



The Contributions of Martial Art Training and Other Physical Activities to Health Status: Data from the ECLS-K Survey

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Abstract

Objective: Physical activity is an effective strategy to combat the negative health impacts of sedentary lifestyles. Martial Arts Training (MAT), a vigorous form of physical activity, offers an approach to achieving positive physical health. The goal of this study was to identify the prevalence of MAT among youths aged 5 to 13 and the relative contribution of MAT to the physical health of these youth in comparison to other determinants, (i.e., physical activities, race, and socioeconomic status). **Methods:** Data for this analysis were taken from 22,782 participants in the Early Childhood Longitudinal Study (ECLS-K), a nationally representative, longitudinal investigation of child development, school readiness, and early school experiences in the United States. The current investigation used an OLS regression strategy to evaluate parental report of their children's physical health. **Results:** The results indicated that MAT participation rated seventh of eight identified physical activities. The OLS regression analysis indicated that, controlling for all other variables in the regression model, physical activity, socioeconomic status (SES) and attending a Catholic school accounted for a significant increase in physical health. Conversely, racial/ethnic identification as Black, Latinx, or Asian/Pacific Islander significantly decreased reported physical health compared to their White counterparts. No significant relationship emerged between MAT and physical health. **Conclusion:** The results were evaluated in the context of the limited scope of the survey question regarding MAT, type of alternate physical activity, and site of physical activity. Finally, suggestions are offered for future investigations into the contributions of MAT to physical health.

Keywords: Health disparities, Martial Arts, Physical activity, Socioeconomic status

I. Introduction

In the 1950s a significant change in major health threats facing the population of the United States took place: Improved public health and advances in the treatment of infectious

diseases ushered in the emergence of chronic diseases as the major health threat (Breslow, 2006). These chronic diseases are often associated with high levels of stress and sedentary behavior, reflecting an unbalanced lifestyle (Marlatt & Gordon, 1985). Lifestyle imbalance results from a greater number of 'must dos' than 'want to dos' in a person's life, that is, the life demands on an individual are greater than the life pleasures. Lifestyle balance, which Marlatt describes through the lens of Buddhism, requires the individual to achieve balance through the integration of mind, body, and spirit (Marlatt, 2002).

This new era has also ushered in an expansion of intervention strategies utilized by health professionals (Barnett & Shale, 2013A; Caldwell, Harrison, Adams & Triplett, 2009; Dittmann, 2004; Novotney, 2009). Non-biological, non-verbal approaches have gained increased attention as alternative methods for affecting lifestyle change (Barnett & Shale, 2013B; Novotney, 2009). Such interventions take on additional importance in light of increasingly diverse populations facing health professionals.

It is in this context that martial arts training (MAT) may represent a promising addition to the intervention practices of health professionals. MAT focuses on the achievement of personal growth through physical, mental, and spiritual discipline. The emphasis on growth, in combination with its accessibility to all age groups, makes MAT a valuable addition to intervention strategies available to address effectively the growing lifestyle issues facing the population. Despite its increasing popularity in the United States MAT remains an underutilized health intervention by physical and mental health professionals, perhaps because of over-emphasis on its combat aspects (Hyams, 1979; Wesier, Kutz, Jacobson, Kutz & Weiser, 1995).

The goals of this analysis were to: (a) determine the prevalence of MAT among a population of youth in the fifth and sixth grades and (b) determine the relationship of MAT and other forms of sports-related physical activity (e.g., individual sports, dance) with physical health among this cohort of youth.

Literature Review

This section will explore the prevalence of physical activity among children in the United States and the definition, history and scholarly research focusing on MAT. Because health determinants are multi-dimensional, and as a mechanism for controlling potentially confounding factors, the contributions of race/ethnicity, demographics, and SES, will be discussed.

What are the Martial Arts?

