Published in final edited form as:

J Sch Health. 2017 October ; 87(10): 769–775. doi:10.1111/josh.12549.

Relationship Between Adherence to Individual Goals Within the 5-2-1-0 Guidelines for Obesity Prevention and Number of PACER Laps in Adolescents

Kibum Cho, PhD^a, Emily Jones, PhD^b, Christa Lilly, PhD^c, Sean Bulger, EdD^d, Luciana Braga, PhD^e, and Eloise Elliott, PhD^f

^aInstructor, College of Sports and Arts, Hanyang University, Hanyangdeahak-ro, Sangnok-gu, Ansan, Gyeonggi-do 15588, Korea

^bAssociate Professor, College of Physical Activity and Sport Sciences, West Virginia University, POBox 6116, Morgantown, WV 26505

^cAssistant Professor, School of Public Health, West Virginia University, POBox 9190, Morgantown, WV 26506

^dAssociate Professor, College of Physical Activity and Sport Sciences, West Virginia University, POBox 6116, Morgantown, WV 26505

^eAssistant Professor, Department of Kinesiology (Yolo 283), California State University Chico, Chico, CA 95929

^fWare Distinguished Professor, College of Physical Activity and Sport Sciences, West Virginia University, POBox 6116, Morgantown, WV 26505

Abstract

BACKGROUND—The purpose of this study was to evaluate the relationship between adolescents' adherence to the 5-2-1-0 goals and the number of completed Progressive Cardiovascular Endurance Run (PACER) laps.

METHODS—Participants included 1792 students aged 10 to 16 years who were randomly selected across 9 data collection periods between 2012 and 2014. The Survey of Physical Activity and Nutrition was used to measure time spent in physical activity and sedentary behavior, and dietary intake and the dependent variable was the number of PACER laps achieved. The Kruskal-Wallis test and pairwise post hoc comparisons were conducted.

RESULTS—Only 0.95% (N = 17) participants met all 4 goals outlined within the 5-2-1-0 guidelines. Whereas 10.04% met 3 (N = 180), 41.63% met 2 (N = 746), 34.99% met 1 (N = 627), and 12.39% did not meet any goals (N = 222). Pairwise comparisons indicated there were significant differences: between groups not meeting any of the 5-2-1-0 goals and other groups (meeting one goal [p = .000], 2 goals [p = .000], 3 goals [p = .000], and all 4 [p = .008]).

CONCLUSIONS—The positive relationship between PACER laps and adherence to the 5-2-1-0 goals suggests targeted and sequential behavioral changes may have positive implications on adolescents' cardiovascular fitness and body mass index.

Keywords

cardiovascular health; nutrition; physical activity; physical fitness; sedentary behavior

The prevalence of obesity among children and adolescents in the United States has increased precipitously over the past 30 years and is currently a major public health concern.¹ In 2012, 31.8% of youth aged 2 to 19 years were overweight or obese (≥ 85 percentile for body mass index [BMI]), and 16.9 % were obese (≥ 95 percentile for BMI).² Research indicates that obese youth are at risk of developing several physical and mental health problems including type 2 diabetes, cardiovascular diseases, and depression, among others.³

Obesity is associated with habitual energy imbalance causing the accumulation of excessive energy in the body in the form of adipose tissue.⁴ The causes of such imbalance are attributed to complex interactions among genetics, environment, and behavioral factors.⁵ Dietary habits and inactive lifestyles, however, seem to be the primary behaviors influencing energy imbalance and obesity.⁶ Data from the 2013 Youth Risk Behavior Surveillance (YRBS) revealed only 27.1% of participant high school students met the recommended 60 minutes of daily physical activity, while 41.3% played video games or used computers for non-academic purposes during 3 or more hours per day.⁷ The report also indicated that 19.4% of students drank a sugary beverage 2 or more times per day across the 7 days prior to the survey.

