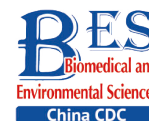


Letter to the Editor

**Insufficient Physical Activity among Students Aged 6–17 Years in China, 2016–2017***

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Regular physical activity of sufficient duration and intensity can provide health benefits such as improved physical fitness, which promotes bone health, prevents hypertension, improves mental health, and reduces adiposity^[1]. Furthermore, the benefits of regular physical exercise during youth may persist into adulthood^[2]. The World Health Organization (WHO) recommended that children and young people aged 5–17 years old should accumulate at least 60 minutes of moderate to vigorous intensity physical activity daily^[1]. In 2016, the WHO reported that the global prevalence of insufficient physical activity among adolescents aged 11–17 years remained high at 81.0%^[3]. Also in 2016, a school-based survey including students of Grades 4 to 12 in China found that close to 70% of students did not meet the recommendation^[4]. To examine the prevalence of insufficient physical activity among Chinese students aged 6–17 years, the data from the China Nutrition and Health Surveillance of Children and Lactating Mothers (CNHSCLM) in 2016–2017 was used.

The CNHSCLM was conducted at 275 districts or counties across 31 provincial-level administrative divisions in 2016–2017. Using a multi-stage stratified cluster randomized sampling method, a representative sample of Chinese students aged 6 to 17 years old was selected randomly. Based on their economic and social development, 275 districts/counties were classified into four subgroups: big cities, medium/small cities, non-poor rural areas, and poor rural areas. Two townships/subdistricts were randomly selected from each district/county; a primary school and a junior middle school were randomly selected from each township/subdistrict; a senior high school was

randomly selected from each district/county; for every grade in each selected school, one class was randomly selected; 28 students were selected from each class. This study was approved by the ethical committee of the National Institute for Nutrition and Health of the Chinese Center for Disease Control and Prevention. The ethical approval number was 201614. A total of 74,623 students who met the inclusion criteria were invited, among which 72,840 students completed the survey. After excluding 2,235 participants with incomplete data (e.g., living on campus, physical activity), 70,605 students aged 6–17 years were included in this study.

The information on demographics, physical activity, and other behaviors (e.g., diet, smoking, drinking) was collected through face-to-face questionnaire interviews by trained interviewers at the local Centers for Disease Control and Prevention. For the students in grades 1 to 3 from primary school, questionnaires were completed with the assistance of their parents or their main caregivers. Physical activity was measured by asking students whether they carried out moderate-to-vigorous intensity physical activity, the frequency of the activities (days per week), and the time spent doing the activities in a day. Insufficient physical activity was defined as participants not doing an average of 60 minutes of moderate-to-vigorous-intensity physical activity per day, across the typical week.

All statistical descriptions in this study were weighted to obtain nationally representative estimates. The weight of the sample was calculated by data from the China's Sixth National Census in 2010. Rao-Scott chi-square tests were used for comparisons among unordered categorical variables, whereas logistic regression models were used to

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examine the trend for ordered categorical variables. Statistical significance was determined as a two-sided $P < 0.05$. All statistical analyses were performed using the software SAS (version 9.4, SAS Institute Inc., Cary, USA).

A total of 70,605 participants were included in this study, including 35,258 (49.9%) boys and 35,347

(51.1%) girls. The number of aged 6–11 years and rural areas subjects was 39,314 (55.7%) and 37,284 (52.8%), respectively (Table 1).