The Asian martial arts have been described as '... any of several arts of combat and self-defense (as karate and judo) that are widely practiced as sport' (Brudnak, Dundero & Van Hecke, 2002, p. 485). A more esoteric description has been offered by Hyams (1979) who referred to the martial arts as 'essentially avenues through which (practitioners) can achieve spiritual serenity, mental tranquility, and the deepest self-confidence' (p1).

Although the presence in the United States of martial art dojos "... a Sanskrit word meaning "place of enlightenment" (Rosenberg & Sapochnik, 2003, p. 453), can be traced to the 1950s, the discipline experienced a surge in popularity in the 1970s (Beasley, 2018). In

2009, Woodward (2009) estimated that 6.5 million individuals participated in MAT in the United States. More recently, the number of participants has been estimated at around 3.4 million (Statista, 2018).

An innovation in the evolution of martial arts in the United States is the emergence of two approaches to MAT, traditional and modern (Woodward, 2009). Woodward (2009) describes the differences between these two approaches as follows:

Modern martial arts usually have their origins in the Orient and are typically combat arts that have been modified for sport, self-defense, and recreation. Traditional martial arts schools often incorporate mental or meditative training into their practice to encourage positive personal transformation (p. 40).

This distinction has major implications for what students receive in their respective dojos. While all martial art senseis (instructors) seek to teach the mind-body-spirit disciplines to their students, traditional senseis see the spiritual development of students as an essential element of their teaching responsibilities. The modern sensei may focus more on the sports aspects of martial arts, i.e. physical and mental elements of the training.

Physical Health benefits of MAT

A sedentary lifestyle has been associated with the obesity epidemic among children (Beaulieu, Butterfield, Mason, & Loovis, 2012; Hoelscher, Barroso, Springer, Castrucci, & Keider, 2009; Katzmarzyk et al., 2016). Physical activity has been identified as a mechanism to combat the negative health consequences of a sedentary lifestyle. *The Physical Activity Guidelines for Americans*: Office of Disease Prevention, Health Promotion, 2008 recommends that children and adolescents between the ages of 6 and 16 engage in a minimum of 60 minutes/day of physical activity. The benefits are optimized when the exercise program includes: (a) a vigorous/moderate level of aerobic exercise at least three days a week, (b) muscle strengthening exercise a least three days/week, and (c) bone strengthening exercise at least three days/week.

Katzmarzyk et al. (2016), utilizing data from the 2016 *United States Report Card on Physical Activity for Children and Youth*, provided information on the physical activity levels of children and youth across ten indicators, including Organized Sport Participation, Active Play, and Community and the Built Environment. In Organized Sport Participation, 54.0% of high school students were reported to be participants on at least one sports team, with significant gender differences (males 59.6% compared to 48.5% of females). In Active Play, the proportion of U.S. children and youth participating in daily unstructured, unorganized active play could not be calculated due to a lack of data. Finally, the indicator Community and the Built Environment was defined as the proportion of children and youth living in neighborhoods with at least one park or playground area. Analysis of this indicator suggested that 84.6% of children were reported to live in neighborhoods with at least one park or playground area. Hoelscher et al. (2009) published data on the prevalence of self-reported physical activity and sedentary behavior among a representative probability sample of 4th, 8th, and 11th grade students in Texas from the 2000-2002 School Physical Activity and Nutrition (SPAN) Survey. MAT was included in the category of other organized physical activities. Results indicated that in the fourth grade, 44% reported participating in 'other activities'

compared to 76.2% who reported participating in team sports activities. In the eighth grade, 30% reported participating in 'other activities' compared to 66.2% in team sports activities. Finally, in the eleventh grade, 31% reported participating in 'other activities' compared to 64.5% in team sports activities. There were significant differences in participation as a function of gender and race/ethnicity. Using data from the National Center for Education Strategies, Beaulieu, Butterfield, Mason, and Loovis (2012) investigated the strategies used in elementary schools to increase physical activity among students. Results indicated that non-traditional strategies, e.g. martial arts, dance, and outdoor adventure activities, were the most frequent activities. Significant differences in frequency were found by SES and race/ethnicity.

