

Physical Activity Prevalence in Caregivers of Children With Different Ages and Its Association With Their Psychological and Physical Health Problems

Byungmo Ku^{1*}, Seungbeen Ghim²

¹ Physical Education and Sports Science Academic Group, National Institute of Education, Nanyang Technological University, Singapore, Singapore

² Health Management and Policy, College of Public Health and Human Sciences, Oregon State University, Corvallis, OR, United States

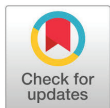
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ABSTRACT

OBJECTIVES The purpose of the current study was to estimate the prevalence of meeting national physical activity guidelines among caregivers and to examine the association between meeting the guidelines and psychological and physical health problems in caregivers.

METHODS 2018 National Health Interview Survey (NHIS) datasets and the national physical activity guidelines (i.e., 150 minutes of moderate-to-vigorous physical activity per week) were used in the current study.

RESULTS The prevalence of meeting national physical activity guidelines among caregivers of young children, school-aged children, and adolescents were 46.78%, 48.55%, and 46.54%, respectively. Physically active caregivers of school-aged children showed significantly lower likelihoods of anxiety and obesity compared to physically inactive caregivers of school-aged children. Physically active caregivers of adolescents showed significantly lower likelihoods of type 2 diabetes, hypertension, hyperlipidemia, obesity, neck pain, and back pain compared to physically inactive caregivers of adolescents.

CONCLUSIONS As parents often experience some health problems, they should be encouraged to meet the national physical activity guidelines. Health care professionals should promote physical activity behaviors in caregivers by considering caregiver's health conditions.

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Introduction

It has been widely known that physical activity provides a variety of benefits such as managing physical problems (e.g., high blood pressure, diabetes, and arthritis symptoms), improving psychological health (e.g., anxiety and depression), and preventing weight gain [1]. To achieve these substantial health benefits, adults should participate in at least 150

minutes of moderate-to-vigorous physical activity per week, according to the U.S. Department of Health and Human Services [2]. Even though the importance of physical activity has been highlighted, more than 15% of adults across the United States still do not meet the physical activity guideline [3].

Among adults, caregivers in particular are a group that may experience physical activity barriers such as child-care duties and responsibilities [4]. Caregiving is the complex and mosaic process of rearing a child [5]. Caregivers spend a large amount of time, as well as physical and emotional resources,

***Correspondence:** Byungmo Ku Ph.D; Physical Education and Sports Science Academic Group, National Institute of Education, Nanyang Technological University, Singapore, Singapore; Phone: 9156-5317; E-mail: Byungmo.ku@nie.edu.sg



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to take care of their children. As caregivers' lifestyles may be changed to meet the needs of their children, they may have fewer opportunities to participate in physical activity [6] and the relationship between physical activity and levels of social support available to the women. The empirical basis for this examination was provided through a study of activity levels and barriers to physical activity experienced by a sample of 543 mothers of young children from differing socioeconomic backgrounds. The data indicate that more than two-thirds of the mothers were inadequately active in their leisure time for health benefit. While the vast majority of mothers expressed a desire to be more active, they were inhibited in their ability to act out their leisure preferences by a combination of structural (e.g., lack of time, money, energy). Studies indicate that possible reasons for physical activity decline in caregivers include working longer hours, lack of child care, and deficits of social support [7]. In addition, caregivers experience other physical activity barriers, including adverse psychological symptoms such as high levels of caregiving stress from a new parental role [8], problematic relationship adjustment [9], and depression and anxiety [10].

The physical activity barriers may reduce caregivers' physical activity. Studies indicate that caregivers participate in less physical activity compared to adults without children [4]. Specifically, a systematic review indicates that young female adults with children participate in less physical activity compared to young female adults without children [11]. The effect size for the physical activity decline during motherhood ranged from small to medium [11]. A longitudinal study found that pregnancy decreases physical activity in women by 12.6% and postpartum periods decrease physical activity in women by 21.7% [7]. The onset of motherhood has been considered a reliable predictor for physical activity change in adults [11]. Even though studies have examined physical activity in caregivers, to our knowledge, these studies are limited to young caregivers who have young children. As a child ages and becomes independent from caregivers, caregivers' physical activity may change. Thus, it is necessary to examine physical activity prevalence (i.e., meeting the national physical activity guidelines; 150 minutes of moderate-to-vigorous physical activity per week) in caregivers of children of different ages.

