Cardiovascular Risk in Preschool Children

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Abstract

Background: Cardiovascular disease is the leading cause of death in the United States for both men and women among all racial and ethnic groups. Identifying risk factors early in life can facilitate use of preventive strategies.

Objective: The purpose of this study was to identify modifiable (tobacco smoke exposure, physical inactivity, dietary fat intake, overweight, high blood pressure) and non-modifiable (family history, sex, age) cardiovascular risk factors in low-income preschool children.

Method: 205 low-income preschool children, aged 3-5 years, were recruited to participate. Parents completed a multi-generational cardiovascular health history form and a 24-hour dietary recall for themselves and their child. Data for height, weight, and blood pressure were obtained from the child within the context of the health exam.

Results: Of the 205 children, 61% reported ethnicity as Latino/Hispanic, 31.7% non-Hispanic white, 1.0 % non-Hispanic black, 3.9% Asian, and 2.4% mixed race. The number of males (50.7%) and females (49.3%) was similar. Only 22 children (10.7%) had no identified cardiovascular risk factors. At least one modifiable risk factor was present in 179 (87.3 %) children. There were 52 (25.5%) children with a body mass index (BMI) over the 85th percentile for age; 44 (22.3%) children with a systolic or diastolic blood pressure over the 90th percentile for sex, age and height; 128 (66.3%) children with a dietary fat intake of >30%; 77 (37.6%) children who watched TV or played video games more than 2 hours per day; and 48 (23.4%) children who were exposed to passive tobacco smoke.

Discussion: The identification of cardiovascular risk factors in almost 90% of presumably healthy preschoolers provides evidence to support testing of interventions that can improve health behaviors and reduce risks. Key Words: cardiovascular, pediatrics, Hispanic

Background

Cardiovascular disease (CVD) is the leading cause of death in the United States for both men and women among all racial and ethnic groups (US DHHS, 2000a). Analysis of mortality data revealed the influence of key risk factors: smoking, overweight, physically inactive, hypertensive, elevated cholesterol, and diabetes (Byers, Anda, McQueen, Williamson, Mokdad, Casper et al., 1998). CVD is also the leading cause of death in Colorado. In 2003, 9,228 individuals died due to CVD, accounting for 31.4% of all Colorado resident deaths, with heart disease accounting for 6,483 of CVD deaths (70.3%) (Colorado Department of Public Health and Environment, 2005). Despite a national decline in CVD mortality from 1990 to 1998, the index of disparity among racial and ethnic groups remained significant (Keppel, Pearcy, & Wagener, 2002). Three health-related behaviors that contribute to CVD are the top three leading health indicators in Healthy People 2010: physical activity, overweight and obesity, and use or exposure to tobacco use (US DHHS, 2000b). Based on their life course health development framework, Halfon and Hochstein (2002) assert that identifying risk and protective factors early can "shift our emphasis on treatment in the later states of disease to the promotion of earlier, more effective preventive strategies and interventions" (p. 434). Further, decisions which increase resistance to cardiovascular risks (e.g., breastfeeding, participation in physical activity) and the onset of lifestyle habits which predispose to cardiovascular risk (e.g., unhealthy food choice, sedentary behavior, smoking) are "frontloaded" in the lifespan, most often occurring in the first two decades of life (Halfon & Hochstein, 2002).

The purpose of this study was to identify the existence of cardiovascular risk factors within a low-income, pre-school population. Families recruited for participation were largely of Hispanic ethnicity. The review that follows highlights findings from the literature concerning

cardiovascular risks among low-income children and those of Hispanic ethnicity. Research concerning cardiovascular risk factors indicates that individuals with low income are less physically active, more likely to be obese, and more likely to smoke (US DHHS, 2000b). Low-income families reported a higher percentage of food insufficiency, and their children reported lower energy and higher cholesterol intakes, more overweight, and significantly more time watching television (Casey, Szeto, Lensing, Bogle, & Weber, 2001). Children represent 40% of those living in poverty. More than 12.1 million children lived below the federal poverty line ($16,090 a year for a three-person family) in 2005, up by 400,000 since 2001. Of the additional poor children, 223,000 were Latino and over 153,000 were African American (Children's Defense Fund, 2004).

