who were diagnosed with HFASD by child psychiatrists based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association, 1994). We divided participants into two groups: those who exhibited criminal behaviour (the criminal group) and those without a history of criminal behaviour (the control group). There were 36 participants (30 males, 6 females) in the criminal group, and their mean age was 16.83 years (age range = 7–30 years, $SD = 5.59$). There were 139 participants (117 males, 22 females) in the control group, and their mean age was 14.89 years (age range = 6–28 years, $SD = 4.24$; Table 1). There were no significant between-group differences with regard to gender, age or sub-diagnosis (Table 2).

2.2. Measures

2.2.1. Data collection procedure

We collected data by reviewing existing clinical records as well as interviewing participants and their parents. Child psychiatrists obtained any information that was missing from the clinical records by interviewing participants and their parents. Clinical psychologists and child psychiatrists with more than 15 years of experience with developmental disorders collected all the data.

2.2.2. Childhood adversity

We used dichotomous items for CAs (Green et al., 2010), which included two types of CAs: maladaptive family functioning (MFF) CAs and other CAs. MFF CAs included seven items: parental mental illness, parental substance abuse, parental criminality, family violence, physical abuse, sexual abuse, and neglect. Other CAs included five items: parental death, parental divorce, other types of parental loss, life-threatening childhood physical illness, and extreme childhood economic adversity.

In addition to the above-mentioned CAs, the age of the individual at initial diagnosis with HFASD, bullying or being bullied, and propensity for hyperactivity were also included because these items are risk factors for criminal behaviour in individuals with HFASD (e.g., Connor, 2002; Lord, 1995; Wing, 1996).

All items concerning family and parents focused on only biological factors (Green et al., 2010). The MFF parental illness item was assessed by recording family histories of major depression, generalised anxiety disorder and panic disorder. If participants lived in foster homes, they were rated as experiencing other parental loss. We assessed family economic adversity based on whether the family received welfare, other forms of governmental assistance, or both.

2.2.3. Criminal behaviour data

Using clinical records, we collected additional information about the criminal group, such as the types and frequencies of criminal behaviour, the onset of criminal behaviour and the age at which their last criminal behaviour was observed. Regarding the types of criminal behaviour, kleptomania entails the stealing of both material goods and money. Sexual misconduct includes voyeurism, peeping, juvenile prostitution and lingerie theft. The participants checked all the behaviours that applied to them. We also assessed the frequency of criminal behaviours using a 3-point Likert scale: “only

Table 2
Mean (*SD*) age and IQ of each group.

	Criminal (<i>N</i> = 36)		Control (<i>N</i> = 139)		<i>t</i>
	<i>M</i>	(<i>SD</i>)	<i>M</i>	(<i>SD</i>)	
Age	16.83	(5.59)	14.89	(4.24)	−1.94 n.s.
IQ	96.86	(18.25)	92.20	(13.46)	−1.43 n.s.

once (no recurrence at the time of the assessment)”, “multiple recurrent incidents without a current episode” and “multiple recurrent incidents with a current episode”.

2.3. Data analyses

First, the types and frequency of criminal behaviours in the criminal group were calculated. Second, the CA prevalence rates for each group were calculated, and the χ^2 test and unadjusted odds ratio (OR) were used to analyse the associations between CAs and the groups. Third, based on Green et al.'s (2010) suggestion, a logistic regression analysis estimated the influence of each CA. Several multivariate models were estimated; each included a CA dummy variable.

The first logistic regression model was additive; it included a separate predictor variable for each of the CAs without interaction terms. Fourteen CAs except for the “age of initial HFASD diagnosis” was included. This model also included the “number of the CAs” experienced by participants as an additional predictor for each of the 14 CAs (Green et al., 2010). Following Green et al.'s (2010) suggestion, a cut-off point for the number of the CAs was explored to compare the two groups. We observed significant differences between the two groups in the number of CAs when the number of CAs was divided into groups of “4 or less” and “5 or more,” which indicates that 5 was an appropriate cut-off point for this variable. Hereafter, the number of CAs refers to a dichotomous variable.

The second model included all 15 CAs. We added the variables using the forced entry method in the first and second models. The third model used the stepwise method to explore the best combination of these variables. This method included 15 CAs for the type and number of CAs. Survival coefficients and their standard errors were exponentiated and reported as ORs and 95% confidence intervals (95% CI), respectively. We used the Akaike information criterion (AIC) to select the best multivariate model (Burnham & Anderson, 2002) and evaluated statistical significance using 2-tailed tests ($p < 0.05$).

