

1 Original Article

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3 Main Title: Compliance with a physical activity guideline among junior high school students

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5 Short running title: Compliance with a physical activity guideline

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1 **Abstract**

2 **Background** There was no nation-wide moderate- to vigorous-intensity physical activity (MVPA)  
3 data among Japanese adolescents. This study assessed the **compliance with** the MVPA guideline in  
4 adolescents using a random sampling survey in Japan. The factors associated with meeting the  
5 guideline were also examined. **Methods** Participants were 1st to 3rd grade Japanese junior high school  
6 students (307 boys and 255 girls). We analyzed data of the National Sports-Life Survey of Teens 2019  
7 which used the Japanese version of PA questions in the WHO Health Behaviour in School-aged  
8 Children survey and potential correlates of MVPA. **Results** The **compliance with** meeting PA guideline  
9 by the WHO for Japanese students was 19.0% (95% CI, 15.8 - 22.3). The **compliance** for boys was  
10 significantly higher than that of girls (23.1%; 95% CI, 18.4 - 27.8; vs, 14.1%; 95% CI, 9.8 -18.4).  
11 Meeting PA guideline was significantly associated with boys in the second grade than boys in the first  
12 grade (OR 1.78; 95% CI, 1.02 - 3.09), liking PA (for all: OR 2.97; 95% CI, 1.32 - 6.69; for girls: OR  
13 2.99; 95% CI, 1.01 - 8.81), and sports participation (for all: OR 4.77; 95% CI, 2.32 - 9.80; for boys:  
14 OR 6.00; 95% CI, 1.81 - 19.89; for girls: OR 4.08; 95% CI, 1.63 - 10.21). **Conclusion** The results  
15 suggest that more than 80% junior high school students were insufficiently physically active in Japan.  
16 Preference for PA and sports participation may be important correlates of sufficient PA.

17

18 **Keywords:** Inactivity, Youth, Epidemiology, Gender

## 1 **1. Introduction**

2 Physical inactivity in adolescence is associated with adverse health problems.<sup>1,2</sup> Insufficient  
3 physical activity (PA) during childhood often extends into adulthood.<sup>3</sup> Previous studies pointed out  
4 high **compliance** of global inactivity for adolescents.<sup>4,6</sup> For example, the World Health Organization  
5 (WHO) global recommendations on PA for health state that children and youth aged 5-17 should  
6 accumulate at least 60 minutes of moderate- to vigorous-intensity PA (MVPA) daily.<sup>7</sup> In fact, more  
7 than 80% of adolescents fail to meet this MVPA guideline all over the world, and insufficient physical  
8 activity is more prevalent among girls than among boys in many countries.<sup>5</sup> However, there are no  
9 nationally representative MVPA data in many countries, and the MVPA levels of Japanese adolescents  
10 are unknown.<sup>4,6,8</sup> Thus, the gaps in knowledge and evidence hinder measures for national promotion  
11 of PA for Japanese adolescents.

12 The most recent global comparison study obtained MVPA data from existing WHO surveys  
13 and other multi-country surveys (for example, the Global School-based Student Health Survey, and  
14 the Health Behaviour among School-aged Children [HBSC]).<sup>5</sup> The HBSC study is a WHO  
15 collaborative cross-national study of adolescent health and well-being in Europe and North America.  
16 Therefore, we examined the validation of HBSC PA questionnaire for Japanese adolescents in the  
17 Japanese version (**n=108**): the HBSC PA questionnaire has acceptable validity for Japanese  
18 adolescents (**r = .32, P < .001**).<sup>9</sup> Another study also suggested that the HBSC questionnaire is a valid

1 measure of levels of MVPA at group or national level.<sup>10</sup> Recently, we reported that the **compliance**  
2 **with** recommended MVPA level in population-based study of a rural setting in Japan.<sup>11</sup> The  
3 **compliance with** MVPA recommendation was 20.1% among those aged 9-15 years old. Moreover,  
4 meeting recommended MVPA level was significantly associated with belonging to a medium-  
5 population-density or low-population-density area (vs. high-population-density area). In Japan,  
6 nationwide surveillance of PA in adults has been conducted using the pedometer-determined step  
7 counts by the Ministry of Health, Labour and Welfare. Ihara et al.<sup>12</sup> reported that that men and women  
8 living in larger cities took more steps compared to those living in smaller cities. Thus, the **compliance**  
9 of PA for adolescents might differ depending on the setting, e.g. urban versus rural location, or  
10 depending on the size and population density of the urban setting. Abe et al.<sup>11</sup> also reported that MVPA  
11 was associated with grade, gender, and preference for PA, and was not associated with body weight  
12 status, screen time and consumption of breakfast. However, there is no evidence of the correlates of  
13 MVPA for adolescents in all Japan.

