

Original Research

An Analysis of the Medical Costs of Obesity for Fifth Graders in California and Texas

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ABSTRACT

International Journal of Exercise Science 9(1): 26-33, 2016. The prevalence of childhood obesity in the United States increased more than three-fold from 1976 - 1980 to 2007 - 2008. The Presidential Youth Fitness Program's FitnessGram® is the current method recommended by the President's Council on Fitness, Sports & Nutrition for assessing health-related fitness factors, including body composition. FitnessGram® data from California and Texas, the two most populous states, over a three-year time span indicate that more than one-third of fifth grade students, typically ten-year-olds, are obese. Previous studies report that an obese ten-year-old child who remains obese into adulthood will incur elevated direct medical costs beyond his or her normal-weight peers over a lifetime. The recommended elevated cost estimates are approximately \$12,660 when comparing against a normal-weight child who gains weight as an adult and approximately \$19,000 compared to a child who remains at normal weight as an adult. By applying these figures to FitnessGram® results from California and Texas, each group of fifth grade students in each of the two states will incur between \$1.4 and \$3.0 billion in direct medical costs over a lifetime. When the percentage of obese fifth graders is extrapolated to the rest of the United States' 4 million ten-year-olds, this results in more than \$17 billion (accounting for adulthood weight gain) or \$25 billion (not accounting for adulthood weight gain) in added direct lifetime medical costs attributable to obesity for this single-year age cohort. This information should be used to influence spending decisions and resource allocation to obesity reduction and prevention efforts.

KEY WORDS: Childhood, FitnessGram, obese

INTRODUCTION

The prevalence of obesity in the United States has increased over the past several decades. According to the National Health and Nutrition Examination Survey (NHANES) results, between the years of 1988 and 1994, 22.9% of adults aged 20 years and older exceeded the criteria for adult obesity [body mass index (BMI) ≥ 30

kg·m⁻²] (17). By the 2011-2012 survey, that percentage had increased to 35.1% (19). This represents more than a 50% increase in obesity prevalence among American adults aged 20 years and older over the course of two decades. Perhaps more concerning is the prevalence of obesity among American youth, defined by the Centers for Disease Control and Prevention (CDC) as a BMI greater than or equal to the 95th percentile

on the CDC growth charts (2). Among children and adolescents aged 2 - 19 years, the prevalence of obesity increased from 5.5% between the years of 1976 and 1980 to 16.9% between 2007 and 2008 (18) and remained 16.9% between 2011 and 2012 (19).

Analyses of several large-scale data pools confirm that obesity contributes to the risk for development of many negative health outcomes including coronary heart disease, hypertriglyceridemia, hypercholesterolemia, hypertension, and type II diabetes (20, 23). Using secondary data, Thompson and colleagues developed a model to analyze the relationship between BMI and several disease conditions in adults (23). Notably, they found that the risks for hypertension and type II diabetes are at least 2- and 3-fold higher for obese individuals with BMI values of 32.5 kg·m⁻² and 37.5 kg·m⁻², respectively, as compared to normal-weight individuals with BMI values of 22.5 kg·m⁻². Obesity-related health risks are not limited to adults. According to an analysis of Bogalusa Heart Study data, the odds ratios between childhood obesity and many cardiovascular disease risk factors, including hypercholesterolemia, hypertriglyceridemia, hyperinsulinemia, and hypertension are between 2.4 and 12.6, indicating a strong, positive association between childhood obesity and these specific risk factors (8).

Obesity-related health complications come at a substantial economic cost. Finkelstein and colleagues estimated that in 2006, the annual per capita medical expenditure for an obese person was \$1,429 (adjusted to reflect 2008 dollars) higher than for a

person of normal weight, which represents 42% higher medical costs for obese individuals compared to individuals with normal body weights (5). Data from over 3,000 counties and county equivalents across the United States indicate that in 2006, approximately 54 million individuals met the criteria for obesity (16). This equates to an extra \$77 billion (adjusted to reflect 2008 dollars) in medical spending attributable to obesity in 2006 alone.

