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ABSTRACT

As an objective toward its mission of providing HIV-AIDS education, the Higher Education Consortium for AIDS Prevention surveyed students of Florida's State University System to determine their health risk behaviors. The instrument used, the "Health Risk Behavior Survey for University Students," was adapted for college students from one used by the Centers for Disease Control. The six behavior categories questioned were: (1) intentional and unintentional injuries; (2) tobacco use; (3) alcohol and drug use; (4) sexual behaviors; (5) dietary habits; and (6) physical activity or exercise. Approximately 2,000 surveys were mailed, of which 1,150 were completed (response rate of 57%). Of the responses, 685 were from females and 460 from males. Scales were derived for each category of risk. Results indicated that these six dimensions were indeed scalable. Such scaling permits the examination of the covariances and testing of a latent trait model that would help explain the interactions of this highly complex construct. (Contains 1 figure, 6 tables, and 73 references.) (SLD)

SCALING HEALTH RISK BEHAVIORS OF COLLEGE STUDENTS*

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INTRODUCTION

In 1990, the Higher Education Consortium for AIDS Prevention (HECAP) was established as a five-year project through funding provided by a cooperative agreement between the University of Central Florida (UCF) and the Division of Adolescent and School Health (DASH) of the Centers for Disease Control and Prevention (CDC). As one of five universities in the nation to receive this award, UCF/HECAP's primary mission is to provide HIV-AIDS prevention education to university students and educators.

As one objective toward completing this mission, HECAP surveyed students of Florida's State University System to determine their health risk behaviors. The instrument used, called the *Health Risk Behavior Survey for University Students* (HRBS-U), was modeled after the CDC's *Youth Risk Behavior Survey* (YRBS) used to measure health risk behaviors of secondary students. Some of the YRBS questions, however, were clearly inappropriate for college students and were modified, resulting in an instrument, renamed HRBS-U, which better reflected behaviors of the college population.

As with the YRBS, the HRBS-U focuses on six behaviors. These categories have been determined by the CDC, in conjunction with federal health, and state and federal department of education officials, to be those behaviors which significantly contribute to the morbidity and mortality of young adults in the United States. The six categories are described below:

- **Intentional and unintentional injuries:** A health-risk behavior encompassing those activities related to intentional physical injuries, such as suicide and homicide, as well as behaviors related to unintentional physical harm, such as seat belt use, motorcycle helmet use, driving under the influence of alcohol, etc.
- **Tobacco use:** Tobacco use is a health-risk behavior which is measured by the frequency of use, amount of use, and age at first use. Health-risk within this category involves smokeless tobacco as well as cigarettes.
- **Alcohol and drug use:** A health-risk behavior involving the use of alcohol or drugs such as marijuana, cocaine, steroids, etc. Questions of interest regarding alcohol and drug use measure frequency of use, amount used, as well as age first used.

- **Sexual behaviors**: Questions relating to sexual activities are aimed at those behaviors most likely to result in human immunodeficiency (HIV) infection, other sexually transmitted diseases (STDs), and unintended pregnancies. Typical questions involve frequency of sexual intercourse, number of partners, and use of condoms and other birth control. Questions regarding the use of drugs and alcohol during a sexual encounter are also included in this category.
- **Dietary habits**: Behaviors regarding dietary habits are measured with questions regarding the number of fruits and vegetables consumed daily and the dietary fat intake. Questions regarding whether individuals are overweight or underweight and whether they are attempting to lose or gain weight are also asked.
- **Physical activity, or exercise**: Physical activity questions of interest focus on frequency of exercise. Types of exercise include heavy aerobic, stretching, and strengthening.

PURPOSE OF THIS RESEARCH

Historically, most self-report instruments used to assess health risk behaviors have been treated categorically, although many items exhibit an underlying ordinal component. The categorical nature of the items has made it difficult to scale risk components of the instruments. Investigators have been forced to report simple percentages by item, a procedure which makes comparisons of individuals or demographic groups very burdensome. Under the present scoring rubric for the HRBS-U, it is simply impossible with any degree of confidence to say whether one individual is "riskier" than another. In order to answer questions such as this, scaled scores were derived and validated and their unidimensionality established. Using the scaled scores developed from the HRBS-U, it is possible to make comparisons among demographic groups of college students in Florida. Further, scaled scores allow the groups who exhibit multiple high risk tendencies to be identified.

Finally, the scaling of health-risk behavior permits examination of the covariances among the risk behaviors and testing of a latent trait model. A model of student behavior would help us understand the interactions among the six risk behaviors identified by the CDC and measured by the HRBS-U, thus leading to a better understanding of the health-risk behaviors of the college population. This knowledge is crucial if we are to address these

concerns and work towards a health education approach that focuses on health consciousness and disease prevention.