3. Results

3.1. Criminal behaviour features

The most common problem in the criminal group was theft, followed by sexual misconduct, violence, and running away (Table 3). Trouble act was sending spoofed e-mail; one of male participants was bullied by his female friends, and he spoofed her as a retaliation. Table 3 shows that 47.2% of participants in the criminal group exhibited the problem “only once (no recurrence at assessment)”; the same proportion exhibited the problem “multiple recurrent incidents without a current episode”. The onset of criminal behaviour ranged from 5 to 21 years old, with a mean (*SD*) age of 11.42 (4.45) years. The age at which the last criminal behaviour occurred ranged from 6 to 24 years old, with a mean (*SD*) age of 14.31 (4.39) years (Table 4). The most common age for the onset of criminal behaviour was 6 years old (19.4%), followed by 8 (11.1%), 14 (11.1%) and 16 (11.1%). The last criminal behaviour was most commonly displayed between age 14 (11.1%) and 18 (11.1%).

Table 3
The type and frequency of criminal behaviour in the criminal group.

	<i>N</i>	(%)
Type ^a		
Theft, kleptomania (things, money)	20	(55.6)
Sexual misconduct (voyeurism, peeping, juvenile prostitution, lingerie theft)	9	(25.0)
Violence	9	(25.0)
Running away	7	(19.4)
Arson	4	(11.1)
Blackmail	2	(5.6)
Trouble act	1	(2.8)
Frequency		
Only once (no recurrence at the time of the assessment)	2	(5.6)
Multiple (recurrent incidents without a current episode)	17	(47.2)
Multiple (recurrent incidents with a current episode)	17	(47.2)
Total	36	(100)

^a Checked all that apply.

Table 4

The information about onset of criminal behaviour and age at which most recent criminal behaviour.

Age	Onset		Most recent	
	N	(%)	N	(%)
5	1	(2.8)	0	(0.0)
6	7	(19.4)	1	(2.8)
7	2	(5.6)	2	(5.6)
8	4	(11.1)	1	(2.8)
9	1	(2.8)	1	(2.8)
10	0	(0.0)	2	(5.6)
11	2	(5.6)	2	(5.6)
12	2	(5.6)	3	(8.3)
13	3	(8.3)	3	(8.3)
14	4	(11.1)	4	(11.1)
15	2	(5.6)	1	(2.8)
16	4	(11.1)	7	(19.4)
17	1	(2.8)	1	(2.8)
18	2	(5.6)	4	(11.1)
19	0	(0.0)	1	(2.8)
20	0	(0.0)	0	(0.0)
21	1	(2.8)	0	(0.0)
22	0	(0.0)	1	(2.8)
23	0	(0.0)	0	(0.0)
24	0	(0.0)	2	(5.6)
Total	36	(100)	36	(100)
M (SD)	11.42 (4.45)		14.31 (4.39)	

3.2. The prevalence of childhood adversity

The frequency of the presence of each CA is shown in Table 5. Significant differences in MFF CAs were observed between the criminal group and the control group with regard to family violence, physical abuse, sexual abuse and neglect. Specifically, more participants in the criminal group experienced these CAs than those in the control group. With regard to the other CAs, significant differences were observed in parental death, parental divorce and other parental loss: More participants in the criminal group experienced these CAs compared with controls. With regard to the additional CAs, no significant differences were observed in bullying or hyperactivity. The mean age at which HFASD was first diagnosed in the criminal and control groups were 10.25 ($SD = 4.68$, range = 2–22) and 5.94 ($SD = 3.79$, range = 1–17) years, respectively. The

Table 5

Prevalence of childhood adversities (CAs).