In addition to examining physical activity prevalence in caregivers, it is also important to examine the association between meeting the national physical activity guidelines and psychological and physical health in caregivers. While raising a child, caregivers experience mixed feelings about caregiving such as pleasure, love, stress, and depression [5]. Even though caregiving provides caregivers with joyful experiences such as watching their child grow, it also provides them with challenging experiences. Specifically, some caregivers experience adverse psychological wellbeing such as high levels of caregiving stress from a new parental role [8], problematic relationship adjustment [9], and depression and anxiety [10]. These adverse psychological effects in caregivers may also negatively influence their physical health [12]. A meta-analysis including 176 studies indicated that caregiver depressive symptoms were highly associated with physical health conditions such as chronic illnesses and hospitalizations [12]. One way for caregivers to improve their psychological and physical health is to participate in physical activity. It remains unclear, however, whether meeting the national physical activity guidelines is associated with caregivers' psychological and physical health. As the association between physical activity and health in individuals may be inevitable [13] and may vary depending on characteristics of individuals [14], it is important to examine the association between physical activity and psychological and physical health in caregivers.

Therefore, the current study had two main purposes: 1) examining physical activity prevalence in caregivers and 2) examining the association between meeting the national physical activity guidelines and psychological and physical health in caregivers. It was hypothesized that a large number of caregivers would not meet the physical activity guidelines. It was also hypothesized that caregivers who do meet the national physical activity guidelines would be less likely to report adverse psychological and physical health problems compared to caregivers who do not meet the physical activity guidelines.

Methods

Data source

In the current study, 2018 National Health Interview

Survey (NHIS) datasets were used. The NHIS is an annual survey conducted by the U.S. Census Bureau on behalf of the National Center for Health Statistics (NCHS). The purpose of the NHIS is to monitor health status, health care access, and progress toward meeting national health objectives. A household representative is interviewed by an interviewer from the NCHS, and the interview covers wide ranges of health-related topics.

Identification of caregiver groups

The NHIS survey did not contain a data file directly indicating caregivers. To identify caregivers of children, the person file and sample adult file in the NHIS were used. Among families ($n=55,563$) in the person file, 25,417 household representatives aged 18 and older were selected as adults. Adults without children were removed from the present study. Thus, the remaining adults with children were included and labeled as caregivers in the current study.

Identification of caregivers' physical activity behaviors

The NHIS measured the frequency of physical activity in caregivers by using the following questions: "How often do you do light or moderate leisure-time physical activities for at least 10 minutes that cause only light sweating or a slight to moderate increase in breathing or heart rate?" and "How often do you do vigorous leisure-time physical activities for at least 10 minutes that cause heavy sweating or large increases in breathing or heart rate?" In addition, they measured the duration of caregivers' physical activity by using the following questions: "About how long do you do these light or moderate activities each time?" and "About how long do you do these vigorous leisure-time physical activities each time?"

The frequency and duration of moderate and vigorous physical activity were multiplied. After this, the multiplied moderate physical activity and vigorous physical activity were summed up to calculate the total minutes of caregivers' moderate-to-vigorous physical activity (MVPA) per week. As the national physical activity guidelines suggest 150 minutes of MVPA participation per week [2], if the MVPA of caregivers was equal to or greater than 150 minutes, the caregivers were labeled as physically activity caregivers (PAC). If the MVPA

was less than 150 minutes, the caregivers were labeled as physically inactive caregivers (PIC).

Identification of psychological and physical health problems in caregivers

The current study included a total of 12 health problems in caregivers. Among the 12 health problems, two were psychological health problems, specifically anxiety and depression. To identify these health problems, the following questions were used in the NHIS survey: "Do you take medication for these feelings (e.g., worried, nervous, or anxious)?" and "Do you take medication for depression?" The remaining ten health problems were physical health problems, including arthritis, back pain, hyperlipidemia, diabetes, heart conditions, hypertension, neck pain, obesity, and stroke. To identify physical health problems, the following question was used except for obesity: "Have you ever been told by a doctor or health professional that you have [name of a physical condition]?" For heart condition identification, if a caregiver reported any of the following heart diseases, he/she was considered as a caregiver who has a heart condition: coronary heart disease, angina pectoris, myocardial infarction, and any kind of heart condition or heart diseases. This approach was used in a previous study [15]. For obesity identification, the body mass index (BMI; weight (kg) / height (m)²) was used. If the BMI score was over 30, it was coded as obesity.

Categorization of caregivers

Caregivers were categorized into three groups and labeled based on their child's age (0 – 4 [young children], 5 – 11 [school-aged children], and 12 – 17 [adolescents] years old). Within each group, caregivers were divided into two groups based on whether they met the national physical activity guidelines (i.e., 150 minutes of moderate-to-vigorous physical activity per week): Physically Active Caregivers (PAC; meeting the physical activity guidelines) and Physically Inactive Caregivers (PIC; not meeting the physical activity guidelines).

