

Physical Activity in Youth Dance Classes

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abstract

BACKGROUND AND OBJECTIVES: The majority of youth are not meeting the US Department of Health and Human Services physical activity guidelines. Dance is a popular activity, particularly for girls, and has the potential to increase physical activity for many youth. This study investigated physical activity of children and adolescents in 7 dance types: ballet, hip-hop, jazz, Latin-flamenco, Latin-salsa/ballet folklórico, partnered, and tap.

METHODS: Data were collected in 17 private studios and 4 community centers in San Diego, California. A total of 264 girls from 66 classes participated ($n = 154$ children; $n = 110$ adolescents). Physical activity was measured with accelerometers, and activity levels during class were calculated.

RESULTS: Participants recorded an average of 17.2 ± 8.9 minutes of moderate-to-vigorous physical activity (36% of class), but this varied by age and dance type. For children, dance type differences were observed with percent of class in moderate-to-vigorous physical activity ranging from 13.6% (Latin-flamenco) to 57% (hip-hop). For adolescents, there were no differences across dance types. Children were more active than adolescents in all types except ballet. Children and adolescents were more active in private compared with community center classes.

CONCLUSIONS: Overall, physical activity in youth dance classes was low; 8% of children and 6% of adolescents met the Centers for Disease Control and Prevention 30-minute guideline for after-school physical activity during dance. To increase physical activity in dance classes, teaching methods could be employed to increase activity in all types, or emphasis could be placed on greater participation in more active dance types.

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WHAT'S KNOWN ON THIS SUBJECT: The majority of youth are not meeting the recommended physical activity guidelines. Dance classes are popular for girls and have potential to provide physical activity for many youth. Little is known about how active youth are in different dance types.

WHAT THIS STUDY ADDS: Objectively measured physical activity in dance classes are low and generally provide less physical activity than youth sports. There is a public health imperative to engage the dance profession in efforts to improve the health impact of youth dance classes.

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Ms Cain conceptualized and designed the study, participated in data management and analyses, and drafted parts of the manuscript; Ms Gavand carried out the final analyses and drafted parts of the manuscript; Dr Conway participated in study design, consulted on analyses and interpretation, and critically reviewed and revised the manuscript; Ms Peck participated in study design, data collection, initial analyses and interpretation, and drafted parts of the manuscript; Dr Bracy participated in study design, data management, initial analyses and interpretation, and critically reviewed and revised the manuscript; Ms Bonilla participated in study design, coordinated data collection, participated in data management and results interpretation, and critically reviewed and revised the manuscript; Ms Rincon participated in study design, results interpretation and critically reviewed and revised the manuscript; Dr Sallis conceptualized the study, participated in study design, and critically reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

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Children and adolescents are recommended to accumulate at least 60 minutes of moderate-to-vigorous physical activity (MVPA) most days,¹ because of its multiple physical and mental health benefits.² However, data based on objective measures with accelerometers reveal 42% of children and 8% of adolescents are meeting these guidelines.³ The Centers for Disease Control and Prevention recommends that schools provide 30 minutes of MVPA per day, with after-school activities providing the remaining 30 minutes.⁴

Most physical activity among adolescents occurs after school in organized and structured programs such as sports teams and dance lessons.⁵ Dance is particularly popular among girls,^{6,7} which means it has the potential to reduce the well-documented gender differential in youth physical activity.⁸ Dance has many health benefits such as muscle and bone strengthening, increased flexibility, improvements in balance and spatial awareness, and enhanced cognitive functioning. Dance can contribute to an overall healthy lifestyle and can also provide an opportunity for social interaction.^{9,10} Dance is commonly taught in schools and community-based dance studios. The National Dance Education Association estimates that ~43% of youth in the United States obtain dance instruction at schools, most often during physical education. An unknown number of US youth take classes in more than 30 000 dance studios.¹¹ Dance has the potential to contribute to a healthy lifestyle and overall MVPA. Among female youth who reported dancing, almost 40% of their total MVPA was attributable to dance.⁷ Another study revealed that girls obtained 70% more MVPA and 8% less sedentary time on days they attended dance classes.¹²

There are numerous dance styles that vary in amount and intensity of physical activity. O'Neill et al¹³ found that adolescent jazz/tap classes

provided more MVPA compared with ballet (19.6% vs 12.5% of class time, respectively). Nelson et al¹⁴ found that swing, fun dance, and merengue generated higher heart rates compared with foxtrot, waltz, and tango in a fifth grade school-based dance program. Huang et al¹⁵ found that ballroom/partnered dances such as swing, merengue, tango, and foxtrot promoted MVPA during at least 50% of the class time in 9- to 11-year-old children. However, several popular dance types such as hip-hop, flamenco, and salsa have not been evaluated. If it is confirmed that specific dance types are found to be particularly good sources of physical activity for children and adolescents, more active dance types can be recommended for school and community programs as a means of increasing youth physical activity, particularly among girls.