In 2016–2017, the prevalence of insufficient physical activity among Chinese students aged 6–17 years was 84.3% (95% confidence interval [CI]: 80.8%–87.9%), in boys 81.7% (95% CI: 77.9%–85.4%),

Table 1. Demographic characteristics of participants

Characteristics	Total N (%)	Boy N (%)	Girl N (%)
Total	70,605 (100.0)	35,258 (49.9)	35,347 (51.1)
Age, years			
6–11	39,314 (55.7)	19,545 (55.4)	19,769 (55.9)
12–14	17,363 (24.6)	8,749 (24.8)	8,614 (24.4)
15–17	13,928 (19.7)	6,964 (19.8)	6,964 (19.7)
Residence			
Urban	33,321 (47.2)	16,643 (47.2)	16,678 (47.2)
Rural	37,284 (52.8)	18,615 (52.8)	18,669 (52.8)
Living on campus			
No	51,074 (72.3)	25,622 (72.7)	25,452 (72.0)
Yes	19,531 (27.7)	9,636 (27.3)	9,895 (28.0)
Household chores time (min/week)			
0	43,565 (61.7)	22,033 (62.5)	21,532 (60.9)
1–29	4,942 (7.0)	2,434 (6.9)	2,508 (7.1)
30–59	7,074 (10.0)	3,524 (10.0)	3,550 (10.0)
60–89	6,425 (9.1)	3,063 (8.7)	3,362 (9.5)
≥ 90	8,599 (12.2)	4,204 (11.9)	4,395 (12.4)
On campus exercise (days/week)			
7	14,912 (21.1)	7,855 (22.3)	7,057 (20.0)
4–6	14,060 (19.9)	7,225 (20.5)	6,835 (19.3)
2–3	18,438 (26.1)	9,362 (26.6)	9,076 (25.7)
≤ 1	23,195 (32.9)	10,816 (30.7)	12,379 (35.0)
Off campus exercise (days/week)			
7	5,040 (7.1)	2,931 (8.3)	2,109 (6.0)
4–6	2,933 (4.2)	1,687 (4.8)	1,246 (3.5)
2–3	12,598 (17.8)	6,936 (19.7)	5,662 (16.0)
≤ 1	50,034 (70.9)	23,704 (67.2)	26,330 (74.5)
Walking/biking to/from school (min/week)			
0	40,577 (57.5)	19,666 (55.8)	20,911 (59.2)
1–59	6,982 (9.9)	3,626 (10.3)	3,356 (9.5)
60–119	8,690 (12.3)	4,444 (12.6)	4,246 (12.0)
120–179	5,484 (7.8)	2,894 (8.2)	2,590 (7.3)
≥ 180	8,872 (12.6)	4,628 (13.1)	4,244 (12.0)

and in girls 87.4% (95% CI: 84.1%–90.7%). The prevalence of insufficient physical activity among those aged 15–17 years [88.5% (95% CI: 86.4%–90.6%)] was significantly higher than those in other age groups ($P < 0.001$). The prevalence of insufficient physical activity among students living on campus was higher than those not living on campus [87.5% (95% CI: 84.8%–90.2%) vs. 82.9% (95% CI: 78.7%–87.2%), $P = 0.001$]. The prevalence of insufficient physical activity increased with a decrease in the exercise frequency on and off campus (all $P < 0.001$). The prevalence of insufficient physical activity declined with increased time spent on household chores and walking or biking to and from school (all $P < 0.001$) (Table 2). In addition, the unweighted prevalence of insufficient physical activity among students was 86.0% (95% CI: 85.7%–86.2%). Detailed outcomes are presented in the [Supplementary Table S1](#) (available in www.besjournal.com).

The lowest prevalence of insufficient physical activity was observed among students who exercised daily both on and off campus in all age groups (all $P < 0.001$). With the decline in exercise frequency, the prevalence of insufficient physical activity increased among students in all age groups (all $P < 0.001$). The prevalence of insufficient physical activity declined with increased time spent on household chores and walking or biking to and from school in all age groups (all $P < 0.001$) (Table 3).

This study shows that the weighted prevalence of insufficient physical activity among students remains high in China, especially among girls, living on campus students and those aged 15–17 years. In 2016–2017, more than four-fifths of Chinese students aged 6–17 years had insufficient physical activity.