PERSPECTIVES

In 1990, the U.S. Public Health Service published a document entitled *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*. This report outlined objectives of the national health agenda aimed at increasing the prevention of disease and promoting positive health behaviors in Americans. Subsequently, the American College Health Association formed a task force on National Health Objectives in Higher Education to focus these national health objectives more specifically toward the college population. The result of this effort was the publication, *Healthy Campus 2000: Making it Happen*. This document provides objectives intended to increase the health conscious practices of college students in America.

This study addresses the health concerns of college students by examining the health-risk behaviors of undergraduate students in Florida's State University System through the development of scales for each of the six health-risk behaviors -- intentional and unintentional injuries, tobacco use, drug and alcohol use, sexual behavior, dietary habits, and exercise. By modeling thes behaviors, and examining the interrelationships among them with respect to students who are at risk in each of these categories, we can significantly add to the knowledge of this population and, hopefully, gain some insight into how to best address educating these young adults.

This review of the literature is intended to provide a summary of the research indicating why these health-risk behaviors are significant and to discuss their prevalence in the young adult population. In addition, literature examining how these behaviors are interrelated is reviewed.

Intentional and Unintentional Injuries

The category of intentional and unintentional injuries is the third leading cause of death in the United States and the leading cause of death among children and young adults, ages 5-24 (Kochanek & Hudson, 1995). As the name implies, this category encompasses injuries or deaths which are intentional (e.g., suicide or homicide), as well as those which

occur as a result of accidents, including motor vehicle crashes. To understand the magnitude of the problem in this category, in 1992 73% of all deaths among 15-24 year olds were from four causes: motor vehicle crashes, other unintentional injuries, homicide, and suicide (Kochanek & Hudson, 1995).

In examining intentional and unintentional injuries, the leading cause of death for adolescents and young adults is motor vehicle crashes. Lack of proper seat belt use and driving under the influence of alcohol are two factors thought to significantly account for these fatalities. It is estimated that proper seat belt use would reduce the number of motor vehicle fatalities by 40-50% and reduce the number of serious injuries resulting from motor vehicle crashes by 45-55% (National Committee for Injury Prevention and Control, 1989). However, only 41 states require mandatory seat belt use, and surveys indicate that while a significant number of people now use seat belts, many do not (U.S. Department of Health and Human Services, 1992). Results from the 1992 National Health Interview Survey (Centers for Disease Control and Prevention, 1994b) indicated that only 36.1% of students 18-21 years old consistently wore a seat belt. In Florida, West, Rumbough, and Dziuban (1994) reported that 81% of students wore a seat belt most of the time or always when they were the passengers, and 84% of students wore a seat belt most of the time or always while driving. In Texas, researchers reported that 81% of college students surveyed wore seat belts consistently (AIDS Consortium of Texas Colleges and Universities, 1995).

Nearly half of all deaths caused by motor vehicle crashes, homicides, and suicides have been shown to involve alcohol; excessive use of which is commonly encountered in the college setting (Perrine, Peck, & Fell, 1988). Tragically, students frequently drive while under the influence of alcohol, or ride with someone who is under the influence. For example, 34.5% of those respondents 18-21 years old in the CDC national survey reported that within the 30 days prior to the study they had ridden with a driver who had been drinking alcohol (Centers for Disease Control and Prevention, 1994b). West, Rumbough and Dziuban (1994) reported that 36% of the university students surveyed in Florida had driven a car while under the influence of alcohol. Twenty-two percent (22%) of university students surveyed in Texas had driven under the influence in the past month (AIDS Consortium of Texas Colleges and Universities, 1995).

Finally, homicide and suicide comprise the intentional injuries within this category and account for a significant number of preventable deaths in college students. For example, homicide and legal intervention are the leading cause of death among black males 15-24 years of age (Kochanek & Hudson, 1995). Nine out of ten homicide deaths involve a weapon such as a gun, knife, or club (U.S. Department of Health and Human Services, 1990a). In 1991, almost half of all violent crimes were committed by young persons 12-24 years of age (U.S. Department of Health and Human Services, 1994).

Suicide is the third leading cause of death among 15-24 year olds in the United States, accounting for 13% of all deaths in this age group in 1992. It is the second leading cause of death for 15-24 year old white males (Kochanek & Hudson, 1995). The rate of suicides has tripled for this age group since 1950 (U.S. Department of Health and Human Services, 1990b). Within Florida, 8% of all students surveyed reported that they had seriously considered suicide, while 2% had actually attempted suicide within the past year (West, Rumbough & Dziuban, 1994). Texas researchers reported that 3% of students (4% of females and 2% of males) had seriously considered suicide in the past year. Less than 1% of students had attempted suicide (AIDS Consortium of Texas Colleges and Universities, 1995).

