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Changes in Physical Activity from Walking to School

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Active commuting to school (e.g. walking or bicycling) has been suggested as a strategy to increase children's physical activity^{1, 2} and a number of walk-to-school websites now exist.^{3–5} Several observational studies have found positive associations between walking to school and physical activity^{6–9} but they are unable to determine the causal direction. Adult-chaperoned walks to school (i.e., walking school bus^{1, 5}) have been evaluated^{10–12} but no research was found that assessed objectively measured changes in physical activity from walking to school. Walk-to-school programs can be a component of comprehensive school health plans, have particular relevance for school nurse/health staff and physical education faculty and can be adapted to suit the schools' physical and social environment. Therefore, we completed a small, short-term pilot and feasibility randomized control trial to 1) test the feasibility of the walking school bus as an intervention strategy and 2) to identify any changes in physical activity from walking to school.

A randomized controlled trial design was used with all participants completing one week of baseline automobile commuting. Students were then randomized, for the second week, to either a control group that continued to be driven to school or an intervention group that participated in the walking school bus.

Families were recruited from one elementary school (Menlo Park, CA). Eighteen families responded and met the inclusion criteria: 1) student in 3rd–5th grade and 2) currently being driven to school at least four days/week. Six families declined to participate, due to time constraints (n=4), shared custody (n=1), and general concern (n=1). Therefore, 12 students were randomized to a control (CON, n=6) or intervention (WALK, n=6) group. All students completed the study protocol as designed. One student in the WALK group was excluded from analysis due to activity monitor malfunction, leaving five WALK and six CON students in the analysis sample. This study was approved by the Stanford University Administrative Panel on Human Subjects in Medical Research.

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This work was conducted at the Stanford Prevention Research Center, Stanford University School of Medicine.

This study was conducted during March and April of 2005. The ActiGraph physical activity monitor was used to measure physical activity.^{13–15} One-minute data collection time intervals (epochs) were used for this study. An elastic belt with an attached monitor was fit to each student on the first day of the study (always a weekend). Students were instructed to wear the monitor at all times for 14 consecutive days except when swimming, bathing, or sleeping. All students were instructed to maintain their normal activities during the baseline week. On the fifth day, families were notified of their group randomization and, for the WALK group, the planned route and schedule. The morning commute for the CON group was not altered.

A walking school bus, led by one study personnel, followed the safest route to school based on the location of the students' homes relative to each other and the school. Students walked at their normal pace but were encouraged to stay together as a group. A wagon, pulled by the study personnel, was used to transport backpacks and instruments. If a student lived more than 1.6 Km from the school, the parent/guardian dropped the student off at one of the other student's homes (1.1 Km from school) and he/she walked the remainder of the trip.

Raw accelerometer data were reduced to summary variables using a custom software program.⁹ For analysis, accelerometer data were summarized for the total week and weekdays. Each weekday was also divided into four time blocks; before-, during-, and after-school and evening. Average monitor counts·min⁻¹ and the average percent of time spent in moderate-to-vigorous physical activity (%MVPA) were calculated for each student using age-specific count cutoffs¹⁶ and change scores (intervention–baseline) calculated. Between group comparisons used non-parametric Wilcoxon Rank Sum tests with a two-tailed alpha=0.05.

CON (n=6) and WALK (n=5) students were (mean±SD) 9.5±1.02 and 9.7±0.90 years old. The CON group had four boys (all Caucasian) and two girls (1 Caucasian, 1 Chinese). The WALK group had two boys and three girls (all Caucasian). On average, CON and WALK students lived 1.3±0.68 and 0.9±0.46 Km from school. The time required to walk to school for the WALK students ranged from 10–36 minutes and was proportional to the distance traveled 0.4–1.1 Km (mean, 0.8 Km) (Spearman r=0.95).

Compared to students in the CON group, WALK students significantly increased their counts·min⁻¹ and %MVPA ($p \leq 0.02$) before school (Table 1). This difference was even more pronounced when only looking at the General Commute Time (GCT), defined as the 45 minutes before school ($p < 0.01$). While there was no change for the CON group (12 min of MVPA), the WALK group added, on average, 14 minutes of MVPA during the GCT (between group $p = 0.05$). No significant differences were detected for the other weekday periods. No significant between group differences were detected (all $p \geq 0.40$) for the change in counts·min⁻¹ or % MVPA averaged over all useable days or weekdays.