According to previous studies, the causes of obesity are generally related to physical inactivity, sedentary behavior, and dietary intake.^{8–10} However, an identified limitation to obesity-related research is the narrow focus on 1 or 2 health behaviors as opposed to the relationship or association of multiple variables.^{11,12} For example, the associations between BMI and adiposity have been examined in relation to discrete variables such as fruit juice or sugary beverage consumption,^{13,14} eating dinner while watching television,¹⁵ and physical inactivity and sedentary behavior.¹⁶ In an attempt to bring attention to the impact of lifestyle decisions on children's health, numerous government, educational, and public health organizations have launched integrated marketing campaigns and related initiatives focused on the risks of and steps to prevent obesity in children and adolescents, such as Let's Move Active Schools.

The *5-2-1-0 Let's Go!* Campaign is a nationally recognized youth obesity prevention initiative that addresses physical activity, sedentary time, and diet.¹⁷ The program was established in Maine in 2006 and is based on an ecological approach recognizing that health behaviors are affected by a myriad of individual, social, and environmental variables. Thus, through a collaborative effort between schools, healthcare practices, and community organizations, 5-2-1-0 Let's Go! Aims to address the underlying health behaviors associated with childhood obesity through the delivery of a simple and consistent message about daily healthy choices.¹⁸ The 5-2-1-0 messages state that children should eat at least 5 servings of

fruits and vegetables per day, limit recreational screen time to less than 2 hours a day, engage in 1 hour of daily physical activity, and drink *no* sugary beverages.¹⁸

Annual reports from 5-2-1-0 Let's Go! initiative indicated the importance of health messages for students within the state of Maine and across other states over an 8-year period.¹⁹ Interestingly, the 5-2-1-0 message has also been adopted by several other health promotion practices and organizations across the United States given its simplicity and potential for change in children's dietary and sedentary habits.¹⁷ Although limited research has been conducted on the 5-2-1-0 Let's Go! Program effectiveness, findings from initial studies show positive outcomes related to increased awareness of healthy habits among parents, increased prevalence of healthy habits among children, increased fruits and vegetables consumption, and decreased hours of screen time.^{18,20,21}

Nevertheless, data continue to show evidence of young people not meeting the 5-2-1-0 recommendations. Rogers and Motyka¹⁸ revealed that only 0.4% of US adolescents met all 4 goals represented within 5-2-1-0 recommendations. BMI or skinfold test may be simple and good measurements to explain students' health affected by adherence of 5-2-1-0 recommendations due to inexpensive and easy-to-perform method;²² however, it has its limitations. Researchers have identified that alternative measures, such as waist circumference and waist-to-height ratio are better predictors of cardiovascular disease risk in children and youth than BMI.^{23,24} However, teachers in school environments tend to be reluctant to collect skinfold measures or even waist circumference because of the cumbersome and relatively invasive nature of the protocols.²⁵ Therefore, alternative measures are needed to estimate body composition and it has been suggested that aerobic fitness test performance, if strongly correlated with anthropometric measures, could serve as a proxy measure for health status of for youth populations.²³ In addition, fewer studies have depicted the association between multiple health behavior variables and physical fitness outcomes such as the Progressive Cardiovascular Endurance Run (PACER) test.

The PACER is a popular aerobic capacity fitness test that is used in school and physical education settings.²⁶ The PACER test can be used to estimate aerobic capacity and converts to a measure of maximal oxygen uptake, or VO_2 max. As a potential alternative to BMI and skinfold thickness measures, the PACER test has been identified by various researchers as a reliable and noninvasive estimate of cardiovascular health and when used within school-based settings results from the PACER test have closely correlated with VO_2 max and insulin resistance.^{27,28} Others, such as Burns et al²³ observed statistically significant correlations between percent body fat, waist-to-height ratio, and cardiorespiratory fitness test scores in youth, with weak correlations between BMI and cardiorespiratory fitness scores. Testing protocols, resources, and training materials have been developed for researchers and practitioners to administer field tests, such as the PACER test.²⁶ Given the reliability, ease of use, and correlation with health-related outcomes, the PACER test appears to be a suitable proxy for BMI in youth populations.

