

Obesity & Hypertension in Elementary-Age Children

The problems of obesity and being overweight in U.S. children and adolescents, along with co-occurring conditions such as hypertension and diabetes, are a major concern. The 2007-2008 National Health and Nutrition Examination Survey found that 17% of children and adolescents ages 2-19 years are obese based on measurements of their height and weight.¹ In Ohio, approximately 14.8% of children are overweight according to the U.S. Department of Health and Human Services, while the numbers seem much more serious for Cuyahoga County.² Calculated from the self reported height and weight of the Youth Risk Behavior Survey for Cuyahoga County, 13.7% of middle school students are obese with BMIs in the 95th percentile while 19.9% would be considered overweight.³ Many studies, including two longitudinal studies of cardiovascular disease risk factors, the Muscatine Study and the Bogalusa Heart Study, have convincingly shown that being overweight or obese during adolescence is a determinant of a number of cardiovascular disease risk factors in adulthood.⁴ The longitudinal Bogalusa Heart Study found that adolescent obesity tracks moderately into adulthood, implying that preventing obesity during childhood may be advantageous to health in later life.⁵ A more immediate advantage is that fit children perform better academically; this link to academic success is a major emphasis in policy change efforts by the American Heart Association.⁶

One of the clinical effects and principle risk factors of obesity is primary hypertension. Familial predisposition, ethnicity and poverty also are risk factors. Hypertension continues to be epidemic in both the African American and Hispanic communities and are leading contributors to the human, social and economic burden of illness borne by these communities and to the alarming disparities in minority health outcomes identi-

fied in Healthy People 2010.⁷ Hypertension, along with unhealthy diet, physical inactivity, obesity, and hypercholesterolemia, is a risk factor and contributor to the development of cardiovascular disease.⁸ There is mounting evidence of the association between elevated blood pressure in children and premature morbidity and mortality because of cardiovascular issues in later life.⁹

Hypertension and pre-hypertension are often undiagnosed in children and adolescents, despite the national discussion about the high proportions of overweight and obesity among children in the United States as well as the prevalence of related conditions.¹⁰ Untreated elevated blood pressures are precursors to the development of kidney disease, cardiac disease, and other chronic conditions. If elevated blood pressure in children continues undiagnosed and untreated, they can develop serious chronic illness by young adulthood. Often thought of as a silent disease, researchers in Texas found that a majority of their pediatric hypertensive patients reported more than one symptom of hypertension such as headache, difficulty initiating sleep, and daytime tiredness as compared to a control group.¹¹ They were able to reduce these symptoms within four to six months of treatment for hypertension.¹² Not only is blood pressure reduction important for the current quality of life for children and adolescents, but it is possible to reduce the risk of later cardiovascular disease through even small reductions in blood pressure.¹³ It is imperative that diagnosis and treatment of children and adolescents with hypertension go hand in hand with education and policy efforts aimed at combating obesity and overweight in this population.

Hypertension in Children: Screening in Cleveland's Public Schools



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CONTEXT

In 2005, as part of a comprehensive partnership between Cleveland Metropolitan School District (CMSD), the Francis Payne Bolton School of Nursing at Case Western Reserve University and the American Heart Association, approximately 200 children in the 7th and 9th grades received routine state mandated health screenings measuring the students' height, weight, and blood pressure. These screenings administered by the nursing students documented that, based on body mass index (BMI), 45% of the children screened were overweight or obese. That is approximately double the national average for children in comparable age groups. Additionally, over 29% of these children in the 7th and 9th grades had significantly elevated blood pressures based on age, gender and height. These findings generated not only concern for the health consequences to children in the age range being screened, but also questions about the level of obesity and elevated blood pressures existing at younger ages prior to screening.

The children in CMSD were identified as being vulnerable to a range of health-related problems based on poverty, ethnicity and the inadequate numbers of nursing personnel within the schools to provide essential health screening and monitoring, thereby allowing for early intervention and remediation. Based on data from the 2008-2009 Ohio Department of Education annual report, CMSD serves nearly 48,000 students (69.6% African-American, 15.2% Caucasian, 11.7% Hispanic, 0.6% Asian/Pacific Islander, 0.3 % American Indian, and 2.7% multi-racial) 100% of whom are economically disadvantaged.¹⁴ In the past five years this school district has been challenged by low academic performance, financial difficulties resulting in lay-offs of over 2000 personnel including teachers, social workers and nurses, significant losses of services and programming, and multiple school closings and restructuring that are still in progress. Of significance to this project, the nurse/student ratio has ranged from 1:1426 to

the current 1:910, well above the nationally recommended nurse/student ratio of 1:750.