	N (%)			$\chi^2(1)$
	CD	Control	Total	
I. Maladaptive family functioning CAs				
Parental mental illness	6 (16.7)	15 (10.8)	21 (12.0)	0.9
Parental substance use	1 (2.8)	1 (0.7)	2 (1.1)	1.1
Parental criminality	0 (0.0)	0 (0.0)	0 (0.0)	-
Family violence	2 (11.1)	4 (1.4)	6 (3.4)	8.1**
Physical abuse	13 (36.1)	10 (7.2)	23 (13.1)	20.9***
Sexual abuse	2 (5.6)	0 (0.0)	2 (1.1)	7.8**
Neglect	9 (25.0)	3 (2.2)	12 (6.9)	23.4***
II. Other CAs				
Parental death	3 (8.3)	2 (1.4)	5 (2.9)	4.9*
Parental divorce	10 (27.8)	11 (7.9)	21 (12.0)	10.7**
Other parental loss	3 (8.3)	1 (0.7)	4 (2.3)	7.4**
Physical illness	7 (19.4)	24 (17.3)	31 (17.7)	0.1
Economic adversity	5 (13.9)	8 (5.8)	13 (7.4)	2.8
III. Additional CAs				
Bullying	23 (63.9)	104 (74.8)	127 (72.6)	1.7
Hyperactivity	21 (58.3)	80 (57.6)	101 (57.7)	0.0
The age of initial HFASD diagnosis	-	-	-	-
No. of CAs				
≥5	9 (25.0)	2 (1.4)	11 (6.3)	26.9**

* Significant at the 0.05 level, two tailed.

** Significant at the 0.01 level, two tailed.

*** Significant at the 0.001 level, two tailed.

Table 6

Bivariate and multivariate associations (odds ratios) between childhood adversities (CAs) and criminal behaviour.

	OR (95% CI)		
	Bivariate	Multivariate (additive)	Multivariate (interactive)
I. Maladaptive family functioning CAs			
Parental mental illness	1.7 (0.6–4.6)	0.9 (0.2–3.7)	0.7 (0.1–3.3)
Parental substance use	3.9 (0.2–64.6)	0.2 (0.0–73.3)	0.1 (0.0–32.2)
Parental criminality	–	–	–
Family violence	8.6* (1.5–48.8)	3.9 (0.3–57.6)	2.7 (0.1–49.2)
Physical abuse	7.3* (2.9–18.6)	4.1* (1.2–13.8)	3.3 (0.9–12.1)
Sexual abuse	0.2* (0.1–0.3)	–	–
Neglect	15.1* (3.8–59.5)	5.3* (1.0–29.4)	2.9 (0.4–19.4)
$\chi^2(df)$ (p value)	–	$\chi^2(5) = 32.6$ ($p < 0.001$)	–
II. Other CAs			
Parental death	6.2 (1.0–38.8)	0.4 (0.0–6.1)	0.2 (0.0–4.6)
Parental divorce	4.5* (1.7–11.6)	3.7 (0.8–17.5)	3.3 (0.6–18.0)
Other parental loss	12.5* (1.3–124.5)	3.8 (0.1–102.7)	3.6 (0.1–145.7)
Physical illness	1.2 (0.5–2.9)	0.5 (0.1–2.0)	0.4 (0.1–1.7)
Economic adversity	2.6 (0.8–8.6)	0.7 (0.1–5.3)	0.4 (0.0–4.7)
$\chi^2(df)$ (p value)	–	$\chi^2(5) = 16.3$ ($p < 0.01$)	–
$\chi^2(df)$ (p value)	–	$\chi^2(10) = 36.9$ ($p < 0.001$)	–
III. Additional CAs			
Bullying	0.6 (0.3–1.3)	0.5 (0.2–1.3)	0.5 (0.2–1.3)
Hyperactivity	1.0 (0.5–2.2)	1.4 (0.5–3.7)	1.6 (0.6–4.3)
The age of initial HFASD diagnosis	–	1.2* (1.1–1.3)	1.2* (1.1–1.4)
$\chi^2(df)$ (p value)	–	$\chi^2(3) = 30.3$ ($p < 0.01$)	–
$\chi^2(df)$ (p value)	–	$\chi^2(13) = 53.2$ ($p < 0.001$)	–
No. of CAs			
≥5	22.8* (4.7–111.6)	–	17.7 (0.6–553.2)
$\chi^2(df)$ (p value)	–	–	$\chi^2(14) = 56.7$ ($p < 0.001$)

* Significant at the 0.05 level, two tailed.

initial HFASD diagnosis occurred at a significantly older age for participants in the criminal group than for those in the control group ($t = -5.78$, $df = 173$, $p < 0.001$).

Regarding the number of CAs, significantly more participants in the criminal group belonged to the “5 or more group” than those in the control group.