The current study aimed to investigate the physical activity of children and adolescents in 7 general types of studio dance classes including: ballet, jazz, hip-hop, Latin-flamenco (Latin-F), Latin-salsa and ballet folklorico (Latin-SBF), tap, and partnered dance (which included ballroom, merengue, and swing). Because fees can be a barrier to participation among youth from low-income families, dance classes in full-fee private and reduced-fee or free community center studios were contrasted to assess whether the setting was associated with physical activity during dance classes.

METHODS

Recruitment

Five hundred fifty-one private and public dance studios in San Diego County, California, were identified from online business directories. Eligible studios offered group classes in at least 1 of the dance types of interest. Dance types were selected to represent a broad range of commonly taught styles. Two hundred eighty-seven studios did not meet these

criteria, and 54 were closed. From the list of 210 eligible studios, contacts were made in a random order until 4 community centers and 17 private studios agreed to participate. Ten studios declined to participate in the study. Community centers were recruited to assess dance classes available to lower income youth.

After obtaining permission from the dance studios, research staff visited individual dance instructors to explain the study and get permission to collect data in their classes, which included both the teacher and students wearing an accelerometer for the length of the class and completing a brief survey. Only beginner and intermediate level classes were eligible. Research assistants then visited classes to solicit interest among students to participate. Students had to be girls between 5 and 18 years old, willing to wear an accelerometer during the entire dance lesson, and be participating in the study for the first time (ie, have not participated in the study during a different dance class). Although data were collected from girls and boys, few participants were boys. Thus, only girls were included in analyses. Parental consent and child assent were obtained, and the study protocol was approved by the San Diego State University Institutional Review Board.

Dance Class Characteristics

Research staff observed each dance lesson and recorded the number of girls present for the class (ie, class size, which included both study participants and nonparticipants), and the start and end time of each lesson to compute class length (minutes).

Student Characteristics

Parents reported their child's age, gender, and race/ethnicity (coded as white non-Hispanic versus other). Parents also reported their child's height and weight, and BMI was calculated (kg/m^2). BMI percentiles

were calculated by using age- and gender-specific guidelines.¹⁶

Dance Instructor Characteristics

Dance instructors reported their age, gender, race/ethnicity (coded as white non-Hispanic versus other), and years of experience teaching dance.

Physical Activity

Each participant and dance instructor was fitted with a waist-worn Actigraph GT3× accelerometer before the dance lesson.

Accelerometers have been validated for objectively assessing physical activity in youth and are widely used.^{3,17,18} Accelerometer data were collected at 15-second epochs by using the normal filter and scored using Freedson 3 Metabolic Equivalent of Task (MET) age-specific cut points for youth and Freedson Adult cut points for instructors.^{19,20} Sedentary behavior was defined as ≤ 100 cpm.^{21,22} The exact start and end times of class that were recorded by research assistants were used to eliminate all nonclass time from the accelerometer data. MeterPlus version 4.3 (www.meterplussoftware.com) was used to summarize minutes of sedentary, light, moderate, vigorous, and MVPA (moderate + vigorous) during dance classes. Total time (minutes) and percent of class time (minutes divided by class

length) spent in each intensity level were calculated.

Statistical Analysis

SPSS version 21.0 (IBM SPSS Statistics, IBM Corporation) was used for analyses. Descriptives for participant, class, and instructor characteristics were summarized for each dance type by 2 age groups: children (5–10 years old) and adolescents (11–18 years old). Mixed linear regression analyses were performed to assess the effect of dance types on the various physical activity outcomes for children and adolescents separately, adjusting for covariates as fixed effects and instructor and dance class as random effects to account for participant clustering of students within classes and classes within instructors. Hip-hop was set as the reference group. To identify covariates to include in the models, Spearman's correlations were performed with each of the student and teacher variables and physical activity outcomes. Variables with significant correlations ($P < .05$) with at least 1 physical activity outcome were included as covariates in all models. Covariates included in the models were student's age, race/ethnicity (non-Hispanic/white or other), class length (for "total time" outcomes), BMI percentile, instructors' MVPA (minutes), and whether the class was private or

community based. All dance types were represented in both private and community-based settings, with the exception of partnered and Latin-SBF, which were only found in private studios.