Statistical analysis

Descriptive statistics including mean and percentages were implemented for caregivers' demographic information. The

analysis of variance (ANOVA) was conducted to calculate differences in caregivers' age and children age across the three groups. Chi-squared tests were implemented for caregivers' gender, race, marital status, federal poverty level, work status, and health care coverage. Compliances with physical activity guidelines in caregivers in each group were calculated. To calculate the odds ratio (OR) for demographic information associated with meeting the national physical activity guidelines in caregivers, multivariable logistic regressions were implemented. Prevalence of psychological and physical health problems in each group were calculated. To calculate the odds ratio for psychological and physical health problems associated with meeting the national physical activity guidelines, multivariable logistic regressions were implemented by controlling for caregivers' age, gender, race, federal poverty level, marital status, working status, and child age. The health care coverage was dummy coded into private and others. Race was dummy coded into White and others. The NHIS sampling weights were implemented for all analyses by using sampling weight codes from the NHIS data. Stata version 15 was used for all analyses [16].

Results

The average age of caregivers of young children, school-aged children, and adolescents was 33.66 (9.49), 39.1 (10.54), and 43.25 (12.42), respectively ($F(2, 51840) = 429.46, p < .001$). The average age of young children, school-aged children, and adolescents was 1.93 (1.44), 8.03 (2.00), and 14.64 (1.69), respectively ($F(2, 85157.34) = 27791.41, p < .001$). The prevalence of female caregivers of young children, school-aged children, and adolescents was 59.54%, 59.49%, and 59.41%, respectively. The race of caregivers of young children, school-aged children, and adolescents was mostly White/Caucasian (75.72%, 74.62%, and 76.95%, respectively). The prevalence of caregivers who reported that they were living with their spouse or partner was 75.67%, 68.97%, and 61.29% for young children, school-aged children, and adolescents, respectively. The prevalence of caregivers of young children, school-aged children, and adolescents who were below the federal poverty level (<100) were 16.32%, 13.18%, and 12.52%, respectively.

Currently working caregivers of young children, school-aged children, and adolescents were 72.84%, 76.99%, and 76.62%, respectively. More detailed demographic information about caregivers is listed in <Table 1>.

Meeting the national physical activity guidelines and associated demographic factors among caregivers

Among caregivers of young children ($n = 1,696$), 46.78% met the national physical activity guidelines. In this group, significant demographic factors associated with meeting the physical activity guidelines were caregiver's age ($OR = 0.98, p < 0.001$), child's age ($OR = 1.01, p = 0.01$), federal poverty level ($OR = 1.33, p < 0.001$), insurance type ($OR = 1.31, p < 0.002$), and caregiver's gender ($OR = 0.81, p = 0.001$).

Among caregivers of school-aged children ($n = 2,421$), 48.55% met the national physical activity guidelines. In this group, significant demographic factors associated with meeting the national physical activity guidelines were caregiver's age ($OR = 0.98, p < 0.001$), federal poverty level ($OR = 1.31, p < 0.001$), and race ($OR = 1.41, p < 0.003$).

Among caregivers of adolescents ($n = 2,376$), 46.54% met the national physical activity guidelines. In this group, significant demographic factors associated with meeting the national physical activity guidelines were caregiver's age ($OR = 0.98, p < 0.001$), federal poverty level ($OR = 1.31, p < 0.001$), insurance type ($OR = 1.46, p < 0.014$), and caregiver's gender ($OR = 0.78, p = 0.007$). <Table 2> includes physical activity prevalence and <Table 3> includes all demographic variables associated with meeting the national physical activity guidelines among caregivers of children of different ages.

Prevalence of psychological and physical health problems among PAC and PIC

Caregivers of young children who met the physical activity guidelines showed significantly lower prevalence of health problems compared to caregivers of young children who did not meet the physical activity guidelines, including: arthritis (7.94% vs. 11.50%), diabetes (3.72 vs. 6.00%), heart problems (3.89% vs. 7.00%), and hypertension (13.05% vs. 17.33%).