Although preliminary data support the impact of 5-2-1-0 Let's Go! on increased awareness, studies exploring relationships between adherence of 5-2-1-0 recommendations and health benefits have not been well documented. Additional study is needed to better understand the

relationship between youth health behaviors and indicators of health status. Therefore, the purpose of this study was to examine the relationship between adolescents' adherence to the 5-2-1-0 goals and the number of completed PACER laps.

METHODS

Participants

This study was conducted as part of a larger school-based health and physical activity intervention called Greenbrier CHOICES (Children's Health Opportunities Involving Coordinated Efforts in Schools), between 2012 and 2014. The setting was 2 Appalachian middle schools (6th–8th grades) in the second largest county in West Virginia, enrolling ~1200 students. The demographic makeup of the school-aged population in Greenbrier County was 94.4% Caucasian and 5.6% other races.

Participants in this study were recruited from the 2 public middle schools in Greenbrier County, WV. In accordance with the Greenbrier CHOICES Project participant recruitment and selection protocol, ~30% of eligible participants were randomly selected at 9 data collection windows between 2012 and 2014 and were 3169 (ages 10 to 16 years old). Of those selected, passive consent was obtained unless participant or guardian actively opted out of the study. If a participant opted out of any data collection windows or did not complete either the provided survey or PACER test, he/she was removed from the eligible participant list.

Instrumentation

Progressive Aerobic Cardiovascular Endurance Run—The Progressive Aerobic Cardiovascular Endurance Run (PACER) test, a 20-m shuttle run, developed by the Cooper Institute for Aerobics Research was used to measure aerobic capacity.²⁹

The PACER is scored by the number of completed laps. Completed PACER laps are recorded by an observer on designed scoring sheets. A single score is assigned to participants based upon the number of PACER laps completed. The score is interpreted based upon norm-referenced criteria for cardiorespiratory fitness established by the Cooper Institute for Aerobics Research.²⁹

Survey of Physical Activity and Nutrition—The Survey of Physical Activity and Nutrition (SPAN) instrument, a self-report survey, developed by Hoelscher et al was used to assess school physical activity, sedentary behavior, and dietary intake.³⁰ Table 1 represents the SPAN items used by the research team to calculate participant adherence to the 4 goals outlined in the 5-2-1-0 guidelines. According to SPAN survey responses, participants were given a code based upon the number of 5-2-1-0 goals they met, such as 0, 1, 2, 3, or 4.

Data Collection Procedures

All data were collected in the school gymnasium across 9 designated data collection windows twice per semester. Grade-specific groups gathered at appointed times to complete the SPAN survey and PACER test. Research team members managed the onsite data

collection. Participants were instructed on how to complete the 11 for physical activity, sedentary behavior, and nutrition questions on the SPAN survey, and research team members helped clarify participant questions or concerns as needed. After completing the SPAN survey, the 20-m PACER test protocol and recording requirements was explained. Two rounds of the PACER test were conducted with students serving as observers/recorders on the designed recording sheets. School personnel and research team members monitored test completers and recorders to ensure adherence to protocols.

Data Analysis

All data analysis was conducted in SPSS v. 21. Descriptive statistics including number of scores, mean, median, mode, and range were used to describe PACER laps in 5 groups divided by adherence of 5-2-1-0 guidelines. Shapiro-Wilk test for normality was significant, which meant violated normality of assumption ($p < .05$). Therefore, the Kruskal-Wallis test (the nonparametric equivalent to a one-way ANOVA) was used to assess whether PACER laps were different for the 5 adherence groups; a test with $p < .05$ was considered significant. Adherence to the 5-2-1-0 guidelines grouping variable (eg, number of goals met) was the independent variable and the number of completed PACER laps was the dependent variable. Given a significant Kruskal-Wallis test, pairwise post hoc comparisons were conducted using the Dunn procedure,³¹ which adjusts each p value for each of the pairwise comparisons to protect against inflated type I error.