Although the global trend of insufficient physical activity significantly decreased between 2001 and 2016 for boy adolescents aged 11–17 years^[3], it was reported that the prevalence of insufficient physical activity among Chinese students aged 6–17 years increased from 76.0% in 2004 to 81.5% in 2015^[5]. The level of physical activity among Chinese school-aged children has been shown to remain at a low level^[4]. During the same period, the prevalence of insufficient physical activity in China among students aged 6–17 years (84.3%) was significantly higher than among students aged 6–17 years in the United States (77.0%)^[6]. The study showed that the prevalence of insufficient physical activity in girls was significantly higher than in boys, which is similar to that found in previous studies^[7]. A global survey of 1.6 million adolescents aged 11–17 years found that

the prevalence of insufficient physical activity in girls was 7.1 percentage points higher than in boys, and this difference was particularly apparent in high-income countries^[3]. In addition to physical and physiological differences, this may also relate to the personality differences between boys and girls, and different recreational programs outside of class.

The study found that the prevalence of insufficient physical activity living on campus was higher than those not living on campus. This may be attributed to the limited time for household chores and active commuting among students living on campus. It is suggested that students living on campus should enhance independent physical exercise. Previous studies have shown that walking/cycling to and from school can be a part of meeting children's physical activity^[8]. The results suggest that the prevalence of insufficient physical activity decreased with time spent walking/bicycling to/from school increased in students. The results also showed that 42.5% of children walk/bike to/from school, which was lower than in 2010–2012 (64.2%)^[9]. Physical activity on campus appears to tend to decline over time among students. A study found a declining trend in physical activity at school among Chinese students aged 6–17 years between 2004 and 2015^[10]. This study found that, under the same weekly exercise frequency, the prevalence of insufficient physical activity is higher for intramural sports compared to exercise outside of school. As a result, students should take physical education programs at school, and participate in on-campus sports activities. In addition, the prevalence of insufficient physical activity increased with age in this study. Similar results have been found in other studies^[4]. It is suggested to focus on the physical activity levels of adolescents in the upper grades.

This study was subject to at least one limitation. The physical activity information was self-reported by the participants or their guardians, and there may be recall bias in the physical activity. In the future, studies based on wearable device collection of physical activity information are needed to estimate the physical activity more accurately in students.

In summary, more than four-fifths of Chinese students aged 6–17 years had insufficient physical activity in 2016–2017. This study indicated that further measures are recommended to promote the physical activity of students in China, such as actively organizing sports activities within school campuses and enhancing the duration of moderate to vigorous physical activity for students within schools, especially among girls, living on campus students,

Table 2. Prevalence of insufficient physical activity among students aged 6–17 years in China, 2016–2017