Caregivers of school-aged children who met the physical activity guidelines showed significantly lower prevalence of health problems compared to caregivers of young children

Table 1. Weighted descriptive statistics in caregivers of young children, school-aged children and adolescents

	Caregivers of young children (n=1,696)				Caregivers of school-aged children (n=2,421)				Caregivers of adolescents (n=2,376)			
	Total	Active group (n=813)	Inactive group (n=883)	P value	Total	Active group (n=1,203)	Inactive group (n=1,218)	P value	Total	Active group (n=1,120)	Inactive group (n=1,256)	P value
Age (years)												
Caregiver's age (SD)	33.66 (9.49)	33.03 (8.15)	34.20 (10.51)	0.131	39.10 (10.54)	38.14 (9.37)	40.01 (11.47)	0.069	43.25 (12.42)	42.10 (12.04)	44.26 (12.67)	0.024
Child age (SD)	1.93 (1.44)	1.97 (1.43)	1.90 (1.45)	0.330	8.03 (2.00)	8.03 (2.00)	8.03 (2.02)	0.853	14.64 (1.69)	14.66 (1.68)	14.61 (1.69)	0.277
Caregiver's gender (%)												
Male	40.46	43.97	37.36	0.014	40.51	42.98	38.18	0.019	40.59	44.92	36.82	< 0.001
Female	59.54	56.03	62.64		59.49	57.02	61.82		59.41	55.08	63.18	
Race (%)												
White	75.72	78.61	73.18	0.015	74.62	78.57	70.89	0.001	76.95	78.93	75.23	0.129
Black	15.02	12.73	17.03		14.51	12.38	16.51		12.23	10.36	13.85	
Asian	6.27	5.04	7.34		6.84	5.53	8.07		6.11	6.00	6.21	
Others ¹	3.00	3.62	2.45		4.04	3.52	4.53		4.72	4.72	4.71	
Marital status (%)												
Married	75.67	80.37	71.54	< 0.001	68.97	72.09	66.02	0.003	61.29	63.86	59.05	0.026
Others ²	24.33	19.63	28.46		31.03	27.91	33.98		38.71	36.14	40.95	
Federal poverty level (%)												
<100	62.70	12.27	19.91	< 0.001	13.18	10.44	15.79	< 0.001	12.52	9.04	15.63	< 0.001
≥100 & <200	18.46	17.95	23.14		21.58	18.01	24.98		17.62	13.96	20.88	
≥200 & <400	5.32	30.95	28.96		28.42	26.65	30.09		30.75	28.21	33.01	
≥400	13.53	38.84	27.99		36.83	44.89	29.14		39.11	48.78	30.49	
Work status (%)												
Currently working	72.84	74.10	71.73	0.330	76.99	81.30	72.92	< 0.001	76.62	80.16	26.47	< 0.001
Not working	27.16	25.90	28.27		23.01	18.70	27.08		23.38	19.84	73.53	
Healthcare coverage (%)												
Private	62.70	70.22	56.09	< 0.001	64.94	71.34	58.90	< 0.001	66.72	74.75	59.72	< 0.001
Medicare or Medicaid	18.46	14.41	22.01		16.99	12.95	20.80		17.61	13.05	21.59	
Other coverage	5.32	4.45	6.08		4.06	3.65	4.45		4.00	3.42	4.51	
Uninsured	13.53	10.92	15.81		14.01	12.06	15.84		11.67	8.79	14.18	

Notes. Rounded to two decimal places. Young children = children aged from 0 – 4 years old. School-aged children = children aged from 5 – 11 years old. Adolescents = children aged from 12 – 17 years old. Others¹ = American Indian and Alaska Native (AIAN) only, race group not releasable, and multiple races. Others² = Spouse not in household, widowed, divorced, separated, never married, and unknown marital status.

who did not meet the physical activity guidelines, including: anxiety (8.72% vs. 11.98%), depression (7.76% vs. 10.63%), arthritis (10.46% vs. 15.24%), back pain (27.28% vs. 32.06%), high cholesterol (14.88% vs. 18.36%), diabetes (4.50 vs. 8.32%),

hypertension (16.60% vs. 23.34%), and obesity (28.11% vs. 40.42%).

Caregivers of school-aged children who met the physical activity guidelines showed significantly lower prevalence of

Table 2. Weighted physical activity prevalence in caregivers of young children, school-aged children and adolescents (Percent and confidence interval)

	Total (n=6,493)	Caregivers of young children (n=1,696)	Caregivers of school- aged children (n=2,421)	Caregivers of adolescents (n=2,376)	P value
Active (%)	47.35 (0.46~0.49)	46.78 (0.44~0.49)	48.55 (0.46~0.51)	46.54 (0.44~0.49)	0.371
Inactive (%)	52.65 (0.51~0.54)	53.22 (0.51~0.59)	51.45 (0.49~0.54)	53.46 (0.51~0.56)	

Note. Rounded to two decimal places. Active = caregivers meet the national physical activity guidelines. Inactive = caregivers do not meet the national physical activity guidelines.

