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Physiological health parameters among college students to promote chronic disease prevention and health promotion

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ABSTRACT

This study aimed to provide physiologic health risk parameters by gender and age among college students enrolled in a U.S. Midwestern University to promote chronic disease prevention and ameliorate health. A total of 2615 college students between 18 and 25 years old were recruited annually using a series of cross-sectional designs during the spring semester over an 8-year period. Physiologic parameters measured included body mass index (BMI), percentage body fat (%BF), blood serum cholesterol (BSC), and systolic (SBP) and diastolic (DBP) blood pressure. These measures were compared to data from NHANES to identify differences in physiologic parameters among 18–25 year olds in the general versus college-enrolled population. A quantitative instrument assessed health behaviors related to physical activity, diet, and licit drug use. Results suggest that average physiologic parameters from 18 to 25 year olds enrolled in college were significantly different from parameters of 18–25 year olds in the general population. Generally, men reported higher percentiles for BMI, SBP, and DBP than women, but lower %BF and BSC percentiles than women at each age. SBP and DBP significantly increased with age and alcohol use. Students in the lowest (5th) and highest percentiles (95th and 75th), for most age groups, demonstrated DBP, BMI, and %BF levels potentially problematic for health and future development of chronic disease based on percentiles generated for their peer group. Newly identified physiologic parameters may be useful to practitioners serving college students 18–25 years old from similar institutions in determining whether behavior change or treatment interventions are appropriate.

1. Introduction

Developing physiological health risk parameters (here after referred to as physiologic parameters) is a scientific approach concerned with establishing typical or desirable values for behavior, education, health, or other cultural or societal aspects (VandenBos, 2007). Cut-off scores for screening characterize what is desirable or unusual in a defined population at a specific point in time (O'Connor, 1990; Porta, 2008; Vogt, 1999). Desirable scores are often part of an initial screening process and consultation with a healthcare provider to ultimately decide on more definitive and expensive testing and whether behavioral changes and/or medical treatment are indicated (Black and Johnson, 2015; Frauenknecht and Black, 2003; Porta, 2008). Examining patient health and behavioral parameters at the earliest stage of development may increase longevity by reducing mortality, morbidity, injury, and disability, and may reduce the gross national product for healthcare costs by introducing preventive interventions earlier in life (Black and Johnson, 2015).

Physiologic age- and gender-specific health parameters have been identified and examined in adults for several decades, especially regarding the development of chronic diseases such as cardiovascular, diabetes, cholesterol, and hypertension (Gilbert and Nijland, 2008; Rodgers et al., 2006). While primarily physiologic in nature, health outcomes are due to a myriad of complex factors, such as health-related behaviors, which vary by age and gender (Krieger, 2003; O'Loughlin et al., 2011). Standards based on age and gender distributions have been reported as the most reliable and valid because of being less susceptible to measurement error and bias (Black and Johnson, 2015; Porta, 2008; Tombaugh, 2004). Developing physiologic parameters for a specific homogenous segment of a population would enhance the sensitivity, specificity, and accuracy of screening measures for that population segment (Black and Johnson, 2015).

Adolescents and young adults may not necessarily have the healthiest physiologic parameters (Belsky et al., 2015; Helms et al., 2014). For example, according to the Framingham Heart Study, adolescents and young adults with reportedly average or healthy physiologic parameters demonstrated physical evidence of atherosclerosis upon premature mortality, as confirmed by autopsies (Mahmood et al., 2014). Investigators from the Pathobiological Determinants of Atherosclerosis in Youth

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(McMahan et al., 2006) study suggested that identifying physiologic parameter risk factors at a younger rather than an older age is a better predictor of potential chronic disease development and severity when comorbidities are present.

College students are susceptible to chronic diseases because they engage in deleterious health behaviors, such as physical inactivity and binge drinking, that deviate from those in the general adult population (Carter et al., 2010; Lenk et al., 2012; Nelson et al., 2007; Quinn and Fromme, 2011). College students are at risk for higher rates of chronic diseases, including high blood serum cholesterol, increased blood pressure, and greater body mass index (BMI) (Sparling et al., 1999; Spencer, 2002). Currently, there are no screening criteria or national surveillance data health parameters that distinguish 18–25 years olds in the general population from 18 to 25 year olds enrolled in colleges or universities. Approximately 20.4 million in 2013 or 40% of all 18–25 year olds were enrolled in an institute of higher education (National Center for Education Statistics, 2013), and this age group's representation is expected to increase in the next decade as education becomes more affordable (National Center for Education Statistics, 2016). Therefore, it is imperative for the health and economic well-being of the nation to develop health risk parameters specifically for college students that are linked to deleterious health behaviors (Henke et al., 2010; Ormond et al., 2011).