Beginning in the 2013 - 2014 school year, the President's Council on Fitness, Sports & Nutrition adopted the Presidential Youth Fitness Program to replace the President's Challenge Physical Fitness Test (22). This program aims to encourage healthy, active lifestyles among youth. As part of this program, schools use the Presidential Youth Fitness Program's FitnessGram® to assess health-related fitness and use these data to inform physical education instruction. The FitnessGram® Scientific Advisory Board has developed four categories for classification of body composition: Very Lean, Healthy Fitness Zone (HFZ), Needs Improvement - Some Risk (NI - SR), and Needs Improvement - High Risk (NI - HR). Risk level was established based on body fat percentage, and body fat cutoff percentages were converted to corresponding BMI values. For ten-year olds, the NI - HR category includes boys with a BMI ≥ 20.8 kg·m⁻² and girls with a BMI ≥ 21.0 kg·m⁻² (12, 13, 15). These BMI cutoff values are lower than those utilized by the CDC, which defines childhood obesity as having a BMI at or above the 95th percentile on sex-specific BMI-for-age growth charts (2). The corresponding BMI values that the CDC uses to indicate obesity are 22.03 kg·m⁻² for

boys aged 10.00 – 10.49 years, 24.16 kg·m⁻² for boys aged 10.50 – 10.99 years, 23.18 kg·m⁻² for girls aged 10.00 – 10.49 years, and 23.35 kg·m⁻² for girls aged 10.50 – 10.99 years (11). Thus, using the CDC childhood obesity estimates could result in a substantial underestimation of the number of children at risk for negative health outcomes based upon BMI.

Children identified as obese by BMI have an increased risk of developing health complications that were previously thought to be limited to adults such as hypertension and type II diabetes mellitus (3). These conditions are also well-known risk factors for the development of cardiovascular disease. Obese children aged ten years and older are likely to remain obese into early adulthood (28), and therefore, accrue medical costs associated with obesity-related conditions. Knowledge of the medical costs associated with childhood obesity can provide a basis by which to justify the cost of childhood obesity prevention and treatment efforts. To this end, Finkelstein and colleagues analyzed the lifetime direct medical costs for an obese ten-year-old beyond the costs that a ten-year-old at a normal body weight would incur over his or her lifespan (7). The six investigations included in the meta-analysis each estimated longevity using a variety of factors such as probability of survival based on weight status (6), gender, and race (4, 14, 23-25, 27). Based upon this meta-analysis, two low- and high-end cost estimates were provided: one that accounted for adulthood weight gain among normal-weight children and one that compared against children who remained at normal weight through adulthood. Results suggested that an obese

ten-year-old, typically in the fifth grade, will incur between \$12,660 (low-end; recommended) and \$19,630 (high-end) of incremental direct medical costs when accounting for weight gain through adulthood and between \$16,310 (low-end) and \$19,350 (high-end) with a recommended cost estimate of \$19,000 when contrasted with a child who remains at normal weight throughout adulthood (4, 7, 14, 23, 24, 27). Using these recommended estimates along with results from the FitnessGram® body composition classifications, the purpose of this analysis is to estimate the lifetime economic impact of childhood obesity for this single age cohort in the two most populous states, California and Texas.

METHODS

FitnessGram® data from the school years 2010-2011, 2011-2012, and 2012-2013 were obtained for California (1) and Texas (21). These data were school-level and included boys and girls from all public school districts in these two states. The total number of fifth grade students tested for BMI in California and in Texas and the number of fifth grade students in each BMI category were calculated for each of the three school years. The FitnessGram® Scientific Advisory Board has determined that BMI values at or above 20.8 kg·m⁻² for ten-year-old boys and 21.0 kg·m⁻² for ten-year-old girls represent high health risk (15). The California report included the total number of fifth graders tested for body composition as well as the number and percentage of students in each fitness zone. The Texas report included data for each grade level and further separated the data by district and gender. The total

number of fifth graders tested for body composition and the number and percentage of students in each fitness zone were calculated using Excel. Then, using the low, high, and recommended cost estimates suggested by Finkelstein and colleagues (7), the lifetime direct medical costs attributable to obesity were calculated for students in the NI - HR category for each of the three school years in California and in Texas by multiplying the number of students in this category by the corresponding cost estimate per obese student. Calculations were performed using two sets of elevated lifetime direct medical cost estimates. The first set of estimates compared the direct medical costs for obese children against the direct medical costs for normal-weight children who gain weight as adults. The second set of estimates compared the direct medical costs for obese children against the direct medical costs for normal-weight children who remain at normal body weight as adults. The results reflect the lifetime direct medical costs attributable to obesity for each fifth grade cohort over the three-year period in California and Texas. The analysis used the costs estimated for a ten-year-old obese child; however, it should be noted that students in the fifth grade range from ages 9-11.

