Measuring Environmental Health Perception Among College Students

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Abstract

One's knowledge, perception, and attitude are fundamental in determining how one behaves regarding environmental hazards. While science has made great strides in promoting environmental health, threats still exist, largely due to individual actions in response to potential health hazards. Undergraduate students ($n = 395$) enrolled in an introductory Health Education course participated in an environmental health awareness survey examining knowledge, attitudes, and behaviors. Results indicated that there was a general lack of knowledge among participants about environmental health-related issues. In addition, it was determined that males were more likely to have positive attitudes towards issues relating to air quality and the green environment. Further analyses revealed that there was a significant relationship between age and attitudes toward issues dealing with sustainability. In addition, race/ethnicity predicted attitudes toward water quality and recycling behaviors. While students typically possessed positive attitudes toward environmental health, they engaged in non-eco-friendly behaviors. Because knowledge influences a person's attitude, and ultimately behavior, continued efforts in environmental health education should be refined.

Introduction

The environment in which people live exposes them to various health risks including air pollution, contaminated water, lead, and mercury. Environmental health involves evaluating how these negative exposures affect human health and well-being and determining ways to control or eliminate those hazards. Over the years, technology has assisted in advancing environmental health. For instance, technology has expanded methodologies for ascertaining toxicity and removing hazardous substances such as lead from homes, gasoline, and water supplies. Despite these advances, threats from environmental hazards persist as a result of human behavior, including how individuals respond to those threats.

Tempte and McCall (2001) argue that individual level awareness of and concern for environmental hazards is lacking. An individual's level of knowledge about environmental health hazards influences how he or she perceives the level of risk associated with exposure (Johnson, 1993). Individual knowledge regarding health risks is known to profoundly influence risk perception which, in turn, affects a person's attitude. Thus, an individual's knowledge, perception, and attitude are fundamental in determining how that person behaves regarding environmental hazards.

Studies by Flynn, Slovic, and Mertz (1994) and Willis, DeKay, Fischhoff, and Morgan (2005) have suggested that there are six key variables that influence how individuals perceive environmental health hazards. These include the impact the ecological issue generally has on human health, whether the issue can be controlled or corrected, the benefits or negative connotations associated with the risk, how the individual is directly affected, the degree of knowledge the individual has about the issue, and whether or not there are any aesthetic impacts.

According to the Health Belief Model (Rosenstock, 1974), the primary determinants of behavior are whether individuals perceive a threat, how severe they perceive the threat to be, how they value the benefits from changing behavior, what barriers or negative implications they associate with the behavior change, and whether they have the efficacy to change their behavior. Jianguang (1992) suggested that individual perceptions of environmental risks also differ greatly by gender, cultural background, and age. That study showed that regardless of what influences a person's viewpoint, individuals know very little about environmental health risks and do not believe that these risks pertain to them. Likewise, Flynn et al. (1994), found that gender and ethnicity played critical roles in predicting behavior in the sample Americans. For example, women were more likely to state that health hazards carry a high degree of risk. Additionally, Non-Whites were over-represented in areas where waste disposal sites and air pollution predominated.

Leventhal (1973) suggested that knowledge is the only true driving force behind an individual's desire or intention to perform a specific behavior. However, according to the Theory of Planned Behavior, intentions are shaped by attitudes and subjective norms regarding the issue, which then influence individual behavior (Ajzen, 1985). The theoretical implications point to a strong need for interventions that not only educate the general public about which environmental risks exist, but also that stress the fact that everyone who is

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exposed to the hazards is indeed susceptible. Such pointed education could facilitate knowledge and perceptions leading to behavior change.

A literature review found limited research applying Leventhal's and Ajzen's theories to environmental health issues. Therefore, the purpose of this study was to assess college undergraduate students' current level of knowledge, attitudes, and associated behaviors with respect to environmental health. Findings could help researchers determine whether individual knowledge of environmental health has an influence on their health-related beliefs, attitudes, and behaviors.