RESULTS

A total of 264 girls participated in the study ($n = 154$ children and $n = 110$ adolescents). Descriptive characteristics are presented in Tables 1 and 2. Mean age was 7.8 ± 1.5 and 13.1 ± 1.9 for children and adolescents, respectively. The majority of participants were non-Hispanic/white (67.1% and 71.6% of children and adolescents, respectively). The highest percent of overweight/obese children were found in partnered dance (40%) with the lowest in tap (16%). The highest percent of overweight/obese adolescents were found in Latin-SBF classes (50%) with the lowest in ballet (0%).

Covariate-adjusted means for activity outcomes are presented in Table 3, along with results from the mixed model linear regressions investigating the statistical significance of differences between dance types for sedentary, light, moderate, vigorous, and MVPA. For children, significant differences were observed by dance type in all activity categories with the strongest differences found with

TABLE 1 Student, Class, and Instructor Characteristics by Dance Class Type in Children

	All Classes	Latin-F	Latin-SBF	Ballet	Tap	Jazz	Partnered Dance	Hip-Hop
Students	$n = 154$	$n = 16$	$n = 19$	$n = 27$	$n = 29$	$n = 20$	$n = 10$	$n = 33$
Age	7.8 (1.5)	7.6 (1.3)	8.0 (1.6)	7.3 (1.8)	7.9 (1.5)	8.1 (1.4)	7.5 (1.4)	7.9 (1.4)
Non-Hispanic/white, %	67.1	26.7	33.3	55.6	82.8	95.0	80.0	78.8
BMI percentile	0.5 (0.3)	0.5 (0.4)	0.6 (0.3)	0.6 (0.4)	0.3 (0.3)	0.6 (0.3)	0.5 (0.4)	0.6 (0.4)
Overweight/obese, %	27.3	30.8	31.6	36.4	16.0	20.0	40.0	26.7
Classes	$n = 33$	$n = 3$	$n = 3$	$n = 7$	$n = 7$	$n = 3$	$n = 3$	$n = 7$
Class size ^a	9.1 (4.9)	9.3 (4.0)	9.3 (3.5)	6.7 (3.8)	9.3 (6.7)	10.0 (4.4)	11.0 (8.7)	10.1 (4.4)
Class length, min	48.3 (7.6)	49.7 (1.2)	53.8 (6.9)	49.2 (5.6)	45.0 (7.9)	39.0 (1.7)	53.2 (9.6)	49.7 (9.0)
Instructors	$n = 33$	$n = 3$	$n = 3$	$n = 7$	$n = 7$	$n = 3$	$n = 3$	$n = 7$
Age	32.2 (11.4)	52.0 (17.3)	45.0 (9.5)	28.0 (8.4)	30.3 (8.0)	31.7 (10.6)	30.7 (3.5)	25.1 (5.5)
Women, %	87.9	100.0	100.0	100.0	85.7	100.0	66.7	71.4
Non-Hispanic/white, %	62.5	33.3	100.0	71.4	71.4	50.0	66.7	85.7
Experience, y	12.9 (11.1)	25.0 (21.7)	31.3 (10.3)	8.8 (7.7)	8.9 (5.7)	8.1 (8.1)	16.7 (2.9)	8.2 (4.9)
MVPA, min	5.6 (6.5)	1.0 (1.7)	4.2 (5.2)	2.6 (2.0)	3.7 (2.5)	9.8 (5.3)	2.2 (3.3)	12.9 (9.2)

Data are presented as mean (SD) or percent unless noted otherwise.

^a Total number of students attending class; includes study participants plus nonparticipants.

TABLE 2 Student, Class, and Instructor Characteristics by Dance Class Type in Adolescents

