The Physical Educator Vol. 71 • pp. 580–593 • 2014

METHODOLOGY

Health Assessment Data Collection as Part of a College Wellness Course

Laura B. Kruger, Linda D. Roeder, Kenneth D. Brubaker, Jr.

Abstract

The purpose of this investigation was to examine the comprehensive data set of health of college students regarding cardiovascular risk factors, specifically body mass index (BMI), blood pressure (BP), fasting lipid profile, and glucose and to compare results to similar studies. Results were also used to educate individual students regarding their specific risk factors for cardiovascular disease (CVD).

Two hundred twenty-five undergraduate students enrolled in a lifetime wellness core course participated in a basic health screening, which included BP, resting heart rate, height, weight, and BMI, and 136 students completed the comprehensive health assessment, which included all of the above plus fasting lipid profile (total cholesterol, LDL, HDL, triglycerides) and glucose testing. Of the participants, 110 were male and 115 were female (M_{age} = 19.67 years).

More than half of the participants in this study were classified as being overweight or obese according to their BMI calculation. A

Laura B. Kruger is the lifetime wellness coordinator and a professional instructor, Department of Health Sciences, Ashland University; Linda D. Roeder, director of student health center, Ashland University; Kenneth D. Brubaker, Jr., is an assistant professor of sports management, Department of Sport Management, Ashland University.

Linda Roeder is now a certified nurse practitioner at Cleveland Clinic Lorain Geriatrics, Ohio.

Please send author correspondence to Laura Kruger, Dwight Schar College of Nursing & Health Sciences, Ashland University, 401 College Avenue, Ashland Ohio 44805. E-mail: lkruger@ashland.edu

positive moderate linear relationship was found between BMI and age. The mean BP of the participants was 121/74, which is well within the optimal range, but 8% of the participants had elevated BP readings, placing them at risk. The mean total cholesterol level was 164 mg/dL, which falls in the optimal category. Fourteen percent, however, had total cholesterol levels greater than 200mg/dL, which indicates a risk factor for CVD. On a positive note, 63% of the participants had acceptable levels and 21% had optimal levels of HDL. Likewise, 66% of the participants had optimal LDL levels less than 100 mg/dL. Twenty-two percent had mildly elevated levels, and 12% had levels that were high enough to constitute a risk factor. Additionally, the participants were tested for diabetes, which also increases the risk of CVD. Most of the participants (99%) had normal glucose levels.

This study supports the evidence that college students have significant risk factors for CVD. Seventy-three percent of the participants were found to have at least one risk factor and 15% had multiple risk factors. The findings have important implications for future prevention and educational initiatives. Specifically, this knowledge will assist in providing effective programming and curriculum to support behavior change in college students considering the window of opportunity available at the college setting.

Entering college is an exciting time in a person's life with newfound freedoms and a multitude of new experiences. At the same time, however, there are many stressors related to new responsibilities and many life changes during this time. Unfortunately, these stressors often lead college students to make poor choices in relation to their health, increasing the likelihood they will engage in risky health behaviors (Von Ah, Ebert, Ngamvitroj, Park, & Kang, 2004). For the first time, many students are faced with the responsibility and freedom to choose what and when to eat and how and when to exercise, study, and find time for everything they must accomplish. This mixture of newfound freedoms and responsibilities makes for an excellent time to educate students regarding healthier lifestyle choices. Health behaviors formed during young adulthood are expected to have a long-term impact on health later in life (Dinger & Waigandt, 1997). When young adults are faced with making these decisions for the first time in their lives, an excellent window of opportunity exists in which to present education regarding healthy life choices.

Cardiovascular disease (CVD) is the leading cause of death in America today and, according to the National Center for Health Statistics (2012), the fifth leading cause of death among persons aged 15 to 24. Rates of obesity and diabetes mellitus (DM)—two significant risk factors for CVD—are on the rise, especially among adolescents and young adults (U.S. Department of Health and Human Services, 2010).

Body mass index (BMI) is one of the best methods to assess for overweight and obesity. BMI is calculated from a person's weight and height. Standard categories are identified for each weight status as defined by a specific BMI range. See Table 1 for standard weight categories.

Table 1
Standard Weight Status Categories Associated With BMI

BMI	Weight status
Below 18.5	Underweight
18.5–24.9	Normal
25.0–29.9	Overweight
30.0 and above	Obese

Note. Adapted from the Centers for Disease Control and Prevention, n.d.