14 The purpose of this study is therefore to investigate levels of PA for adolescents stratified by  
15 gender and grade level using the National Sports-Life Survey of Teens 2019 by the Sasakawa Sports  
16 Foundation (SSF).<sup>13</sup> Moreover, the relationship with the demographic and biological, psychological,  
17 behavioral, and environmental aspects were examined as the correlates of MVPA.

18

1 **2. Methods**

2 2.1. Data source

3 The SSF has performed a cross-sectional survey based on the two-staged stratified random  
4 sampling to identify the rate of children exercising and playing sports as well as the sports environment  
5 surrounding children and adolescents every 2 years since 2001. The survey was performed for children  
6 and adolescents aged 4 to 11 and 12 to 21 living in all 47 Japanese prefectures from 29th June to 20th  
7 July 2019 during school periods.<sup>13</sup> In the present study, data from those aged 12 to 21 were used for  
8 analysis. The sample was selected based on the two-staged stratified random sampling. All prefectures  
9 in Japan were classified into 10 areas for the stratification. Based on the population size of participants  
10 aged 12 to 21 years in each area, 225 districts were allocated to collect 3,000 participants, with 10 to  
11 19 participants selected in each district. Questionnaires were distributed and collected by the  
12 questionnaire placement method. The response was obtained from 1,675 participants (the response  
13 rate of the survey was 55.8%), with 567 junior high school students. In the present study, data of 562  
14 students who responded a question on MVPA were used for analysis. The SSF approved the secondary  
15 use of these data for research purposes, and all provided data were stripped of personal identifiers.  
16 This is a secondary analysis of the SSF survey. The detail of the survey was described in another report  
17 by the SSF.<sup>13</sup>

18 2.2. Questionnaire

1           The SSF survey included both self-report and their guardian-report questionnaire.<sup>13</sup> We used  
2   only the data from self-report questionnaire except for an annual income of family reported by their  
3   guardians. In the SSF survey, the Japanese version of the HBSC questionnaire made through back-  
4   translation into English was used.<sup>9</sup> The HBSC questionnaire is very widely used and is the basis of  
5   MVPA surveillance of adolescents internationally in the HBSC. The questionnaire records the MVPA  
6   item focusing on the total amount of activity and therefore includes all types of activities undertaken  
7   in and out of school hours. The MVPA item is as follows: “Over the past 7 days, on how many days  
8   were you physically active for a total of at least 60 minutes per day?”. The present study considered  
9   potential moderators of MVPA using a socio-ecological model as recommended.<sup>14-18</sup> The variables  
10   studied for each domain were:  
11   a. a demographic and biological domain: gender, boys or girls; school grade, 1st grades (12-13 years  
12   old) (=reference group), 2nd grades (13-14 years old), or 3rd grades (14-15 years); annual income of  
13   family, < 5 million yen (=reference group), < 8 million yen, or  $\geq$  8 million yen  
14   b. a psychological domain: preference for physical activity, dislike (=reference group), or like; self-  
15   rated health, poor/fair (=reference group), or good/very good  
16   c. a behavioral domain: attendance at sports clubs, no (=reference group) or yes; consumption of  
17   breakfast, skipping (=reference group), or every day; active transportation, no, or yes  
18   d. environmental domain: geographical region, high (living in Tokyo Special Ward or ordinance-

1 designated cities) (=reference group), medium (living in cities in more than 100 thousand people), or  
2 low population density area (living in cities in under 100 thousand people or towns and villages)