3.3. CAs and the likelihood that individuals with HFASD will display criminal behaviours

First, each CA variable was examined using a bivariate model that did not control for the influence of each variable. The MFF categories family violence, physical abuse, sexual abuse and neglect had significant ORs (Table 6). Neglect had the largest OR (OR = 15.1). With regard to the other CAs, the significant ORs for parental divorce (OR = 4.5) and other parental loss (OR = 12.5) indicate that the risk for criminal behaviour increases for those who experience these CAs. Concerning the additional CAs, the ORs for bullying and hyperactivity were not significant. Lastly, the OR for the number of CAs was significant, which means that the risk for criminal behaviour increased as individuals experienced more CAs.

Second, we conducted a multivariate logistic regression analysis to control for the influence of each variable (Table 6). The results of this analysis revealed that the ORs for physical abuse and neglect were significant. Sexual abuse was not included in the analysis because none of the participants in the control group reported sexual abuse. The other CAs did not affect the likelihood of criminal behaviour (i.e., the ORs were not significant after controlling for the other variables). With regard to the additional CAs, the OR for the age of initial HFASD diagnosis was significant. In the multivariate model, the authors examined χ^2 statistics and the AIC in the following models: one in which only the MFF CAs were entered ($\chi^2(5) = 32.6$ ($p < 0.001$), AIC = 153.61); one in which only the other CAs were entered ($\chi^2(5) = 16.2$ ($p < 0.001$), AIC = 171.6); one in which only the additional CAs were entered ($\chi^2(3) = 30.3$ ($p < 0.001$), AIC = 153.6); one in which the MFF CAs and the other CAs were entered ($\chi^2(10) = 36.9$ ($p < 0.001$), AIC = 161.0); and one in which all CAs were entered ($\chi^2(13) = 53.2$ ($p < 0.001$), AIC = 150.7). The latter model provided the best fit for the data.

Finally, the multivariate model that included all the types and numbers of the CAs was examined to control the influences of each variable (Table 6). The model was interactive in that the type and number of CAs were both included in the model (Green et al., 2010). Only the OR for the age of initial HFASD diagnosis was significant in this model ($\chi^2 = 56.7$, $df = 14$, $p < 0.001$, AIC = 149.2).

3.4. Determining the best combination of variables to predict the most common criminal behaviours in individuals with HFASD

A logistic regression analysis using the backward selection method determined the variable that most contributed to the risk for criminal behaviour in individuals with HFASD (Table 7). Among all of the variables, the Wald statistic confirmed that

Table 7
The results of a logistic regression analysis with backward selection.

	B	SE ^a	Wald (df= 1)	OR	95% CI
The age of initial HFASD diagnosis	0.18	0.05	13.34***	1.20 ^o	(1.1–1.3)
Neglect	1.85	0.77	5.70**	6.34 [*]	(1.4–28.8)
Physical abuse	1.32	0.57	5.30**	3.73 [*]	(1.2–11.4)
Bullying	-0.84	0.49	2.96**	0.43	(0.2–1.1)
Parental divorce	1.01	0.59	2.96**	2.74	(0.9–8.6)
$\chi^2(5)$	49.5***				
AIC	138.4				
Correct classification (%)	85.7				

^a Significant at the 0.05 level, two tailed.

** Significant at the 0.01 level, two tailed.

*** Significant at the 0.001 level, two tailed.

the age of initial HFASD diagnosis, neglect, physical abuse, bullying and parental divorce were significant. The model that included these five variables initially provided the best fit in this study ($\chi^2 = 49.5$, $df = 5$, $p < 0.001$, $AIC = 138.4$). Of these five variables, only the ORs for the age of initial HFASD diagnosis, neglect and physical abuse were significant. Individuals who experienced childhood neglect or physical abuse were most likely to have criminal behaviours later in life. Criminal behaviour was 6.3 times more likely to occur in those who experienced neglect and 3.1 more likely in those who experienced physical abuse compared with the control group. There was a 1.2-fold increase in criminal behaviours for each year that the psychiatric diagnosis was delayed.