The National College Health Assessment (NCHA), a national research survey organized by the American College Health Association (ACHA), is the largest known comprehensive data set on the health of college students. The results from the Fall 2011 ACHA (2012a) survey showed that 60.8% of the students studied had a normal BMI between 19 and 24.9 kg/m^2. However 21.6% of students had a BMI of 25 to 29.9 kg/m^2, which placed them in the overweight category, and 12.5% of students had a BMI of 30 or above, which placed them in the obesity category. The proportion of teens with diabetes or prediabetes more than doubled from 9% in 1999 to 23% in 2008, according to a summary of the National Health and Nutrition Examination Survey (NHANES) prepared by May, Kuklina, and Yoon (2012). The NHANES was used to study 3,383 adolescents aged 12 to 19 from 1998 to 2008. Prediabetes is defined by the American Diabetes Association (2012) as a fasting blood glucose between 100 and 125 mg/dL or a 2-hour oral glucose tolerance test glucose level of 140 to 199 mg/dL.

Other significant risk factors, as defined by the National Heart, Lung, and Blood Institute (2001), include elevated low-density lipoprotein (LDL) levels, low high-density lipoprotein (HDL) levels, and hypertension. According to the NHANES, 22% of adolescents had borderline high/high LDL, whereas only 6% had low HDL. Fourteen percent had prehypertension or hypertension. Prehypertension is systolic blood pressure (BP) of 120 to 139 mm Hg and/or a diastolic BP of 80 to 89 mm Hg, whereas hypertension systolic BP of 140 mm Hg or over and/or a diastolic BP of 90 mm Hg or above. The good news is that these are modifiable risk factors.

Many colleges provide health or wellness courses as a mandatory requirement for students. These courses help to meet ACHA's *Standards of Practice for Health Promotion in Higher Education*. These guidelines were revised in May 2012 to include new guiding principles, one of which is that health promotion professionals in higher education must deliver prevention initiatives. These classes provide an excellent venue for educating students regarding modifiable risk factors for CVD. By participating in health assessment screenings, students are able to identify their own modifiable risk factors directly and learn how to make appropriate lifestyle changes that may decrease these risks. The purpose of this paper was to outline results from such a health assessment screening offered through a mandatory lifetime wellness class at a mid-sized private university. In the lifetime wellness class, students were educated about the importance of "knowing your numbers" and other health behaviors for lifelong health. Therefore, this health assessment was appropriate for students as it provided personal information regarding their anthropometric measures including height, weight, BMI, and BP and resting heart rate. In addition, students were highly encouraged to participate in laboratory testing to determine their lipid levels, including total cholesterol, LDL, HDL, triglycerides, and fasting glucose.

Once the students received their results, class time was used to review the categories and outline the optimal values for each. In addition, time was spent discussing what lifestyle changes would improve each student's results. Some instructors went a step further and assigned their students to develop personal wellness goals based on the needs identified through their health assessment, a physical fitness assessment, and a family health history assignment. Students who chose to improve their lipid levels or BMI indicated appropriate lifestyle changes to reach these goals based on the education provided.

Providing such an individualized health assessment will hopefully promote healthier and better informed choices based on the students' personal information during this time of life when lifestyle changes may become lifelong behaviors (Morrell, Lofgren, Burke, & Reilly, 2012).

Methods

Participants

The sample included 110 male and 115 female undergraduate students from a lifetime wellness core course at a mid-sized university in the Midwest. As part of the course, students participated in a basic or comprehensive health assessment to become aware of their baseline levels. The researchers analyzed the data from the students who volunteered to participate in either of the health assessments during the spring 2012 semester. The mean age of the participants was 19.67 years; approximately 93% were between ages 18 and 22.

Trained health care professionals conducted the basic and comprehensive health assessments in the student health center at the university. The basic health assessment included identifying each participant's BP, resting heart rate, height, weight, and BMI. Students also had the option of choosing the comprehensive health assessment, which included identifying items in the basic health assessment along with a blood draw to identify their lipid levels (total cholesterol, HDL, LDL, triglycerides) and blood glucose. This required students to participate in a 12-hour fast beforehand. The sample of blood was taken from an arm vein. The sample was spun to separate the serum and was then sent to Quest Laboratories for analysis. Results were returned to the student health center in approximately 24 hours.