Tobacco Use

Cigarette smoking is the single most preventable cause of premature death in the United States (U.S. Department of Health and Human Services, 1989; McGinnis & Foege, 1993). In 1990, an estimated 61,000 U.S. women died from cardiovascular disease attributed to smoking (Centers for Disease Control and Prevention, 1995b).

Glynn, Manley, Mills & Shopland (1993) estimated that more than 400,000 Americans die each year due to smoking -- a greater number than the deaths attributed to AIDS, alcohol, cocaine, heroin, homicide, suicide, motor vehicle crashes, and fires combined. Smoking costs more than 80 billion dollars in health care and lost worker productivity per year (U.S. Department of Health and Human Services, 1994). The CDC estimated that direct medical costs due to smoking were more than 50 billion dollars in 1993 (Centers for Disease Control and Prevention, 1994c).

The Centers for Disease Control and Prevention estimate that in 1993, 46 million U.S. adults were current smokers (smoked 100 cigarettes and currently smoked daily or on some days). Of those who were regular smokers, 20.4% smoked daily. Cigarette smoking was significantly higher among men (24 million smokers) than women (22 million smokers) (Centers for Disease Control and Prevention, 1994c).

While drug and alcohol use is known to decrease with age, smoking prevalence does not (Johnston, O'Malley, & Bachman, 1992; Chen & Kandel, 1995). Surveys indicate that 70% of smokers want to quit. However, of the 34% of smokers who attempt to quit each year, only 2.5% are successful (Centers for Disease Control and Prevention, 1993).

Eighty-seven percent (87%) of daily smokers began prior to 18 years of age (Centers for Disease Control and Prevention, 1995b). Johnston, O'Malley, and Bachman (1992) found that 22% of 19-28 year olds smoke daily, and 16% of that age group smoke a half-pack a day or more. Results from the National Health Interview Survey indicated that 76.9% of 18-21 year olds have tried cigarettes while 37.6% are current smokers (Centers for Disease Control and Prevention, 1994b). Similarly, West, Rumbough, and Dziuban (1994) found that 78% of all college respondents in Florida had tried smoking, and 23% reported that they had smoked within the past 30 days. These statistics are similar to those found in Texas where researchers reported that 26% of college students were current smokers, and 72% of students had tried cigarettes in their lifetimes (AIDS Consortium of Texas Colleges and Universities, 1995).

Drugs and Alcohol

In 1992, 11,703 persons in the United Stated died as a direct result of drug-induced causes, while 19,568 persons died as a result of alcohol-induced causes (Kochanek & Hudson, 1995). These statistics exclude deaths caused by accidents, suicides, homicides and other causes of which nearly half are thought to involve alcohol (Perrine, Peck, & Fell, 1988).

The college years are often thought of as a time of great experimentation with drugs and alcohol. Most high school seniors and college students have tried alcohol and, unfortunately, it is actively used in this age group. For example, Schukit, Klein, Twitchell &

Springer (1994) found that over 90% of the men sampled on a college campus had tried alcohol. The CDC found that 86.7% of 18-21 year olds had tried alcohol (Centers for Disease Control and Prevention, 1994b). Similarly, West, Rumbough, and Dziuban (1994) found that 93% of college students had tried alcohol.

There is research which indicates that alcohol use may be increasing among college students. Wechsler & Isaac (1992) found that alcohol use has greatly increased among women, with more than twice as many women getting drunk in 1992 as in 1977. Several studies found episodes of "binge" drinking, defined as five or more drinks in an episode, to be on the rise (Johnston, O'Malley, & Bachman, 1992; Wechsler & Isaac, 1992; Schuckit et al., 1994). Johnston, O'Malley, and Bachman, (1992) found that 43% of college students had experienced occasions of heavy drinking in the past two weeks. Binge drinking was more common among men (52%) than women (35%). Similarly, Schuckit et al. (1994) found that between 1980 and 1992, the average number of drinks per occasion had increased from 2.4 to 3.8, respectively. The CDC found that 39.7% of 18-21 year olds had experienced at least one episode of 5 or more drinks within the past 30 days (Centers for Disease Control and Prevention, 1994b), and West, Rumbough and Dziuban (1994) reported that 38% of students had engaged in binge drinking in the past 30 days. Researchers in Texas reported that 33% of college students there had experienced at least one episode of binge drinking in the past month (AIDS Consortium of Texas Colleges and Universities, 1995).