Characteristics	Total		Boy		Girl	
	<i>N</i> *	Prevalence % (95% <i>CI</i>)	<i>N</i> *	Prevalence % (95% <i>CI</i>)	<i>N</i> *	Prevalence % (95% <i>CI</i>)
Total	60,709	84.3 (80.8, 87.9)	29,423	81.7 (77.9, 85.4)	31,286	87.4 (84.1, 90.7)
Age, years						
6–11	33,415	81.7 (77.1, 86.4)	16,301	80.2 (75.4, 85.0)	17,114	83.5 (79.0, 88.0)
12–14	14,956	84.1 (80.0, 88.3)	7,249	80.8 (75.8, 85.7)	7,707	88.1 (84.6, 91.6)
15–17	12,338	88.5 (86.4, 90.6)	5,873	84.6 (82.2, 87.0)	6,465	92.7 (90.7, 94.8)
<i>P</i> value for trend		< 0.001		0.011		< 0.001
Residence						
Urban	28,679	84.1 (79.6, 88.6)	13,903	81.2 (76.3, 86.1)	14,776	87.4 (83.2, 91.5)
Rural	32,030	84.5 (79.2, 89.9)	15,520	82.0 (76.4, 87.7)	16,510	87.4 (82.3, 92.6)
<i>P</i> value for difference		0.901		0.833		0.981
Living on campus						
No	43,602	82.9 (78.7, 87.2)	21,257	80.4 (75.8, 84.9)	22,345	85.9 (81.9, 89.9)
Yes	17,107	87.5 (84.8, 90.2)	8,166	84.6 (81.6, 87.7)	8,941	90.5 (87.9, 93.1)
<i>P</i> value for difference		0.001		0.012		< 0.001
Household chores time (min/week)						
0	39,270	89.0 (86.6, 91.5)	19,360	86.8 (84.0, 89.6)	19,910	91.6 (89.5, 93.7)
1–29	4,207	82.1 (75.2, 89.1)	2,003	79.7 (72.4, 87.0)	2,204	84.8 (78.0, 91.7)
30–59	5,878	83.0 (78.5, 87.5)	2,872	80.4 (74.7, 86.1)	3,006	85.9 (81.6, 90.2)
60–89	5,198	79.2 (75.4, 83.0)	2,377	74.4 (69.3, 79.5)	2,821	84.1 (80.6, 87.6)
≥ 90	6,156	69.0 (62.5, 75.5)	2,811	64.7 (58.7, 70.7)	3,345	73.7 (65.9, 81.5)
<i>P</i> value for trend		< 0.001		< 0.001		< 0.001
On campus exercise (days/week)						
7	10,908	72.2 (66.9, 77.4)	5,487	68.7 (62.8, 74.7)	5,421	76.6 (72.0, 81.2)
4–6	10,798	73.5 (68.3, 78.8)	5,326	70.3 (65.2, 75.3)	5,472	77.4 (71.7, 83.2)
2–3	16,296	87.5 (83.5, 91.5)	8,071	85.5 (81.6, 89.3)	8,225	90.0 (85.7, 94.2)
≤ 1	22,707	97.9 (97.3, 98.5)	10,539	97.3 (96.4, 98.2)	12,168	98.5 (98.0, 99.0)
<i>P</i> value for trend		< 0.001		< 0.001		< 0.001
Off campus exercise (days/week)						
7	2,932	53.7 (44.8, 62.6)	1,635	51.4 (42.1, 60.7)	1,297	57.7 (49.0, 66.4)
4–6	2,035	69.2 (63.7, 74.8)	1,133	66.6 (61.4, 71.8)	902	73.7 (66.3, 81.1)
2–3	9,811	74.4 (69.2, 79.7)	5,276	72.3 (66.7, 78.0)	4,535	77.4 (72.4, 82.3)
≤ 1	45,931	90.7 (88.5, 92.9)	21,379	89.2 (87.0, 91.4)	24,552	92.3 (90.0, 94.6)
<i>P</i> value for trend		< 0.001		< 0.001		< 0.001
Walking/biking to/from school (min/week)						
0	36,838	89.5 (86.4, 92.6)	17,505	87.8 (84.8, 90.9)	19,333	91.4 (88.1, 94.6)
1–59	5,745	82.3 (79.7, 85.0)	2,896	80.2 (77.1, 83.2)	2,849	85.0 (81.8, 88.1)
60–119	7,051	81.8 (78.0, 85.6)	3,461	78.4 (74.2, 82.7)	3,590	85.7 (81.8, 89.6)
120–179	4,329	76.7 (70.8, 82.6)	2,221	72.7 (64.9, 80.5)	2,108	81.8 (77.1, 86.4)
≥ 180	6,746	72.5 (65.3, 79.7)	3,340	68.7 (61.4, 76.1)	3,406	77.3 (69.9, 84.7)
<i>P</i> value for trend		< 0.001		< 0.001		< 0.001

Note. * *N* = Physically inactive participants (unweighted). *CI* = confidence interval.