RESULTS

Participant Demographics

Participants for this study included 1792 students aged 10 to 16 years (6th = 678; 7th = 622; 8th = 492) in 2 public middle school in rural Appalachia. There were 883 (49.27%) girls and 909 (50.73%) boys. The data for this study were collected from September 2012 to April 2014 across 9 collection windows. After data cleaning, the number of valid participants who completed the SPAN survey and PACER test ranged from 132 to 258 at each collection window (Table 2).

Adherence to 5-2-1-0 Goals

Figure 1 reflects participant adherence to the individual 5-2-1-0 goals as reported from the SPAN survey. Overall, 49.27% ($N = 883$) of participants consumed 5 or more fruits and vegetables per day (goal 5); 38.45% ($N = 689$) spent 2 hours or less of screen time per day (goal 2); 47.27% ($N = 847$) spent 1 hour or more in physical activity per day (goal 1); and 17.19% ($N = 308$) consumed 0 sugary drinks in a day (goal 0). Only 0.95% ($N = 17$) met all 4 of the 5-2-1-0 goals; 10.04% of the participants met 3 of the goals ($N = 180$); 41.63% met 2 ($N = 746$); 34.99% met 1 ($N = 627$); and 12.39% did not meet any of the goals ($N = 222$).

Completed PACER Laps by Adherence Group

Results indicated that when participants met more of the goals, they additionally completed more PACER laps. The group meeting all 4 goals had on average 30.29 PACER laps; those adhering to 3 goals had on average 26.84 laps; 2 goals had on average 25.48 laps; 1 goal had on average 23 laps. The participants who did not meet any goals completed on average 16.83

PACER laps (Table 3). The Cooper Institute for Aerobics Research recommends that PACER laps for participants aged 10 to 16 years is a minimum of 17 laps. According to these data, the only group that did not achieve the minimum number of PACER laps to achieve aerobic capacity was those who did not meet any 5-2-1-0 goals.

Relationship Between Guideline Adherence and PACER Laps

There was a significant difference between PACER laps by different adherence of 5-2-1-0 guidelines (chi-square [4, N = 1792] = 57.98, $p = .0001$). Pairwise comparisons conducted as post hoc procedures and the result indicated that there were significant differences: between groups not meeting any 5-2-1-0 goals and other groups (meeting 1 goal [$p = .000$], 2 goals [$p = .000$], 3 goals [$p = .000$], and all 4 goals [$p = .008$]). However, there were no significant differences between groups who met at least 1 or more of the 5-2-1-0 goals. As a result, those who met at least 1 of the 5-2-1-0 goal achieved higher PACER laps on average than participants in the group who did not.

DISCUSSION

Findings from this study suggest that adherence to individual 5-2-1-0 goals vary greatly among adolescents. For example, nearly half of the participants spent at least 1 hour in physical activity per day, while one sixth of participants consumed fewer than 1 sugar-sweetened beverage per day. According to a nationwide surveillance study conducted by Iannotti and Wang,³² 51.7% of US adolescents reported spending at least 1 hour daily engaged in physical activity; which is like the results of the current study with 47.3% of adolescents reporting meeting the daily recommendation of physical activity. However, this study found only 17.2% of the sampled Appalachian adolescents met the goal of zero sugar-sweetened beverages per day, while the previous research has indicated 34.9% of adolescents met this goal. The variability of sugary-sweetened beverage data between studies may be attributed to the use of different scales and adherence guidelines. For instance, the study by Iannotti and Wang permitted 1 sugar-sweetened beverage per day to meet the goal,³² while the 5-2-1-0 guidelines in the current study did not permit the consumption of any sugar-sweetened beverages per day, which is stricter than criteria provided by other studies. Therefore, it is important that commonly used guidelines establish consistent criteria to be used not only in surveillance research but also in messaging and healthy living campaigns.

The findings also suggest there was a significant difference between PACER laps and the number of 5-2-1-0 goals met. The positive relationship between PACER laps and adherence to 5-2-1-0 variables suggest targeted behavioral changes may have related implications on adolescents' cardiovascular fitness and BMI. For example, the data indicate that participant achievement of more PACER laps may be associated with additional health behaviors such as increased daily consumption of fruits and vegetables, decreased screen time, and reduced sugar-sweetened beverages, even if the participant does not meet daily recommendation of physical activity. Further research in this area is needed to explore this positive relationship.