Just as alcohol is a significant concern with young adults, so too is the frequent use of illicit drugs with this population. Before reaching age 30, 75% of young adults have tried an illicit drug, and 50% of those used an illicit drug that was not marijuana. Over two percent (2.3%) of 19-28 year olds smoked marijuana daily, and 4.8% have tried crack cocaine (Johnston, O'Malley, & Bachman, 1992). Other studies have indicated that 45.8% of 18-21 year olds have tried marijuana, and 11.4% have tried cocaine (Centers for Disease Control and Prevention, 1994b). West, Rumbough, and Dziuban (1994) reported that 53% of college students had tried marijuana, and 15% had used marijuana in the past month. Fifteen percent of the college sample had used cocaine. Thirty-four percent (34%) of students in Texas reported that they had tried marijuana while 3% had used it within the past month. Eight

percent of students had tried cocaine (AIDS Consortium of Texas Colleges and Universities, 1995).

Sexual Behavior

The rate of sexually transmitted diseases (STDs) in the U.S. is the highest in the industrialized world (Donovan, 1994). Human immunodeficiency virus (HIV) infection has now become the second leading killer of 25-44 year olds in the United States, (Kochanek & Hudson, 1995). Considering the 8-10 year latency factor of HIV, many individuals who died from infections related to this virus contracted HIV while in their teens and 20s. According to the CDC, cases of HIV among heterosexual men, women, and minorities is rising (Centers for Disease Control and Prevention, 1994a). The risk of contracting HIV, or another STD, is known to be linked to several factors, including early age at first intercourse, number of lifetime sexual partners, having multiple partners over a short period of time, and of course, failing to use a condom (Sawyer & Moss, 1993; Vail-Smith & White, 1992; Burkett, et al., 1992

The college population is one in which the majority is already sexually active, even as freshmen (DeBuono, Zinner, Daamen, & McCormack, 1990; Turner et al., 1994; MacDonald et al., 1990; CDC, 1994b). Nationally, the CDC (1994b) found that 81.7% of 18-21 year olds had experienced sexual intercourse. These statistics are similar to those found by West, Rumbough and Dziuban (1994) and by the AIDS Consortium of Texas Colleges and Universities (1995) who reported respectively that 87% and 82% of college students had engaged in sexual intercourse..

Murstein and Mercy (1994) conducted the fourth in a series of studies at a northeastern university examining how the sexual behaviors and beliefs of students over a 17 year time period have changed. They found that there was little change in the sexual behaviors of college students even with the threat of AIDS. Students understood that condoms help prevent the spread of HIV and reported that they had changed their sexual behaviors as a result of the fear of HIV. However, only a minority of students (35%) reported always using condoms. These results are similar to those found by Butcher, Manning and O'Neal (1991) who reported that only 15% of the sexually active students

always used a condom. Twenty-nine percent (29%) never used condoms, even though 87% of those surveyed indicated that condoms were effective in preventing HIV. Similarly, West Rumbough and Dziuban (1994) reported that only 37% of college students used a condom during their last intercourse, and Texas researchers reported that 45% of Texas students used a condom during their last intercourse (AIDS Consortium of Texas Colleges and Universities, 1995).

These studies are especially alarming because it seems reasonable to assume that young adults are having risky sexual encounters which put them at risk of contracting STDs or HIV because they are ignorant regarding the transmission of those diseases. However, the statistics quoted here indicate that this is not the case. Students do know about HIV, its transmission, and the fact that condoms help prevent the spread of the disease. Yet, they still do not practice safe sex. Why? Many studies now seek the answer to this question -- to determine not just that college students do not practice safe sex, but to try to understand why they do not. This research includes examining the predictors for having multiple sex partners and not wearing condoms.

Dietary Behaviors

Diet is recognized as critical to health and well-being. A high intake of fat is now known to be associated with an increased risk for obesity, cardiovascular disease, coronary heart disease, and cancers of the breast, colorectal, endometrium, ovary and prostate (U.S. Department of Health and Human Services, 1988; Manson, et al. 1992; LaVecchia, 1992; Ip, 1993; Potischman, et al. 1993; Giovannucci, et al. 1993). Being overweight, when linked to other diet and exercise habits, is associated with an increased risk for coronary heart disease, diabetes mellitus, gallbladder disease, joint disease, and certain cancers (U.S. Department of Health and Human Resources, 1988; Pi-Sunyer, 1993). There is research which suggests that a diet high in fruits and vegetables and low in fat can reduce the risk of cardiovascular disease, strokes, and cancers of the lung, stomach, and colon (National Research Council Committee on Diet and Health., 1989; Woteki and Thomas, 1992; U.S. Department of Health and Human Services, 1988).