4. Discussion

4.1. Characteristics of individuals with HFASD who exhibit criminal behaviours

In this study, the most common criminal behaviour was theft (55.6%), followed by sexual misconduct (25.0%), violence (25.0%), and running away (19.4%). Theft is also the most common criminal behaviour in the general Japanese population (Ministry of Justice, Japan, 2008) and in many European countries (e.g., Junger-Tas et al., 2010). The rates of sexual misconduct, violence, and running away in the general Japanese population are not high (Japanese Ministry of Justice, 2008); thus, the relatively high rate of sexual misconduct in this study may be a characteristic of individuals with HFASD. Hellemans, Colson, Verbraeken, Vermeiren, and Deboutte (2007) interviewed 24 adolescents and adults with HFASD regarding their sexuality and reported that approximately one-third required sexual development or behavioural interventions. Indeed, previous case studies have reported that individuals with HFASD and excessive sexual interest engaged in sexual misconduct (e.g., Kohn et al., 1998; Murrie et al., 2002). Accordingly, a feature of ASD was derived: Restricted and repetitive patterns of behaviour, interests, and activities may take on a sexual aspect, and their unique or intense sexual interests may lead to criminal behaviour (Murrie et al., 2002).

In the present study, 94.4% of participants in the criminal group exhibited “multiple recurrent incidents with a current episode of criminal behaviour” or “multiple recurrent incidents without a current episode;” 5.6% of participants reported only once and no recurrences illicit behaviours at the time of the assessment.” This result corresponds with many previous case studies reporting that individuals with HFASD repeat criminal behaviours (e.g., Baron-Cohen, 1988; Chen et al., 2003; Mawson et al., 1985). As mentioned earlier, restricted and repetitive patterns of behaviour, interests, and activities might contribute to recurrent criminal behaviour. Moreover, a lack of empathy for others (Wing, 1981), which relates to severe and sustained impairments in social interactions, might also be related to recurrent criminal behaviour (Woodbury-Smith et al., 2005).

More importantly, these individuals often repeat criminal behaviours even though they were seeing child psychiatrists and receiving traditional interventions. These findings reflect the difficulty of intervening in cases of criminal behaviour. Preventive approaches should focus on ASD traits.

4.2. Criminal behaviour risk factors in individuals with HFASD

The results indicated that the age at which HFASD was first diagnosed, physical abuse and neglect significantly predicted criminal behaviour in individuals with HFASD. This finding corresponds with previous case reports suggesting that a delayed initial diagnosis and appropriate treatment lead to violent behaviours (Mukaddes & Topcu, 2006). Our findings demonstrating that neglect and physical abuse have significant effects are also in agreement with previous results from the general population. For example, childhood neglect and physical abuse significantly predict aggression that results in violent crime arrests in adulthood (Maxfield & Widom, 1996). Thus, neglect and physical abuse are significant risk factors of criminal behaviour in the HFASD population. Neglect and physical abuse exert a large influence on children’s physical and psychological development. For instance, when children experience neglect or physical abuse, their physical growth is stunted, and their mental status is unstable; these children are more likely to have mental disorders such as depression or aggression towards others (Child Welfare Information Gateway, 2008). Such problems exert negative influences on their

emotional regulation, friendships and adjustment to school (Sroufe, Egeland, Carlson, & Collins, 2005), which may result in criminal behaviour.

This study is one of the few to assess the relationship between the age of initial HFASD diagnosis and the likelihood of criminal behaviour. The results show that a later diagnosis is correlated with an increased prevalence of criminal behaviour. In general, the presence of HFASD is easily overlooked in young children (De Giacomo & Fombonne, 1998) because speech delays, a common characteristic of ASD, are unlikely to be observed. Later diagnoses lead to a lack of early medical and educational interventions and perhaps the inability to acquire social skills and adapt to society (e.g., Lord, 1995). It is critical that children with ASD increase their repertoire of appropriate behaviours at an early age (Howlin, 1997; Richman, 2001); thus, late diagnoses might be a significant risk factor of social adaptation failures in individuals with ASD.

Parents of children with ASD typically report higher levels of parenting stress and affective symptoms compared with parents of normally developing children and those of children with other disabilities (e.g., Bristol & Schopler, 1984; Dumas, Wolf, Fisman, & Culligan, 1991). Moreover, Hastings and Johnson (2001) found that parental stress correlated with levels of autism symptoms. From these findings, one might associate a delayed ASD diagnosis with criminal behaviour. A delayed diagnosis leads to a poor prognosis (Lord, 1995) and elevates parental stress; the parents may also become depressed or apathetic, which leads to harsher disciplines that could develop into child abuse (Sullivan & Knutson (2000). Child abuse exacerbates the child's socio-emotional development, which might lead to criminal activity.