An expert panel of the American Heart Association (Williams, Hayman, Daniels, Robinson, Steinberger, Paridon, & Bazzarre, 2002) released a scientific statement concerning cardiovascular health in childhood. They cite the following areas for health promotion in childhood: physical activity, obesity, insulin resistance and type II diabetes mellitus, hypertension, high blood cholesterol, and cigarette smoking.

Physical Activity

The development of physical activity behaviors is influenced by a number of factors: physiologic and developmental factors, environmental factors, and psychological, social and demographic factors (Kohl & Hobbs, 1998). National studies indicate that children in the United States are increasingly sedentary. Review articles have documented the effectiveness of school-based activity interventions (Robbins, Pender, Conn et al., 2001) but also cited the lack of research concerning physical activity among the preschool population (Stone, McKenzie, Welk, & Booth, 1998). Studies of activity involving preschool children have shown Anglo-American

children to be more active than Mexican-American children and male children more active than female children (Sallis, Nader, Broyles et al., 1993).

Evidence suggests that increased physical activity lowers risk of coronary heart disease (Sesso, Paffenbarger, & Lee, 2000). The relationship between physical activity and dietary behaviors is well-established and complex. A study of a racially diverse sample of adults from a managed-care plan provided evidence that sedentary individuals consumed less healthful foods (fruits, vegetables, fiber) and more harmful foods (saturated fat, cholesterol) than those reported to be more active (Gillman, Pinto, Tennstedt, Glanz, Marcus, & Friedman, 2001). Similar results were demonstrated in a sample of Hispanic adults (Hovell, Sallis, Hofstetter, Barrington, Hackley, Elder et al., 1991). In a five-year study of low-income Mexican-American adults linking weight, physical activity and cardiovascular risk, the amount of physical activity was associated with a change in the level of LDL cholesterol (Rainwater, Mitchell, Comuzzie, VandeBerg, Stern, & MacCluer, 2000).

Obesity

The prevalence of pediatric overweight ($\geq 95^{th}$ percentile of the age and sex-specific BMI) has increased dramatically in the United States (Polhamus, Dalenius, Thompson, Scanlon, Borland, Smith, & Grummer-Strawn, 2004). Both 6-11 year olds and 12-19 year olds show an increase in overweight from 11 to 16 percent from 1994 to 2002 (US DHHS, 2005). The proportion of overweight preschoolers (ages 4-5) has increased dramatically from 5.8% for girls in 1971-74 to 10.8% in 1988-1994 (4.4% to 5.0% for boys). The highest prevalence was among Mexican-American children with 12% of boys and 13.2% of girls identified as overweight (Ogden, Troiano, Briefel, Kuczmarksi, Flegal, & Johnson, 1997). The prevalence of overweight among low-income preschoolers is even higher, with 21.2% of four to six year olds at or above

the 85th percentile based on weight-for-height (Mei, Scanlon, Grummer-Strawn, Freeman, Yip, & Trowbridge, 1998). "The increasing prevalence of overweight among 4- to 5-year old children indicates that prevention activities need to begin in the preschool years" (Ogden et al., 1997). The focus on preventive activities during preschool years may reduce the need for treatment in later childhood and adolescence and potential morbidity and mortality in adulthood.

Parental obesity is a reliable predictor of childhood obesity. If both parents are obese, there is a 70% likelihood that their children will be obese. If one parent is obese, there is a 50% likelihood that his/her child is obese. If neither parent is obese, there is only a 10% likelihood of childhood obesity (Epstein, 1996). In addition, prior to age 3, parental obesity is the greatest predictor of a child's risk of obesity in adulthood. From ages 3 to 9, parent and child obesity are both predictors of adult obesity. After age 10, the child's body mass index (BMI) is the greatest predictor of adult obesity (Whitaker, Wright, Peppe, Seidel, & Dietz, 1997).

Compared to skinfold thickness, among preschool children, the sensitivity and specificity of BMI-for-age in detecting underweight and overweight was consistently better than use of the Rohrer Index (Mei, Grummer-Strawn, Pietrobelli, Goulding, Goran, & Dietz., 2002). All adults (aged 18 years or older) who have a BMI of 25 or more are considered at risk for premature death and disability as a consequence of overweight and obesity. These health risks increase even more as the severity of an individual's obesity increases.