Heart disease and stroke are currently the leading causes of death among adults in the U.S., accounting for more deaths than all other health problems combined. More than 2,500 Americans die each day from heart attacks and strokes -- that's one American every 34 seconds. It is estimated that the costs associated with heart disease exceed $48 billion dollars per year, and stroke costs are estimated to be $17 billion in the same period (American Heart Association, 1994).

Although death rates for cardiovascular disease are declining, this rate among women in 1991 was approximately five times higher than that for lung or breast cancer. A high proportion of these deaths are preventable through the reduction of several factors namely, cigarette smoking, physical inactivity, and high-fat diet (Centers for Disease Control and Prevention, 1995a).

With statistics indicating the link between diet and health, recommendations from the American Heart Association, the American Cancer Society, and the United States Departments of Agriculture and Health and Human Services are presently for Americans to reduce dietary fat intake to no more than 30% of the total calories consumed and to increase the intake of fruits and vegetables to five or more servings per day (U.S. Department of Health and Human Services, 1990b; U.S. Department of Health and Human Services, 1988; Woteki and Thomas, 1992; Committee on Diet and Health of the National Research Council, 1989).

Current statistics indicate a rising percentage of adolescents who are overweight. The increase in prevalence of overweight young people is thought to be associated with an increase in dietary caloric intake, as well as a decrease in physical activity levels. Interestingly, among overweight adolescents, this increase has occurred as levels of participation in physical education by high school students are steadily declining (Centers for Disease Control and Prevention, 1994d).

Unfortunately, the results of poor dietary habits evolve over time and perhaps the old adage "out of sight, out of mind" is the reason many young adults (and older, for that matter) do not practice healthy eating habits. Many of the illnesses and death associated with diet appear in adulthood. Therefore, it is easy for young adults to ignore the effect that eating has on their health. However, research shows that the onset of atherosclerosis, or "hardening of

the arteries", can be detected in youth with hig diets (Woteki, and Thomas 1992). Therefore, it is important to begin good dietary practices early in life.

Recent studies indicate that the majority of young adults do not follow the advice established by the medical community. For example, the CDC (1994b) found that 27.7% of 18-21 year olds had consumed 2 or more servings high in dietary fat the previous day. Only 10.9% of that age group reported five or more servings of fruits and vegetables.

Exercise

Research has indicated that physical activity can decrease the risk for a number of chronic diseases such as coronary heart disease, hypertension, non-insulin-dependent diabetes mellitus, osteoporosis, colon cancer and anxiety and depression (Pate, et al. 1995; Leclerc, 1992). McGinnes and Foege (1993) estimated that of all deaths occurring in the United States each year, approximately 250,000 (12%) can be attributed to lack of physical activity. Blair et al. (1989) found that an increased level of physical fitness delayed all-cause mortality primarily through a decrease in cardiovascular disease and cancer.

Scientific evidence now has proved that substantial health benefits can be obtained from regular, moderate-intensity exercise (as opposed to vigorous exercise). Because of this finding, the CDC and American College of Sports Medicine have recommended that "every U.S. adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week" (Pate et al. 1995, p. 404). Furthermore, it has also been established that to obtain health benefits, exercise need not be in one session, but can be accumulated over intermittent activities throughout the day (Debusk, Stenestrand, Sheehan, & Haskell as cited in Pate, et al. 1995).

Studies have shown a significantly lower death rate from coronary heart disease in people who perform an average of 47 minutes vs. 15 minutes of exercise per day (Leon, Connett, Jacobs, & Rauramaa, 1987). Research shows that the risk of death due to coronary heart disease is related to the level of activity performed (Paffenbarger et al. 1993, Blair et al., 1989; Leon, Connett, Jacobs, Rauramaa, 1987; Edelund et al., 1988; Sandvik et al., 1993).

In discussing the research available on the health benefits of physical activity, Pate et al. (1995) provided the following summary:

> We believe that the most reasonable interpretation of the currently available data is that (1) caloric expenditure and total time of physical activity are associated with reduced cardiovascular disease incidence and mortality; (2) there is a dose-response relationship for this association; (3) regular moderate physical activity provides substantial health benefits; and (4) intermittent bouts of physical activity, as short as 8 to 10 minutes, totaling 30 minutes or more on most days provide beneficial health and fitness effects.(p. 405).

Furthermore, regarding flexibility and muscular strength exercise, Pate et al. (1995) noted

> that people who maintain or improve their strength and flexibility may be better able to perform daily activities, may be less likely to develop back pain, and may be better able to avoid disability, especially as they advance into older age. (p. 405).