To our knowledge, this is the first experimental study to investigate the effect of walking to school on physical activity. The walking school bus did prove feasible in this small sample. Compared to students that were driven to school, those that walked to school increased their MVPA during the GCT by 14 minutes per day.

Qualitative data collected at the end of the intervention indicated that the walking school bus was well liked. Parents noted that it was a, “less stressful start to the day” and another mentioned, “She can do it! And she enjoys walking. She even wanted to walk home”. Students indicated that they enjoyed walking with others and one student noted that he, “Didn't feel as tired in the morning compared to when I am driven to school”. Two students indicated they did not like getting up earlier and none of the students liked the “loud, embarrassing wagon”. Five of the six students in the WALK group said they would continue to walk to school.

In this experimental study we found no significant group differences for total daily or weekday physical activity or percent of time spent in MVPA. This was likely due to insufficient power to detect such differences, given the high variability of physical activity behavior and measurement error.

The 14 minute increase in MVPA during the general commute time for the WALK students represents approximately 25% of the recommended 60-minutes of MVPA per day. The promising results of this small experimental study justify larger walk to school experiments to examine whether walk to school interventions can impact total daily physical activity and MVPA, as well as other health and behavior outcomes. Additional community level benefits include less car congestion and emissions and improved neighborhood safety via more frequent social interactions with neighbors and greater community cohesion. Since walking to school will likely take longer than being driven, the morning routine may change to accommodate this. The child may need to get up earlier, potentially reducing the amount of time for sleeping and eating breakfast. Therefore, quality and quantity of sleep, consumption of breakfast and overall dietary behavior of students that walk to school should be considered. Lastly, such school- and community-based efforts should seek to engage school personnel and parent and community volunteers as walking school bus chaperones.¹⁷ The experiences from such programs can be incorporated into physical education and science curriculums as experiential learning opportunities (e.g., walkability audits; car, bike, and pedestrian counts; step or distance goals for active commuting, etc...).

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References

- Centers for Disease Control and Prevention. Kidswalk-to-School: A Guide to Promote Walking to School. Centers for Disease Control and Prevention. 2004 [Accessed March 30, 2007]. Available at: <http://www.cdc.gov/nccdphp/dnpa/kidswalk/pdf/kidswalk.pdf>
- Tudor-Locke C, Ainsworth BE, Popkin BM. Active commuting to school: An overlooked source of children's physical activity? *Sports Medicine* 2001;31(5):309–313. [PubMed: 11347681]
- North Carolina Highway Safety Research Center. National Center for Safe Routes to School. 2007 [Accessed March 8, 2007]. Available at: <http://www.saferoutesinfo.org/>
- National Center for Safe Routes to School. Walk to school website. [Accessed September 12, 2007]. Available at: <http://www.walktoschool.org/>
- Pedestrian and Bicyclist Information Center. Starting a Walking School Bus. Partnership for a Walkable America. [Accessed September 12, 2007]. Available at: <http://www.walkingschoolbus.org/>
- Cooper AR, Page AS, Foster LJ, Qahwaji D. Commuting to school: are children who walk more physically active? *Am J Prev Med* 2003;25(4):273–276. [PubMed: 14580626]
- Cooper AR, Andersen LB, Wedderkopp N, Page AS, Froberg K. Physical activity levels of children who walk, cycle, or are driven to school. *Am J Prev Med* 2005;29(3):179–184. [PubMed: 16168866]
- Gordon-Larsen P, Nelson MC, Beam K. Associations among active transportation, physical activity, and weight status in young adults. *Obes Res* 2005;13(5):868–875. [PubMed: 15919840]
- Sirard JR, Riner WF Jr, McIver KL, Pate RR. Physical activity and active commuting to elementary school. *Med Sci Sports Exerc* 2005;37(12):2062–2069. [PubMed: 16331130]
- Johnston BD, Mendoza J, Rafton S, Gonzalez-Walker D, Levinger D. Promoting physical activity and reducing child pedestrian risk: Early evaluation of a walking school bus program in central Seattle. *J Trauma: Injury, Infection, and Critical Care* 2006;60(6):1388–1389.
- Kearns RA, Collins DCA, Neuwelt PM. The walking school bus: extending children's geographies? *Area* 2003 Sep;35(3):285–292.