RESULTS

The percentage of fifth grade students with BMI values in each category remained stable from the 2010 - 2011 school year through the 2012 - 2013 school year within each state (see Table 1). Just over half of fifth graders in each state were identified as having BMI values in the HFZ, whereas at least one-third of fifth graders in each state

were identified as having BMI values in the NI - HR category. In California, between 33.7 and 34.2 percent of students were categorized as NI - HR for BMI, and in Texas, between 36.5 and 36.8 percent of students were categorized as NI - HR for BMI during this timeframe. Despite their geographical distance from one another, California and Texas had comparable percentages of students in each category for each of the three school years.

The number of fifth grade students who had BMI values in the NI - HR zone for each year in each state was multiplied by the estimated per capita lifetime direct medical costs of obesity previously established by Finkelstein and colleagues (7). The resulting values represent the low, high, and recommended statewide lifetime costs of obesity for the ten-year-old cohorts accounting for adulthood weight gain (see Table 2) and compared to children who maintain normal weight as adults (see Table 3).

DISCUSSION

Using the Presidential Youth Fitness Program's FitnessGram® body composition data, results indicate that in each of the two most populous states, childhood obesity for each cohort of fifth graders over the 3-year timeframe will cost between \$1.4 and \$3.0 billion (compared to normal-weight children who become overweight as adults) and \$1.8 and \$3.0 billion (compared to normal-weight children who remain at normal weight as adults) beyond the direct medical expenses for children of normal weight who remain at normal weight throughout adulthood. These results represent the costs solely for fifth graders

CHILDHOOD OBESITY MEDICAL COST ANALYSIS

Table 1. Number and percentage of fifth graders in each BMI category by state and school year. BMI = body mass index; HFZ = healthy fitness zone; NI - SR = needs improvement - some risk; NI - HR = needs improvement - high risk.

	# Tested (BMI)	# in HFZ (BMI)	% in HFZ	# in NI - SR	% in NI - SR	# in NI - HR	% in NI -HR
California							
2010 - 2011	456,409	237,819	52.1	62,528	13.7	156,092	34.2
2011 - 2012	450,104	236,387	52.5	61,214	13.6	152,585	33.9
2012 - 2013	447,619	238,342	53.2	58,638	13.1	150,848	33.7
Texas							
2010 - 2011	337,514	170,307	50.5	44,133	13.1	123,074	36.5
2011 - 2012	296,887	149,524	50.4	38,233	12.9	109,130	36.8
2012 - 2013	326,982	163,958	50.1	42,660	13.0	120,364	36.8

Table 2. Calculated lifetime direct medical costs of obesity for students in the NI - HR zone in California and Texas, accounting for adulthood weight gain. NI - HR = needs improvement - high risk.

	# in NI - HR	Low/Recommended Cost Estimate \$12,660	High Cost Estimate \$19,630
California- High Risk			
2010 - 2011	156,092	\$1,976,124,720	\$3,064,085,960
2011 - 2012	152,585	\$1,931,726,100	\$2,995,243,550
2012 - 2013	150,848	\$1,909,735,680	\$2,961,146,240
Texas- High Risk			
2010 - 2011	123,074	\$1,558,116,840	\$2,415,942,620
2011 - 2012	109,130	\$1,381,585,800	\$2,142,221,900
2012 - 2013	120,364	\$1,523,808,240	\$2,362,745,320

Table 3. Calculated lifetime direct medical costs of obesity for students in the NI - HR zone in California and Texas, compared to children who maintain normal weight as adults. NI - HR = needs improvement - high risk.

	# in NI - HR	Low Cost Estimate \$16,310	High Cost Estimate \$19,350	Recommended Cost Estimate \$19,000
California- High Risk				
2010 - 2011	156,092	\$2,545,860,520	\$3,020,380,200	\$2,965,748,000
2011 - 2012	152,585	\$2,488,661,350	\$2,952,519,750	\$2,899,115,000
2012 - 2013	150,848	\$2,460,330,880	\$2,918,908,800	\$2,866,112,000
Texas- High Risk				
2010 - 2011	123,074	\$2,007,336,940	\$2,381,481,900	\$2,338,406,000
2011 - 2012	109,130	\$1,779,910,300	\$2,111,665,500	\$2,073,470,000
2012 - 2013	120,364	\$1,963,136,840	\$2,329,043,400	\$2,286,916,000

in California and Texas and not the additional accrued expenses for children of other ages as Finkelstein and colleagues only estimated costs for the ten-year-old age group (7). Additionally, these values represent only the direct medical costs and not indirect costs, such as absenteeism, which would result in higher estimates. Throughout the three years for which data were analyzed, the number of fifth graders who presented with BMI values in the NI - HR zone remained stable. This underscores the need for the development of effective childhood obesity prevention and reduction efforts.