	All Classes	Latin-F	Latin-SBF	Ballet	Tap	Jazz	Partnered Dance	Hip-Hop
Students	<i>n</i> = 110	<i>n</i> = 12	<i>n</i> = 6	<i>n</i> = 23	<i>n</i> = 19	<i>n</i> = 18	<i>n</i> = 9	<i>n</i> = 23
Age	13.1 (1.9)	11.7 (0.9)	12.0 (2.0)	14.0 (1.7)	13.6 (2.3)	12.8 (1.9)	13.1 (1.7)	13.0 (1.8)
Non-Hispanic/white, %	71.6	41.7	83.3	78.3	68.4	88.9	77.8	63.6
BMI percentile	0.5 (0.3)	0.6 (0.3)	0.6 (0.5)	0.4 (0.3)	0.5 (0.3)	0.6 (0.3)	0.5 (0.3)	0.5 (0.3)
Overweight/obese, %	18.1	33.3	50.0	0.0	16.7	20.0	11.1	22.7
Classes	<i>n</i> = 33	<i>n</i> = 4	<i>n</i> = 3	<i>n</i> = 5	<i>n</i> = 6	<i>n</i> = 3	<i>n</i> = 4	<i>n</i> = 8
Class size ^a	8.5 (5.0)	5.3 (2.9)	9.7 (3.1)	7.2 (3.9)	9.0 (6.6)	9.8 (3.3)	11.3 (6.9)	8.3 (6.1)
Class length, min	50.2 (11.6)	43.8 (6.4)	52.7 (6.5)	55.2 (15.0)	46.2 (8.7)	43.5 (11.3)	61.5 (16.4)	50.2 (9.5)
Instructors	<i>n</i> = 33	<i>n</i> = 4	<i>n</i> = 3	<i>n</i> = 5	<i>n</i> = 6	<i>n</i> = 3	<i>n</i> = 4	<i>n</i> = 8
Age	34.5 (13.4)	46.0 (18.6)	45.0 (9.5)	35.4 (11.4)	36.5 (19.5)	31.0 (8.8)	32.5 (4.7)	24.4 (5.0)
Women, %	84.8	100.0	100.0	80.0	100.0	100.0	50.0	71.4
Non-Hispanic/white, %	56.3	25.0	100.0	60.0	83.3	66.7	75.0	57.1
Experience, y	15.2 (13.5)	20.0 (20.3)	31.3 (10.5)	14.8 (9.4)	17.9 (20.3)	9.9 (7.5)	16.3 (2.5)	6.1 (4.8)
MVPA, min	5.6 (6.2)	0.0 (0.0)	3.7 (5.5)	5.6 (5.9)	3.5 (3.4)	10.0 (4.1)	2.0 (2.7)	11.1 (8.0)

Data are presented as mean (SD) or percent unless noted otherwise.

^a Total number of students attending class; includes study participants plus nonparticipants.

percent of class time spent in MVPA ($F = 6.4, P < .001$), which ranged from 13.6% in Latin-F to 57% in hip-hop classes. For adolescents, there were no significant overall differences across dance types in any activity category. As can be seen in Table 3, the ranges of means across dance types for all activity categories were much narrower for adolescents than for children.

Hip-hop classes provided the least amount of sedentary time

(9.1 minutes; 18.5% of class time) and the most MVPA (26.9 minutes; 57% of class time) for children, whereas ballet provided the most MVPA for adolescents (16.6 minutes; 31% of class time). Latin-SBF classes were the least sedentary for adolescents (9.9 minutes; 17.3% of class time). Latin-F classes were the most sedentary for children and adolescents (26.9 minutes; 55% of class time and 23.2 minutes; 43.8% of class time, respectively) and provided

the least amount of MVPA (6 minutes; 13.6% of class time and 4 minutes; 6.7% of class time, respectively) compared with other dance types.

Descriptive characteristics of the sample for private and community center classes are presented in Table 4. Private classes had a higher percent of overweight/obese children and adolescents (30.4% and 21.9%, respectively) compared with community centers (21.3% and 9.4%).

TABLE 3 Relationship of Sedentary, Light, Moderate, Vigorous, and Moderate-to-Vigorous Intensity Physical Activity With Dance Class Type