### 3 2.3. Statistical Analysis

4 The proportions of children meeting the MVPA recommendation (7 days/week) **with 95%**  
5 **confidence interval (95% CI)** were calculated and expressed by the demographic and biological,  
6 psychological, and behavioral domains.<sup>7</sup> A Chi-squared test was used to examine gender differences.  
7 Associations between meeting the recommendation versus not meeting with possible correlates of  
8 MVPA adjusted for gender were assessed with odds ratios obtained from polytomous logistic  
9 regression analysis. Analyses stratified by gender were used to examine the relationship between  
10 meeting the MVPA recommendation with independent variables. None of the variables had  
11 correlations of sufficient strength to indicate multicollinearity evaluated by the Kendall's coefficient  
12 of agreement ( $\tau < 0.38$ , data not shown). All statistical analyses were conducted using IBM SPSS  
13 statistics version 23.0J for Windows (IBM Corp., Armonk, NY, USA). P-value  $< 0.05$  **for the two-**  
14 **tailed test** was taken to indicate statistical significance.

15

### 16 **3. Results**

17 The characteristics of study participants are presented in Table 1.

18 Table 2 shows the **compliance with** MVPA guideline by demographic, biological,



1 psychological, and behavioral domains. Overall, 19.0% (95% CI, 15.8 - 22.3) of participants met the  
2 WHO recommended level of MVPA. The compliance for boys was higher than that of girls (23.1%;  
3 95% CI, 18.4 - 27.8; vs, 14.1%; 95% CI, 9.8 -18.4;  $p < 0.01$ ).

4 Associations of possible correlates with meeting the PA recommendation were assessed  
5 using odds ratios and the results are shown in table 3. Meeting PA recommendation was significantly  
6 associated with boys in the second grade than boys in the first grade (OR 1.78; 95% CI, 1.02 - 3.09),  
7 liking PA (for all with adjustment for gender: OR 2.97; 95% CI, 1.32 - 6.69; for girls: OR 2.99; 95%  
8 CI, 1.01 - 8.81) (vs dislike), and sports participation (for all with adjustment for gender: OR 4.77; 95%  
9 CI, 2.32 - 9.80; for boys: OR 6.00; 95% CI, 1.81 - 19.89; for girls: OR 4.08; 95% CI, 1.63 - 10.21) (vs  
10 non-participation). Furthermore, liking PA was positively associated with self-rated health ( $\tau=.16$ ),  
11 sports participation ( $\tau=.38$ ) and active transportation ( $\tau=.09$ ). Sports participation was also positively  
12 associated with self-rated health ( $\tau=.23$ ) and consumption of breakfast ( $\tau=.13$ ).

13

#### 14 4. Discussion

15 This study assessed the compliance with the PA guideline in the junior high school students using  
16 a random sampling survey for all of Japan. This is the first study to describe the compliance with WHO  
17 recommended MVPA level using a randomly selected sample of Japanese adolescents. The associated  
18 factors were also examined. As a result, the compliance with PA guideline by the WHO for Japanese

1 students was 19.0%. The **percentage** for boys was higher than that of girls (23.1% vs 14.1%). **The**  
2 **compliance with** PA guideline was significantly associated with boys in the second grade than boys in  
3 the first grade, liking PA, and sports participation.

4 **Hallal et al.<sup>4</sup> reported that 80.3% of adolescents fail to compliance with the WHO MVPA**  
5 **guideline when assessed by HBSC and WHO Global School based Student Health Survey among**  
6 **adolescents aged 13 - 15 years in 105 countries. While, for adults, 31.1% (aged 15 years or older) do**  
7 **not reach public health guidelines for recommended levels of PA for 122 countries. Thus, the**  
8 **compliance with PA guideline for the present study (19.0%) was similarly low.** For the Japanese  
9 adolescents assessed by the HBSC questionnaire, junior high school students living in a rural setting  
10 had a slightly higher **compliance with** MVPA recommendation (22.0% of 920 students) than this  
11 sample (19.0%).<sup>11</sup> Moreover, Japanese girls (14.1%) in the present study were much less likely to meet  
12 the PA guideline than boys (23.1%), a finding which is consistent with international trends.<sup>4,5</sup>