FitnessGram® results indicate that on average, 33.9% of fifth graders in California and 36.7% of fifth graders in Texas have BMI values that place them at high risk for problematic health outcomes. The number of ten-year-olds in the US population was just over 4 million on July 1 each year from 2010 to 2012 (26). If the percentage of fifth graders with BMI values in the NI - HR category in California and Texas were extrapolated to the US population of ten-year-olds, this results in a potential lifetime economic burden of approximately \$17 billion (accounting for adulthood weight gain) or \$25 billion (not accounting for adulthood weight gain) in direct medical costs beyond that of individuals at a healthy weight for each single-year age cohort.

In contrast to these findings, NHANES data from 2011 - 2012 indicate that 17.7% of children aged 6 - 11 were classified as obese by BMI according to the CDC standards (19). Using this obesity estimate along with recommended cost estimates, the increased lifetime economic burden of obesity would

be approximately \$9 billion (accounting for adulthood weight gain) or \$13.5 billion (not accounting for adulthood weight gain) in direct medical costs for each single-year age cohort. This discrepancy might be partially due to the method used for the determination of childhood obesity. The CDC defines obesity for youth ages 2 - 19 as having a BMI greater than or equal to the 95th percentile on sex-specific BMI-for-age growth charts (2). Using this method, the minimum BMI values that indicate obesity are 22.03 kg·m⁻² for boys aged 10.00 - 10.49 years, 24.16 kg·m⁻² for boys aged 10.50 - 10.99 years, 23.18 kg·m⁻² for girls aged 10.00 - 10.49 years, and 23.35 kg·m⁻² for girls aged 10.50 - 10.99 years (11). The BMI values that indicate childhood obesity per the CDC method are higher than those utilized in the FitnessGram® to indicate high risk of excess adiposity-associated health problems. The FitnessGram® Scientific Advisory Board has identified body fat percentages that correspond with increased metabolic syndrome and cardiovascular disease risk factors in children and calculated the associated BMI values (9, 13). These BMI values, 20.8 kg·m⁻² for ten-year-old boys and 21.0 kg·m⁻² for ten-year-old girls, were identified as the cutoff values for high-risk BMI (15). Meta-analysis conducted by Javed and colleagues suggests that the CDC BMI standard to determine childhood obesity status compared to reference measures of adiposity defined as a high body fat percentage (i.e., dual-energy X-ray absorptiometry scan, hydrostatic weighing, or air-displacement plethysmography) is highly specific (pooled specificity = 0.93) but less sensitive (pooled sensitivity = 0.73) and thus might fail to detect excess body fatness in over 25% of cases (10). Therefore,

the lower BMI cutoff values used to determine high-risk BMI in the FitnessGram® will increase the sensitivity of the childhood obesity estimate.

While the FitnessGram® is a useful tool to help identify children who are at increased risk based on BMI and researchers can use this information to estimate the economic impact of obesity, a limitation of this study is that FitnessGram® results were not available for many states. Data from states in the Midwest and Northeast are lacking. As the FitnessGram® is administered to students nationwide as part of the Presidential Youth Fitness Program, more data will become available and more rigorous analysis should be performed on nationwide data. However, the current analysis uses data from the two most populous states in the union and underscores the large economic impact of childhood obesity.

Using BMI data from the Presidential Youth Fitness Program's FitnessGram® over a three-year timespan and the estimated lifetime direct medical costs associated with obesity as recommended by Finkelstein and colleagues (7), results indicate that the estimated lifetime medical costs of childhood obesity in the two most populous states, California and Texas, are between \$1.4 and \$3.0 billion for each single-year age cohort analyzed. This information can be used to encourage spending, resource development, and prevention program implementation to reduce obesity in these two states. Further analyses should be conducted to estimate the economic burden associated with childhood obesity using the criterion-referenced FitnessGram® BMI standards

across the United States when data are available.

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