Hypertension

Elevated blood pressure in childhood is a major health concern. The development of high blood pressure begins in childhood and is now believed to be a strong predictor of adult hypertension. In a meta-analysis of peer-reviewed scientific literature published since 1997, the National High Blood Pressure Education Program (NHBPEP) Working Group on High Blood

Pressure in Children and Adolescents (2004) found that hypertension is both an identifiable and significant health issue among young children. They reported that primary or essential hypertension develops in the childhood years, dispelling the misconception that essential hypertension is an exclusively adult phenomenon. Most cardiovascular and pediatric experts agree that routine blood pressure screening should begin at age 3.

Findings from the NHBPEP (2004) study prompted the recommendation that children greater than or equal to 3 years of age have their blood pressure measured at least once during every health care episode. The American Heart Association and the American Academy of Pediatrics subsequently supported these findings (Williams, et al., 2002; Moran, Panzarino, Darden, & Reigart, 2003). In an effort to determine what physicians caring for children are actually doing with regard to blood pressure screening, Moran, Panzarino, Darden, and Reigart (2003) conducted a secondary analysis of the National Ambulatory Medical Care Surveys (NAMCS) database, and found that physicians routinely caring for children in the 3 to 5 year age range screened for high blood pressure at only 38% of the visits in 1996, down from 41% in 1985.

Elevated blood pressure in children is defined as a blood pressure that persists on repeated measurement at the 95th percentile or greater for age, height, and gender (NHBPEP, 2004). According to the committee on Atherosclerosis, Hypertension, and Obesity in the Young, the primary reason for screening children for high blood pressure is to identify children with a blood pressure at the 90th percentile or higher identified as at risk for hypertension. Once these children are identified, education and intervention can begin that will address lifestyle factors that are known to contribute to elevated blood pressure (Williams, et al., 2002). The NHBPEP (2004) recommendations are that children with identified blood pressure levels in the

prehypertensive and hypertensive range follow the same lifestyle modifications as adults with hypertension.

Ethnicity has also been shown to have an important effect on both systolic and diastolic blood pressure. A 10-year longitudinal study from 1989 to 1999 by Dekkers, Sneider, van den Oord, and Treiber (2002) examined the effect of ethnicity on the development of systolic and diastolic blood pressure from childhood into early adulthood. The age range studied was 4.9 to 27.5 years. Ethnicity was found to have a significant effect on systolic blood pressure levels in both male and female subjects. African American participants had higher average systolic blood pressure levels than Caucasian participants. In addition, ethnicity also had a significant effect on diastolic blood pressure in males and female. African American participants had higher diastolic blood pressure levels than Caucasian participants. The subjects in this study were either Caucasian or African American. In the study described previously by Moran et al. (2003), participants were over 82% white. Although meta-analyses have revealed important information about the importance of childhood blood pressure screening among Caucasian and children of other ethnicities, a large portion of the studies analyzed have failed to evaluate blood pressure and blood pressure screening among Hispanic children. The effect of ethnicity on the development of blood pressure among children of backgrounds other than Caucasian or African American is an indication for further study.

High Blood Cholesterol

Children with high cholesterol levels are more likely than the general population to have high cholesterol levels as adults and frequently come from families in which there is a high incidence of coronary heart disease among adult members (National Cholesterol Education Program, 1992). Autopsy studies have shown that the development of atherosclerosis that is

partly attributed to elevated blood cholesterol begins in childhood (Berenson, Srinivasan, Weihang, Newman, Tracy, & Wattigney, 1998). Autopsies performed on 204 persons between the ages of 2 and 39 years who died of various causes found fatty streaks in the coronary arteries which increased with age from approximately 50% in the 2 to 15 year age group to 85% in the 21 to 39 year age group ($p = .01$), thus providing evidence for targeted cholesterol screening in the preschool age group.

Citing concerns of labeling young people as patients with a "disease," the NCEP Expert Panel recommends against universal cholesterol screening for children. The current recommendation is to selectively screen for elevated cholesterol levels in all children greater than two years of age who have a family history of premature cardiovascular disease or at least one parent with high blood cholesterol (NCEP, 2001; Valente, Newburger, & Lauer, 2001; Williams et al., 2002).