The additional CA categories, hyperactivity and being bullied, were not significantly correlated with criminal behaviour; however, researchers have observed that there are significant correlations among these variables in the general population. For example, children who lack control at age three exhibit aggression later in life (Caspi, Henry, McGee, Moffitt, & Silva, 1995). Moreover, alienation from friends was positively correlated with aggression (Schwartz, McFadyen-Ketchum, Dodge, Pettit, & Bates, 1998). One possible explanation for the present study's non-significant results is the high percentages of hyperactivity and bullying in both the criminal and control groups. The lack of a significant between-group difference with regard to hyperactivity and bullying may have masked the relationship between these factors and risk of criminal behaviours. Hyperactivity is often observed in children with ASD (e.g., Wing, 1996), and these children are often ridiculed and become targets of bullying because they fail to comprehend the intentions of others (Heinrichs, 2003; Yoshida & Uchiyama, 2004). Therefore, although hyperactivity and bullying were not significantly correlated with criminal behaviour in individuals with HFASD in the present study, practitioners must still consider these factors when working with this population.

4.3. Limitations

This study selected several CAs to predict criminal behaviour in individuals with HFPDD. However, many of these CAs are environmental factors; the only individual factors were physical illness and hyperactivity. As a result, other individual factors (e.g., hereditary) were not taken into account. In addition, the interaction between individual factors and environmental factors was not examined. Therefore, future studies are needed to examine the influence of biological and environmental factors on criminal behaviour in individuals with HFASD.

Except for the age of initial HFASD diagnoses, all the CAs were rated as either present or absent, even though the severity of these factors may differ among individuals. Sampson and Laub (1994) assessed quantitative variables similar to CAs and explained that family poverty interrupted informal social control processes in the family. The lack of informal social control in families increased the risk for delinquency. Thus, insufficient family functioning (e.g., economic adversity, parental criminality and family violence) might postpone the timing and age at which HFASD is first diagnosed. Therefore, studies that rate the presence and level of child abuse or neglect using multilevel rather than dichotomous scales may reveal additional details regarding the relationships among criminal behaviours and these variables. Moreover, prospective studies might provide additional information on this topic.

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Research in Developmental Disabilities

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Evaluation of the Japanese version of the Developmental Coordination Disorder Questionnaire as a screening tool for clumsiness of Japanese children

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Intelligence quotient (IQ)

ABSTRACT

Developmental Coordination Disorder (DCD) is characterized by clumsiness and coordination difficulties. DCD interferes with academic performance and participation in physical activities and psychosocial functions, such as self-esteem, cognition, or emotion, from childhood through adolescence to adulthood. DCD is a common pediatric condition and its prevalence is estimated to be 6% worldwide. Although English questionnaires are available, there is no questionnaire to identify DCD in Japan, and therefore, no information on its prevalence is available. Recently, we developed the Japanese version of the Developmental Coordination Disorder Questionnaire (DCDQ-J). The purpose of this study was to describe the applicability of the DCDQ-J for use with a community-based population of children in Japan and to investigate the relationships between coordination and attention-deficit hyperactivity disorder (ADHD) tendencies or intelligence. The DCDQ-J was completed by 6330 parents or guardians of children and adolescents. We employed the ADHD-rating scale and determined the intelligence quotient (IQ) of the children. Two-way analysis of variance showed that the scores linearly increased as the children's grades advanced in 2 subscales, namely, control during movement and fine motor. In contrast, non-linear changes were found in the scores of the general coordination subscale. The total scores of the DCDQ-J and ADHD-RS were significantly correlated, but no relationship between DCDQ-J scores and IQ was found. The DCDQ-J is expected to be a useful screening tool to identify and assess motor coordination difficulties of children in Japan and enable cross-cultural comparisons.

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1. Introduction

Daily living and school activities of children require various motor skills. Such motor skills depend on coordination of a wide range of movements of body parts, such as appropriate speed and strength, precise timing of movements, and control of posture and balance. The sum of the above-mentioned functions is called "coordination" and is one of the important brain functions that develops along with children's growth (Zwicker, Missiuna, & Boyd, 2009).

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Insufficient coordination function is likely to induce delayed motor development, clumsiness, limited manual dexterity, and difficulty in posture. In addition, children with insufficient coordination tend to show retarded development of activities of daily living, including eating, toileting, dressing, and tool using, as well as school activities, including writing, drawing, playing musical instruments, gymnastics, and outdoor play. In fact, many clinical reports show that difficulty in coordination correlates with slow learning of basic daily living, studying, and various other activities (Missiuna, Moll, Law, King, & King, 2006; Polatajko & Cantin, 2005; Tseng, Howe, Chuang, & Hsieh, 2007).