Despite the importance of healthy behaviors, these results suggest that adolescents may not need to meet all criteria established within 5-2-1-0 guidelines at the same time to experience

promising health outcomes. Results indicated that only 0.95% of the participants in a rural Appalachian community met all individual goals, which is comparable to previous findings whereby only 0.4% of participants in a nationwide study met all of the 5-2-1-0 goals.¹⁷ Although additional research is needed to explore further and substantiate 5-2-1-0 adherence trends within adolescent populations and groups, it is interesting to note that in both studies less than 1% of participants documented meeting all 4 health behavior goals. This may provide initial evidence of the challenges adolescents face in prioritizing and modifying health goals when multiple messages are presented. From the perspective of parents and school personnel, studies have indicated that targeted health messaging and strategies within the school day are perceived as valuable and necessary.²⁰ In fact, almost 90% of teachers surveyed expressed a desire to implement the 5-2-1-0 goals/guidelines in school settings. Yet, to date, there is little evidence to suggest that adolescents must meet all health goals simultaneously, therefore, school personnel may consider employing motivational interviewing techniques to guide adolescents in the process of behavior change through student-centered goal setting sessions focused on a one 5-2-1-0 criterion at a time, rather than all areas (eg, nutrition, physical activity, screen time, and sugary drink consumption).³³ Motivational interviewing is designed to allow individuals to “think about and verbally express their own reasons for and against change, how their current health behavior may conflict with their health goals, and how their current health behavior or health status affects their ability to achieve their life goals.”³³ Providing adolescents with the tools, resources, and support to achieve health recommendations, specifically within one area at a time, may result overtime in a greater percentage of adolescents meeting all 4 goals.

Interestingly, the results indicated that average of PACER laps was not significantly different between adolescents who met at least 1 or more of the 5-2-1-0 goals. These results suggest that teachers and administrators in schools could strategically select 1 or 2 goals to focus on for adolescents’ health promotion, rather than emphasizing all goals at the same time. Rogers et al revealed that the 5-2-1-0 guidelines are generally implemented in childcare programs, elementary schools, and afterschool programs by encouraging healthy behaviors.²⁰ However, the unique contextual factors, sociocultural issues and financial constraints within school environments can make prioritizing health outcomes a difficult task. In fact, lack of time to prepare and financial constraints for implementation have been identified as common barriers when providing school-based health interventions for obesity prevention.^{34–36} In addition, limiting screen time in school has been reported as the most difficult goal to achieve because of the lack of control schools have on students’ time outside of school hours.²⁰ Therefore, school teachers and administrators need not only consider their environments (eg, facilities, spaces, budgets, and time) to implement health strategies, but also communicate with and support parents to help their children in implementing targeted health goals within home and school settings.

Limitations

The study has several limitations. The PACER test was run by adolescents in a “volunteer-based” setting which meant their efforts may not have truly reflected their cardiovascular fitness, and confounding factors (that were not measured) are degree of peer influence, lack of motivation, and assessment fatigue (data collection windows punctuated every other

month due to mandated schedule). Therefore, future studies need to include additional measurements such as 1 mile run or curl-up to support PACER test. In addition, the sample consisted of middle school students (6th to 8th grades) and heavily Caucasian (~90%). Therefore, future studies need to include all ages and diverse student populations.

Conclusions

Adherence to the individual 5-2-1-0 goals were associated with PACER laps. Findings highlight that among the 4 health promotion goals, adolescents should strive to meet at least one at a time to experience positive health outcomes.

IMPLICATIONS FOR SCHOOL HEALTH

Students in rural areas encounter unique challenges such as lack of physical education classes, sidewalks, exercise facilities, and food availability that may contribute to the prevalence of obesity.³⁷ These regional features not only affect the individual development process but also decrease access to healthcare services affecting the quality of life.³⁸ This study identified a relationship between adherence to individual 5-2-1-0 goals and increased PACER laps which is a measure of aerobic health. Results suggest adolescents may experience positive health outcomes simply by meeting one of the 5-2-1-0 goals, yet potential compounded benefits may be experienced when more than one goal is met.