The objective regarding physical activity in *Healthy People 2000* is to "increase to at least 30 percent the proportion of people aged 6 and older who engage regularly, preferably daily, in light to moderate physical activity for at least 30 minutes per day." Currently, it is estimated that only 22% of adults are active at this level, and 24% or more are completely sedentary (Pate, et al. 1995).

Only 21.2% of 18-21 year olds participated in 5 or more days of 30 minutes of exercise in the week preceding the National Health Interview Survey (Centers for Disease Control and Prevention, 1994b). West, Rumbough and Dziuban (1994) reported that 32% of the female respondents and 52% of the males participated in three or more days of activities which made them breathe hard or sweat in the past seven days. Thirty-three percent (33%) of females and 33% of males participated in strengthening or toning exercise on at least three of the past seven days. In Texas, 49% of females and 57% of males participated in three or more days of activities which made them breathe hard or sweat in the past seven days while

30% of females and 44% of males participated in strengthening or toning exercises (AIDS Consortium of Texas Colleges and Universities, 1995).

Interrelationships Among the Six Behaviors

A review of the previous research which has examined the unidimensionality of health behaviors indicates that there are a number of variables which are considered to be health-related. For example, studies have included biological, psychological, behavioral, social and physical conditions related to health. Previous studies have found that there is an interrelationship among health behaviors: however, the dimensionality of these behaviors varies from study to study.

Aaro, Laberg, and Wold (1995) found two underlying factors when examining the health related behaviors of 15 year olds in Norway. An *addictive behaviors* factor consisted of smoking, use of alcohol, drinking coffee, unhealthy food consumption, risk-seeking behavior and health food with positive loadings and meal regularity and safety seeking behavior with negative loadings. A second factor, *health enhancing behaviors* consisted of physical activity (hours per week), oral hygiene, healthy food consumption, meal regularity and safety seeking behavior all with positive loadings.

Previously, Aaro (1986) analyzed health behaviors in the adult Norway population. He found two health dimensions, *health enhancing behaviors* and *addictive behaviors and daily life irregularity* in addition to a third factor containing seemingly unrelated behaviors.

Norman (1985), in two studies among college students found that two factors consistently appeared. The first consisted of smoking and alcohol consumption, while the second included stress and sleep.

Langlie (1979) found two factors when studying health behaviors. The first was termed direct risk behaviors and consisted of driving behavior, pedestrian behavior, personal hygiene, and smoking behavior. The second termed indirect risk behaviors included seat belt use, medical checkups, dental care, immunization behavior, miscellaneous examinations, exercise and nutrition.

Mechanic (1979) through visual examination of the intercorrelation matrix of variables concluded that the health behaviors he examined: seat belt use, smoking, exercise, drinking, risk taking, physical activity, release (limiting activities based on physical condition), preventive medical care, physical health, and personal control over illness were independent in adults he surveyed. Williams and Wechsler (1972) found that health behaviors of 35 to 54 year old women were multidimensional. However, many of the items used in their analysis were not behavioral.

Harris and Guten (1979) identified five clusters of health-protective behaviors. *Health practices* are composed of behaviors that are composed of routine daily health activities such as getting enough sleep, eating sensibly, etc. *Safety practices* contain behaviors that prevent accidents or help cope with accidents which do occur. *Preventive health care* consists of dental and physical checkups. *Environmental hazard avoidance* involves avoiding areas of crime or pollution, and *harmful substance avoidance* relates to smoking and drinking habits. Steele and McBroom (1972) found health behavior to be multidimensional, but consistent forms were found only among a small proportion of respondents. Their study involved health services such as physical checkups, dental visits, eye doctor visits and health insurance rather than the health behaviors studied here.

Kannas (1981) found five factors related to health behaviors in Finnish young men. They consisted of (1) sugar and fat consumption, (2) 'La dolce vita' or alcohol, smoking and multiple sexual partners, (3) active health-oriented behaviors, (4) regular eating and resting, and (5) dental care. However, these factors explained a small proportion of the variance in the original variables.

Hays, Stacy, and DiMatteo (1984) examined the health behaviors of high school and college students. They found a cohesive drug use factor consisting of alcohol use, cigarette use and hard drug use. However, they did not propose any additional factors related to the remaining behaviors -- meal regularity, exercise, and hours of sleep, except to indicate that these behaviors were outside the perimeter of drug use behaviors. Hansell and Mechanic (1990) confirmed the findings of Hays et al. (1984) results. Also, Jessor (1984) indicated that a drug use factor existed among adolescents and consisted of the use of cigarettes, alcohol, and hard drugs and suggested that these are related to a "problem behaviors" dimension.