13 In the present study the analysis of demographic and biological correlates revealed that the  
14 **compliance** of sufficient PA in the second-grade boys (30.5%) was higher than that of the first-grade  
15 boys (20.0%). Abe et al.<sup>11</sup> reported that the **compliance** among second-grade junior high school boys  
16 (31.7%) was similar with that of first-grade boys (32.0%) in rural settings in Japan. The reason for the  
17 higher **compliance** in the present study is not clear, as other potential factors also didn't correlate with  
18 grade in the present study. In Japan, education through junior high school is compulsory. More than

1 97% of junior high school students go on to high school in Japan.<sup>19</sup> According to the survey by the  
2 Japan Sports Agency, the percentage of participation in sport for the second-grade boy students  
3 (91.2%) was higher than that of first-grade boy students (87.9%).<sup>20</sup> Thus, the second-grade boy  
4 students might have more opportunities to do PA than the first-grade boy students. Socioeconomic  
5 status (SES), as measured by annual income of the family in the present study, was not significantly  
6 associated with compliance with the MVPA guideline. A previous systematic review reported that  
7 adolescents with higher SES are more physically active than those with lower SES.<sup>21</sup> On the other  
8 hand, a systematic review for Chinese adolescents showed that family socioeconomic status was not  
9 associated with physical activity.<sup>22</sup> Another review pointed out that SES was associated with MVPA  
10 when questionnaire data were used to measure MVPA but not when accelerometry was used to  
11 measure MVPA in the UK.<sup>23</sup> Moreover, the recent global comparison study also reported that there  
12 was no clear pattern of MVPA level according to country income group.<sup>5</sup>

13 For the psychological factors, meeting the MVPA guideline was significantly associated with  
14 liking PA. The result was consistent with that from a previous study for Japanese children and  
15 adolescents.<sup>9</sup> Previous reviews showed that liking PA is positively correlated with actual participation  
16 in PA among adolescents.<sup>24,25</sup> Liking PA was also positively associated with sports participation in the  
17 present study ( $\tau=.38$ ). On the other hand, there was no association in the present study between self-  
18 rated health and the compliance of PA. Previous studies have investigated the associations between

1 PA and self-rated health in adolescents.<sup>26-28</sup> There are differences in the criteria used to operationalize  
2 the WHO MVPA guideline between studies. However, Galán et al.<sup>26</sup> reported that the frequency of  
3 undertaking MVPA (1-2, 3-4, 5-6 and 7 days, using 'never' as the reference) increased, the association  
4 with self-rated health was stronger. The inconsistency with the present study was therefore not likely  
5 to be due to differences in the way the MVPA guideline was operationalized between the present study  
6 and previous studies.

7 For behavioral potential correlates of compliance with the MVPA guideline, our results support  
8 findings from previous reviews which show participation in sport/exercise has a positive relationship  
9 with PA.<sup>29,30</sup> As we mentioned above, liking PA is also related with meeting the PA guideline.  
10 Moreover, the relationship between sports participation and liking PA was positive ( $\tau=.38$ ). This  
11 suggests that a sport participation in adolescence and enjoyment of PA might contribute to PA. On the  
12 other hand, consumption of breakfast and active transportation were not associated with meeting PA  
13 guideline in the present study. There are discrepancy in the results of associations between breakfast  
14 eating behaviours and PA in previous studies.<sup>31-34</sup> One of the reasons, the number of students in  
15 skipping breakfast were low in the present study. The prefecture-level school lunch coverage rate for  
16 Japanese junior high school students was 89.9%.<sup>35</sup> The school lunch nutrition standards were regulated  
17 by the School Lunch Program Act.<sup>36</sup> A recent study suggested that appropriate nutritional intake  
18 through school lunch may be effective to reduce childhood obesity.<sup>37</sup> Thus, any potential association

1 between PA and consumption of breakfast might be blunted by the provision of school lunch in Japan.  
2 Many studies have shown that active commuting to school has health benefits in children.<sup>38-41</sup>  
3 Interestingly, we found that active commuting to school was not a significant predictor in achieving  
4 sufficient levels of PA, in contrast to other studies.<sup>42-44</sup> The probable reason for the inconsistency is  
5 that most students used active transportation to school in the present study (83.6%). The percentage  
6 was similar with the national survey of the Japan Sports Agency (82% for second junior school  
7 students).<sup>45</sup> Japan has established in legislation which states that public junior high schools should be  
8 located within no more than 6 km from the students' home. A previous nationally representative study  
9 from Thailand also showed that active commuting to school didn't associate with overall PA.<sup>46,47</sup>  
10 Further research is needed to better understand the contribution of active transportation other than  
11 active commuting to school to MVPA, such as particularly walking and cycling to and from park or  
12 shopping.