Procedures

Participating in the health assessment is required for the course for students to establish a baseline of health information. The nominal cost for this testing is included in the course fee. Students could choose to complete the basic or comprehensive health assessment.

Students reported to the student health center during the week their course section was assigned. The student health center allocated time two mornings each week to complete health assessments. Students were given a copy of their results and were encouraged to bring them to class, where a discussion of normal versus abnormal levels was held. Lifestyle changes that may improve these levels

were also discussed during class. The human subject review board of the university approved the study.

Data Analysis

Descriptive data were used to determine how many participants had a high BMI, BP, and total cholesterol. Descriptive data were also used to determine participants' LDL and HDL levels. Furthermore, *t* tests were used to make gender comparisons regarding BMI, BP, total cholesterol, LDL, and HDL levels. Last, correlations were used to describe the relationships among BMI, BP, total cholesterol, and LDL levels.

Results

Of the 225 participants, 89 (40%) participated in the basic health assessment and 136 (60%) participated in the comprehensive health assessment, which included fasting lipid profile and glucose testing. Subcategories included athletic status, age, and gender. See Figure 1 for a comparison of students by population.

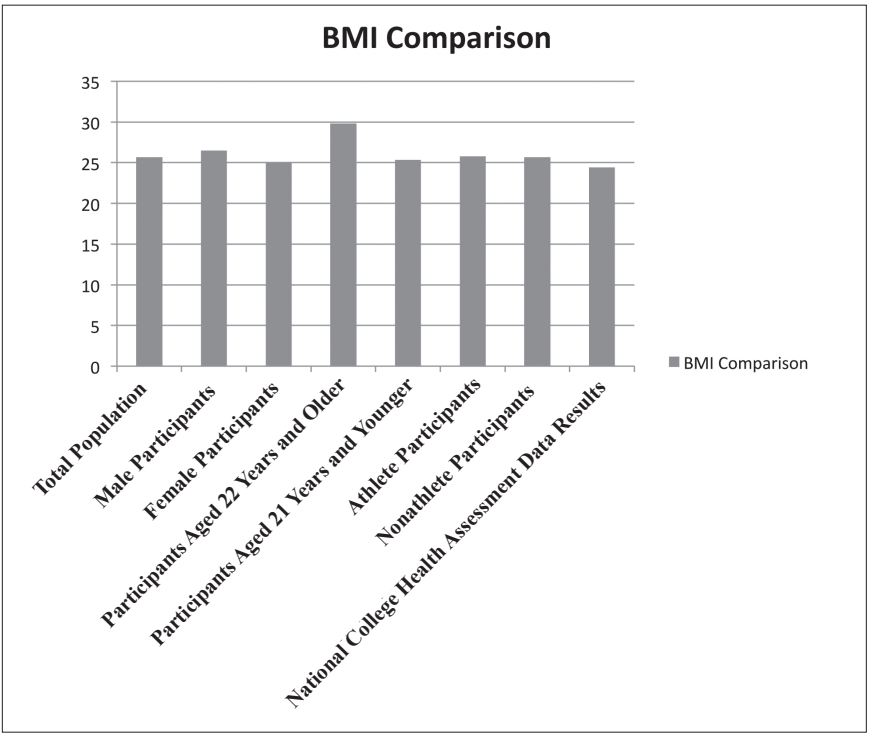

Figure 1. BMI comparison of undergraduate college students by population.

In this study, the researchers reviewed the BMI differences among the segmented populations, which included males, females, athletes, nonathletes, participants aged 21 years and younger, and participants aged 22 and older. The mean BMI among the population was 25.7 kg/m^2, which is considered overweight according to the Centers for Disease Control and Prevention (n.d.). The population with the highest BMI was aged 22 years and older (23 students) with a BMI of 29.8 kg/m^2. Among the participants, 51.6% were classified as overweight or obese and 47% were considered normal.

The mean BP among the participants was 121/74. Females had a mean BP of 117/74, and males had a mean BP of 123/73. Athletes had a lower diastolic mean of 70 mm Hg compared to a mean of 74 mm Hg in nonathletes. Six percent (13) of the participants had a systolic BP higher than 140, whereas only 2% (5) had a diastolic BP higher than 90. Only one of the numbers must be elevated to be considered high BP, so 8% (18) of individuals had elevated BP readings. Only four participants had elevated systolic and diastolic BP.