Persons obtaining high scores on the "problem behaviors" seem to possess a set of personality characteristics which Jessor terms "unconventionality." Vingilis and Adlaf (1990) seem to support Jessor's notion of problem behaviors in a study among high school students.

As is indicated by this review of the research examining the interrelationship of health-risk behaviors, there is a wide range of health behaviors which have been identified which vary from study to study. While no studies were found examining the six health-risk behaviors examined here (intentional and unintentional injuries, tobacco use, drug and alcohol use, sexual activity, dietary habits and exercise), the review of the research performed previously appears to indicate that there is reason to believe that a meaningful interrelationship does exist among health behaviors. Certainly, there is support for the examination of this possibility.

METHOD

Subjects

The *Health Risk Behavior Survey for University Students* was initiated in the spring of 1993 by HECAP. Eight of the nine universities in Florida's state university system participated: University of Central Florida, University of Florida, Florida A&M University, Florida Atlantic University, Florida International University, Florida State University, University of North Florida, and University of South Florida. The University of West Florida declined to participate.

Undergraduate students were selected at random by data administrators at their respective schools. The number of subjects selected from each school was proportional to that school's enrollment size. Approximately 2,000 surveys were mailed, of which 1,150 were completed for a return rate of 57%. Of the responses received, 685 were from females and 460 were from males. Thirty-one percent were 25 years of age or older, and 19% were married (West, Rumbough & Dziuban, 1994).

Survey Instrument

The instrument consisted of 77 questions representing the six categories of risk behaviors identified by the CDC. Nine of these questions were demographic involving age, gender, class rank, ethnicity, academic performance, marital status, on/off campus housing,

and paternal/maternal education level. Eighteen questions were about behaviors concerning intentional and unintentional injuries, eight questions regarded tobacco use, 13 questions involved drug and alcohol use, 14 questions regarded sexual behavior, 11 questions involved dietary habits, and four questions focused on physical activity. The questions were developed by the CDC in conjunction with Departments of Education from all states, 16 education agencies, 19 federal agencies including the U.S. Department of Education, and by leading authorities in each of the six categories.

Scaling procedure

In examining the questions of the HRBS-U, it was determined that questions which might identify risk in the unmarried population, such as frequency of sexual intercourse or method of birth control, would not appropriately index risk for the married subsample. Clearly, the patterns of sexual behavior can be expected to vary greatly between the married and unmarried population. Thus, including responses from those who are married would confound the results. Accordingly, this study was conducted with the unmarried sample (N=932).

Scales were derived for each category of risk: intentional and unintentional injuries, drug and alcohol use, tobacco use, sexual behavior, dietary habits, and physical activity. Only those questions which contained ordinal components were used. Table 1 indicates an example of the score derived for an individual question. Any questions in which responses could not be ranked in this manner were not used for scale development.

Table 1. Procedure for rank ordering individual scores.

Question: During your life, how many times have you used marijuana?	
Response	Respondent's score on item
a. 0 times	1 (least risky)
b. 1 or 2 times	2
c. 3 to 9 times	3
d. 10 to 19 times	4
e. 20 to 39 times	5
f. 40 to 99 times	6
g. 100 or more times	7 (most risky)

A respondent's score for any of the six categories was formed by the summation of that individual's ordered response score to each question. Thus, for a health risk category with j ordinal questions, an individual's score for that category was determined by:

$$\sum_{1}^{j} q$$

where q indicates an individual response on a question.

RESULTS

The internal consistency (the proportion of the variance in each scale score that is attributable to the true score) for each of the six scales was indexed with coefficient alpha (Cronbach, 1951). Alpha is derived by the following function:

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\Sigma\sigma_i^2}{\sigma_t^2}\right)$$

where k indicates the number of items, σ_i^2 indicates the variance of the i^{th} item, and σ_t^2 is the variance of the composite score.

Table 2 presents the internal consistency reliabilities for the six scales. As indicated, the drugs and alcohol scale was most reliable ($\alpha = 0.82$). The low reliability of the eating scale ($\alpha = 0.35$) is cause for concern and indicates that perhaps this subsection should be

examined more closely. However, in spite of the low reliability of this scale, it was decided to include it in this research.

Table 2. Reliabilities of the scales.

Scale	Coefficient Alpha
Injuries	0.63
Tobacco	0.78
Drugs/Alcohol	0.82
Sexual Behavior	0.63
Eating	0.35
Exercise	0.74

Summary statistics for the six scales are presented in Table 3. The sample size, mean, standard deviation, range of scores, skewness, and kurtosis for each scale are reported.