Relying solely on parent interviews to report a family history of elevated blood cholesterol may fail to correctly identify high risk children. O'Loughlin, Lauzon, Paradis, Hanley, Levy, Delvin, and Lambert (2004) sought to determine the usefulness of a parent history of hypercholesterolemia and cardiovascular disease as a screening criterion for hypercholesterolemia in youths ($n = 2,217$). Parents of the participants were asked to complete a self-report parent history specifically asking about hypercholesterolemia. Study participants, ranging in age from 9 to 16, had their blood drawn after an overnight fast for total cholesterol, high-density lipoprotein, and triglyceride levels. Approximately one quarter of the parents reported a history of hypercholesterolemia and/or cardiovascular disease. The authors found that both the sensitivity and specificity for high LDL (> 130 mg/dl) were low: 50.6% and 69.1%. The positive predictive value was 7.7%, only 2.9% higher than the true population prevalence of

4.8%, thus indicating that the parent history criteria performs only marginally better in identifying youths with high cholesterol than would random population screening. Self-reported parent history is not useful in identifying children with elevated LDL levels according to the study conclusions.

The recommendation of the National Cholesterol Education Program (NCEP) is for all healthy children greater than the age of two to follow a diet low in saturated and total fat, and low in cholesterol. Children with identified LDL levels $\geq$ 130 mg/dl or total cholesterol levels $\geq$ 200 mg/dl require further intervention (1992). Diet education for the parent and the child is the primary focus for children with elevated blood cholesterol. Drug therapy is generally reserved for children greater than 10 years of age who have persistent elevated blood cholesterol levels after following strict dietary recommendations (Williams, et al., 2002).

Tobacco Use or Exposure

In 1996, about 15 million children under age 18 were exposed to environmental tobacco smoke in the home (American Heart Association, 2003). When dealing with children exposed to passive tobacco smoke, smoking cessation efforts are directed primarily at parents and other household members smoking in the home. A thorough smoking history should be obtained from parents and other family members (Williams et al., 2002). Parent education should include information on the health hazards of exposing children to tobacco smoke. Smoking cessation should be encouraged. Children exposed to passive tobacco smoke experience potentially damaging cardiovascular effects, particularly adverse changes in serum cholesterol levels and early atherosclerosis.

Summary

This study was designed to assess the presence of cardiovascular risk among a sample of presumably healthy 3-5 year old children. The early onset of risk factors along with the opportunity of frequent contacts with health professionals makes the preschool period an important time for risk assessment and intervention.

Methods

Sample and Setting

Parents of children presenting for well-child exams in one of four pediatric primary care faculty practice sites or health assessments through the Child Find program were invited to enroll their child in the study. The faculty practice sites serve Medicaid and uninsured patients and were located within the urban fringe of a major metropolitan area in the Mountain West. Child Find is a community-based preschool screening program. One of the school-based health center sites, located in a preschool, hosted Child Find intakes, which facilitated enrolling children and performing assessments in the adjacent clinic.

A total of 205 children participated in the study.

Procedure

An evidence-based protocol (Figure 1) was developed, then reviewed and approved by the human subjects institutional review board. Parents were approached in the waiting room of the clinic or after they checked in at Child Find. Consenting parents completed a multi-generational cardiovascular health history form and a 24-hour dietary recall for themselves and their child. Parents were offered a free total cholesterol screen if they were unaware of their own cholesterol level. Data for height, weight, and blood pressure were obtained on the child. If risk factors were identified, parents were asked permission to perform a fingerstick cholesterol test on their child.

Measurement and Instruments

The data collection forms were designed to elicit and document data concerning the child, his/her parents, and his/her grandparents. The family data form had a picture of a tree on the cover, depicting a family tree. Some providers entered the names of family members on the branches of the trees to facilitate data collection. It was translated into Spanish using the translation-back translation technique. For grandparents, requested data concerned ethnicity, race, current age or age at death, nativity, and history of cardiovascular disease (as illustrated in Table 1). For parents, requested data concerned ethnicity, race, language spoken in the home, age, nativity, history of cardiovascular disease, cholesterol level, smoking behaviors, physical activity, and 24-hour dietary recall. For children, requested data concerned date of birth, sex, ethnicity, race, passive smoke exposure, inactivity, and 24-hour dietary recall. The provider forms were designed to record physiologic measures. All forms were designed using TELEForm® to permit data entry via scanning. Specific variables are described below.