MAT is a vigorous form of physical activity that potentially provides multiple health related benefits as a result of its aerobic and anaerobic activities (Callaghan, 2004). Multiple investigators have reported physical health benefits accrued by children and adolescents (Bell, 2008; Callaghan, 2004; Paul, 2011; Toskic, Lilić, & Toskic, 2014). Martial Art classes are held from once a week to seven days a week, depending on the dojo's schedule. In a review of the physical benefits of MAT, Woodward (2009) reported: (a) significantly better aerobic capacity, (b) better balance, (c) greater strength, (d) lower body fat percentages, and (e) greater flexibility compared to sedentary controls. Additional health benefits include positive effects on the immune system (Larkey, Jahnke, Etnier, & Gonzalez, 2009) and sufficient adaptability to meet the requirements for special needs practitioners, such as children with autism spectrum disorders (Paul, 2011). An additional benefit of MAT is its low cost, which makes it accessible to most income levels, thus facilitating participation (Bell, 2008). The accessibility of MAT makes it a useful tool to address low income population health disparities, defined by the Minority Health and Health Disparities Research and Education Act (2013) as, '... a significant disparity in the overall rate of disease incidence, prevalence, morbidity, mortality or survival rates in the population as compared to the health status of the general population' (Isaac, 2013, p. 13).

The contributions of MAT to children's mental health have also been investigated. In a study focusing on the mental health outcomes of children as they progressed through kindergarten, third, and fifth grades, Strayhorn and Strayhorn (2009) used data collected from the Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999 (ECLS-K). The investigator's independent variable was participation in MAT. Outcome variables of interest in the study included: (a), self-control in the classroom setting, (b) approach to learning behavior, (c) interpersonal skills behavior, (d) external problem behaviors, and (e) internal problem behavior. Results indicated that MAT was not significantly associated with any of these outcome variables. The investigators noted several important study limitations including the absence of information on the length, frequency, and type of MAT received by the participants. The investigators suggested the need for additional research that addresses these limitations.

Experiencing MAT benefits requires overcoming barriers. Several investigators (Dougherty, 2001; Lowry, 2004; Nardi, 1983; Southeron & Reisman, 1990; Stranderg, 1984; Strayhorn & Strayhorn, 2009) suggested the high dropout rates of MAT participants is a significant issue when evaluating its effects. While many martial arts instructors accept dropping out as a function of the difficulty inherent in the physical, mental, and spiritual

demands of MAT, health professionals argue that strategies to increase continued participation will be necessary if MAT is to contribute to improved health indices. Obstacles to long term MAT include: (a) student-based barriers, such as the willingness to endure pain (Lowry, 2004); (b) instructor-based barriers, such as a conflict between the instructor's philosophy of MAT and the goals of the student/parent (Stranderg, 1984); (c) discipline based barriers, such as the balance between rigor in training and boring repetition (Southeron & Reisman, 1990); and (d) environment based barriers, such as competing demands (Marlatt, 2002).

Additional Factors Affecting Physical Health.

While physical activity is an integral element in a healthy lifestyle, it does not exist in a vacuum. Rather, physical activity is part of an often complex lifestyle that includes school, work, family, sports, recreational activities, and financial resources (Ratcliffe & McKernan 2010). Increased demands in any of these areas can easily create the unbalanced lifestyle described by Marlatt (2002). The following section will examine other physical health factors that may function as potential confounders.

A reading of the literature suggests that health is multidetermined (LaVeist, 2005; Ward, Johnson & O'Brien, 2013; Wilson et al, 2011). Other than physical activity, factors associated with health include race/ethnicity and sociodemographic characteristics (Ratcliffe & McKernan, 2010). LaVeist (2005, p. 134) describes the multideterminants of health using a three-component framework: (a) socioeconomic factors (SES), e.g poverty, exposure to stress, exposure to pollution, access to resources; (b) psychosocial or behavioral factors, e.g. inactivity, substance abuse; (c) biophysiological factors, e.g. gene-environment interactions.