However, the cause of such coordination problems is likely to be mistakenly considered as the lack of discipline by parents or poor motivation of children. If inappropriate measures against such problems are continuously taken, a feeling of self-denial and/or emotional difficulties may occur in children, which may result in self-distrust, exacerbate a repugnance to exercise and school activities, and may worsen the problems (Missiuna et al., 2006; Piek, Baynam, & Barrett, 2006; Polatajko & Cantin, 2005; Skinner & Piek, 2001; Tseng et al., 2007). Parents/guardians (Missiuna, Moll, King, King, & Law, 2007; Stephenson & Chesson, 2008) and teachers (Rivard, Missiuna, Hanna, & Wishart, 2007; Sugden & Chambers, 2003) may often lose patience with their developmental delay or feel disgusted with themselves, which may result in a bad relationship with the child (Cairney, Veldhuizen, & Szatmari, 2010). In addition, some studies have pointed out that coordination is deeply related to children's development of cognition and socialization because coordination increases children's ability to explore and manipulate their environment and encourages them to participate in social activities (Cairney et al., 2010; Missiuna et al., 2006; Piek et al., 2006).

The 4th edition of the diagnostic and statistical manual of mental disorders (DSM-IV) (American Psychiatric Association; Diagnostic and statistical manual of mental disorders: DSM-IV-TR, 2000) defines developmental coordination disorder (DCD) as "a marked impairment in the development of motor coordination, which interferes with daily living and studying." The incidence rate of DCD is 6%, and it is a relatively common pediatric condition (American Psychiatric Association; Diagnostic and statistical manual of mental disorders: DSM-IV-TR, 2000); however, there is no scale to facilitate the screening of DCD in Japan, which makes it difficult to evaluate the children's actual motor performance. The Developmental Coordination Disorder Questionnaire (DCDQ) is a parent rating scale for screening pediatric DCD (Wilson, Kaplan, Crawford, Campbell, & Dewey, 2000; Wilson et al., 2009). Recently, we developed a Japanese version of the DCDQ (DCDQ-J) (Nakai et al., 2009) for the Japanese children and conducted a preliminary investigation on both the reliability of our questionnaire and the psychometric properties.

This relatively large-scale school-based study aimed to study the applicability of the DCDQ-J as a screening tool for DCD in Japanese children. Furthermore, in order to evaluate the validity of the DCDQ-J, we investigated the relationships between coordination and ADHD tendencies or intelligence. DCD interferes with coordination in children whose intellectual level is within the normal range (American Psychiatric Association; Diagnostic and statistical manual of mental disorders: DSM-IV-TR, 2000); thus, the scores of the DCDQ-J should not be significantly related to intelligence. On the other hand, the scores of the DCDQ-J may be positively associated with ADHD tendencies, since DCD is frequently associated with ADHD (Fox & Lent, 1996; Kopp, Beckung, & Gillberg, 2010; Lingam et al., 2010).

2. Methods

2.1. Participants

Parents/guardians of all students in public nursery schools, elementary schools, and junior high schools in the participating city were invited to take part in this study. Nursery school students (middle class: 4- to 5-year-old students; senior class: 5- to 6-year-old students) and all elementary and junior high school students were included in this study. The questionnaire was sent to the parents/guardians via the teachers. The responses from the 6330 respondents were analyzed. Table 1 shows the details of the children, as reported by the respondents. The majority (94%) of the respondents were mothers. Approximately 5% of the respondents were fathers, and the rest were grandparents. Data from parents and guardians of children in special classrooms was excluded from the study. The number of data inputs varied at analysis because missing data was excluded.

2.2. Development of the DCDQ-J

DCDQ 2007 is a parent questionnaire consisting of 15 items and was designed to screen for coordination disorders in children aged 5–15 years (Wilson et al., 2000, 2009). There are 3 subscales, namely, "control during movement (6 subitems)", "fine motor (4 subitems)", and "general coordination (5 subitems)". The descriptions of each item are scored as follows by a 5-point scale based on the comparison between the child and other (children): "Not at all like your child (1 point)", "A bit like your child (2 points)", "Moderately like your child (3 points)", "Quite a bit like your child (4 points)", and "Extremely like your child (5 points)", with higher scores indicating better coordination. Recently, the DCDQ-J was developed and adapted to the Japanese culture (Nakai et al., 2009) in accordance with the International Guidelines (Beaton, Bombardier, Guillemin, & Ferraz, 2000).