Methods

Survey Developmental Factors

Content.

The survey instrument consisting of 36 items was designed to measure knowledge, attitudes, and behaviors of students in order to better understand how well issues pertaining to environmental health are understood by college-age individuals. Core survey question areas were selected based on a literature review of articles from federal and academic sources, including the Centers for Disease Control and Prevention (CDC).

The survey was a combination of demographic questions, knowledge, belief/attitude, and behavior questions regarding environmental health concepts. Eleven knowledge questions were in multiple-choice format and reflected core areas of environmental health (air pollution, water quality, food safety, toxic chemicals, etc.). Beliefs and attitudes were measured using 11 Likert-type scales ranging from 1 (*strongly disagree*) to 4 (*strongly agree*), and 14 behavior questions utilized a 4-point Likert-type scale ranging from 1 (*not at all*) to 4 (*always*) measuring the specific behaviors. Readability for each section was assessed using an online test reporting the Simplified Measure of Gobbledygoop (SMOG) score (Online-Utility.org, 2011). The SMOG score for the demographic section was 8.9, knowledge scored 13.4, attitude scored 8.3, and behavior was 8.1. Content validity was established by a literature review and was corroborated by experts in the field of environmental health through modified Delphi rounds (Ratnapradipa, Brown & Wodika, 2011) to ensure the questions pertained to the core areas.

Demographic information.

Demographic information consisted of gender, race/ethnicity, home-town county and state, year in school, age, and international student status. Utilizing demographics such as gender and age can assist in the prediction of beliefs, behaviors, and knowledge regarding the field of environmental health (Dunlap & Van Liere, 1978; Scott and Willits, 1994). Additionally, targeting age as a demographic variable can attest to the levels of certain beliefs and attitudes

in regards to environmental health (Corral-Verdugo, Bechtel & Fraigo-Sing, 2003).

Survey Distribution

Institutional Review Board approval was obtained before research was conducted. Researchers contacted the instructors of 22 sections of a Foundations of Human Health course at a large Midwestern university to explain the study and schedule appropriate times for students to complete the survey. During one week of the Spring 2010 semester, researchers visited the classrooms of all 22 sections where they informed the students of the study and informed students that they did not have to complete the survey and would not be penalized for partially completed or non-completed surveys. Researchers distributed surveys to students and instructed participants to turn over their survey and raise their hand when they were finished. The qualifications for completing this survey were that students be able to read English and be at least 18 years old. Participation in the survey was voluntary, and they survey took approximately 15 minutes to complete.

Sample

Participants consisted of 395 undergraduate students at a large Midwest university. Survey results from the 22 sections were aggregated for statistical analysis. The average age was 19.59 years. Table 1 provides a breakdown of participants according to race/ethnicity and year in school by gender. Most of those who completed the survey were female (54.2%, $n = 214$) and were in their freshman year (62.5%, $n = 246$). In addition, there were several different racial/ethnic groups that were represented within the population. The majority of the participants were White (54.2%, $n = 214$) and Black (29.9%, $n = 117$). Hispanics ($n = 28$) represented 7.1% of respondents and 4.6% of respondents marked multiple categories ($n = 18$). Other groups included Asian (2.8%, $n = 11$), Pacific Islander (0.5%, $n = 2$) and Native American (0.5%, $n = 2$).

Statistical Analyses

Factor analysis.

A factor analysis was performed to determine whether items fit into categories. From the factor analysis three belief/attitude subscales were created that assessed the participants' beliefs/attitudes toward environmental health. The first subscale was titled "Healthy Home and Planning." The Cronbach's Alpha for this subscale was 0.733. It contained the following statements: "I believe that secondhand smoke is hazardous to an individual's health;" "I think mold can cause health problems;" "The government should provide incentives for 'Green' practices;" "It should be illegal to smoke around children;" "I believe an improperly functioning furnace can lead to health problems;" "Every family should have an emergency plan;" and "Every individual should have a 72-hour disaster supplies kit easily available."