Therefore, whereas comprehensive health promotion messages such as 5-2-1-0 may be easily implemented within the school environment through signage and verbal prompts, it may be more advantageous for school personnel to select a single health behavior within the 5-2-1-0 guidelines to focus on at a time. School personnel may elect to assess the student body relative to health behaviors to determine which criteria would be focused on at a given time. Once established, it may be meaningful to conduct an audit of current environmental assets and constraints that may be affecting students' health decisions throughout the school day. Then if feasible, create environmental prompts (after school programs, school food change, and vending machine removal), sequentially targeted and tailored health messaging (first semester: reduce 30 minutes on screen time, second semester: consume 1 more vegetables/fruits), and interpersonal supports (motivational interviewing activities) that would encourage positive behavior change and goal achievement/adherence.

Human Subject Approval Statement

The West Virginia University Institutional Review Board has an acknowledgment of this approved study on file. In addition, parents provided written consent form for their children to participate.

Acknowledgments

This study was supported by the Carol M. White Physical Education Program (PEP) grant (PR/Award #: Q215F110479) from US Department of Education in 2011. The website is www2.ed.gov/programs/whitephysed/2011awards.html.

References

1. Finucane MM, Stevens GA, Cowan MJ, et al. National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 million participants. *Lancet*. 2011; 377(9765):557–567. [PubMed: 21295846]
2. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011–2012. *JAMA*. 2014; 311(8):806–814. [PubMed: 24570244]
3. Steele RG, Janicke DM. Changing times call for changing methods: introduction to the special issue on innovative treatments and prevention programs for pediatric obesity. *J Pediatr Psychol*. 2013; 38(9):927–931. [PubMed: 24006274]
4. Astrup A, Hill JO, Rössner S. The cause of obesity: are we barking up the wrong tree? *Obes Rev*. 2004; 5(3):125–127. [PubMed: 15245380]
5. Cliff DP, Okely AD, Morgan PJ, Jones RA, Steele JR. The impact of child and adolescent obesity treatment interventions on physical activity: a systematic review. *Obes Rev*. 2010; 11(7):516–530. [PubMed: 19656311]
6. Goran MI, Treuth MS. Energy expenditure, physical activity, and obesity in children. *Pediatr Clin North Am*. 2001; 48(4):931–953. [PubMed: 11494644]
7. [Accessed March 17, 2016] Youth Risk Behavior Surveillance—United States, 2013. 2013. Available at: <http://www.cdc.gov/mmwr/pdf/ss/ss6304.pdf>
8. Daniels SR, Benuck I, Christakis DA. Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents: summary report. *Pediatrics*. 2011; 128:213–256.
9. US Department of Health and Human Services. [Accessed March 17, 2016] Healthy People 2020. 2016. Available at: <http://www.healthypeople.gov/2020/default.aspx>
10. Liebman M, Pelican S, Moore SA, et al. Dietary intake, eating behavior, and physical activity-related determinants of high body mass index in rural communities in Wyoming, Montana, and Idaho. *Int J Obes*. 2003; 27(6):684–692.
11. Budd GM, Volpe SL. School-based obesity prevention: research, challenges, and recommendations. *J Sch Health*. 2006; 76(10):485–495. [PubMed: 17096821]
12. Patrick K, Norman GJ, Calfas KJ, et al. Diet, physical activity, and sedentary behaviors as risk factors for overweight in adolescence. *Arch Pediatr Adolesc Med*. 2004; 158(4):385–390. [PubMed: 15066880]
13. Jensen BW, Nielsen BM, Husby I, et al. Association between sweet drink intake and adiposity in Danish children participating in a long-term intervention study. *Pediatr Obes*. 2013; 8(4):259–270. [PubMed: 23630030]
14. O'Neil CE, Nicklas TA, Kleinman R. Relationship between 100% juice consumption and nutrient intake and weight of adolescents. *Am J Health Promot*. 2010; 24(4):231–237. [PubMed: 20232604]
15. Liang T, Kuhle S, Veugelers PJ. Nutrition and body weights of Canadian children watching television and eating while watching television. *Public Health Nutr*. 2009; 12(12):2457–2463. [PubMed: 19405988]
16. Ullrich-French SC, Power TG, Daratha KB, Bindler RC, Steele MM. Examination of adolescents' screen time and physical fitness as independent correlates of weight status and blood pressure. *J Sport Sci*. 2010; 28(11):1189–1196.
17. Foltz JL, Cook SR, Szilagyi PG, et al. US adolescent nutrition, exercise, and screen time baseline levels prior to national recommendations. *Clin Pediatr (Phila)*. 2011; 50(5):424–433. [PubMed: 21282256]
18. Rogers VW, Motyka E. 5-2-1-0 goes to school: a pilot project testing the feasibility of schools adopting and delivering healthy messages during the school day. *Pediatrics*. 2009; 123(5):272–276.
19. Dish BM, Dish PM, Dish SM, et al. CDC grand rounds: childhood obesity in the United States. *MMWR Morb Mortal Wkly Rep*. 2011; 60(02):42–46. [PubMed: 21248681]