SES has been found to have direct and indirect effects on health. For example, social selection theories present a cyclical pattern of poor health as a result of low SES: Poorer health indices lead to less human capital (e.g., education, occupation, wealth) to be competitive. This lowered level of human capital leads to a lowered ability to compete, which in turn leads to lower SES (LaVeist, 2005).

SES also influences health through access to the resources that it provides, for example, area of residence and educational opportunities (Gerberding & Marks, 2004; LaVeist, 2005). Income inequality theory measures the status of groups in geographic area with a focus on the distribution of income within the geographic area (LaVeist, 2005). The effect of income inequality on health occurs regardless of the actual income level of individual residents, due to the additive effect of living in a low-income area (LaVeist, 2005).

While SES is an important contributor, race/ethnicity must also be considered when evaluating health disparities. Health disparities create an unequal disease burden, which disproportionately affects the morbidity, mortality, disability, and survivorship of people of color, e.g., people of Asian, Native Hawaiian/Pacific Islander, African, Latinx, and Native American/Alaskan Native descent (Office of Minority Health, 2016; Thorpe, et al., 2004).

The goal of this article is to identify the prevalence of MAT among youth aged 5 to 13 and the contribution of MAT to the health indices of this group of youths compared to the effects of race, socioeconomic status, and other forms of physical activity. The null hypothesis of this study was that there was no accrued benefit to physical health status from participating

in MAT or the other forms of physical activity referenced in the Early Childhood Longitudinal Study.

II. Method

1. Participants

Data came from 22,782 participants in the Early Childhood Longitudinal Study, Kindergarten Class of 1998 – 1999 (ECLS-K), a U.S. Department of Education funded investigation under the auspices of the National Center for Education Statistics. The ECLS-K followed students from kindergarten through middle school (eighth grade). The survey sampled a national sample of 22,782 kindergarteners in the fall of 1998 and the spring of 1999 (Waves 1 – 2); again in the first grade, fall 1999 (Wave 3) and spring 2000 (Wave 4); the spring of the third grade 2002 (Wave 5); the spring of the fifth grade 2004 (Wave 6); and the spring of the eighth grade 2007 (Wave 7). Interviews were also conducted with the children's parents, teachers, and school administrators.

2. Measurement

The parent survey that took place in Wave 6 in the spring of 2007 described the prevalence of MAT compared to other physical activities and where activities occurred. The location of physical activities was identified from the question 'In the last 12 months, did {CHILD} regularly get exercise through any of the following organizations?' Options included: (a) Exercise-Public Park/Recreation Center, (b) Exercise-Place of Worship, (c) Exercise-Sports Team/League, (d) Exercise-YMCA/Other Org, (e) Exercise-Health Club, (f) Exercise-Scouts/Daisies, (g) Exercise-4H/Farm Clubs. The MAT and Physical Activities variables are described below.

The predictor variables included three domains surveyed at Wave 1, 2, or 6 in the parent's interview or school administrator interview: the student level domain, the demographic domain, and the economic domain. Each domain is discussed below.

3. Procedure

1) The Student Level Domain

Two variables were included in this domain, MAT and Physical Activity. The Martial Arts Training variable was extracted from a Wave 6 question that asked the parents what physical activities the child had engaged in over the past 12 months. It was then recoded as a dichotomous variable, similar to the approach used by Strayhorn and Strayhorn [2009]. The Physical Activity variable was taken from the same item in Wave 6, as was the martial arts item. Martial Arts, however, was excluded from the recoded Physical Activity. The following options were available to the parent in this item: (a) individual sports, (b) group sports, (c) recreational sports, (d) dance, (e) playground activities, (f) callisthenic/general exercise, and (g) other (specify). These physical activities were recoded into a single variable using the Count

command in SPSS 24 and subsequently converted into six-point Likert scale from no physical activity – one, to six – physical activities.