13 Finally, geographical region didn't associate with the compliance of PA in the present study. Abe  
14 et al.<sup>11</sup> reported that lower population density was associated with a lower compliance with the  
15 recommended MVPA level compared with a high population density among Japanese children and  
16 adolescents in the rural area. Kowaleski-Jones et al.<sup>48</sup> reported that an increase in population density  
17 is associated with less time spent in MVPA among youth aged 6 to 11 years but more MVPA among  
18 teens. Thus, one of the reasons of discrepancies between studies might be due to a difference of study

1 participant age among studies. In a systematic review for East Asian adolescents, inconsistent findings  
2 on the association between residential density and PA were obtained.<sup>49</sup> Further studies comparing  
3 participants from different age groups in Japan are needed.

4       There are limitations to consider for the present study. First, the SSF survey was conducted at the  
5 end of June to July. Previous reviews have reported that there are seasonal differences in PA.<sup>50</sup> The  
6 end of June to July is the beginning of summer in Japan, with no extreme weather; however, it is  
7 associated with the rainy season in most of the parts of Japan, which may lead to the underestimation  
8 of PA. Therefore, the results may be slightly different from the habitual status. In addition, the results  
9 are based on nationally representative data by careful random sampling, but the sample size was not  
10 large. These limitations should be kept in mind. Second, the associations between PA and correlates  
11 don't indicate causal relationships because this is a cross-sectional study. Third, the MVPA level was  
12 assessed by a self-reported questionnaire. However, as above mentioned, Murphy et al.<sup>10</sup> reported that  
13 the questionnaire used in HBSC has some evidence of criterion validity relative to accelerometry and  
14 is used widely for MVPA surveillance internationally.<sup>10</sup> Recall bias might have influenced results in  
15 that subjectively measured PA overestimates compared with objectively measured PA, but the HBSC  
16 questionnaire seems to avoid this problem, at least at group level. Despite these limitations, the present  
17 study is the first study which assessed the compliance of PA with WHO HBSC questionnaire in  
18 Japanese adolescents. In future studies, assessment of domain-specific activities (i.e., physical

1 education, recess, sedentary behavior) might enhance the understanding of mechanisms underlying  
2 the association between PA and potential factors.

3

#### 4 **5. Conclusions**

5 This study describes the compliance with the PA guideline in the junior high school students by  
6 a random sampling survey for all Japan by the SSF. The compliance with the WHO guideline for  
7 MVPA among Japanese students was only 19.0%. The compliance among boys was significantly  
8 higher than that of girls (23.1% vs, 14.1%). Meeting PA guideline was associated with higher odds  
9 ratios for liking PA for all and girls, sports participation for all and each gender, and grade for boys.  
10 The results suggest that preference for PA and sports participation may be important to achievement  
11 of the MVPA guideline.

12

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15

#### 16 **Disclosure**

17 Rie Takenaga and Takahiro Suzuki are employees of Sasakawa Sports Foundation.

18

1 **Author contribution**

2 CT and TA have given substantial contributions to the conception or the design of the manuscript, CT,  
3 TA, RT, TS, SN, ST, and JJR to acquisition, analysis and interpretation of the data. All authors have  
4 participated to drafting the manuscript, JJR revised it critically. All authors read and approved the final  
5 version of the manuscript. All authors contributed equally to the manuscript and read and approved  
6 the final version of the manuscript.

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1 Table 1. Participants' characteristics variables.