	Minutes					Percent of Class Time				
	Sedentary (Min) ^a	Light (Min) ^a	Moderate (Min) ^a	Vigorous (Min) ^a	MVPA (Min) ^a	Sedentary (% Time) ^b	Light (% Time) ^b	Moderate (% Time) ^b	Vigorous (% Time) ^b	MVPA (% Time) ^b
Children										
Overall F dance type	6.62***	2.77*	6.46***	2.06	5.60***	6.48***	3.36*	6.25***	2.88*	6.42***
Ballet	15.0 (1.7)*	19.0 (1.6)**	11.6 (1.5)**	2.2 (1.4)**	13.9 (2.1)***	30.9 (3.5)*	39.6 (2.9)***	25.0 (3.2)**	4.5 (2.5)**	29.5 (4.2)***
Partnered	11.2 (2.3)	14.2 (2.0)	15.3 (2.1)	6.2 (1.8)	22.3 (2.9)	22.5 (4.8)	29.5 (3.8)	33.4 (4.3)	13.4 (3.3)	47.5 (5.7)
Latin-SBF	11.1 (2.2)	16.2 (1.9)	16.8 (1.9)	3.2 (1.8)	18.1 (2.8)*	23.2 (4.5)	34.6 (3.6)*	35.5 (4.1)	5.3 (3.2)*	39.0 (5.3)*
Latin-F	26.9 (2.5)***	14.2 (2.2)	3.6 (2.3)***	2.3 (2.0)	6.0 (3.2)***	55.0 (5.2)***	30.7 (4.1)	8.7 (4.7)***	4.9 (3.6)*	13.6 (6.2)***
Tap	13.1 (1.6)	15.8 (1.3)*	15.9 (1.5)	3.5 (1.2)*	19.2 (2.1)*	27.3 (3.4)	33.1 (2.4)*	33.4 (3.1)	7.0 (2.2)*	40.3 (4.0)**
Jazz	11.4 (2.2)	13.5 (1.6)	16.1 (1.9)	5.9 (1.5)	22.1 (2.7)	23.0 (4.5)	27.1 (3.2)	34.5 (4.1)	13.5 (2.9)	48.4 (5.3)
Hip-hop	9.1 (1.7)	11.9 (1.6)	19.5 (1.5)	7.3 (1.4)	26.9 (2.2)	18.5 (3.6)	23.8 (3.0)	41.6 (3.2)	15.4 (2.6)	57.0 (4.2)
Adolescents										
Overall F dance type	2.14	1.62	1.98	1.18	1.67	2.22	1.68	2.09	1.7	1.75
Ballet	17.0 (2.6)	21.6 (2.0)	11.9 (1.8)	4.1 (1.3)	16.6 (2.8)	31.4 (5.0)	41.7 (3.8)	22.7 (3.6)	8.3 (2.4)	31.0 (5.1)
Partnered	15.5 (4.1)	30.5 (3.2)	8.8 (2.8)	-0.1 (2.0)	9.3 (4.1)	26.8 (8.0)	54.5 (6.1)	21.7 (5.4)	1.5 (3.6)	23.2 (7.6)
Latin-SBF	9.9 (4.0)	28.8 (3.1)	11.3 (2.7)	0.4 (1.9)	11.2 (3.9)	17.3 (7.8)	53.5 (5.9)	21.2 (5.1)	-0.2 (3.5)	23.9 (7.3)
Latin-F	23.2 (3.8)	25.0 (2.8)	4.1 (2.3)	0.1 (1.7)	4.0 (3.4)	43.8 (7.3)	48.0 (5.5)	7.2 (4.5)	-0.9 (3.0)	6.7 (6.5)
Tap	15.6 (2.5)	23.7 (1.9)	9.6 (1.8)	3.4 (1.3)	12.7 (2.7)	27.5 (4.9)	44.2 (3.7)	18.8 (3.5)	6.6 (2.4)	26.0 (5.0)
Jazz	16.9 (3.0)	21.0 (2.3)	11.0 (2.3)	3.2 (1.6)	13.9 (3.5)	29.9 (5.8)	37.5 (4.5)	22.6 (4.5)	6.9 (3.0)	30.2 (6.3)
Hip-hop	12.4 (2.5)	24.1 (1.9)	14.0 (1.9)	2.1 (1.3)	15.6 (2.8)	22.3 (4.8)	46.4 (3.7)	27.3 (3.6)	3.0 (2.4)	30.6 (5.2)

* $P \leq .05$; ** $P \leq .01$; *** $P \leq .001$.

^a Analyses adjusted for age, race, class length, BMI percentile, instructor MVPA, community versus private, and clustering within dance classes and instructors.

^b Analyses adjusted for age, race, BMI percentile, instructor MVPA, community versus private, and clustering within dance classes and instructors.

^c Reference group is hip-hop.