2) Demographic Domain

SES was divided into two domains, Demographic and Economic. Two variables were included in the Demographic Domain: (a) Race/Ethnic Group, and (b) Child's Age in Months. As indicated above, race/ethnicity is well recognized as a determinant of health (Callinan, Holman, Esposito & McDonald, 2013; LaVeist, 2005; LaVeist & Isaac, 2013; Mask-Jackson, 2007). The variables White, Black, Latinx, Asian/Pacific Islanders, and Other Racial Group were extracted from an original Wave 1 question that asked parents to provide the racial/ethnic group to which their child belonged. Each variable was then recoded as a dichotomous variable. White students, the most frequently selected option, served as the reference group in this analysis. Child's Age in Months, a composite variable, was taken directly from the Wave 1 Parents' Survey.

The economic domain consisted of three variables from the Wave 1 Parents' Survey and the Wave 2 School Administrator Survey: (a) type of school, (b) location of school, and (c) SES. The direct and indirect relationship of poverty to health status makes this domain an important factor to include in this analysis (Ratcliffe & McKernan, 2010). The type of school variable was taken from the Wave 2 School Administrator Survey. The item asked school administrators to identify the type of school the designated child was registered to attend. Options included: (a) Catholic school, (b) other religious school, (c) private school, and (d) public school. Each option was then recoded as a dichotomous variable. Public school, the option with the most students, served as the reference group in the analysis. The location of school item was derived from the Census Bureau's TIGER geographic information system. The options included: (a) central city, (b) urban fringe, (c) large town, and (d) small town and rural area. Each option was then recoded as a dichotomous variable for this analysis. Urban fringe and large town were combined and recoded as School Located in Suburban Area. Urban was used as the reference group in the analysis. Socioeconomic Status, a composite variable, was taken directly from the Wave 1 Parents' Survey. SES is considered by some to be a measure of the ability to access necessary resources, i.e. place of residence, quality of school (Mask-Jackson, 2007). Indeed, one of the concerns expressed regarding physical activity among lower SES populations centers on the lack of access to exercise equipment or a safe environment in which to engage in inexpensive forms of exercise, such as walking (Wilson et al., 2011).

The dependent variable for the multivariate analysis was physical health scale, taken from the Parents' Survey in Wave 7 in the spring of 2007. This measure asked the parents to report the child's health on a five-point Likert scale from Excellent – 1 to Poor – 5. Additional information regarding these variables can be found in Table 1.

Table 1. Mean, Standard Deviations, Ranges, and Description of ECLS-K Variables

Variable	Mean	SD	Range	Description ECLS-K Variable Name and Label
Dependent Variable				
Physical Health Scale	4.4	.78	1 - 5	P7HSCALE 'Would you say {CHILD}'s health is ..'.
Predictor Variables				
Activity Domain				
Martial Arts	.08	.27	0 - 1	P6TYPAC5 'What types of exercise or physical activity did {CHILD} get at the places you just mentioned'
Physical Activity	1.54	1.98	0 - 6	PHYACT6 Sum of seven options from question, 'What types of exercise or physical activity did {CHILD} get at the places you just mentioned' (a) Individual sports, (b) Group sports, (c) Recreational sports, (d) Dance, (e) Playground activities, (f) Callisthenic/General exercise, and (g) other (specify)
Demographic Domain				
White	.55	.50	0 - 1	WKRACETH Race and ethnicity of the child is White
Black	.15	.36	0 - 1	WKRACETH Race and ethnicity of the child is Black
Latinx	.18	.38	0 - 1	WKRACETH Race and ethnicity of the child is Hispanic
Asian/Pacific Islander	.07	.26	0 - 1	WKRACETH Race and ethnicity of the child is Asian/Pacific Islander
Other Racial Group	.04	.20	0 - 1	WKRACETH Race and ethnicity of the child is other
Child's Age in Months	68.4	4.35	54 - 79	R1_KAGE 'I have recorded that {CHILD} was born on {DATE OF BIRTH}. Is that correct?/What is {CHILD}'s date of birth?'
Economic Domain				
Catholic School	.11	.31	0 - 1	S2KSCTYP School type is Catholic School Derived from S2PUBLIC, S2CATHOL, S2OTHREL, S2OTHPRI, CS_TYPE2 1
Religious School	.06	.24	0 - 1	S2KSCTYP School type is Religious School Derived from S2PUBLIC, S2CATHOL, S2OTHREL, S2OTHPRI, CS_TYPE2
Private School	.04	.21	0 - 1	S2KSCTYP School type is Private School Derived from , S2CATHOL, S2OTHREL, S2OTHPRI, CS_TYPE2
Public School	.78	.41	0 - 1	S2KSCTYP School type is Public School Derived from S2PUBLIC, S2CATHOL, S2OTHREL, S2OTHPRI, CS_TYPE2
Urban	.41	.49	0 - 1	KURBAN
Suburban	.39	.49	0 - 1	KURBAN
Rural	.20	.40	0 - 1	KURBAN
Socioeconomic Status	.01	.80	7.50	WKSESL 'Continuous SES measure'