	Total		Boys		Girls	
	n	%	n	%	n	%
Grade	562		307		255	
1st grades (12–13 years old)	187	33.3	105	34.2	82	32.2
2nd grades (13–14 years old)	196	34.9	95	30.9	101	39.6
3rd grades (14–15 years old)	179	31.9	107	34.9	72	28.2
Annual income of family	453		249		204	
< 5 million yen	160	35.3	89	35.7	71	34.8
< 8 million yen	172	38.0	96	38.6	76	37.3
$\geq$ 8 million yen	121	26.7	64	25.7	57	27.9
Preference for physical activity	558		305		253	
Dislike	93	16.7	30	9.8	63	24.9
Like	465	83.3	275	90.2	190	75.1
Self-rated health	561		307		254	
Poor/fair	67	11.9	30	9.8	37	14.6
Good/very good	494	88.1	277	90.2	217	85.4
Sports participation	560		306		254	
No	157	28.0	53	17.3	104	40.9
Yes	403	72.0	253	82.7	150	59.1
Consumption of breakfast	562		307		255	
Skipping	69	12.3	37	12.1	32	12.5
Every day	493	87.7	270	87.9	223	87.5
Active transportation	561		306		255	
No	92	16.4	40	13.1	52	20.4
Yes	469	83.6	266	86.9	203	79.6
Geographical region	562		307		255	
Tokyo Special Ward	16	2.8	7	2.3	9	3.5
Ordinance-designated cities	132	23.5	74	24.1	58	22.7
Cities in more than 100 thousand people	232	41.3	130	42.3	102	40.0
Cities in under 100 thousand people	122	21.7	62	20.2	60	23.5
Towns and villages	60	10.7	34	11.1	26	10.2

1 Table 2. Compliance with moderate-to-vigorous physical activity guideline.

Grade	Total			Boys			Girls		
	n	%	95% CI %	n	%	95% CI %	n	%	95% CI %
1st grades (12–13 years old)	37	19.8	14.1 - 25.5	21	20.0	12.3 - 27.7	16	19.5	10.9 - 28.1
2nd grades (13–14 years old)	43	21.9	16.1 - 27.7	29	30.5	21.3 - 39.8	14	13.9	7.1 - 20.6
3rd grades (14–15 years old)	27	15.1	9.8 - 20.3	21	19.6	12.1 - 27.2	6	8.3	1.9 - 14.7
Total	107	23.6	15.8 - 22.3	71	28.5	18.4 - 27.8	36	17.6	9.8 - 18.4
Annual income of family									
< 5 million yen	28	17.5	11.6 - 23.4	16	18.0	10.0 - 26.0	12	16.9	8.2 - 25.6
< 8 million yen	35	20.3	14.3 - 26.4	25	26.0	17.3 - 34.8	10	13.2	5.6 - 20.8
≥ 8 million yen	26	21.5	14.2 - 28.8	18	28.1	17.1 - 39.1	8	14.0	5.0 - 23.1
Preference for physical activity									
Dislike	7	7.5	2.2 - 12.9	3	10.0	-0.7 - 20.7	4	6.3	0.3 - 12.4
Like	100	21.5	17.8 - 25.2	68	24.7	19.6 - 29.8	32	16.8	11.5 - 22.2
Self-rated health									
Poor/fair	8	11.9	4.2 - 19.7	6	20.0	5.7 - 34.3	2	5.4	-1.9 - 12.7
Good/very good	99	20.0	16.5 - 23.6	65	23.5	18.5 - 28.5	34	15.7	10.8 - 20.5
Sports participation									
No	9	5.7	2.1 - 9.4	3	5.7	-0.6 - 11.9	6	5.8	1.3 - 10.3
Yes	97	24.1	19.9 - 28.2	67	26.5	21.0 - 31.9	30	20.0	13.6 - 26.4
Consumption of breakfast									
Skipping	10	14.5	6.2 - 22.8	6	16.2	4.3 - 28.1	4	12.5	1.0 - 24.0
Every day	97	19.7	16.2 - 23.2	65	24.1	19.0 - 29.2	32	14.3	9.7 - 19.0

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Active transportation															
No	18	19.6	11.5	-	27.7	10	25.0	11.6	-	38.4	8	15.4	5.6	-	25.2
Yes	88	18.8	15.2	-	22.3	60	22.6	17.5	-	27.6	28	13.8	9.0	-	18.5
Geographical region															
Tokyo Special Ward	2	12.5	-3.7	-	28.7	1	14.3	-11.6	-	40.2	1	11.1	-9.4	-	31.6
Ordinance-designated cities	24	18.2	11.6	-	24.8	16	21.6	12.2	-	31.0	8	13.8	4.9	-	22.7
Cities in more than 100 thousand people	49	21.1	15.9	-	26.4	33	25.4	17.9	-	32.9	16	15.7	8.6	-	22.7
Cities in under 100 thousand people	21	17.2	10.5	-	23.9	14	22.6	12.2	-	33.0	7	11.7	3.5	-	19.8
Towns and villages	11	18.3	8.5	-	28.1	7	20.6	7.0	-	34.2	4	15.4	1.5	-	29.3

1

2 n: number of meeting the physical activity guideline, 95% CI: 95% confidence interval.