TABLE 4 Student, Class, and Instructor Characteristics by Private and Public Dance Classes in Children and Adolescents

	Children		Adolescents	
	Private	Community	Private	Community
Students	<i>n</i> = 103	<i>n</i> = 51	<i>n</i> = 76	<i>n</i> = 34
Age	7.8 (1.6)	7.8 (1.4)	12.9 (2.0)	13.5 (1.7)
Non-Hispanic/white, %	61.4	78.4	73.3	67.6
BMI percentile	0.6 (0.3)	0.5 (0.4)	0.6 (0.3)	0.5 (0.3)
Overweight/obese, %	30.4	21.3	21.9	9.4
Classes	<i>n</i> = 26	<i>n</i> = 7	<i>n</i> = 25	<i>n</i> = 8
Class size	7.8 (4.6)	13.9 (2.8)	7.6 (4.6)	11.6 (5.4)
Class length, min	50.5 (7.1)	40.3 (2.4)	51.8 (10.4)	45.3 (14.6)
Instructors	<i>n</i> = 22	<i>n</i> = 3	<i>n</i> = 22	<i>n</i> = 5
Age	31.9 (12.5)	33.3 (6.7)	33.6 (12.8)	37.5 (15.5)
Women, %	84.6	100.0	84.0	87.5
Non-Hispanic/white, %	60.0	71.4	54.2	62.5
Experience, y	13.7 (12.1)	9.6 (5.3)	15.5 (13.2)	14.5 (15.2)
MVPA, min	5.3 (6.9)	6.9 (4.9)	4.9 (6.3)	8.0 (5.5)

Data are presented as mean (SD) or percent unless noted otherwise.

Table 5 presents the covariate-adjusted means for activity outcomes along with the results from the mixed model linear regressions investigating the differences between private studio classes and community center classes in activity categories. Children in private dance studios were more active with 20.6 minutes spent in MVPA (44.1% of class time) compared with children in community center classes who had 16 minutes MVPA (34.5% of class time). Adolescents in private dance studios spent more time in vigorous activity (6.4% of class time) compared with adolescents in community center classes (0.8% of class time).

Figure 1 reveals covariate-adjusted means for minutes of MVPA during dance classes by dance type and age group. Children were more active than adolescents in all dance types except ballet, with a 20.3-minute difference between the least and most active dance type (Latin-F and hip-hop, respectively). There were smaller differences among dance types for adolescents with a 12.6-minute MVPA difference between the least and most active dance type (Latin-F and ballet, respectively). The biggest within-dance type difference between age groups was found with partnered dance with children getting 13 more minutes of MVPA compared

with adolescents. Within-dance type differences for most other types ranged from 2.4 to 11.1 minutes between children and adolescents.

DISCUSSION

Objectively measured physical activity during youth dance classes varied dramatically, from 4 to 27 minutes, depending on dance type and age of student. The Centers for Disease Control and Prevention recommends that schools provide 30 of the total 60 minutes of MVPA per day, with after-school activities providing the remaining 30 minutes.³ Only 8% of children and 6% of adolescents in the current study met these 30-minute guidelines in dance classes. A study using similar methods revealed that from 50% to 100% of participants in youth sports practices achieved 30 minutes of MVPA.²³ Though dance classes have the potential to reduce gender-based disparities in physical activity by appealing mainly to girls, the public health promise of dance classes is not being delivered.

Dance as physical activity in youth is not well studied. Studies to date had small sample sizes, limited age ranges, limited types of dance, and short dance sessions.^{12–15} The current study revealed over twice as much class time in MVPA in ballet

TABLE 5 Relationship of Sedentary, Light, Moderate, Vigorous, and Moderate-to-Vigorous Intensity Physical Activity With Private and Public Dance Classes

	Minutes					Percent of Class Time				
	Sedentary (Min) ^a	Light (Min) ^a	Moderate (Min) ^a	Vigorous (Min) ^a	MVPA (Min) ^a	Sedentary (% Time) ^b	Light (% Time) ^b	Moderate (% Time) ^b	Vigorous (% Time) ^b	MVPA (% Time) ^b
Children										
Overall F class type ^c	1.85	0.05	2.10	1.07	4.29*	1.95	0.18	1.73	2.52	5.05*
Private	12.8 (0.9)	14.7 (0.8)	15.2 (0.8)	5.4 (0.7)	20.6 (1.1)*	26.1 (1.8)	30.4 (1.5)	32.4 (1.6)	11.6 (1.3)	44.1 (2.1)*
Community	15.2 (1.5)	15.2 (1.9)	13.0 (1.3)	3.4 (1.7)	16.1 (1.9)	31.1 (3.0)	32.0 (3.4)	28.1 (2.7)	6.6 (2.7)	34.5 (3.6)
Adolescents										
Overall F class type ^d	0.25	0.65	0.38	2.78	0.38	0.43	0.67	0.75	5.30*	0.06
Private	16.7 (1.5)	23.9 (1.2)	9.5 (0.9)	3.1 (0.7)	12.7 (1.4)	30.7 (3.0)	44.4 (2.3)	18.6 (1.8)	6.4 (1.2)*	25.2 (2.6)
Community	14.9 (3.2)	26.0 (2.4)	10.7 (1.7)	0.7 (1.3)	11.0 (2.4)	26.2 (6.2)	48.6 (4.7)	21.8 (3.2)	0.8 (2.2)	23.8 (5.0)

P < .05.