20. Rogers VW, Hart PH, Motyka E, Rines EN, Vine J, Deatrick DA. Impact of let's go! 5-2-1-0: a community-based, multisetting childhood obesity prevention program. *J Pediatr Psychol.* 2013; 38(9):1010–1020. [PubMed: 23933841]
21. Tucker SJ, Ytterberg KL, Lenocho LM, et al. Reducing pediatric overweight: nurse-delivered motivational interviewing in primary care. *J Pediatr Nurs.* 2013; 28(6):536–547. [PubMed: 23531463]
22. US Centers for Disease Control and Prevention. [Accessed July 7, 2017] About Child & Teen BMI. 2015. Available at: https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html
23. Burns R, Hannon JC, Brusseau TA, Shultz B, Eisenman P. Indices of abdominal adiposity and cardiorespiratory fitness test performance in middle-school students. *J Obes.* 2013; 2013:912460. <https://doi.org/10.1155/2013/912460>. [PubMed: 23533727]
24. Savva SC, Tornaritis M, Savva ME, et al. Waist circumference and waist-to-height ratio are better predictors of cardiovascular disease risk factors in children than body mass index. *Int J Obes.* 2000; 24(11):1453–1458.
25. Ihmels M, Welk GJ, McClain JJ, Schaben J. The reliability and convergent validity of field tests of body composition in young adolescents. *J Phys Act Health.* 2006; 3:67–77.
26. Vincent SD, Barker R, Clarke M, Harrison J. A comparison of peak heart rates elicited by the 1-mile run/walk and the progressive aerobic cardiovascular endurance run. *Res Q Exerc Sport.* 1999; 70(1):75–78. [PubMed: 10100338]
27. Le Masurier GC, Corbin CB. Steps counts among middle school students vary with aerobic fitness level. *Res Q Exerc Sport.* 2006; 77(1):14–22. [PubMed: 16646348]
28. Varness T, Carrel AL, Eickhoff JC, Allen DB. Reliable prediction of insulin resistance by a school-based fitness test in middle-school children. *Int J Pediatr Endocrinol.* 2009; 2009:487804. <https://doi.org/10.1155/2009/487804>. [PubMed: 19956706]
29. Plowman, SA., Meredith, MD. *Fitnessgram/Activitygram Reference Guide.* 4. Dallas, TX: The Cooper Institute; 2013.
30. Hoelscher DM, Day RS, Kelder SH, Ward JL. Reproducibility and validity of the secondary level school-based nutrition monitoring student questionnaire. *J Am Diet Assoc.* 2003; 103(2):186–194. [PubMed: 12589324]
31. Dunn OJ. Multiple comparisons using rank sums. *Technometrics.* 1964; 6(3):241–252.
32. Iannotti RJ, Wang J. Patterns of physical activity, sedentary behavior, and diet in US adolescents. *J Adolesc Health.* 2013; 53(2):280–286. [PubMed: 23642973]
33. Resnicow K, Dilorio C, Soet JE, Borrelli B, Hecht J, Ernst D. Motivational interviewing in health promotion: it sounds like something is changing. *Health Psychol.* 2002; 21(5):444–451. [PubMed: 12211511]
34. Gittelsohn J, Merkle S, Story M, et al. School climate and implementation of the Pathways study. *Prev Med.* 2003; 37:97–106.
35. Ward DS, Saunders R, Felton GM, Williams E, Epping JN, Pate RR. Implementation of a school environment intervention to increase physical activity in high school girls. *Health Educ Res.* 2006; 21(6):896–910. [PubMed: 17099074]
36. Shaya FT, Flores D, Gbarayor CM, Wang J. School-based obesity interventions: a literature review. *J Sch Health.* 2008; 78(4):189–196. [PubMed: 18336677]
37. Reed DB, Patterson PJ, Wasserman N. Obesity in rural youth: looking beyond nutrition and physical activity. *J Nutr Educ Behav.* 2011; 43(5):401–408. [PubMed: 21906552]
38. Chenoweth E, Galliher RV. Factors influencing college aspirations of rural West Virginia high school students. *J Res Rural Educ.* 2004; 19(2):1–14.