STUDY DESIGN

Focusing on 4th and 7th grade children in 40 elementary schools in a major urban school district, this project had two main objectives: (1) to document the levels of overweight and obese children and, (2) to document the levels of elevated blood pressures within this population.

Over 5,000 children were initially screened in the Fall semester of 2008 and again the following Spring using a protocol following standardized guidelines established by the CDC Fourth Report. Reports of the screening results were forwarded to parents with recommendations for follow-up when appropriate. Children who screened with two elevated blood pressures received a 3rd follow-up blood pressure screening.

STUDY FINDINGS

The analysis of the results for the first 2,005 of the more than 5,000 children screened is presented in Table 1. Initial results of the study revealed that 16% of the children were considered overweight based on BMI and 26.8% were obese. Additionally, the data showed a significant correlation between BMI and normal, pre-hypertensive, and hypertensive blood pressure in these children (see Table 2). Those with higher BMIs were more likely to have elevated blood pressures with 14.6% of overweight and 17.5% of obese children being pre-hypertensive and 13.7% of overweight and 30.1% of obese children already being hypertensive. The percentage of children with BMI's above the 95th percentile is well above the national average for this age group (19.6%).¹⁵ BMI's in this range predispose children to co-morbidities including the development of type 2 diabetes as well as hypertension. Left untreated, these children are at risk of serious chronic disease by young adulthood.

Table 1: BLOOD PRESSURE AND BODY MASS INDEX IN CHILDREN IN THE 4TH-6TH GRADES

BLOOD PRESSURE (BP) CATEGORY	BODY MASS INDEX (BMI) PERCENTILES				TOTAL BY BP CATEGORY
	UNDERWEIGHT <5TH %ILE	NORMAL WEIGHT 5TH-84TH %ILE	OVERWEIGHT 85TH-94TH %ILE	OBESE <95TH %ILE	
Normal <90th percentile	93.8% (n=45)	79.4% (n=872)	71.7% (n=230)	52.4% (n=282)	71.3% (n=1429)
Pre-hypertensive 90th-95th Percentile	4.2% (n=2)	10.7% (n=118)	14.6% (n=47)	17.5% (n=94)	13.0% (n=261)
Hypertensive >95th percentile	2.1% (n=1)	9.8% (n=108)	13.7% (n=44)	30.1% (n=162)	15.7% (n=315)
Total in each Weight Category	100% (n=48)	100% (n=1098)	100% (n=321)	100% (n=538)	100% (n=2005)

FUTURE INITIATIVES

Based on these findings, nursing students and faculty are now working together with the school district to develop an intervention targeting the students with elevated blood pressures and their families. This includes sending a letter from the school district nurse manager and the school nurse inviting parents to an information session to discuss both the implications of their child's blood pressure elevation and ways of improving their child's health. The letter targets parents of children who had a clinically significant pattern of two or more elevated blood pressure screenings and showed signs of being pre-hypertensive and hypertensive. Currently in its pilot phase, the goal of this intervention is to increase physical activity and

Table 2: CHI SQUARE TESTS

	VALUE	df	ASYMP SIG (2-SIDED)
Pearson Chi-Square	158.187	6	.000
Likelihood Ratio	152.707	6	.000
Linear by Linear Association	149	1	.000

N of Valid Cases: 2005

improve school nutrition in a population appropriate way by working with parents, children and school personnel. Two additional proposals involve district wide screening of school children and the identification of a demonstration school to assess the impact of increased activity and improved nutrition.

