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Cardiovascular Disease Risk in Children and Adolescents

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Atherosclerosis is a global health issue beginning in childhood. Children's early development of cardiovascular disease (CVD) risk factors may include exposure to key biological components responsible for vascular inflammation in young adults. A retrospective medical record review based on the 2008 American Academy of Pediatrics childhood lipid screening recommendations examined current and initial CVD risk factors for 227 at-risk school-aged children during wellness exams to better determine the age when children are most likely to convert from being risk-free to at risk for CVD. An original risk trend algorithm analyzed risk clustering and risk trend progression. Risk onset was young (M=2.88 years), with family risk most prevalent and risk clustering and accumulation noted, perhaps precluding primordial prevention.

CARDIOVASCULAR DISEASE IS a complex and global health problem that begins in childhood. Atherogenic dyslipidemia, hypertension, left ventricular hypertrophy, and insulin resistance are evidence of cardiovascular disease in children (Hayman et al., 2007). Data from the Bogalusa Heart Study (Berenson, Srinivasan, Bao, Newman, Tracy, & Wattigney, 1998; Newman, Freedman, & Voors, 1986), and Pathobiological Determinants of Atherosclerosis in Youth (PDAY) (Gidding et al., 2006), both prospective pediatric cardiovascular epidemiological studies, showed that atherosclerosis has its origins in childhood, is associated with risk factor development at early ages, and progresses to measureable vascular changes in young adulthood.

Ripatti et al. (2010) define coronary heart disease (CHD) as myocardial infarction (MI), unstable angina pectoris, coronary revascularization, or sudden cardiac death, and define cardiovascular disease (CVD) as the previous factors plus ischemic stroke events. Libby and Theroux (2005) detail how years of research has modified our understanding of the biological processes involved in atherosclerosis from the previously held perception that coronary artery disease (CAD) was a localized disease composed of arterial stenosis and plaques that obstructed blood flow. Atherosclerosis is now recognized as an arterial remodeling disorder (hardening and thickening of arterial walls) based on exposure to systemic inflammatory factors involved with diseases like dyslipidemia, hypertension, diabetes, obesity, and even bacterial infections that raise CVD risk (Libby & Theroux, 2005).

Christakis (2011) surmised that problems with clinical decision making tools and prediction rules for disease related back to "the underlying philosophical approach that many clinicians have to the practice of medicine"; further stating "they are either unable or unwilling to articulate a treatment threshold as aficionados of evidence-based medicine would have them do and then act on it" (p. 91). He advocated that patients either have a particular disease or not, and that tools that do not "perfectly predict outcomes" make it difficult for clinicians to tolerate the possibility of the risk of a missed diagnosis and subsequent "perceived potential [negative] consequences of inaction" (both p. 91) regardless of the predicted chance of having the disease. This merits

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consideration when nurse clinicians assess cardiovascular health and identify CVD risk in children, as the nursing intervention approach would differ for promoting primordial prevention, or defining potential disease risk (threshold), and treating known disease.

Strasser (1978) originally developed the concept of primordial prevention as a way to address world health problems, being concerned with preserving risk-factor free populations in developing societies from penetration of risk factor epidemics [like CVD]. More recently Berenson and Srinivasan (2010) suggest that primordial prevention in pediatrics is aimed to improve lifestyle and health behaviors in children and in family cultures, before abnormal risk factors develop. Gupta and Deedwania (2011) developed a continuum for CVD prevention that has primordial prevention as its base. They direct health care professionals to strive for risk-free populations at baseline and to recognize areas such as socioeconomic status as an individual risk factor for CVD, thus incorporating public health financing and access to care issues into their model, which continues on with promotion of smoking cessation, healthy diets and physical activity and focusing medical education on preventive care. As wellness and preventative care are at the heart of nursing education, this model is an adequate framework for childhood CVD health promotion.