12. Kingham S, Ussher S. An assessment of the benefits of the walking school bus in Christchurch, New Zealand. *Transport Res A-Pol* 2007 Jul;41(6):502–510.
13. Wrist activity monitor technical manual. Shalimar, FL: Computer Science and Applications, Inc.; 1991. Computer Science and Applications I.
14. Louie L, Eston RG, Rowlands AV, et al. Validity of heart rate, pedometry, and accelerometry for estimating the energy cost of activity in Hong Kong Chinese boys. *Pediatr Exerc Sci* 1999;11(3): 229–239.
15. Trost SG, Ward DS, Moorehead SM, Watson PD, Riner W, Burke JR. Validity of the Computer Science and Applications (CSA) activity monitor in children. *Med Sci Sports Exerc* 1998;30(11): 629–633. [PubMed: 9565947]
16. Freedson PS, Sirard J, Debold E, et al. Calibration of the Computer Science and Applications, Inc. (CSA) accelerometer. *Med Sci Sports Exerc* 1997;29:S45.
17. Kingham S, Ussher S. Ticket to a sustainable future: An evaluation of the long-term durability of the Walking School Bus programme in Christchurch, New Zealand. *Transp Policy* 2005 Jul;12(4):314–323.

Table 1Average counts·min⁻¹ and percent of time spent in MVPA by group by weekday time blocks, all days, and weekdays

	Counts Min ⁻¹ (Mean±SD)		Percent of time spent in MVPA (%)	
	Control	Walk	Control	Walk
Before School				
Complete Time Block [*] (5:00 am – 8:09 am)				
Baseline Week	681.4 ± 209.0	849.0 ± 129.7	30 ± 10	34 ± 6
Experimental Week	664.2 ± 237.9	1652.0 ± 314.7	28 ± 9	59 ± 7
Difference	-17.2	803.0	-2	25
General Commute Time [*] (7:25 am – 8:09 am)				
Baseline Week	720.3 ± 183.3	1052.9 ± 202.2	30 ± 10	42 ± 10
Experimental Week	732.9 ± 259.6	2169.3 ± 477.5	31 ± 11	72 ± 11
Difference	12.6	1116.5	1	30
During School (8:10 am – 2:54 pm)				
Baseline Week	774.9 ± 172.0	730.3 ± 217.9	27 ± 5	26 ± 9
Experimental Week	713.8 ± 147.5	631.6 ± 210.1	23 ± 4	22 ± 7
Difference	-61.1	-98.7	-4	-4
After School (2:55 pm – 5:59 pm)				
Baseline Week	989.9 ± 509.7	1171.4 ± 497.2	34 ± 11	36 ± 11
Experimental Week	1157.8 ± 665.2	1085.3 ± 481.2	38 ± 16	36 ± 9
Difference	167.9	-86.1	4	0
Evening (6:00 pm – 9:59 pm)				
Baseline Week	765.7 ± 328.1	629.7 ± 220.9	28 ± 8	23 ± 8
Experimental Week	736.2 ± 323.7	577.6 ± 198.2	27 ± 10	23 ± 8
Difference	-29.6	-52.1	-1	0
All Days				
Baseline Week	847.7 ± 316.3	793.7 ± 187.8	29 ± 8	28 ± 7
Experimental Week	812.2 ± 258.4	775.5 ± 210.6	28 ± 7	27 ± 7
Change	-35.6	-18.2	-1	-1
Weekdays				
Baseline Week	821.1 ± 252.4	788.3 ± 157.9	29 ± 6	28 ± 7
Experimental Week	832.2 ± 299.3	810.1 ± 197.9	28 ± 8	29 ± 7
Change	11.2	21.7	-1	1

* Wilcoxon Rank Sum Exact Tests of change values between groups for each variable; p-value ≤0.02.