Table 1

Participant Demographic Characteristics by Gender

Race/Ethnicity	Gender		Total (n = 392*)
	Male	Female	
White	109 (27.8%)	105 (26.8%)	214 (54.6%)
Black	39 (9.9%)	78 (19.9%)	117 (29.8%)
Hispanic	14 (3.6%)	14 (3.6%)	28 (7.1%)
Multi-racial	7 (1.8%)	11 (2.8%)	18 (4.6%)
Asian	9 (2.3%)	2 (0.5%)	11 (2.8%)
Pacific Islander	0	2 (0.5%)	2 (0.5%)
Native American	1 (0.3%)	1 (0.3%)	2 (0.5%)
College Grade Level	Gender		Total (n = 393*)
	Male	Female	
Freshman	104 (26.5%)	142 (36.1%)	246 (62.6%)
Sophomore	40 (10.2%)	32 (8.1%)	72 (18.3%)
Junior	21 (5.3%)	22 (5.6%)	43 (10.9%)
Senior	14 (3.6%)	18 (2.5%)	32 (8.1%)

Note. *Not all participants provided demographic information. Male (N = 179). Female (N = 213). Gender not reported (N = 2).

The second subscale was titled "Sustainability." The Cronbach's Alpha for this subscale was 0.706. It was comprised of the following statements: "Environmental health issues affect me and/or my family;" "Global climate change caused by carbon dioxide (CO_2) affects me and/or my family;" and "I think recycling has health benefits."

The third subscale was titled "Water Quality." The Cronbach's Alpha for this subscale was low at 0.514. It contained the following statements: "Tap water is safe to drink" and "Bottled water is safe to drink."

Four behavior subscales were created in order to gain a better understanding of the current practices of college-age adults. The first behavior subscale was labeled "Personal-Level Issues." The Cronbach's Alpha for this subscale was 0.814. It contained the following statements: "I eat fish more than twice a month;" "I use a thermometer to check to internal temperature when cooking meat;" "I use ear protection when around loud noises, such as while using a lawn mower;" "I use a 're-usable' bag when I buy groceries;" "I check or rotate my emergency supplies;" "I use hands-free listening devices when using a cellular phone;" "I use 'natural' (compost, manure) fertilizer instead of 'chemical' fertilizers;" "I check the batteries on my carbon monoxide detector and/or smoke alarm;" and "I recycle batteries."

The second subscale was labeled "Food Consumption Practices and Noise Pollution." The Cronbach's Alpha for this subscale was 0.648. It contained the following statements: "I check the expiration date before consuming food;" "I use head phones or hands-free listening devices when listening to music;" and "I wash fruits and/or vegetables before eating."

The third subscale was labeled "Everyday Recycling." The Cronbach's Alpha for this subscale was 0.696. It contained the following statements: "I recycle bottles and cans" and "I recycle my newspapers and other paper products."

The fourth subscale was labeled "Exercise." The Cronbach's Alpha for this subscale was 0.604. It contained the following statements: "In the past month, I performed exercise in which my heart rate was elevated for 20 minutes or more" and "I exercise outdoors."

Other analyses.

Before running correlation analyses for knowledge questions, answers were reverse-coded "correct" (1) or "incorrect" (0) in order to obtain a total knowledge score. Bi-variate correlations were used to determine if there was a relationship between demographic variables, the subscales addressing attitude toward environmental health issues, the subscales addressing behavior with regard to those issues, and environmental health knowledge. An independent T-test was used to compare the total knowledge between genders with significance established at $p < 0.05$. A one-way ANOVA was used to compare race/ethnicity classifications and total knowledge score with a $p < 0.05$ level of significance. Multiple linear regression analysis was used to establish which of the predictor variables contributed to the greatest variance in the attitude and behavior subscales at the $p < 0.05$ significance level. All analyses were performed using SPSS for Windows Version 17.0 statistical software (SPSS Inc., Chicago IL).