- ¹ Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. (2010). Prevalence of High Body Mass Index in US Children and Adolescents, 2007–2008. *Journal of the American Medical Association* 303(3), 242-249.
- ² U.S. Department of Health & Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau. (n.d.). The National Survey of Children's Health. Overweight and Physical Activity Among Children: A portrait of States and the Nation 2005. Rockville, MD: U.S. Department of Health & Human Services.
- ³ These are most likely an underestimate, as the data are dependent on self-reported height and weight numbers. Center for Adolescent Health, Department of Family Medicine, Case Western Reserve University. (2008). Cuyahoga County Middle School Youth Risk Behavior Survey Report. Retrieved from <http://www.case.edu/med/adolescenthealth/2008%20Cuyahoga%20County%20Middle%20School%20YRBS%20Report.pdf>
- ⁴ Lauer RM, Lee J, Clarke WR. (1988). Factors affecting the relationship between childhood and adult cholesterol levels: the Muscatine Study. *Pediatrics*, 82,309-318.; Lauer RM, Clarke WR. (1989). Childhood risk factors for high adult blood pressure: the Muscatine Study. *Pediatrics*, 84,633-641.; and Berenson GS, Srinivasan SR, Bao W, Newman WP III, Tracy RE, Wattigney WA. (1998). Association between multiple cardiovascular risk factors and atherosclerosis in children and young adults. The Bogalusa Heart Study. *New England Journal of Medicine*, 338,1650-1656.
- ⁵ Webber LS, Wattigney WA, Srinivasan SR, Berenson GS. (1995). Obesity studies in Bogulasa. *American Journal of Medical Science*, 310(suppl 1), S53-S61.
- ⁶ American Heart Association. (n.d.). FIT Kids. Retrieved from <http://www.fitkidsact.org/default.aspx>
- ⁷ Department of Health and Human Services. (n.d.). "Executive Summary: Goal 2: Eliminate Health Disparities." Retrieved from <http://www.healthypeople.gov/Data/midcourse/html/execsummary/Goal2.htm>
- ⁸ Eriksson JG, Forsen T, Tuomilehto J, Osmond C, Barker DJ. (2001). Early growth and coronary heart disease in later life: longitudinal study. *British Medical Journal*, 322, 949-953.; Guo SS, Huang C, Demerath E, Towne B, Chumlea WC, Slevorgel RM. (2000). Body mass index during childhood, adolescence and young adulthood in relation to adult overweight and adiposity: the Fals Longitudinal Study. *International Journal of Obesity*, 24,1628-1635.; and Thomas NE, Cooper SM, Williams SP, Baker JS, Davies B. (2007). Relationship of fitness, fatness, and coronary heart disease risk factors in 12- to 13-year olds. *Pediatric Exercise Science*, 19(1), 93-101.
- ⁹ Peters RM and Flack JM. (2003). Diagnosis and treatment of hypertension in children and adolescents. *Journal of the American Academy of Nurse Practitioners*. 15(2), 56-63.
- ¹⁰ Cunningham III RJ. (2008). Is pediatric hypertension underdiagnosed? *Nature Clinical Practice Cardiovascular Medicine*. 5(3), 128-129.
- ¹¹ Croix B and Feig DL. (2006). Childhood hypertension is not a silent disease. *Pediatric Nephrology*. 21(4), 527-532.
- ¹² Ibid.
- ¹³ Peters RM and Flack JM. (2003). Diagnosis and treatment of hypertension in children and adolescents. *Journal of the American Academy of Nurse Practitioners*. 15(2), 56-63.
- ¹⁴ Ohio Department of Education. (2009). Cleveland Metropolitan School District Report. Retrieved from <http://www.ode.state.oh.us/reportcardfiles/2008-2009/DIST/043786.pdf>
- ¹⁵ Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. (2010). Prevalence of High Body Mass Index in US Children and Adolescents, 2007–2008. *Journal of the American Medical Association* 303(3), 242-249.