Ethnicity was recorded as a nominal variable with two categories and based on US Census 2000 categories: (1) Hispanic or Latino, and (2) Not Hispanic or Latino. Hispanic or Latino was defined as "a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race."

Race was a nominal variable with five categories. Subjects were asked to identify all that apply (Drevdahl, Taylor, & Phillips, 2001)): American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White (Grieco & Cassidy, 2001).

Acculturation was assessed via proxy by place of birth, and language spoken at home.

Family history was defined as a grandparent who, at age 55 years or younger, had a known myocardial infarction, angina pectoris, peripheral vascular disease, cerebrovascular disease, or

sudden cardiac death, or underwent diagnostic coronary arteriography and was found to have atherosclerosis, or underwent coronary artery bypass surgery or angioplasty (US DHHS, 1998).

Body Mass Index (BMI) was calculated as weight in kilograms (kg) divided by height in meters (kg/m^2). Height was assessed in centimeters and weight in kilograms using standard clinical scales. The child was considered at-risk if the BMI was greater than the 85^{th} percentile for age and sex (US DHHS, 1998).

Blood pressure was assessed using the procedure set forth in the National Health, Lung and Blood Institute's Report of the Second Task Force on Blood Pressure Control in Children (US DHHS, 1996). The child was considered at risk if the systolic or diastolic BP was greater than the 90^{th} percentile for age and sex (National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents, 2004).

Total cholesterol was measured using the Cholestech LDX Analyzer, which is a small, portable system designed to measure the amount of specific substances within blood. A fingerstick sample was sufficient for analysis. Quality controls were completed daily.

Activity was assessed for both parents and their child via parental self-report. Parental activity was assessed via a four-point ordinal scale from the accompanying parent: inactive (no regular physical activity), moderate (sporadically involved in recreational activities), heavy (participation in recreational activity at least three times a week for 30-60 minutes per session), or vigorous (participation in extensive physical activity for 60 or more minutes at least four days per week) (Fontvielle, Kriska, & Ravussin, 1993). Child physical activity was assessed via proxy measures of inactivity including: number of hours sleeping at night, napping during the day, and watching TV or videos or playing video or computer games.

Parental smoking was assessed via two questions: Do you currently smoke? Have you ever smoked since your child was born? (US DHHS, 1998).

ETS exposure was an ordinal variable representing whether or not the child was exposed to tobacco smoke at home or by other caregivers.

Dietary intake was assessed via a 24-hour dietary recall from the accompanying parent(s). Diets were analyzed using Nutritionist Five™ software to determine whether or not dietary fat intake exceeded the recommended maximum level of 30% as well as number of servings of major food groups consumed.

Data Analysis

Data were scanned using TELEForm®, converted to ASCII file format and analyzed via SPSS. Data from Nutritionist Five™ were converted to ASCII file format and imported into SPSS. Descriptive analyses were then conducted in SPSS.

Results

Sample Characteristics

Of the 205 children, 61% reported ethnicity as Latino/Hispanic, 31.7% non-Hispanic white, 1.0 % non-Hispanic black, 3.9% Asian and 2.4% mixed race. The number of boys (50.7%) and girls (49.3%) was similar. Children ranged from 3 years to 5.97 years with a mean age of 4.2 (standard deviation 0.7). Children were predominantly Hispanic (n = 125, 61%) or non-Hispanic white (n = 65, 31.7%), with the remaining participants classified as non-Hispanic black (n = 2, 1.0%), Asian (n = 8, 3.9%), and mixed race (n = 5, 2.4%).

Risk Factors

Only 22 children (10.7%) showed no cardiovascular risk factors. Four additional children (2.0%) presented with only a non-modifiable (i.e., family history) risk factor. At least one

modifiable risk factor was present in 179 (87.3%) children. As illustrated in Figure 2, there were 52 (25.5%) children with a BMI over the 85th percentile; 44 (22.3%) children with a systolic or diastolic blood pressure over the 90th percentile for sex, age and height; 128 (62.4%) children with a dietary fat intake of >30%; 77 (37.6%) children who watched TV or played video games more than two hours per day; and 48 (23.4%) children exposed to passive tobacco smoke.