Results

Knowledge

Only four of the knowledge questions were correctly answered by the majority of the participants. Table 2 provides a list of the knowledge questions and the total percentage of students who correctly answered the question, as well as a breakdown of correct responses by gender. Averages for each knowledge question remained similar for both genders, with no significance demonstrated in an independent T-test. This assessment indicated that approximately 82% ($n = 322$) of the students surveyed displayed knowledge that handwashing is the easiest way to avoid becoming ill.

Approximately 74% ($n = 291$) of participants knew the most common means of solid waste disposal in the United States (landfill). Analyses also revealed that there was a difference among racial/ethnic groups and whether they selected the correct answer. Significantly more Whites (86.4%, $n = 184$) were able to correctly recognize landfill as being the most frequently used manner in which solid waste is disposed when compared to those that identified themselves as being Black (55.6%, $n = 65$).

Likewise, most students (73.7%, $n = 289$) knew which factors contribute to the production of greenhouse gases in the United States. When compared to individuals that identified themselves as being Black (60.2%, $n = 71$), significantly more Whites (80.8%, $n = 173$) and Hispanics (78.6%, $n = 22$) were able to correctly recognize which factors contribute to the production of greenhouse gasses in the United States.

More than half of the respondents (59.8%, $n = 235$) knew the common triggers for asthma. Results also indicated that there was a difference among race/ethnic groups. Significantly more Whites (64.5%, $n = 138$) knew the common triggers for asthma when compared to participants who identified themselves as being Black (50.8%, $n = 60$).

A significant yet weak positive correlation between total knowledge and age was observed ($r = 0.196$, $p = 0.0001$). A highly significant one-way ANOVA ($F = 12.195$, $p = 0.0001$) of the total knowledge score and race/ethnicity was

Table 2

Correct Responses to Knowledge Questions Reported by Gender

Knowledge question	Correct response by gender		Overall correct recponses
	Male ($n = 179$)	Female ($n = 214$)	
In the U.S., the most frequent means of disposing solid waste is:	138 (77%)	153 (71%)	291 (73.9%)
Improper sewage treatment can cause:	23 (13%)	27 (13%)	50 (12.9%)
To prevent the possibility of food-borne illness, chicken should be cooked until it reaches an internal temperature of:	45 (25%)	51 (24%)	96 (24.6%)
The number one risk factor for lung cancer among non-smokers is:	15 (8%)	6 (3%)	21 (5.3%)
Which of the following contributes to the greenhouse gas effect:	131 (73%)	158 (74%)	289 (73.2%)
The easiest and most effective way to avoid becoming ill is:	148 (83%)	174 (81%)	322 (81.8%)
Triggers for asthma can include:	105 (59%)	130 (61%)	235 (59.5%)
Hearing loss begins after long exposure (more than 8 hours a day) to sound at which level:	32 (18%)	39 (18%)	71 (18%)
Potential sources of mercury including which of the following:	73 (41%)	79 (37%)	152 (39%)
Potential sources of radiation exposure include which of the following:	54 (30%)	65 (30%)	119 (30.1%)
Integrated pest management utilizes:	18 (10%)	10 (5%)	28 (7.3%)

determined with Whites having a higher knowledge score ($M = 4.7$) than Blacks ($M = 3.4$).

Attitudes

Three subscales evaluating student attitudes toward environmental health issues were analyzed: Healthy Home and Planning, Sustainability, and Water Quality. Results indicated that knowledge of environmental health issues predicted whether or not a person displayed a favorable attitude toward those issues. Demographic variables were also determined to be significantly associated with the three attitude subscales.