Figure 1.
Number of Students Who Met Individual 5-2-1-0 Goals (N =1792)

Table 1**5-2-1-0 Guidelines' Individual Goals Assessment Questions Analyzed**

5-2-1-0 Goal	SPAN Survey Questions	
5—Eating 5 or more servings of fruits and vegetables daily	1	Yesterday, how many times did you eat any orange vegetables like carrots, squash, or sweet potatoes?
	2	Yesterday, how many times did you eat a salad made with lettuce, or any green vegetables like spinach, green beans, broccoli, or other greens?
	3	Yesterday, how many times did you eat any other vegetables like peppers, tomatoes, zucchini, asparagus, cabbage, cauliflower, cucumbers, mushrooms, eggplant, celery or artichokes?
	4	Yesterday, how many times did you eat fruit?
	5	Yesterday, how many times did you drink 100% fruit juice?
2—Limiting screen time to no more than 2 hours a day	1	On an average school day, how many hours do you watch TV?
	2	On an average school day, how many hours do you play video or computer games or use a computer for something that is not school work?
1—Including at least 1 or more hours of physical activity every day	1	During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?
0—Skipping sugar-sweetened beverages	1	Yesterday, how many times did you drink any punch, Kool-Aid, sports drinks, or other fruit-flavored drinks?
	2	Yesterday, how many times did you drink any regular sodas or soft drinks?
	3	Yesterday, how many times did you drink any diet sodas or soft drinks?

Table 2

Participants Demographic Characteristics (N =1792)

	Variable	Total	Percentage
Sex	Girls	883	49.3
	Boys	909	50.7
Grade	6	678	37.8
	7	622	34.7
	8	492	27.5
School	Eastern Middle School	1334	74.4
	Western Middle School	458	25.6
Data collection windows	September 2012	134	7.5
	October 2012	132	7.4
	February 2013	162	9
	March 2013	219	12.2
	April 2013	178	9.9
	September 2013	258	14.4
	November 2013	237	13.2
	March 2014	251	14
	April 2014	221	12.3

Table 3

PACER Laps of Groups Formed by Adherence of 5-2-1-0 Guidelines

Variable	N	PACER Laps			
		Mean	Median	Mode	SD Range
Group					
Zero goals	222	16.83	14	10	13.06 69
One goal	627	23.4	18	10 *	17.08 93
Two goals	746	25.48	20	16	18 96
Three goals	180	26.84	21	12 *	19.2 87
All four goals	17	30.29	26	1 *	18.61 68
Total	1792	23.86	19	15	17.51 96

* Multiple modes exist. The smallest value is shown.