The purpose of the current study is three-fold. First, to determine the developmental age when children first tend to accrue CVD risk factors, converting from no risk to at risk for CVD and identifying the likely threshold age between primordial and primary prevention; second, to evaluate risk factor profiles and risk clustering; and third, to understand likely risk trend progression for the study population.

Background

A literature review was completed through PubMed and CINHAL for English language research conducted worldwide, predominantly from 2000 to 2011, using search terms focused on atherosclerosis, cardiovascular health and disease, cardiovascular risk recognition, children, adolescents, family history, primordial prevention, and advanced practice nursing. Secondary sources were included if they were meta-analyses of relevant studies, or recommendations from research panel groups and governmental agencies.

Historically relevant, the Framingham heart study was the first to identify age, hypertension, hyperlipidemia, smoking, and diabetes as major determinants for CVD, calling them coronary risk factors (Dawber & Kannel, 1966; Kannel, Dawber, Kagan, Revotskiw, & Stokes, 1961). Recent longitudinal studies of CHD in adults using Framingham risk factor data, developed and examined the validity and reliability of CHD risk score prediction tools for estimating 10-year risk for likelihood of actual cardiovascular events in adults (Framingham Risk Score-FRS). The FRS using traditional CHD risk factors effectively predicted CHD risk in a white middle-age population (Wilson, D'Agostino, Levy, Belanger, Silberhatz, & Kannel, 1998), and later was determined reliable for predicting 5 to 10-year CHD risk in white and black men and women, and could be used in other ethnic groups when recalibrated for risk factor prevalence (D'Agostino, Grundy, Sullivan, & Wilson, 2001). Lloyd-Jones et al. (2004) investigated using the FRS to stratify lifetime CHD risk, finding it predicted short-term risk for men and women, stratified lifetime risk well for women at any age, less well in younger men, and improved lifetime risk prediction in older men.

There has been global interest in pediatric studies of the reliability of CVD risk factor assessment approaches for predicting future CHD in young persons. Several wide-ranging studies provide supportive background for the current study aims to determine age when children first develop CVD risk, and the importance of trending future CVD risk in at risk children. Juonala et al. (2010) conducted an epidemiologic study that pooled data from four international prospective cohort studies (Australia, Finland, two in the United States) to define the age when childhood CVD risk scores began to relate to carotid artery intima-media thickness (IMT), a marker of subclinical atherosclerosis in adults. IMT has consistently associated with future CVD morbidity. Risk factor scores in all four cohorts demonstrated that higher numbers, or clustering of specific childhood CVD risk factors (high total cholesterol, triglycerides, blood pressure, and body mass index) showed stronger predictive associations for higher young adult carotid IMT for children 9 years or older, and were not significant for children at 3 and 6 years of age.

Corvalan, Uauy, Kain, and Martorell (2010) studied 4-year old Chilean preschoolers to clarify the association of obesity with CVD risk in preschoolers, measuring the contribution of obesity indicators (BMI), and measures of central obesity (waist circumference) to cardiometabolic (CM) risk factors [elevated C-reactive protein (C-RP), diabetes, dyslipidemia, hypertension, and interleukin-6-pro-inflammatory risk factors]. Both obesity factors were positively, but weakly, correlated with CM risk status, but were not specifically associated with elevated lipid concentrations. Corvalan et al. (2010) cautioned that BMI and waist circumference were poor indicators for CM risk factors and CVD risk screening in preschoolers as a population because children grow and mature at differing rates. Other researchers agreed that a single threshold to identify CVD risk across all childhood is inappropriate (Eissa, Wen, Mihalopoulos, Grunbaum, & Labarthe, 2009; Lloyd-Jones et al., 2010; Reinehr, Stoffel-Wagener, Roth, & Andler, 2005). This prompts nurse clinicians to evaluate other CVD risk factors in addition to obesity when assessing risk in young children.

McMahan et al. (2005) used PDAY data that combined measures of traditional CHD risk factors in young people 15–34 years old who died of non-cardiac causes with post-mortem measurements of atherosclerotic lesions in their