POLICY AND PRACTICE IMPLICATIONS

Childhood obesity is a complicated issue with an array of contributing factors including: increased sedentary screen time; direct marketing of unhealthy food and drink to children; increased sugar rich drinks; unhealthy school food; lack of recess time and school physical education; hurried/stressed/dual-career/single/working-parent families with less time to cook healthy meals; unsafe environments for play/physical activity; decreased walking to school and other activities coupled with increased travel by car; under-education of parents about obesity and the influence of parental factors; diminishing access to grocery stores with affordable healthy foods in high poverty urban areas; and, primary medical care settings not prepared or reimbursed for treatment of obesity.¹⁶ In addressing these issues, one must also be mindful that labeling children with a disease such as hypertension or obesity can be controversial.¹⁷ Because of these various dynamics, targeted population-based strategies rather than individual interventions are more likely to be successful.¹⁸ Including children, parents, schools, neighborhoods, and the medical community in these efforts, including a greater role for physicians as health advocates,¹⁹ will also improve their efficacy and help to address multiple factors at once.²⁰

Policy and practice efforts aimed at combating childhood obesity requires a multifaceted,

comprehensive educational, legislative, treatment and economic approach at all levels of government and through public-private partnerships.²¹ The American Academy of Pediatrics recommends increasing access to healthy food and drinks, to physical activity and to safe and attractive places to play while limiting access to unhealthy food and drinks and to excessive screen time; using media campaigns to educate consumers; and, instituting relative pricing changes to make healthier food cheaper.²² Policy strategies may also include restrictions on certain advertising, use of warning labels and/or increased taxes on certain unhealthy foods and drinks, restaurant menu-labeling requirements, and incorporation of nutrition education into science curriculum for standardized testing. The Centers for Disease Control published 10 specific guidelines for state policymakers to help prevent obesity through schools, including promoting quality health and physical education, setting nutrition standards for what can be offered in schools and supporting healthy food consumption opportunities for students.²³

Despite promising practices, implementation challenges for school-based interventions exist. Poverty and environmental factors play major roles in combating obesity, and are not easily addressed. At the school level, communities

continue to face major budget gaps and thus funding is critical. It is increasingly challenging to offer healthier food which can both cost more and be more labor intensive. Despite numerous challenges, there are still success stories to be found. The Alliance for a Healthier Generation, a joint effort of the American Heart Association and the Clinton Foundation, highlights several school-based successful interventions including an elementary school in Washington D.C. that increased physical activity for both students and staff by making small changes to their daily routine.²⁴ The Food Trust project in Philadelphia has focused efforts on both school and community levels to improve health through increased access to nutritious foods and better public policy.²⁵ Locally there are efforts by the Cleveland Department of Public Health to increase access to healthy foods, in part by promoting community gardens and grocery store development in underserved neighborhoods, along with a multitude of other efforts targeting increased physical activity and policy changes. The Cleveland Metropolitan School District (CMSD) has also been making strides, for example, by removing trans-fats and adding wheat bread to school lunches. Long-term success for children will depend on continued public and private investments and collaborations for preventative care and timely access to interventions and treatments.

¹⁶ Levy, LZ and Petty K. (2008). Childhood obesity prevention: Compelling challenge of the twenty-first century. *Early Child Development and Care*. 178(6), 609-615.

¹⁷ Beilin, L and Huang, R. (2008). Childhood obesity, hypertension, the metabolic syndrome and adult cardiovascular disease. *Clinical and Experimental Pharmacology and Physiology*. 35, 409-411.

¹⁸ Ibid.

¹⁹ Lavizzo-Mourey, R. (2007). Childhood obesity: What it means for physicians. *Journal of the American Medical Association*. 298(8), 920-922.

²⁰ Levy, LZ and Petty K. (2008). Childhood obesity prevention: Compelling challenge of the twenty-first century. *Early Child Development and Care*. 178(6), 609-615.

²¹ First Lady Michelle Obama's "Let's Move" campaign is an example of such a comprehensive strategy. Retrieved from <http://www.letsmove.gov/>

²² American Academy of Pediatrics. (n.d.) Policy Tool. Retrieved from http://www.aap.org/obesity/matrix_1.html

²³ Centers for Disease Control (n.d.). School-based obesity prevention strategies for state policymakers. Retrieved from http://www.cdc.gov/HealthyYouth/policy/pdf/obesity_prevention_strategies.pdf

²⁴ Alliance for a Healthier Generation (n.d.). A vision of a physically active school. Retrieved from <http://www.healthiergeneration.org/schools.aspx?id=4245>

²⁵ The Food Trust. (n.d.) Homepage. Retrieved from <http://www.thefoodtrust.org/>