4. Analyses

The null hypothesis was tested using ordinary least squared (OLS) regression. A four-step regression model was utilized. In the first step, MAT was the single entry; the second step featured MAT as the first entry, followed by Physical Activity; the third step consisted of MAT first, Physical Activity second, and Demographics third; the final step consisted of MAT as the initial entry, Physical Activity as the second entry, Demographics as the third entry, and Economics as the fourth and final entry.

III. Results

Descriptive data on the prevalence of MAT and other physical activities, and the locations where specific activities were held, are presented in Tables 2 and 3. The results of the OLS regression are presented in Table 4. Only significant results are discussed in this section

Table 2. Physical Activity engaged in by participants by percentages in Wave Six

Physical Activity	Percentage
Group Sports	35.2
Recreational Sports	34.5
Playground Activities	33.6
Individual Sports	23.8
Calisthenics/General Exercise	20.6
Dance	6.3
Martial Arts Training	3.2
Other Exercise	.4

Table 3. Sites of Physical Activity participation by percentage in Wave Six

Organization	Percentage
Exercise – Public Park/Recreation Center	27.8
Exercise-Sports Team/League	27.2
Exercise-Place of Worship	12.4
Exercise-YMCA/Other Org	8.5
Exercise-Scouts/Daisies	8.1
Exercise-Health Club	3.5
Exercise-4h/Farm Clubs	2.0

Table 4. Unstandardized Regression Coefficients (Beta in parentheses) for Physical Health in the ECLS_K (N =6,295)

Variables	Model I	Model II	Model III	Model IV
<u>Martial Arts Training</u>				
Martial Arts	-.02 (-.01)	-.03 (-.01)	-.01 (-.00)	-.02 (-.01)
<u>Child Physical Activity</u>				
Physical Activity		.06*** (.09)	.05*** (.08)	.04*** (.47)
<u>Demographic Variables</u>				
Race (Ref: White)				
Black			-.28*** (-.10)	-.17*** (-.06)
Latinx			-.27*** (-.13)	-.17*** (-.08)
Asian/Pacific Islanders			-.14*** (-.04)	-.14** (-.04)
Other Race			-.10 (-.03)	-.05 (-.01)
Child's Age in Months			-.00 (.01)	-.00 (.01)
<u>Type of School (Ref: Public School)</u>				
Catholic School				.08** (.04)
Religious School				.06 (.02)
Private School				.03 (.01)
<u>Location of School (Reference Urban Area)</u>				
Suburban				-.01 (-.01)
Rural				-.02 (-.01)
Socioeconomic Status				.15*** (.16)

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

Univariate Findings

The data suggest that the most frequent site of physical activity was public park/recreation center (27.8%) followed in order by: sports team/league (27.2%), place of worship (12.4%), YMCA/other organizations (M=8.5%, Scouts/Daises (M=8.1%), health clubs (3.5%), and the 4H/farm clubs (M=2.0%).