Table 3. Associated demographic factors in active caregivers of young children, school-aged children and adolescents (Odd ratio; confidence interval)

	Caregiver's age	Child age	Caregiver's gender	Race	Marital status	Federal poverty level	Working status	Healthcare coverage
Active caregivers of all children (total)	0.98 (0.97~0.98)	1.01 (1.00~1.03)	0.81 (0.72~0.91)	1.24 (1.07~1.43)	1.09 (0.95~1.24)	1.33 (1.25~1.43)	1.03 (0.89~1.19)	1.31 (1.11~1.54)
P value	< 0.001	0.012	0.001	0.004	0.210	< 0.001	0.684	0.002
Active caregivers of young children	0.97 (0.96~0.99)	1.06 (0.98~1.14)	0.74 (0.58~0.95)	1.16 (0.89~1.52)	1.21 (0.92~1.61)	1.31 (1.16~1.48)	0.79 (0.60~1.04)	1.29 (0.92~1.81)
P value	< 0.001	0.136	0.017	0.260	0.174	< 0.001	0.093	0.133
Active caregivers of school-aged children	0.98 (0.97~0.99)	1.03 (0.99~1.08)	0.88 (0.72~1.06)	1.41 (1.13~1.77)	1.02 (0.82~1.27)	1.32 (1.19~1.46)	1.22 (0.97~1.55)	1.25 (0.95~1.64)
P value	< 0.001	0.176	0.180	0.003	0.826	< 0.001	0.089	0.114
Active Caregivers of adolescents	0.98 (0.97~0.99)	1.01 (0.95~1.06)	0.78 (0.65~0.93)	1.14 (0.90~1.43)	1.06 (0.86~1.29)	1.39 (1.25~1.55)	1.06 (0.83~1.35)	1.46 (1.08~1.99)
P value	< 0.001	0.803	0.007	0.277	0.605	< 0.001	0.638	0.014

Notes. Active = caregivers meet the national physical activity guidelines. Inactive = caregivers do not meet the national physical activity guidelines. Caregiver's gender (ref: male), Race was dummy coded into White/Caucasian and others (ref: non-White), Marital status (ref: not married). Working status (ref: not currently working), the healthcare coverage was dummy coded into private and not private (ref: not private).

health problems compared to caregivers of young children who did not meet the physical activity guidelines, including: anxiety (8.61% vs. 12.60%), depression (7.21% vs. 9.86%), arthritis (15.21% vs. 21.35%), back pain (22.90% vs. 33.39%), diabetes (5.57% vs. 10.66%), heart problems (6.72% vs. 9.57%), hypertension (19.15% vs. 26.05%), neck pain (13.00% vs. 20.13%), and obesity (31.42% and 41.17%). More information about prevalence of health problems among caregivers can be found in <Table 4>.

The odds ratio of psychological and physical health problems among PAC and PIC

PAC of school-aged children showed significantly lower likelihoods of health problems compared to PIC of school-

aged children, after controlling for caregivers' age, children's age, caregivers' gender, federal poverty level, and marital status, including: anxiety (OR = 0.70, CI = 0.52 – 0.95, *p* = 0.003) and obesity (OR = 0.61, CI = 0.50 – 0.74, *p* < 0.001). PAC of adolescents showed significantly lower likelihoods of health problems compared to PIC of adolescents, after controlling for caregivers' age, children's age, caregivers' sex, federal poverty level, and marital status, including: back pain (OR = 0.68, CI = 0.55 – 0.84, *p* < 0.001), diabetes (OR = 0.58, CI = 0.41 – 0.84, *p* = 0.003), hypertension (OR = 0.72, CI = 0.58 – 0.90, *p* = 0.005), neck pain (OR = 0.64, CI = 0.50 – 0.83, *p* = 0.001), and obesity (OR = 0.71, CI = 0.59 – 0.85, *p* < 0.001). <Table 5> includes results of multivariable logistic regressions for health problems in caregivers. Appendix 1 includes results

Table 4. Weighted prevalence of psychological and physical health problems between physically active caregivers and physically inactive caregivers (Percent; Confidence interval)