Table 3 illustrates how demographic variables (gender and race/ethnicity) were associated with each attitude subscale. A positive correlation of total knowledge and attitude subscales determined a significant difference between knowledge and the third subscale, Water Quality ($r = -0.115$, $p = 0.025$). Regression analyses determined gender to predict attitudes regarding Healthy Home and Planning ($F(1,375) = 8.867$, $p = 0.003$, $r^2 = 0.023$). Compared to females ($M = 11.4$), males ($M = 12.3$) were more likely to express favorable attitudes towards issues related to Healthy Home and Planning. Race/ethnicity was a significant predictor of Sustainability attitudes ($F(1,375) = 5.413$, $p = 0.005$, $r^2 = 0.028$). Native American participants ($M = 12.5$) had the highest average sustainability attitude score followed by Hispanic ($M = 12.1$), Whites ($M = 11.9$) and Blacks ($M = 11.5$). Both gender and race/ethnicity were found to be significant predictors of Water Quality attitudes ($F(2,374) = 6.406$, $p = 0.002$, $r^2 = 0.182$).

Behaviors

To determine how individuals behave when it comes to reducing risks associated with environmental health, four subscales evaluating student behaviors toward environmental health issues were analyzed: Personal-Level Issues, Food Consumption Practices and Noise Pollution, Everyday Recycling, and Exercise. Results indicated that a person's attitude did predict whether a person engaged in behaviors that would reduce or eliminate the risk associated with environmental health issues. Also, there were knowledge and demographic variables that were determined to be significantly associated with two behavior subscales: Food Consumption Practices and Noise Pollution, and Everyday Recycling.

There was a significant but weak negative correlation between the Healthy Home and Planning attitude subscale and the Food Consumption Practices and Noise Pollution behavior subscale ($r = -0.145$, $p = 0.005$). No other variables were significantly associated with behaviors relating to food consumption practices.

Table 4 displays the results of regression analysis of demographics variables associated with behavior subscales. Regression analyses revealed that gender significantly predicted an individual's food consumption practices and behaviors regarding noise pollution ($F(1, 364) = 10.583$, $p = 0.001$, $r^2 = 0.028$). Females had slightly higher environmentally friendly behaviors towards food consumption practices ($M = 8.99$) as opposed to males ($M = 8.07$). Also, it was determined that race/ethnicity significantly predicted if a person recycled everyday items ($F(1, 386) = 7.910$, $p = 0.037$, $r^2 = 0.018$). Pacific Islander participants were more likely to recycle ($M = 6.00$), followed by Whites ($M = 5.04$), Hispanic and Asian Americans ($M = 4.70$), Native Americans ($M = 4.50$) and Blacks ($M = 4.22$). These results are strongest for Whites, Blacks, and Hispanics, however, due to the small proportion of the sample from the other racial/ethnic groups.

Discussion

The current study was performed on an exploratory basis to assess undergraduate knowledge, attitudes, and behaviors with respect to environmental health. The overall results of this study reveal that most of the participants lacked basic knowledge about environmental health. The majority of

Table 3

Associations between Demographic Variables and Attitudes

Demographic variable	Association	Attitude subscale	r^2	F	P
Male	More favorable attitude towards	Healthy Home and Planning	0.023	8.867*	0.003***
Race/ethnicity	Predicts	Sustainability	0.028	5.413*	0.005***
Gender & race/ethnicity	Predicts	Water Quality	0.182	6.406**	0.002***

Note. $n = 395$.
*$df = 1, 375$. **$df = 2,374$.
*** Statistically significant at $p < 0.05$.

Table 4

Association Between Demographic Characteristics and Behavior Subscales

Demographic variable	Association	Behavior subscale	r^2	F	P
Female	More favorable behavior towards	Food Consumption Practices and Noise Pollution	0.028	10.53*	0.001***
Race/ethnicity	Predicted	Everyday Recycling	0.018	7.910**	0.037***

Note. n = 395.
**df* = 1, 364. ***df* = 1, 386.
*** Statistically significant at *p* < 0.05.

respondents were in their freshman year of college at the time of this survey. This suggests that either more emphasis needs to be placed on environmental health in high school curricula or the topic needs to be introduced during the freshman year of college. Another possibility is that this study measured students too soon; perhaps students have adequate environmental health knowledge by graduation. This study did not have enough seniors to analyze this aspect, so further research in this area is needed.