The most frequently engaged-in physical activities were group sports (35,2%) followed in order by: recreational sports (34.5%), playground activities (33.6%), individual sports

(23.8%), calisthenics/general exercise (20.6%), dance (6.3%), martial arts training (3.2%) and other exercise (.4%)

Multivariate Findings

At the initial step in the analysis with only MAT in the model, no significant results emerged (Table 4). At the second step, however, featuring Martial Arts and Physical Activity, the analysis suggested that controlling for all other variables, every unit increase in physical activity led to .06 unit increases in physical health. This finding was significant at the $\alpha = .001$ level. Similarly, at the third step, featuring Martial Arts, Physical Activity, Race/Ethnic Group, and Child's Age in Months, the analysis suggested that, controlling for all other variables, every unit increase in Physical Activity led to a .05 unit increase in Physical Health, significant at the $\alpha = .001$ level. Parental designation as Black led to a -.28 unit decrease, parental designation as Latinx led to a -.27 unit decrease, and parental designation Asian/Pacific Islanders led to a -.14 unit decrease in comparison to their White counterparts. All were significant at the $\alpha = .001$ level. Finally, at step four controlling for all other variables, every unit increase in Physical Activity led to a .04 unit increase in Physical Health, significant at the $\alpha = .001$ level. Similar to step three, parental designation as Black resulted in a -.17 unit decrease in Physical Health, while parental designation as Latinx resulted in a -.17 unit decrease in Physical Health in comparison to their White counterparts, both significant at the $\alpha = .01$ level. Parental designation as Asian/Pacific Islanders led to a -.14 decrease, significant at the $\alpha = .05$ level. In School domain, every unit increase in attendance at a Catholic school resulted in .08 increase in Physical Health, significant at the $\alpha = .05$ level. Finally, in step four, every unit increase in Socioeconomic Status resulted in a .08 increase in Physical Health significant at the $\alpha = .001$ level.

Based upon these results, the null hypothesis of no Physical Health benefits accruing from MAT was accepted.

IV. Discussion

The results of the investigation indicated that MAT was the second least popular choice for physical activity among the participants in this national sample and that physical activities were held at various sites by multiple organizations. Additionally, the findings indicated that Physical Activity, Socioeconomic Status, and attending a Catholic school contributed to physical health as reported by parents. Finally, being Black, Latinx, or Asian/Pacific Islander was associated with a lower level of physical health. The results of the analysis do not support a relationship between MAT and Physical Health. Each of these findings is discussed below.

Prevalence and Location of Physical Activities

The data indicated that public parks/recreation centers were the leading site of physical activity for participants (27.8%). Such organizations often contract experts in the designated areas to serve as leaders of the activities. Given the limited data gathered in this area, however, it was impossible to ascertain the qualifications and orientations of the instructors, nor the

frequency and curriculum of the activities. This concern is applicable to all the physical activity sites identified in the data.

MAT was the second least popular activity, with the catch-all category of Other Physical Activity as the lowest activity. Only 3.2% of the participants identified as martial arts practitioners. This is in stark contrast to Group Sports at 35.2% and Recreational Sports at 34.5%.

Physical Activities

The finding that Physical Activity contributed to Physical Health is consistent with the recommendations of the Office of Disease Prevention, Health Promotion: 'It's important to encourage young people to try a variety of physical activities' (para, 3). The Physical Activities variable was coded as the sum of seven types of physical activities reported by the parents. The options provided in the variable are functionally similar to the activities listed in the *Physical Activity Guidelines for Americans: Children and Adolescents* (Office of Disease Prevention, Health Promotion, 2008), e.g., dancing, running, playground activities. As stated above, an additional recommendation from these guidelines is that each child engages in at least one hour of physical activity a day, with aerobic activities at least three days a week, muscle strengthening activities at least three days a week, and bone strengthening activities at least three times a week. As indicated above, due to the format of the item, it was not possible to identify the frequency of each activity. The review of the physical activities engaged in by participants suggested, however, that some participants engaged in more than one activity (Table 2). It is reasonable to speculate that participation in several of these activities occurred over a period of multiple days, making the frequency of physical activity in line with the recommendations for daily physical activity. Thus, the finding that physical activity made a significant contribution to health may be a result of the overall effect of participation in multiple activities over the course of a week. Unfortunately, as stated above, the lack of specificity regarding the components of physical activities made it difficult to identify the specific elements contributing to positive health. For example, the item did not provide information on the make-up of group sports, recreational sports, or individual sports.