	Total (n=6,493)			Caregivers of young children (n=1,696)			Caregivers of school-aged children (n=2,421)			Caregivers of adolescents (n=2,376)		
	Active group (n=3,136)	Inactive group (n=3,357)	P value	Active group (n=813)	Inactive group (n=883)	P value	Active group (n=1,203)	Inactive group (n=1,218)	P value	Active group (n=1,120)	Inactive group (n=1,256)	P value
Psychological health												
Anxiety	8.18 (7.21~9.28)	11.52 (10.34~12.83)	< 0.001	6.87 (5.20~9.03)	9.49 (7.25~12.33)	0.098	8.72 (7.13~10.62)	11.98 (10.14~14.11)	0.015	8.61 (7.00~10.54)	12.60 (10.71~14.77)	0.004
Depression	7.11 (6.21~8.13)	9.73 (8.62~10.96)	< 0.001	6.06 (4.49~8.12)	8.40 (6.37~11.00)	0.120	7.76 (6.35~9.46)	10.63 (8.88~12.67)	0.018	7.21 (5.73~9.03)	9.86 (8.26~11.72)	0.031
Physical problems												
Arthritis	11.45 (10.31~12.70)	16.43 (15.11~17.85)	< 0.001	7.94 (6.14~10.20)	11.50 (9.40~13.99)	0.024	10.46 (8.81~12.39)	15.24 (13.21~17.53)	0.001	15.21 (7.25~12.33)	21.35 (7.25~12.33)	< 0.001
Asthma	12.94 (11.62~14.37)	13.85 (12.61~15.20)	0.305	12.93 (10.56~15.73)	13.72 (11.46~16.33)	0.647	13.96 (11.87~16.34)	14.67 (12.70~16.87)	0.630	11.85 (9.85~14.19)	13.15 (11.29~15.27)	0.367
Back pain	25.63 (23.94~27.39)	31.03 (29.24~32.87)	< 0.001	26.88 (23.50~30.54)	26.56 (23.50~29.87)	0.896	27.28 (24.64~30.09)	32.06 (29.15~35.12)	0.015	22.90 (20.38~25.62)	33.39 (30.56~36.35)	< 0.001
Cholesterol	15.71 (14.44~17.08)	18.86 (17.42~20.39)	0.002	11.04 (8.79~13.78)	13.13 (10.87~15.77)	0.220	14.88 (12.91~17.10)	18.36 (16.04~20.92)	0.027	20.19 (17.93~22.66)	23.72 (21.30~26.33)	0.051
Diabetes	4.66 (3.94~5.51)	8.53 (7.61~9.56)	< 0.001	3.72 (2.55~5.38)	6.00 (4.63~7.75)	0.033	4.50 (3.39~5.95)	8.32 (6.74~10.23)	< 0.001	5.57 (4.30~7.18)	10.66 (9.08~12.48)	< 0.001
Heart conditions	5.50 (4.72~6.39)	8.09 (7.13~9.17)	< 0.001	3.89 (2.73~5.50)	7.00 (5.35~9.10)	0.009	5.51 (4.29~7.06)	7.45 (6.02~9.17)	0.061	6.72 (5.36~8.39)	9.57 (7.87~11.59)	0.022
Hypertension	16.54 (15.01~18.18)	22.66 (21.16~24.23)	< 0.001	13.05 (10.59~15.96)	17.33 (14.54~20.52)	0.042	16.60 (14.41~19.04)	23.34 (20.83~26.05)	< 0.001	19.15 (16.79~21.76)	26.05 (23.65~28.61)	< 0.001
Neck pain	13.30 (11.96~14.75)	16.06 (14.67~17.55)	0.004	13.00 (10.60~15.86)	12.06 (10.02~14.46)	0.591	13.79 (11.70~16.18)	15.03 (12.92~17.41)	0.439	13.00 (11.06~15.21)	20.13 (17.79~22.68)	< 0.001
Obesity	29.62 (27.78~31.53)	38.81 (37.07~40.56)	< 0.001	29.38 (25.94~33.07)	33.59 (30.20~37.17)	0.089	28.11 (25.33~31.08)	40.42 (37.52~43.38)	< 0.001	31.42 (28.38~34.63)	41.17 (38.36~44.03)	< 0.001
Stroke	0.82 (0.54~1.22)	1.65 (1.26~2.15)	0.002	0.61 (0.23~1.59)	1.62 (0.92~2.83)	0.064	0.84 (0.45~1.55)	1.37 (0.86~2.18)	0.205	0.95 (0.50~1.81)	1.95 (1.28~2.95)	0.051

Notes. Rounded to two decimal places, 95% confidence interval are in parentheses. Heart conditions includes coronary heart disease, angina pectoris, myocardial infarction, and any kind of heart condition or heart diseases

of all multivariable logistic regressions including all covariates.