There have been several studies conducted on the effectiveness of hand washing in preventing illness (Porzig-Drummond, Stevenson, Case, & Oaten, 2009; White et al., 2003; White, Shinder, Shinder, & Dyer, 2001). As a result of these investigations, reminders to help prevent the spread of disease by washing one's hands can be seen almost everywhere you look, including public restrooms, television commercials, and the internet. These public awareness campaigns may contribute to most students knowing that hand washing is the easiest and most effective way to avoid becoming ill.

Within the last decade, there has been an increase in the media attention given to environmental issues and reducing one's carbon footprint. Many individuals have adopted greener practices in an effort to forestall the decline of the environment. This can also be seen in public school classrooms across America as schools have added environmental education to their curricula (Smith, Rechenberg, Cruey, Magness, & Sandman, 1997). These factors may contribute to the majority of participants in this survey knowing that landfill was the most common means of solid waste disposal utilized in the United States.

Similarly, increased coverage of climate change and global warming has made nearly everyone familiar with the term greenhouse gases. While there may have been conflicting stories about the extent of the effect these gases have on the environment, most would agree that anthropogenic, or human-caused, activities play a major role in the increase in greenhouse gas emissions. Accordingly, the sources of greenhouse gases have also become widely known (Bostrom, Morgan, Fischhoff, & Read, 1994; Boykoff & Boykoff, 2004). It is believed that most of the individuals

who participated in the current study have been exposed to information regarding greenhouse gases and the source of such gases, either through local television programming or through radio, newspaper, or other media. Therefore, knowledge of the factors that contribute to increased greenhouse gas production may be considered common knowledge among the young adult population.

It is thought that knowledge of environmental health risks is a key factor in determining whether or not an individual is concerned about these issues and whether he or she perceives exposure to be hazardous (Johnson, 1993; Tempte & McCall, 2001). However, in the current study, knowledge of the environmental health risks that were analyzed was not observed to be an indicator of a positive attitude toward these issues. In fact, analysis of attitudes toward environmental health issues showed that, overall, most individuals surveyed had a positive attitude toward environmental health issues regardless of their current knowledge level. Part of the explanation for this may be that having a positive attitude toward many environmental issues has become a socially acceptable position to take.

Because a person's attitude is important in forming how he or she behaves (Ajzen, 1985), it would stand to reason that if an individual had a positive attitude toward environmental issues then he or she would also behave in a positive manner regarding those hazards and concerns. However, in the current study, there was not a direct relationship between a person's attitude and his or her behavior regarding avoidance of environmental hazards. This could be a direct result of a lack of understanding regarding environmental health risks; and as Leventhal (1973) pointed out, knowledge is directly related to specific behaviors. Unfortunately, the current study suggests that the majority of college students do not engage in eco-friendly behaviors. It could also be that the attitudes measured did not exactly match the behaviors measured in the survey. Perhaps each behavior must be specifically compared to a corresponding attitude. Tightening the relationship between the knowledge, attitude, and behavior measures should help clarify these relationships.

Several studies (Moran, Wechsler, & Rigotti 2004; Patterson, Lerman, Kaufmann, Neuner, & Audrain-McGovern

2004; Rigotti, Lee, & Wechsler 2000) have shown that college age adults represent a growing population of smokers. For those who started smoking in high school, the pressures of college life often lead them to become heavier smokers. Similarly, many individuals take up the smoking habit as a way to handle stress, fit in socially, or just simply out of boredom. The results of this study imply that the college age individuals surveyed are following this same trend because it was determined that over half of the individuals surveyed smoke at least one cigarette per day.

A behavior of interest was utilization of ear protection. Rawool and Colligon-Wayne (2008) state that many traditional college-age adults are not concerned with the dangers associated with exposure to loud noises. As such, these individuals are less likely to use hearing protection when using lawn mowers or other machinery capable of producing loud noise. In the current study, when asked about limiting exposure to loud noises, the overall results indicated that approximately half of the participants do not utilize ear protection. Furthermore, those who do use ear protection when around loud noises only do so some of the time. One explanation may be that those who do utilize hearing protection some of the time may do so when required for work-related activities, although this was not explored in the current study. It was determined that more men than women exhibit hearing protective behavior. However, these two groups were not significantly different.