Martial Arts

The failure of MAT to contribute to physical health contradicts the evidence of multiple investigations (Callaghan, 2004; Paul, 2011; Woodward, 2009). It was consistent, however, with the findings of Strayhorn and Strayhorn (2009) regarding the impact of MAT on mental health, also based on the ECLS-K data. As suggested by Strayhorn and Strayhorn (2009), a possible explanation for the absence of an observable effect of the MAT on health is measurement error, that is, the use of a single item to collect information on a complex behavior. There are multiple dimensions involved in MAT that the survey item fails to address, e.g., type of training (traditional vs. modern), goals of training (instructor and parent), and content of training. Additional limitations of the current Martial Arts variable include the absence of data on frequency, length of classes, and duration of training.

As stated above, it is believed that the greatest benefits of physical activities accrue when the child exercises daily. According to the *Physical Activity Guidelines for Americans:*

Children and Adolescents (Office of Disease Prevention, Health Promotion, 2008), children and adolescents from the ages of 6 to 16 benefit from a minimum of 60 minutes/day of physical activity. There was no indication in the data of how many days/per week MAT occurred. While we could speculate that children participated in the previously described physical activities on different days, the structure of the Martial Arts variable did not provide data for further speculation.

Moreover, there were no data to indicate the qualifications and orientations of the instructors, nor the frequency and curriculum of the physical activities. This information is important from the perspective of MAT, due to the multiple styles, orientations, and schedule of classes offered by martial arts instructors.

Finally, how long a child participated in MAT is an area that merits attention when evaluating health benefits. The dropout rate from MAT is high. Dropping out can result from unrealistic expectations regarding the energy, time, and sacrifice required (Lowry, 2004). Thus, a student may drop out of MAT before experiencing the physical health benefits that will accrue over time.

Race/Ethnicity

The finding that Black, Latinx, and Asian/Pacific Islander children were less healthy than their White counterparts was consistent with the findings of several investigations (Callinan et al., 2013; Thorpe et al., 2004). While these results came from the 1998 cohort and data suggest that there have been improvements in the health indices of all groups over time, health disparities among racial and ethnic groups continue to be an issue facing health professionals (LaVeist, 2005).

SES

Finally, the finding that health increases directly with SES is consistent with the findings of other researchers (Bell, 2008; LaVeist & Isaac, 2013; Ratcliffe & McKernan, 2010), as is the finding that attending a Catholic school is associated with improved health outcomes (LaVeist, 2005).

V. Conclusion

The findings must be viewed with an appreciation of the limitations of the data. While the ECLS-K is one of the only longitudinal, national studies to include MAT as an area of investigation, and as such provides valuable information, the absence of data regarding curriculum, frequency, duration, and qualifications of instructors makes interpretation of the results difficult.

Given these limitations, the current analysis indicated that physical activity remains a valuable tool against the negative health effects of a sedentary lifestyle. Physical Activity, defined in this investigation as participation in individual sports, group sports, recreational sports, playground activities, dance, and unspecified exercise, had a statistically significant positive effect on Physical Health, as did high Socioeconomic Status and Catholic school

attendance. Conversely, being a Black, Latinx, or Asian/Pacific Island child was correlated with a decrease in Physical Health scores.

The results of the current study indicated that martial arts were among the least popular physical activities. There was no demonstrable effect from Martial Arts on the reported physical health status of children aged 5 to 13. This null result, however, may reflect the limitations of the single item strategy used to measure MAT. We suggest that future investigations of the contributions of MAT to physical health should incorporate more comprehensive questioning routes, e.g., type of martial arts, duration of training, frequency of classes, length of classes, and qualifications of instructors.

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