Bivariate comparisons by sex showed significantly higher risk among boys when compared to girls for passive smoke exposure (30.8% versus 15.8%, $p < .05$) and hours of sedentary activity (50.5% versus 32.5%, $p < .05$)

Analysis of risk factors by ethnicity was conducted among the two largest ethnic groups, Hispanic children and non-Hispanic white children. Bivariate comparisons by ethnicity showed significantly higher risk among white children for positive family cardiovascular history (41.5% versus 19.2%, $p < .01$) and passive smoke risk factors (33.8% versus 18.4%, $p <.05$) when compared to Hispanic children.

Dietary Recall

Initial data from the 24-hour dietary recall provided challenges to the research team. Nutritionist Five™ software was used to analyze the data. The level of specificity available within the software program was much greater than the level of specificity included on the recall forms. For example, when a parent recorded “slice of pizza,” the software program provided 283 choices. Another issue for the dietary recall for preschool children was the amount of food consumed outside the home. Parents were often unaware of what and how much was provided to and eaten by the child in settings where they were not present (e.g., HeadStart, day care). To improve accuracy, the team provided clear instructions in English and Spanish for parents along with measuring cups and spoons to assist with estimating amounts. In addition, the nurse

practitioners completing the well-child exam were asked to review the diet recall data with parents during the visit in order to further specify the type of food, method of preparation, and amount (Gilbert, Barton, & Baramee, 2001).

Further analysis of the 24-hour dietary data revealed the following:

- Preschoolers consumed more than 30% of calories from fat.
- 20% of sample children consumed between 1 and 2 servings of juice and soda.
- 2/3rds of sample children averaged 2.6 servings of fruit (including 100% fruit juice); 1/3rd had no serving of fruit.
- Only 38% of children reported any vegetable intake; those averaged 1 serving.

Discussion

The presence of cardiovascular risk factors in nearly 90% of presumably healthy preschoolers has important implications for the delivery of well-child care to vulnerable populations. It provides evidence to support testing of interventions that are capable of effecting a change in health behaviors. Childhood health-related behaviors can provide a good foundation for adult health or may facilitate precursors of adult disease. Perhaps even more important, there are continuing life span and public health implications regarding the morbidity and mortality due to CVD (Barton, Gilbert, Baramee & Oreskovich, 2002).

The family unit is pivotal when behavioral interventions are focused on preschool children. Socialization within the family and parental modeling of health behaviors are very influential on child behavior (DiLorenzo, Stucky-Ropp, Vancer Wal, & Gotham, 1998; Sallis, Haskell, Wood, Fortmann, Rogers, Blair et al., 1985). This is supported for behaviors such as physical activity (Armstrong & Welsman, 1997; Moore, Lombardi, White, Campbell, Oliveria, & Ellison, 1991), dietary intake (Cutting, Fisher, Grimm-Thomas, & Birch, 1999; Drucker, Hammer, Agras, &

Bryson, 1999; Hood, Moore, Sundarajan-Ramamurti, Singer, Cupples, & Ellison, 2000), and smoking (Andersen, Leroux, Marek, Person, Kealey, Bricker, & Sarason, 2002).

Hence, targeting low-income parents about health risks and healthier behaviors may positively impact the health of their children. This study demonstrates that children as young as preschoolers begin to show evidence of risk for cardiovascular disease. The current emphasis on nutrition and physical activity provide a forum for "teachable moments" for families with young children. Family-based treatments are more likely to be effective due to evidence that children model the behavior of their parents (Hill & Trowbridge, 1998). Further, targeting changes in the home environment may be more effective than school-based interventions (Strauss & Knight, 1999). Finally, addressing strategies at the preventive stage may be more successful and economical when compared to treatment later in life.

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Table 1. Data variables collected from parents about each generation.

Grandparents	Parents	Child
Ethnicity	Ethnicity	Date of birth
Race	Race	Sex
Current age or age at death	Language spoken in the home	Ethnicity
Nativity	Age	Race
History of cardiovascular disease	Nativity	Passive smoke exposure
	History of cardiovascular disease	Inactivity
	Cholesterol level	24-hr dietary recall
	Smoking behaviors	
	Physical activity	
	24-hr dietary recall	

Figure 1. Evidence-based practice protocol to assess for cardiovascular risk factors in preschool children.