The mean total cholesterol level of the participants was 164 mg/dL. Fourteen percent of the participants had an elevated total cholesterol level over 200 mg/dL. The HDL mean was 51 mg/dL, with 63% of the participants having acceptable levels ranging from 41 to 59 mg/dL. Descriptive statistics from the study are shown in Table 2. Optimal HDL levels of 60 mg/dL and greater were found in 21% of the participants, whereas 15% had levels below the optimal level of 40 mg/dL. Men had a mean HDL level of 46 mg/dL, which was the lowest among the subcategories of participants, whereas women had a mean of 56 mg/dL. The HDL mean for athletes was 52.6 mg/dL, whereas the HDL mean for nonathletes was 51 mg/dL. Classifications are shown in Table 3 (National Cholesterol Education Program).

Among LDL levels, the mean was 93 mg/dL, whereas 13% of students aged 22 years and older had a mean LDL level of 99 mg/dL, which was the highest among all groups. Sixty-six percent showed optimal LDL levels of less than 100 mg/dL, whereas 22% had mildly elevated levels between 100 and 128 mg/dL, and 12% had elevated levels between 130 and 152 mg/dL.

The mean triglyceride level for all students was 98 mg/dL. Athletes had the lowest mean level (81.5 mg/dL) among all subcategories, and men had the highest mean level of 109 mg/dL. Eleven percent of participants (15) had elevated triglyceride levels over 150.

Table 2
Descriptive Statistics From This Study

Screening tests	*N*	Range	Minimum	Maximum	*M*	Std. Error	*SD*
Height (in.)	225	21.00	58.00	79.00	67.2933	.27684	4.15258
Weight (lb)	225	239.00	88.00	327.00	169.0842	2.90759	43.61390
BMI	225	32.00	15.00	47.00	25.7911	.37789	5.66836
HDL (mg/dL)	136	84	27	111	51.43	1.103	12.860
LDL (mg/dL)	136	114	38	152	93.26	2.199	25.649
Triglyceride (mg/dL)	136	285	38	323	98.46	3.758	43.822
Cholesterol (mg/dL)	136	142	97	239	164.38	2.714	31.645
Systolic (mm Hg)	225	62	89	151	120.57	.792	11.876
Diastolic (mm Hg)	225	56	44	100	73.70	.580	8.701
Valid *N* (listwise)	136						

Note. HDL = high-density lipoproteins; LDL = low-density lipoproteins.

Table 3
Explanation of Lipid Level Classification

LDL Cholesterol	
> 100	Optimal
100–129	Near optimal/above optimal
130–159	Borderline high
160–189	High
> 190	Very high
Total Cholesterol	
< 200	Optimal
200–239	Borderline high
> 240	High
HDL Cholesterol	
< 40	Low
> 60	High
Triglycerides	
< 150	Normal
150–199	Borderline high
200–499	High
> 500	Very high

Note. Adapted from the National Heart, Lung, and Blood Institute (2001).

The final measurement of the comprehensive health assessment was the fasting glucose level, with a mean of 84 mg/dL. Ninety-nine percent of the participants had normal fasting glucose levels below 100 mg/dL.

Discussion

Results of this study have provided information to guide teachers in future curriculum planning to best serve students based on their needs and health status. This study has also proven the value of continuing to offer a wellness course at the university level to address students' health needs. Based on the data, health assessments will continue to be a part of this course in the future.

The majority of the participants had identifiable risk factors for CVD. Seventy-three (72.8%) percent of students who completed the comprehensive health assessment had at least one risk factor. Risk factors included BMI, elevated BP, elevated total cholesterol and LDL, and low HDL. Fifteen percent had multiple risk factors.

The most interesting finding was that many of the participants were overweight or obese. The mean weight for the population was 169.08 lb and the mean BMI was 25.7 kg/m^2 , which is overweight. In comparison, the NCHA results from spring of 2012 indicated a mean weight of 156.34 lb with a mean BMI of 24.41 kg/m^2, which is considered normal weight (see Table 1). These findings are not surprising considering the growing epidemic of obesity in the news on a daily basis. It is important for college students to identify obesity as a risk factor for CVD and to learn what they can do to achieve a healthier weight. Overall, 51% of the participants in this study were overweight or obese. A positive moderate linear relationship was found between BMI and age (r = .182, p = .006). Students aged 22 and older had the highest mean BMI of 29.8 kg/m^2. BMI categories are described in Figure 1.