National datasets, such as the National Health and Nutrition Examination Survey (NHANES) (National Center for Health Statistics, 2017), exist to capture the physiologic, physical, and emotional health parameters of the general adult population in the US across the lifespan. These large-scale datasets include adults between the ages of 18–25 years old who have "none" or "some" college experience or are identified as having a college degree. The use of these national large-scale datasets could shed light on the physiologic parameters of 18–25 year olds with limited college experience; however, simply reporting "some college" experience does not ensure current part- or full-time enrollment at a university. In fact, some college could indicate the completion of only one semester prior to withdrawal. Through the implementation and widespread use of the American College Health Association's National College Health Assessment (ACHA/NCHA) (American College Health Association, 2014), the US has recognized the importance of assessing the physical and emotional health status and needs of students enrolled in institutions of higher education; a population consisting of diverse groups with unique health risks and needs. Currently, there is a gap in the literature examining the physiologic parameters of 18–25 year olds who identify as enrolled in an institute of higher education, and not simply receiving some college education.

This study aims to: 1) "fill the gap" by examining physiologic parameters (i.e., BMI, percentage body fat, blood serum cholesterol, systolic blood pressure, and diastolic blood pressure) among a sample of 18–25 year olds enrolled in a university; 2) segment physiologic parameters by age and gender; and 3) examine the association of "unhealthy" behavioral health practices of physical inactivity, poor diet, and overuse/abuse of licit drug use with physiologic parameters.

2. Methods

2.1. Participants

Participants were a convenience sample of 2615 college students enrolled part- or full-time in a large U.S. Midwestern University. Among the sample of 17–40 year olds, 95% were between 18 and 25 years old ($M = 20.4$; $Mdn = 20$) and 51% identified as female. Participants were Caucasian (79.3%), Black (8.3%), and "other" (12.4%).

2.2. Procedures

The study design is an observational cross-sectional design in which data were collected during spring semesters over 8 consecutive years, which made it possible to evaluate reliability of data (Black and Johnson, 2015). Additionally, the study design selection was institutionally restricted to accommodate university pedagogical training demands. Participants were recruited through posters and flyers displayed across campus. Institutional Review Board (IRB) approval was obtained before data collection.

2.3. Measures for Physiologic Parameters

2.3.1. Body mass index (BMI)

BMI for each participant was calculated by body weight (lb) and height (in.) (Centers for Disease Control and Prevention, 2015a). A Detecto Mechanical Physician's Eye Level Scale (Model #339) was used to measure weight; height was measured with the scale's metric ruler.

2.3.2. Percentage body fat (%BF)

A 3-site skinfold thicknesses assessed with Lange Skinfold Calipers (patent# 3,008,239) were used to determine %BF. Based on gender, 3-sites were measured 3 times and averaged. The chest, abdomen, and thigh were measured for males (Jackson and Pollock, 1978), and the triceps, thigh, and suprailium were measured for females (Jackson et al., 1980). The Siri formulas (Siri, 1956) were used to estimate %BF (see formulas at the bottom of Table 2).

2.3.3. Blood serum cholesterol (BSC)

BSC was assessed using the finger-stick method with a Kodak DT 60, from Ortho-Clinical Diagnostics and the Boehringer Mannheim Corporation ProAct System from Roche Diagnostics. Participants self-reported whether they fasted or not before the assessment and were asked to reschedule if they had not fasted. Cronbach alpha across independent screeners was $\alpha = 0.91$.

2.3.4. Systolic and diastolic blood pressure

Systolic and diastolic blood pressure (SBP and DBP, respectively) readings were assessed with a sphygmomanometer and stethoscope by following American Heart Association's recommended Korotkoff's sound technique (Pickering et al., 2005). Two evaluators used a training stethoscope, and each independently recorded readings. Training, based on criterion-referenced testing (VandenBos, 2007), continued until both the faculty member and each undergraduate student agreed 100% of the time. Internal consistency of the 3 measurements of BP was sufficient across the sample (Cronbach $\alpha = 0.95$).

2.4. 2.4. Behavioral measures

Thirty-two items assessing dietary and exercise habits and licit drug use were adapted from national data collection instruments (Centers for Disease Control and Prevention (CDC) and National Center for Health Statistics (NCHS), n.d.). Item stems and response options were used from the surveys to preserve the integrity of the original items. The items were separated into 5 categories: 1) age in years; 2) gender; 3) dietary habits (i.e., daily average number of servings of soft drinks, sweets, fatty meats, fast food, fish, poultry, legumes, fruits, vegetables); 4) exercise habits (i.e., type of exercise, minutes per session of exercise, and exercise sessions per week); and 5) licit drug use (i.e., tobacco use, including cigarettes, snuff, and chew and alcohol use, and drinks per day and days per week of drinking alcohol). Each item used in a behavioral health scale was scored from 1 (*best for health*) to 5 (*worst for health*) and the items comprising each scale were then averaged to produce the scale score.

2.5. 2.5. Statistical analyses

All data were analyzed using SAS Version 9.3.1 (SAS Institute, n.d.). Analyses performed were descriptive statistics, linear regression