Discussion

The current study had two main purposes: 1) estimating the prevalence of meeting national physical activity guidelines among caregivers, and 2) examining the association between

meeting the guidelines and psychological and physical health problems in caregivers. Aligned with the first purpose, the current study found that prevalence of meeting the national physical activity guidelines in caregivers of young children, school-aged children, and adolescents was 46.78%, 48.55%, 46.54%, respectively. These results were aligned with a previous study indicating that only 48.8% of caregivers (n = 8599) met

Table 5. Comparison of psychological and physical health between physically active caregivers and physically inactive caregivers (Odds ratio; Confidence interval)

	Total	P value	Caregivers of young children	P value	Caregivers of school-aged children	P value	Caregivers of adolescents	P value
Psychological health								
Anxiety	0.72 (0.59~0.87)	0.001	0.72 (0.47~1.08)	0.114	0.70 (0.52~0.95)	0.021	0.75 (0.54~1.02)	0.067
Depression	0.79 (0.64~0.97)	0.026	0.74 (0.47~1.17)	0.201	0.79 (0.59~1.07)	0.129	0.83 (0.60~1.15)	0.266
Physical problems								
Arthritis	0.79 (0.66~0.94)	0.009	0.79 (0.54~1.17)	0.241	0.80 (0.61~1.06)	0.120	0.78 (0.61~1.01)	0.056
Asthma	0.92 (0.78~1.07)	0.278	0.92 (0.68~1.25)	0.594	0.94 (0.73~1.20)	0.600	0.89 (0.67~1.18)	0.433
Back pain	0.85 (0.75~0.96)	0.008	1.07 (0.82~1.38)	0.629	0.85 (0.70~1.03)	0.101	0.68 (0.55~0.84)	0.000
Cholesterol	0.89 (0.76~1.04)	0.149	0.97 (0.67~1.39)	0.853	0.88 (0.68~1.13)	0.302	0.87 (0.69~1.10)	0.237
Diabetes	0.69 (0.55~0.87)	0.002	0.80 (0.47~1.37)	0.418	0.80 (0.55~1.17)	0.256	0.58 (0.41~0.84)	0.003
Heart conditions	0.79 (0.64~0.99)	0.038	0.65 (0.40~1.05)	0.078	0.86 (0.61~1.22)	0.400	0.80 (0.56~1.15)	0.226
Hypertension	0.78 (0.67~0.92)	0.003	0.88 (0.62~1.26)	0.497	0.81 (0.62~1.04)	0.099	0.72 (0.58~0.90)	0.005
Neck pain	0.84 (0.72~0.99)	0.038	1.05 (0.76~1.46)	0.747	0.95 (0.72~1.25)	0.709	0.64 (0.50~0.83)	0.001
Obesity	0.72 (0.65~0.81)	0.000	0.93 (0.74~1.19)	0.579	0.61 (0.50~0.74)	0.000	0.71 (0.59~0.85)	0.000
Stroke	0.82 (0.49~1.36)	0.436	0.58 (0.17~1.94)	0.372	1.23 (0.47~3.26)	0.671	0.77 (0.34~1.76)	0.533

Notes. Reference group = Physically inactive caregivers (not meeting the physical activity guidelines). Rounded to two decimal places. Covariates = parental age, gender, race, poverty status, marital status, working status, and child age.

the national physical activity guidelines [15]. According to the CDC, the prevalence of meeting the national physical activity guidelines among adults is 54.02% [3]. Compared to this general adult population, caregivers may be less likely to meet the guidelines. A review study suggested that parenthood may be a starting point for reduced physical activity in adulthood [11]. The current study adds new information about physical activity prevalence in caregivers of older children, including school-aged children and adolescents.

Even though more research should be done to determine what factors influence physical activity participation in caregivers of older children, a study indicated that caregivers of school-aged children experience physical activity barriers including family responsibilities, lack of support, scheduling

constraints, and work [17]. Another study indicated that caregivers reported feelings of guilt when they participated in physical activity without their children [18]. Moreover, lack of self-discipline is another physical activity barrier in caregivers of older children [19]. When caregivers perceive that they have low skills to participate in physical activity and don't know how to prioritize their responsibilities, they participate in less physical activity [19]. The current study expands the results of the previous studies by adding demographic factors associated with meeting the national physical activity in caregivers of children of different ages. Specifically, in the current study, caregiver's age, federal poverty level, and gender were consistent predictors for meeting the national physical activity guidelines among caregivers. Thus, it is important for

policymakers or interventionists to target older caregivers, caregivers at or below the federal poverty level, and female caregivers.

The second purpose of the current study was to examine the association between meeting the national physical activity guidelines and psychological and physical health in caregivers. The present study found that PAC of school-aged children showed lower likelihood of experiencing anxiety compared to PIC of school-aged children. Anxiety is a feeling of apprehension, tension, and worry [20]. This is one of the common psychological health complaints [21] which may greatly disrupt a parent's functioning [22], diminish quality of life [23], and negatively influence their child's health [24]. If this is not well treated in an appropriate period, it may develop into an anxiety disorder, a detrimental psychiatric condition. Based on the results of the current study, one way to prevent caregivers' anxiety may be for caregivers of school-aged children to comply with the physical activity guidelines. A recent meta-analysis conducted by found similar results indicating that the odds of experiencing anxiety symptoms after physical activity participation are significantly lower compared to before physical activity participation (OR=0.87, 95% CI=0.77, 0.98) [25]. Although the exact mechanism for the negative association between physical activity and anxiety still remains unclear, potential mechanisms may be related to hormonal response to physical activity, which stimulates the hypothalamic-pituitary-adrenal axis or glucocorticoids circulation [26]. Another potential mechanism may be related to anxiety sensitivity, misinterpreting or catastrophizing anxiety-related sensations such as evaluated heartbeat and blood pressure [27]. Physical activity may help individuals to adjust to the altered physiological responses so that their anxiety level may be reduced [28].