Morrell et al. (2012), in their study of college-aged students, found that the highest prevalence (47%) of overweight and obese students was in the male population. The results of this study were similar, with 61% of males being overweight or obese and 43% of females being overweight or obese. The male participants' BMI mean score of 26.55 is statistically significantly higher than the female participants' BMI mean score of 25.06 (p = .048). See Figure 1.

BP is another important risk factor for CVD. In this study, BP results were mostly within normal limits with an overall mean well within the normal range. Notably, athletes had a significantly lower diastolic BP than nonathletes. Fagard (2006) concluded in his meta-analysis that BP decreases with endurance training. Whether this is due to the benefits of regular physical exercise alone or if differences in nutrition also exist would be a topic for further investigation. A moderate positive linear correlation was found in the current study between elevated BMI and higher BP results (p = .0001).

Abnormal lipid levels account for significant risks for CVD. Only 16.9% of the population studied had abnormal total cholesterol over 200, 17% had suboptimal HDL levels, 38% had abnormal LDL levels, and 11% had abnormal triglycerides. Males had the highest mean total cholesterol of 164.9 mg/dL and the highest mean triglyceride level of 109mg/dL, both of which are optimal. These differences are not statistically significant compared to the results for the females. However, a statistically significant difference was found between the HDL mean scores for males and females. The HDL mean score for females of 56.04 is statistically significantly better

than the HDL mean score for males of 46.10 (p = .0001). Bowden et al. (2005) also found higher HDL levels among females.

Athletes had the healthiest results with a mean total cholesterol of 161.7 mg/dL, a mean HDL at 52.6 mg/dL, and a mean triglyceride level of 81.5 mg/dL. However, no statistical significance was found between athletes and nonathletes regarding lipid level results. These results are consistent with the findings of Koc (2011) .

Overall, 73% of the participants had at least one risk factor for CVD, whereas 15% had two or more risk factors. The most common risk factor in this population was overweight or obesity with 51%; the next was elevated LDL, with 34% of the population having an LDL of 100 mg/dL or greater. The least common risk factor was elevated triglycerides. The findings of this study correlate with the findings of Bowden et al. (2005), Koc (2011), and Morrell et al. (2012).

Limitations

This observational study has a number of limitations. Limited demographic information was obtained. Data were gathered from a convenience sample at a mid-sized university and therefore does not represent much diversity as far as race or ethnic backgrounds.

Using BMI as a measure of obesity has limitations. BMI may be skewed, especially in athletes. With a higher percentage of muscle compared to body fat, athletes tend to weigh more than nonathletes. This difference in weight may not reflect obesity, rather increased muscle mass.

Although BMI is not an ideal measure, it is the most common measurement to determine obesity. A more important anthropometric measurement recommended when screening for CVD risk is waist circumference. Waist circumference specifically predicts obesity-related health risk. According to Janssen, Katzmarzyk, and Ross (2004), using BMI and waist circumference together would predict a greater variance in health risk than BMI alone. For this study, the researchers did not have access to waist circumference to include in the data. This would be an important addition to future studies.

Another limitation to using BMI is that the adult table was used to determine BMI for all participants. The Centers for Disease Control and Prevention (n.d.) recommends using their BMI-for-age growth chart on teens through age 19. This chart takes account of higher body fat ratios for females compared to males.

When BMI was excluded because of its inherent limitations, only 40% of the participants were determined to have risk factors. However, if BMI were not used, another measurement of obesity such as waist circumference would be used and some students presumably would still be classified as obese.

Another limitation to this study was that students were not asked to identify current chronic illnesses such as diabetes or hyperlipidemia. One student had a preexisting diagnosis of type 1 diabetes and had the only abnormal fasting glucose level in this study. It is possible as well that one or more students may have already had a diagnosis of hypertension or abnormal lipids, which may have skewed the results. Finally, in this study, the researchers did not consider nutritional habits or amount of daily exercise.

Conclusions and Recommendations

This study supports the evidence that college students have significant risk factors for CVD. This study provides excellent information to share with future students regarding prevalent risk factors for their age group and the importance to screen college students for these chronic disease risk factors. It will also help professionals change curricula toward future prevention and educational initiatives for students.