^a Analyses adjusted for age, race, class length, BMI percentile, instructor MVPA, community versus private, and clustering within dance classes and instructors.

^b Analyses adjusted for age, race, BMI percentile, instructor MVPA, community versus private, and clustering within dance classes and instructors.

^c Partnered dance, Latin-F and Latin-SBF were only represented in private studios.

^d Partnered dance and Latin-SBF were only represented in private studios.

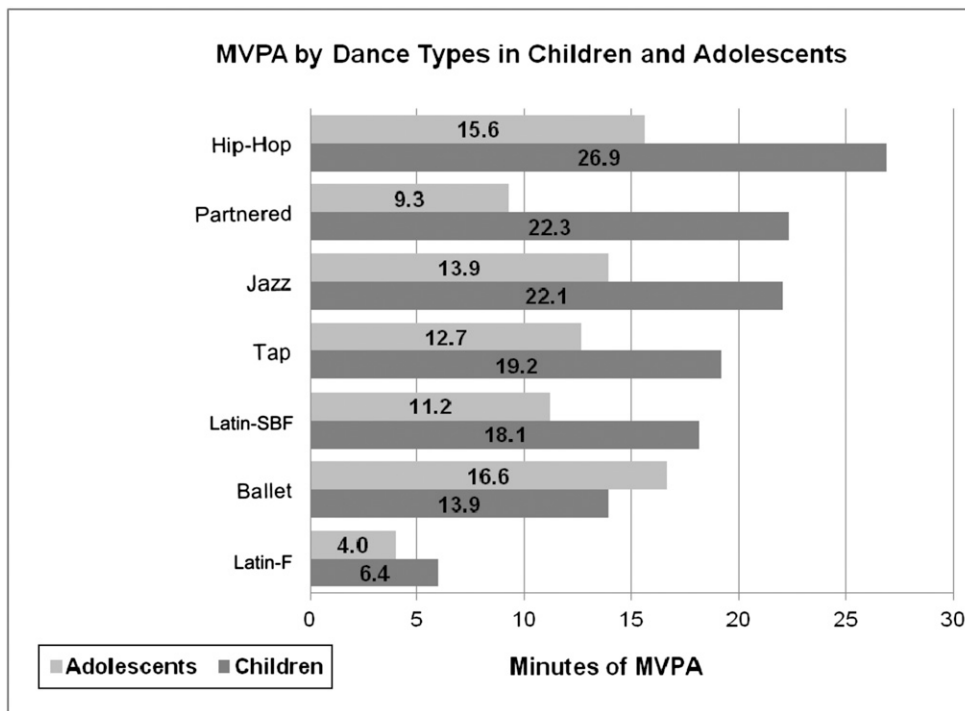


FIGURE 1

Adjusted means for minutes of MVPA during dance classes for children and adolescents. Analyses adjusted for student age, race, class length, BMI percentile, instructor MVPA, community versus private, and clustering within dance classes and instructors.

compared with a previous study using accelerometers,¹¹ but differences in epoch length, accelerometer model, and particularly the use of a 3-MET vs 4-MET cut point could explain this difference.^{17,24}

Children were more active than adolescents in all types of dance classes, except for ballet. This could be because children are more active in general or because dance classes for adolescents may spend more time teaching routines rather than providing opportunities for active dancing. Lower activity levels for adolescents might also reflect adolescent girls' fear of embarrassment and body consciousness, particularly because dance classes are almost always held in rooms with mirrored walls whereby students are often comparing their movements (and bodies) to one another.^{25,26}

Variation by type of dance, specifically in children, was more

dramatic than age differences. Latin-F was the least active for both children and adolescents, whereas hip-hop classes were the most active for children and ballet for adolescents, although the differences across dance types were not significant in adolescents. Partnered dancing was an active dance type for children, but not for adolescents, likely reflecting differences in the type of partnered dance. Common partnered dance styles for children were swing and merengue, whereas the common styles for adolescents were traditional ballroom dances. Ballet was a lighter intensity dance type for children but the most active dance for adolescents. This likely reflects more advanced and active jumps and running for the higher-skilled adolescents. The reasons for the large differences in MVPA across dance types among children but not adolescents should be explored in subsequent studies that assess the nature of the dance moves and instructional practices.