Respondents indicated that they recycle everyday items such as bottles, aluminum cans, and newspapers only some of the time. In their study on the effects of educational background on knowledge, attitudes, and behavior regarding environmental issues, Tikka, Kuitenen and Tynys (2000) found that individuals who display avid recycling behaviors primarily had selected majors in either biology or forestry. On the other hand, they state that individuals who either did not participate in, or rarely participated in recycling activities, were representative of the general student population. This could be a plausible explanation in the current study as well, because the majority of individuals surveyed were freshman and had most likely not yet identified with a major area of study. Alternatively, they may not have the ability or knowledge of how to recycle in their college living arrangements.

There were several limitations to this study. First, as with any survey instrument, several limitations and biases are inherent. Researchers tried to minimize social desirability bias by ensuring anonymity in survey administration. Due to study limitations, researchers were unable to triangulate behaviors with outside measurements to assess accuracy of the self-report. Another limitation was self-selection; although the survey was administered to 22 sections of a course, participation was voluntary and students were allowed to choose whether or not to answer part or all of the survey. The survey was only conducted in English, and as such reflected the course delivery method for general education coursework at the university where it was administered.

Additionally, only one large university in the Midwest was used for this study. As a result, the findings of this study are specific to the individual participants and cannot be generalized to other college populations. Additionally, only an entry-level foundations class was surveyed. Thus, the results may not be representative of the knowledge, attitudes, and behaviors of the entire college population at this university. In order to gain a better understanding of all college age individuals, it would be better to assess individuals in a variety of classes across grade levels and in multiple locations.

Implications for Health Educators and Future Studies

For several knowledge questions, Whites had higher correct response rates than Blacks. Because the students came from a range of geographical locations, the current study did not provide adequate information to determine causation for this difference. Perhaps environmental health educators may need to adjust curriculum to close such knowledge gaps by ensuring that all students receive instruction in basic components of environmental health. Beyond ensuring that students have a basic knowledge base in environmental health, educators may need to assist students in translating that knowledge to a personal risk awareness to affect behavior change. Another suggestion is that health educators may need to include more hands-on or direct application assignments and activities in courses to encourage students to make the connection from knowledge to behavior.

In addition, the current exploratory study provided insight into areas of refinement and future study, including:

- A refined version of this study could be used as pre/post test to examine the effectiveness of educational programs on environmental health behavior change.
- Revise the survey instrument to obtain interval-level data to make more meaningful analysis.
- Refine the subscales so they have greater cohesion and face validity.
- Expand subscales (or use them independently) to link to other health areas that have environmental components, such as asthma and obesity.
- Increase the sample size to improve statistical significance of the data.
- Expand the study to compare different populations, such as comparing freshmen to seniors or graduate students, or comparing results from different geographical areas.
- Expand the study to include larger samples of different racial/ethnic groups to see if the predictor variables hold.

Conclusion

This research suggests that there is a lack of environmental health knowledge among undergraduates. This disturbing fact translates ultimately into irresponsible behavior regarding self protection from environmental hazards and risks. It is

known that repeated exposure to health and environmental issues makes people more likely to incorporate them into their behavior. Thus, because responsible behavior is the desired result, there is an urgent need for increased education in the area of environmental health.

References

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhland & J. Beckman (Eds.), *Action control: From cognition to behavior*. Berlin: Springer-Verlag.

Bostrom, A., Morgan, M. G., Fischhoff, B., & Read, D. (1994). What do people know about global climate change? 1. Mental models. *Risk Analysis, 14*(6), 959-970.

Boykoff, M. T. & Boykoff, J. M. (2004). Balance as bias: Global warming and the US prestige press. *Global Environmental Change, 14*, 125-136.