Knowing that college is a great time to implement new habits, faculty at the university studied will continue to offer health assessments to students in this course. Ideally, students having their own personal numbers as well as education regarding risk factors and methods to decrease these risks will provide motivation for a healthy change. Based on student testimonials, some students have experienced changes in their awareness of their health and their behaviors. However, in the future, researchers should analyze participants pre- and postlearning of lipid and other biometric levels and identify how they will use this data from the health assessment. Thus, a short survey would be included to discover whether students changed their behavior based on the feedback of the health assessment.

Another idea for future researchers would be to assess the results from students' participation in fitness assessments, which are also offered during the lifetime wellness class. Fitness assessments assess the students' cardiorespiratory health, muscular endurance, flexibility, waist-to-hip ratio, and body fat percentage, among other assessments. The data from the fitness assessments would complement the data gathered from health assessments by providing more

specific risk factors and more direction in guiding course curriculum appropriate to students' needs.

Other important longitudinal data could be gleaned from repeating this study with future students every 2 to 3 years or possibly following up with these same students in 2 to 3 years to repeat the research and determine whether significant changes have occurred as a result of their education, awareness, and behavior change.

References

American College Health Association. (2012a). *American College Health Association National College Health Assessment II Fall 2011: Undergraduate students* (Reference group executive summary). Retrieved from http://www.acha-ncha.org/docs/ACHA-NCHA-II_UNDERGRAD_ReferenceGroup_ExecutiveSummary_Spring2012.pdf

American College Health Association. (2012b). *Standards of practice for health promotion in higher education* (3rd ed.). Retrieved from http://www.acha.org/Publications/docs/Standards_of_Practice_for_Health_Promotion_in_Higher_Education_May2012.pdf

American Diabetes Association. (2012). Standards of medical care in diabetes – 2012. *Diabetes Care, 35*(Suppl. 1), S11–S63.

Bowden, R. G., Lanning, B. A., Doyle, E. I., Johnston, H. M., Slonaker, B., & Scanes, G. (2005). Lipid levels in a cohort of sedentary university students. *Internet Journal of Cardiovascular Research, 2*(2), 5.

Centers for Disease Control and Prevention. (n.d.). About BMI for adults. Retrieved from http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html

Dinger, M. K., & Waigandt, A. (1997). Dietary intake and physical activity behaviors of male and female college students. *American Journal of Health Promotion, 11*(5), 360–362.

Fagard, R. H. (2006). Exercise is good for your blood pressure: Effects of endurance training and resistance training. *Clinical & Experimental Pharmacology & Physiology, 33*(9), 853–856.

Janssen, I., Katzmarzyk, P. T., & Ross, R. (2004). Waist circumference and not body mass index explains obesity-related health risk. *The American Journal of Clinical Nutrition, 79*, 379–384.

Koc, H. (2011). The comparison of blood lipid levels of athletes and sedentary college students. *Pakistan Journal of Medical Sciences, 27*(3), 622–625.

May, A. L., Kuklina, E. V., & Yoon, P. W. (2012). Prevalence of cardiovascular disease risk factors among US adolescents, 1998–2008. *Pediatrics, 129*(6), 1035–1041. doi:10.1542/peds.2011-1082

Morrell, J. S., Lofgren, I. E., Burke, J. D., & Reilly, R. A. (2012). Metabolic syndrome, obesity and related risk factors among college men and women. *Journal of American College Health, 60*(1), 82–89.

National Center for Health Statistics. (2000). Health data interactive. Retrieved from www.cdc.gov/nchs/hdi.htm

National Heart, Lung, and Blood Institute. (2001). Adult treatment panel III. Retrieved from http://www.nhlbi.nih.gov/guidelines/cholesterol/

U.S. Department of Health and Human Services. (2010). *Final review, Healthy People 2010: Nutrition and overweight, 2010*. Retrieved from http://www.cdc.gov/nchs/data/hpdata2010/hp2010_final_review_focus_area_19.pdf

Von Ah, D., Ebert, S., Ngamvitroj, A., Park, N., & Kang, D. (2004). Predictors of health behaviours in college students. *Journal of Advanced Nursing, 48*(5), 463–474. doi:10.1111/j.1365-2648.2004.03229.x