It is useful to compare the profile of physical activity of youth dance classes and sports practices, because these are 2 common after-school activity programs. Compared with activity levels in youth soccer and baseball/softball practices,²³ dancing was much less active. Though sedentary time was comparable (30% of class/practice time), children and adolescents had less vigorous intensity activity in dance compared with soccer (mean 7.2% vs 28% of class/practice time, respectively). Some dance types such as jazz, partnered, and hip-hop in children had comparable amounts of vigorous activity compared with baseball/softball (11% of practice time).²³ Vigorous intensity activity is important because it is particularly protective from youth obesity.²⁷ Children's dance classes in private studios provided more MVPA (44% of class time) compared with girls' baseball/softball practices, which spent ~35% of practice time being active, but less MVPA than girls' soccer (over 50% of practice time).²³

The current study included some lower-cost dance classes (approximately \$5/class) to allow comparisons with higher-cost private classes (approximately \$17/class). For children, community center classes had less MVPA compared with private classes, whereas for adolescents, community center classes had less vigorous compared with private classes, even after controlling for the higher activity of instructors. It was also notable that community center classes tended to be shorter in duration, have larger class sizes, and have fewer overweight/obese students. It was unexpected that public classes were serving a lower proportion of overweight/obese girls. This finding should be explored in other locations.

Strengths of the study included an objective measure of physical activity, a large sample size from a variety of dance types, age-specific analyses, and multiple classes for each dance type. Limitations included studying dance in only 1 geographic area. Another limitation was height and weight were reported by parents and not objectively measured. Some dance types might not be measured well with accelerometry, particularly styles with extensive upper body movement, such as flamenco. A study of Latin dancing also revealed that accelerometers were not as sensitive as heart rate monitors for measuring physical activity in overweight and obese women.²⁸ The current study used 3 METs as the lower limit of moderate-intensity physical activity, though other studies used 4 METs or higher^{3,29,30} reflecting a lack of consensus on definitions.¹⁷ A 3-MET cut point will result in higher

estimates of MVPA compared with higher MET values. However, the US physical activity guidelines are based on 3 METs for all age groups,¹ which was the rationale for methods used in the current study. The difference in cut points could explain different MVPA levels between the current study and the O'Neill et al¹³ study, which used a 4-MET cut point.

CONCLUSIONS

The current study confirmed findings from the few previous studies that physical activity levels are low in youth dance classes. It appears that most dance classes are substantially less active than youth sports practices, so 1 of the most common types of after-school activity programs is providing youth participants with limited amounts of physical activity. Thus, there is a public health imperative to engage the dance profession in efforts to improve the public health impact of youth dance classes. A fruitful place to begin would be to work with leading dance organizations to adopt public health and physical activity goals. Though there are important social, developmental, cultural, and aesthetics benefits of dance that should be maintained and strengthened, it should be possible to simultaneously increase physical activity. It should be possible to implement more active dance classes in the estimated 32 000 private dance studios,¹¹ as well as school physical education classes and after-school programs.

Two strategies for increasing physical activity in youth dance classes are suggested by current findings. One

strategy is to alter teaching methods to increase physical activity in all dance types. This could be done by using dynamic rather than static warm up periods, having more frequent and longer practice of dance moves, and including a segment of vigorous exercise in each class to improve fitness. A second strategy is to emphasize greater participation in dance class types with higher levels of physical activity. Present results implied that lower-cost dance classes delivered in community centers attracted more adolescents of color who may experience financial barriers to dance classes in private studios. However, public classes tended to be less active. Closer collaboration between public health and dance instruction professionals could lead to changes in dance class practices that could benefit millions of young people, especially girls who are attracted to dance but are much less likely to meet physical activity guidelines.³

There are several steps pediatricians and pediatric organizations could take to maximize the health benefits of dance classes. Pediatricians could recommend more active dance types for children interested in dance, such as jazz, hip hop, and partnered types. Local pediatric organizations could compile lists of public and private dance studios and indicate which studios have made commitments or taken steps to ensure relatively high levels of physical activity during dance classes. National pediatric organizations could collaborate with dance instructor organizations to develop guidelines and training opportunities designed to increase physical activity during dance classes.

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