This figure represents the protocol data collection process used for this study. Evidence-based practice protocols were used to screen for obesity, hypertension, and hypercholesterolemia. The additional risk factors of dietary fat intake, family history of cardiovascular disease, inactivity, and exposure to environmental tobacco smoke were also assessed.

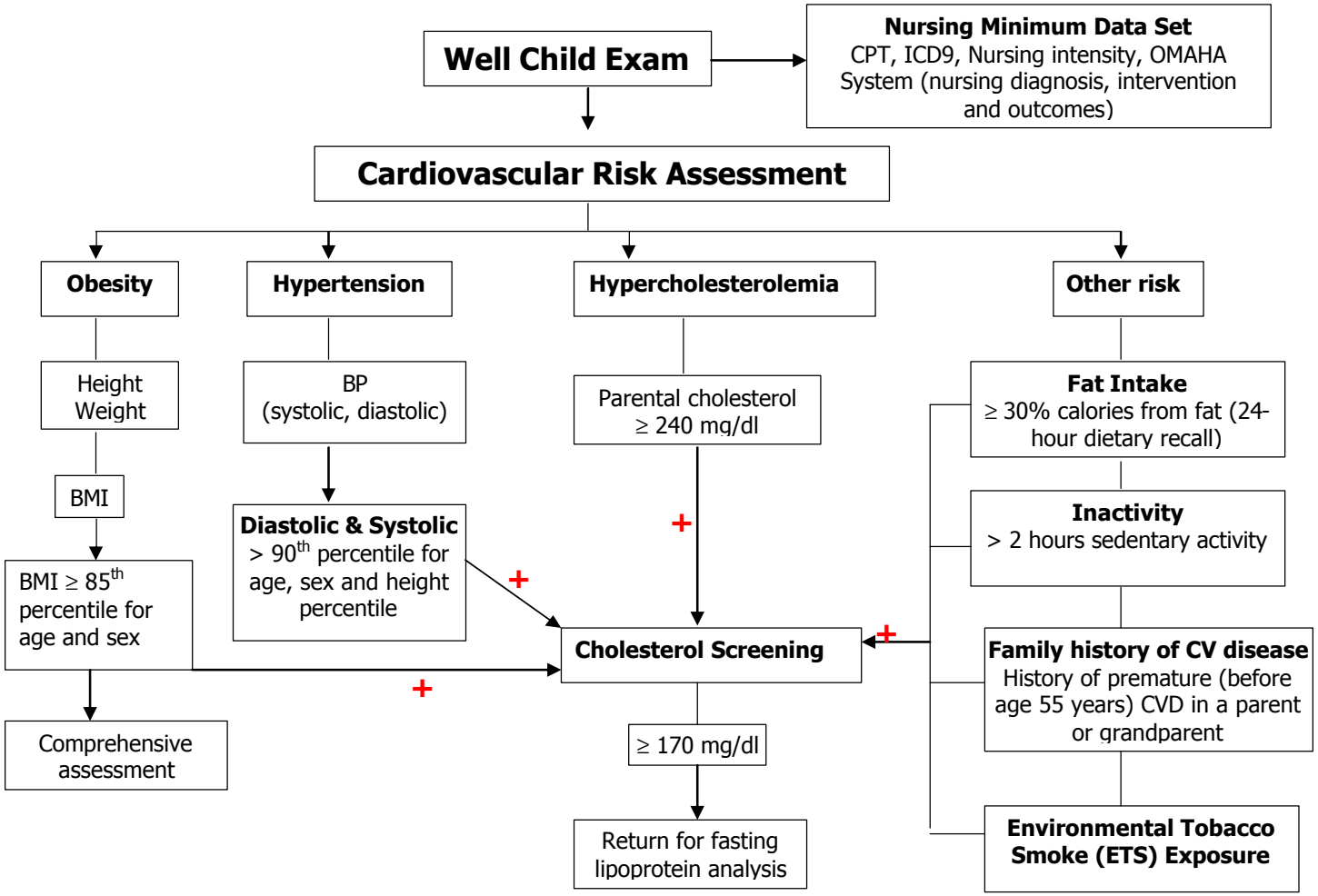

Figure 1. Evidence-based practice protocol to assess for cardiovascular risk factors in preschool children.

Figure 2. The proportion of children identified as having each of the risk factors studied.