We employed the Japanese version of the ADHD-rating scale (Japanese version ADHD-RS) developed by DuPaul, Power, Anastopoulos, & Reid (1998), DuPaul, Power, Anastopoulos, & Reid (2008). Based on the ADHD criteria of DSM-IV (American Psychiatric Association; Diagnostic and statistical manual of mental disorders: DSM-IV-TR, 2000), this scale consists of 2

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

	Male	Female	Total
Nursery school			
Middle (4–5)	174	167	341
Senior (5–6)	154	176	330
Elementary school			
1 (6–7)	422	350	772
2 (7–8)	343	374	717
3 (8–9)	378	363	741
4 (9–10)	314	319	633
5 (10–11)	328	352	680
6 (11–12)	310	292	602
Lower-secondary school			
7 (12–13)	292	268	560
8 (13–14)	229	255	484
9 (14–15)	219	251	470
Total	3163	3167	6330

subscales to measure the 2 major characteristics of ADHD, namely, Inattentive (9 items) and Hyperactive-Impulsive (9 items). Both the school and home forms of the ADHD-RS have been confirmed to have sufficient reliability and validity (DuPaul, Power, Anastopoulos, & Reid, 1998; DuPaul, Power, McGoey, Ikeda, & Anastopoulos, 1998; DuPaul et al., 2008). As in prior surveys, parents or rearers rated each item on a 4-point Likert scale ranging from “Not at all or rarely (0)” to “Sometimes (1),” “Often (2),” or “Very often (3).” Therefore, the higher a child’s score, the more the ADHD tendency.

Our survey employed the DCDQ-J and ADHD-RS and asked the parents or guardians to respond to all of the items for their children.

We measured the intelligence of elementary school children and lower-secondary schoolchildren by using the New Kyoken Support to Intelligence Tests for Each School Grade (Tatsuno, Ishida, & Hattori, 2002). This is a collective intelligence test conducted at the beginning of a school year to assess each child’s intelligence quotient (IQ).

2.3. Procedure

This study was approved by the ethics committee of the Hamamatsu University School of Medicine. To request the cooperation of the target city, we provided the education committee of that city with an explanation of the purpose and method of our study, as well as an outline of our plan to protect the privacy of participants. We obtained consent from all the preschools and elementary and junior high schools in the participating city and performed the survey using the described questionnaires. We informed the parents and guardians before starting the study that participation was optional and that they would be notified of the results after the compilation of statistics.

2.4. Statistical analysis

SPSS version 16 (IBM Corporation, NY, USA) was used for statistical analysis.

3. Results

3.1. Scaling method of the DCDQ-J, confirmatory factor analysis, and reliability of DCDQ-J

A confirmatory-factor analysis of the DCDQ-J was performed by assuming the 3 factors reported by Wilson et al. (Schoemaker et al., 2006; Wilson et al., 2000, 2009). All factor loading values were ≥ 0.5 , while indicators of good fit were slightly low, such as comparative fit index (CFI) = 0.86 and mean square error of approximation (RMSEA) = 0.13. Therefore, 4 error covariances were added according to the modification indices. As a result, the CFI increased to 0.94 and RMSEA decreased to 0.09, which were acceptable results. The α factors were calculated by subscale yielded values for control during movement, fine motor, and general coordination as 0.91, 0.91, and 0.81, respectively, which indicated that the subscales had high levels of internal consistencies. Accordingly, the study employed 3-factor analysis, and total scores per item were defined as subscale scores. The correlation coefficient between the subscales ranged from 0.59 to 0.73. The total scores of all items were defined as all scores of the DCDQ ($\alpha = 0.93$).

3.2. Gender difference and school grade difference in the DCDQ-J

Two-way analysis of variance (ANOVA) with factors of age and school grade was performed to evaluate the subscale scores of the DCDQ-J (Table 2). The main effects of gender ($F(1, 6218) = 78.88, p < 0.001$) and school grade ($F(10, 6218) = 36.70, p < 0.001$) were significant, while the interaction effect ($F(10, 6218) = 0.54$) was not significant in the control