In addition to anxiety in caregivers of school-aged children, physical activity may be protective against cardiovascular diseases in caregivers of adolescents. The current study found that PAC of adolescents showed lower likelihood of experiencing cardiovascular diseases including hyperlipidemia, diabetes, heart conditions, and hypertension, compared to PIC of adolescents. This result is aligned with a previous review study indicating that participating in 150

minutes of moderate physical activity per week reduces the risk of type 2 diabetes by 26% [29]. Another review study also indicated that at least 30 minutes of walking per day is associated with a 50% reduced risk of type 2 diabetes [30]. Physical activity has also been considered as a factor for preventing and treating hypertension [31]. A recent systematic review of 17 systematic reviews and one meta-analysis found strong evidence indicating that physical activity reduces blood pressure among adults with normal blood pressure, prehypertension, and hypertension [31]. In particular, moderate-to-vigorous aerobic physical activity such as bicycling and running is beneficial in reducing blood pressure levels and lowering hypertension incidence [32].

The current study also found that PAC of adolescents showed lower likelihood of experiencing neuro-orthopedic diseases including back and neck pain. This result is supported by a systematic review indicating that physical activity may reduce the risk of chronic low back pain by 11 – 16%, highlighting that physical activity intensity plays an important role in reducing risk of low back pain [33]. Participants who participated in the most intense physical activity showed the lowest incidence of back pain [33]. A meta-analysis highlighted the importance of participating in combined aerobic and muscle-strengthening physical activities to treat back pain [34]. Thus, it is important for caregivers of adolescents to participate in various intense physical activities in order to prevent back and neck pain.

The last finding of the current study was that PAC of school-aged children and adolescents showed lower likelihood of being obese compared their counterparts. Obesity in caregivers is associated not only with developing serious health conditions including type 2 diabetes, hypertension, and atherosclerosis [35] but also with their child's obesity [36]. It has been widely established that there is a significant relationship between caregivers' obesity and the development of obesity in children [36]. Thus, it is important for children's physical health that their caregivers maintain healthy weight status. Based on the results of the current study, meeting the physical activity guideline may help caregivers of school-aged children and adolescents prevent obesity. Ample study has supported the effects of physical activity on weight

management [35]. As a meta-analysis suggested that one of the most effective techniques in managing weight is behavioral change techniques ($d = 0.50$, 65% CI 0.38-0.63) [37], caregivers may try to have a healthy lifestyle such as regular physical activity participation.

One limitation of the current study is that physical activity and psychological and physical health problems of caregivers were measured by self-reported questionnaires, which may not entirely capture their behavior and health. However, the large sample size in the current study may compensate for this limitation. Even though the current study used a national representative dataset from the NHIS, 75.59% of survey respondents were White/Caucasian. Thus, the results of the current study may be limited to White/Caucasian caregivers. The last limitation was that the current study did not control chronic health problems in children, which may influence caregiver's health. The future studies are warranted how child's chronic health problem moderate the association between caregiver's physical activity participation and their psychological and physical health.

Conclusions

In the current study, the prevalence of meeting national physical activity guidelines (i.e., 150 minutes of moderate-to-vigorous physical activity per week) among caregivers of young children, school-aged children, and adolescents was 46.78%, 48.55%, and 46.54%, respectively. This may be a serious public health concern when considering benefits of physical activity participation.

The current study also found that physically active caregivers of school-aged children showed significantly lower likelihoods of anxiety and obesity compared to physically inactive caregivers of school-aged children. In addition, physically active caregivers of adolescents showed significantly lower likelihoods of type 2 diabetes, hypertension, hyperlipidemia, obesity, neck pain, and back pain compared to physically inactive caregivers of adolescents. In other words, caregivers who have those chronic conditions may be less likely to meet the physical activity guidelines. Although all caregivers should be encouraged to meet the national physical

activity guidelines, health care professionals pay extra attention to caregivers who experience chronic conditions.

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Conflicts of Interest

The authors declare no conflict of interest.

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