Corral-Verdugo, V., Bechtel, R. B., & Fraigo-Sing, B. (2003). Environmental beliefs and water conservation: An empirical study. *Journal of Environmental Psychology, 23*, 247-257.

Dunlap, R. E., & Van Liere, K. D. (1978). The new environmental paradigm. *Journal of Environmental Education. 40*(1), 19-28.

Flynn, J., Slovic, P., & Mertz, C. K. (1994). Gender, race, and perception of environmental health risks. *Risk Analysis, 14*(6), 1101-1107.

Jianguang, Z. (1992). Environmental hazards in the Chinese public's eyes. *Risk Analysis, 14*(2), 163-167.

Johnson, B. B. (1993). Advancing understanding of knowledge's role in lay risk perception. *Risk, 4*(3), 189-212.

Leventhal, H. (1973). Changing attitudes and habits to reduce risk factors in chronic disease. *American Journal of Cardiology, 31*(5), 571-80.

Moran, S., Wechsler, H., & Rigotti, N. A. (2004). Social smoking among U.S. college students. *Pediatrics, 114*, 1028-1034.

Online-Utility.org Test Document Readability. (n.d.) Retrieved from http://www.online-utility.org/english/readability_test_and_improve.jsp

Patterson, F., Lerman, C., Kaufmann, V. G., Neuner, G. A., & Audrain-McGovern, J. (2004). Cigarette smoking practices among American college students: Review and future directions. *Journal of American College Health, 52*(5), 203-210.

Porzig-Drummond, R., Stevenson, R., Case, T., & Oaten, M. (2009). Can the emotion of disgust be harnessed to promote hand hygiene? Experimental and field-based tests. *Social Science and Medicine, 68*, 1006-1012.

Ratnapradipa, D., Brown, S., & Wodika, A. (2011). Examining the breadth and depth of environmental health through a modified Delphi Technique. *American Journal of Health Education, 42*, 50-57.

Rawool, V. W., & Colligon-Wayne, L. A. (2008). Auditory lifestyles and beliefs related to hearing loss among college students in the USA. *Noise Health, 10*, 1-10.

Rigotti, N. A., Lee, J. E., & Wechsler, H. (2000). U.S. college students' use of tobacco products: Results of a national survey. *Journal of American Medical Association, 284*(6), 699-705.

Rosenstock, I. M. (1974). Historical origins of the health belief model. *Health Education Monographs, 2*(4), 328-335.

Scott, D., & Willits F. K. (1994). Environmental attitudes and behavior. *Environment and Behavior, 26*(2), 239-260.

Smith, J. M., Rechenberg, C., Cruey, L., Magness, S., & Sandman, P. (1997). The impact of recycling education on the knowledge, attitudes, and behaviors of grade school children. *Education, 118*, 262-266.

Tempte, J. L., & McCall, J. C. (2001). Patient attitudes toward issues of environmental health. *Wilderness and Environmental Medicine, 12*(86), 92.

Tikka, P. M., Kuitenen, M. T., & Tynys, S. M. (2000). Effects of educational background on students' attitudes, activity levels, and knowledge concerning the environment. *The Journal of Environmental Education, 31*(3), 12-19.

White, C., Kolble, R., Carlson, R., Lipson, N., Dolan, M., Ali, Y., Cline, M. (2003). The effect of hand hygiene on illness rate among students in university residence halls. *American Journal of Infection Control, 31*(6), 364-70.

White, C. G., Shinder, F. S., Shinder, A. L., & Dyer, D. L. (2001). Reduction of illness absenteeism in elementary schools using an alcohol-free instant hand sanitizer. *The Journal of School Nursing, 17*, 258-265.

Willis, H. H., DeKay, M. L., Fischhoff, B., & Morgan, M. G. (2005). Aggregate, disaggregate, and hybrid analyses of ecological risk perceptions. *Risk Analysis, 25*(2), 405-428.