1 Table 3. Associations between **physical activity recommendation** and associated factors.

Meeting vs, Non-meeting the recommendation:	n	OR	95% CI	P	n	OR	95% CI	P	n	OR	95% CI	P
<b><i>Demographic and biological factors</i></b>	<b><i>All</i></b>				<b><i>Boys</i></b>				<b><i>Girls</i></b>			
Grade												
1st grade	37	1.00			21	1.00			16	1.00		
2nd grade	43	1.41	( 0.91 - 2.19 )	0.12	29	1.78	( 1.02 - 3.09 )	0.04	14	0.97	( 0.47 - 1.99 )	0.92
3rd grade	27	0.64	( 0.39 - 1.03 )	0.07	21	0.73	( 0.41 - 1.30 )	0.29	6	0.46	( 0.18 - 1.17 )	0.10
Annual income of family*												
< 5 million yen	28	1.00			16	1.00			12	1.00		
< 8 million yen	35	1.07	( 0.67 - 1.73 )	0.77	25	1.23	( 0.68 - 2.23 )	0.49	10	0.82	( 0.36 - 1.85 )	0.63
≥ 8 million yen	26	1.17	( 0.70 - 1.95 )	0.55	18	1.37	( 0.72 - 2.62 )	0.33	8	0.93	( 0.39 - 2.22 )	0.87
<b><i>Psychological factors</i></b>												
Preference for physical activity												
Dislike	7	1.00			3	1.00			4	1.00		
Like	100	2.97	( 1.32 - 6.69 )	0.01	68	2.96	( 0.87 - 10.05 )	0.08	32	2.99	( 1.01 - 8.81 )	< 0.05
Self-rated health												
Poor/fair	8	1.00			6	1.00			2	1.00		
Good/very good	99	1.74	( 0.80 - 3.79 )	0.16	65	1.23	( 0.48 - 3.13 )	0.67	34	3.25	( 0.75 - 14.16 )	0.12
<b><i>Behavioral factors</i></b>												

Compliance with a physical activity guideline among junior high school students

Sports participation										
No	9	1.00			3	1.00			6	1.00
Yes	97	4.77	( 2.32 - 9.80 )	< 0.01	67	6.00	( 1.81 - 19.89 )	< 0.01	30	4.08 ( 1.63 - 10.21 ) < 0.01
Consumption of breakfast										
Skipping	10	1.00			6				4	
Every day	97	1.44	( 0.71 - 2.93 )	0.31	65	1.64	( 0.65 - 4.10 )	0.29	32	1.17 ( 0.39 - 3.57 ) 0.78
Active transportation										
No	18	1.00			10	1.00			8	1.00
Yes	88	0.88	( 0.49 - 1.55 )	0.65	60	0.87	( 0.40 - 1.89 )	0.73	28	0.88 ( 0.38 - 2.06 ) 0.70
<b>Environmental factors</b>										
Geographical region										
High-population-density area	26	1.00			17	1.00			9	1.00
Medium-population-density area	49	1.24	( 0.81 - 1.90 )	0.32	33	1.24	( 0.73 - 2.12 )	0.42	16	1.24 ( 0.61 - 2.52 ) 0.56
Low-population-density area	32	0.87	( 0.53 - 1.43 )	0.59	21	0.85	( 0.46 - 1.57 )	0.59	11	0.93 ( 0.41 - 2.08 ) 0.93

- 1 n: number of meeting the physical activity guideline, Tokyo Special Ward and Ordinance-designated cities, medium-population-density area: more than 1000
- 2 thousand people cities, low population-density area: under 1000 thousand people cities, town and village, adjusted by a gender. OR, odds ratio; CI, confidential
- 3 interval.

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