Table 3. Prevalence of insufficient physical activity among students in different age groups in China, 2016–2017

Characteristics	6–11 years		12–14 years		15–17 years	
	<i>N</i> *	Prevalence % (95% <i>CI</i>)	<i>N</i> *	Prevalence % (95% <i>CI</i>)	<i>N</i> *	Prevalence % (95% <i>CI</i>)
Total	33,415	81.7 (77.1, 86.4)	14,956	84.1 (80.0, 88.3)	12,338	88.5 (86.4, 90.6)
Household chores time (min/week)						
0	23,842	86.4 (82.7, 90.0)	8,210	91.7 (90.3, 93.1)	7,218	92.4 (90.7, 94.1)
1–29	2,261	76.6 (67.3, 86.0)	1,008	83.4 (76.8, 90.1)	938	89.9 (85.7, 94.2)
30–59	2,674	77.6 (70.5, 84.7)	1,718	82.0 (74.8, 89.3)	1,486	89.5 (87.4, 91.6)
60–89	2,177	74.4 (69.1, 79.7)	1,773	79.9 (73.2, 86.5)	1,248	83.4 (79.9, 86.8)
≥ 90	2,461	63.9 (55.0, 72.8)	2,247	68.2 (60.1, 76.3)	1,448	75.5 (71.2, 79.8)
<i>P</i> value for trend		< 0.001		< 0.001		< 0.001
On campus exercise (days/week)						
7	5,231	66.0 (58.2, 73.8)	3,055	73.4 (68.3, 78.5)	2,622	79.1 (75.4, 82.8)
4–6	5,792	66.4 (59.9, 73.0)	2,765	75.9 (68.6, 83.1)	2,241	83.0 (79.1, 86.8)
2–3	8,439	85.2 (79.7, 90.6)	4,380	86.5 (81.5, 91.5)	3,477	91.8 (89.8, 93.7)
≤ 1	13,953	97.8 (97.0, 98.6)	4,756	98.0 (97.3, 98.7)	3,998	98.0 (96.9, 99.2)
<i>P</i> value for trend		< 0.001		< 0.001		< 0.001
Off campus exercise (days/week)						
7	1,689	49.4 (38.5, 60.2)	758	54.8 (44.6, 65.1)	485	64.2 (57.3, 71.1)
4–6	1,178	63.9 (56.7, 71.1)	516	71.1 (63.3, 78.9)	341	78.2 (71.5, 84.9)
2–3	5,796	71.4 (65.1, 77.7)	2,482	74.1 (66.3, 81.9)	1,533	81.7 (78.3, 85.1)
≤ 1	24,752	89.9 (87.2, 92.6)	11,200	91.1 (89.0, 93.3)	9,979	91.6 (89.4, 93.9)
<i>P</i> value for trend		< 0.001		< 0.001		< 0.001
Walking/biking to/from school (min/week)						
0	20,891	87.9 (83.8, 92.0)	8,380	90.6 (88.0, 93.3)	7,567	91.3 (89.0, 93.7)
1–59	3,094	77.1 (73.3, 81.0)	1,490	85.4 (82.1, 88.6)	1,161	88.7 (85.2, 92.3)
60–119	3,886	77.5 (71.3, 83.6)	1,948	83.7 (80.0, 87.4)	1,217	88.6 (85.5, 91.6)
120–179	2,261	72.3 (63.6, 81.0)	1,281	77.8 (70.8, 84.7)	787	84.1 (79.7, 88.5)
≥ 180	3,283	68.9 (60.7, 77.1)	1,857	68.7 (57.6, 79.8)	1,606	79.7 (74.8, 84.6)
<i>P</i> value for trend		< 0.001		< 0.001		< 0.001

Note. * *N* = Physically inactive students (unweighted). *CI* = confidence interval.

and those aged 15–17 years.

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XUE Tao Tao and GAO Xing Xing designed the study and wrote the manuscript. WANG Li Min, ZHANG Xiao, ZHAO Zhen Ping, and LI Chun collected the data. ZHANG Mei, NYASHA Grace Mudoti, and LIU Chen Yi revised the manuscript. ZHANG Mei and WANG Li Min supervised the study.

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