Table 3. Summary statistics for risk scales.

Scale	N	Mean	S.D.	Range	Skewness	Kurtosis
Injuries	906	28.57	6.35	17-52	0.55	0.30
Tobacco	919	15.05	7.42	8-37	1.05	0.18
Drugs	916	26.37	9.62	13-67	0.86	0.45
Sex	903	27.32	6.54	13-43	-0.68	.02
Eating	920	13.79	2.13	8-21	-0.11	-0.17
Exercise	927	24.11	6.22	4-32	-0.78	0.16

Correlation and Regression Analyses

A 6 x 6 correlation matrix among the scaled scores was derived to examine the intercorrelations among the risk scales across the 932 unmarried subjects. The results, presented in Table 4, indicate that drugs and alcohol have the highest correlation with three other areas: injuries (r = 0.47), tobacco (r = 0.57) , and sex (0.46). It would appear that those

who are "risky" with regard to drugs and alcohol are also risky when it comes to intentional and unintentional injuries, tobacco, and sex. Positive, but weaker correlations also were found between tobacco and injuries (r = 0.23), sex and injuries (r = 0.22), sex and tobacco use (r = 0.29) and exercise and eating (r = 0.21). As these correlations were positive, it appears that people who engage in one risky behavior might also tend to engage in another.

Exercise was found to be negatively correlated with intentional and unintentional injuries (r = -0.21) indicating that those who have poor exercise habits would tend to have safer practices when it comes to intentional and unintentional injuries, and vice versa. Exercise also had extremely low correlations with regard to tobacco (r = 0.07), drugs and alcohol (r = -0.02), and sex (r = 0.03) which indicates that there is little correlation between whether one exercises and uses tobacco and drugs and alcohol, or practices safe sex.

Eating habits had virtually no correlation with four of the remaining five behaviors (r = 0.01 for injuries, r = 0.01 for tobacco, r = -0.01 for drugs and alcohol, and r = 0.06 for sex), suggesting that the behaviors in these four areas are independent of whether one practices healthy dietary habits. In fact, eating was found to be positively correlated with exercise (r = 0.21) which is not surprising since those who eat well typically exercise also.

Table 4. Correlations among the scales.

	Injuries	Tobacco	Drugs & Alcohol	Sex	Eating	Exercise
Injuries						
Tobacco	0.23					
Drugs & Alcohol	0.47	0.57				
Sex	0.22	0.29	0.46			
Eating	0.01	0.01	-0.01	0.06		
Exercise	-0.21	0.07	-0.02	0.03	0.21	

The results of multiple regression analysis using the least squares solution for predicting each scale from the remaining five are presented in Table 5. In each case, the squared multiple correlations were determined by:

$$R^2 = \frac{SS(REG)}{SS(TOT)}$$

where SS(REG) is the sums of squares due to regression and SS(TOT) is the total sums of squares. The largest amount of variance was accounted for by predicting drugs and alcohol from the remaining five behaviors ($R^2 = 0.51$). Eating ($R^2 = 0.06$) and exercise ($R^2 = 0.11$) were not predicted well using the remaining behaviors.

Table 5. Proportion of variance accounted for when predicting each scale from the remaining five.

Scale	R^2
Injuries	0.27
Tobacco	0.33
Drugs/Alcohol	0.51
Sexual Behavior	0.22
Eating	0.06
Exercise	0.11

Component and Factor Analysis

The intercorrelation matrix based on a random sample of half the subjects (N=466) for the six risk scales was subjected to a principal component analysis. Raw components were extracted according to the eigenvalues of the matrix greater than one and then transformed according to the normal varimax criterion (Kaiser, 1958) and Harris-Kaiser (1964) procedures. The analysis produced two components. The first, determined by injuries, tobacco, drugs, and sex, we have named "risk", since these behaviors involve alternatives which involve risk in which negative consequences can be seen immediately. The second component, determined by eating, and exercise we have named "maintenance", as these behaviors involve health maintenance options.

The principal components solution was used as an initial input for a confirmatory factor analysis (CFA) which was performed on the remaining half (N=466) of the sample. The model for this procedure is:

$$\Sigma_0 = \Lambda \Phi \Lambda' + \Psi$$

where Σ_0 is the reproduced correlation matrix, Λ is the factor pattern matrix, Φ is the factor correlation matrix and Ψ is the matrix of error variates. Using LISREL VIII™ (Jöreskog & Sörbom, 1994), the model presented in Figure 1 was identified with $\chi^2(9) = 8.39$, $p=.50$.

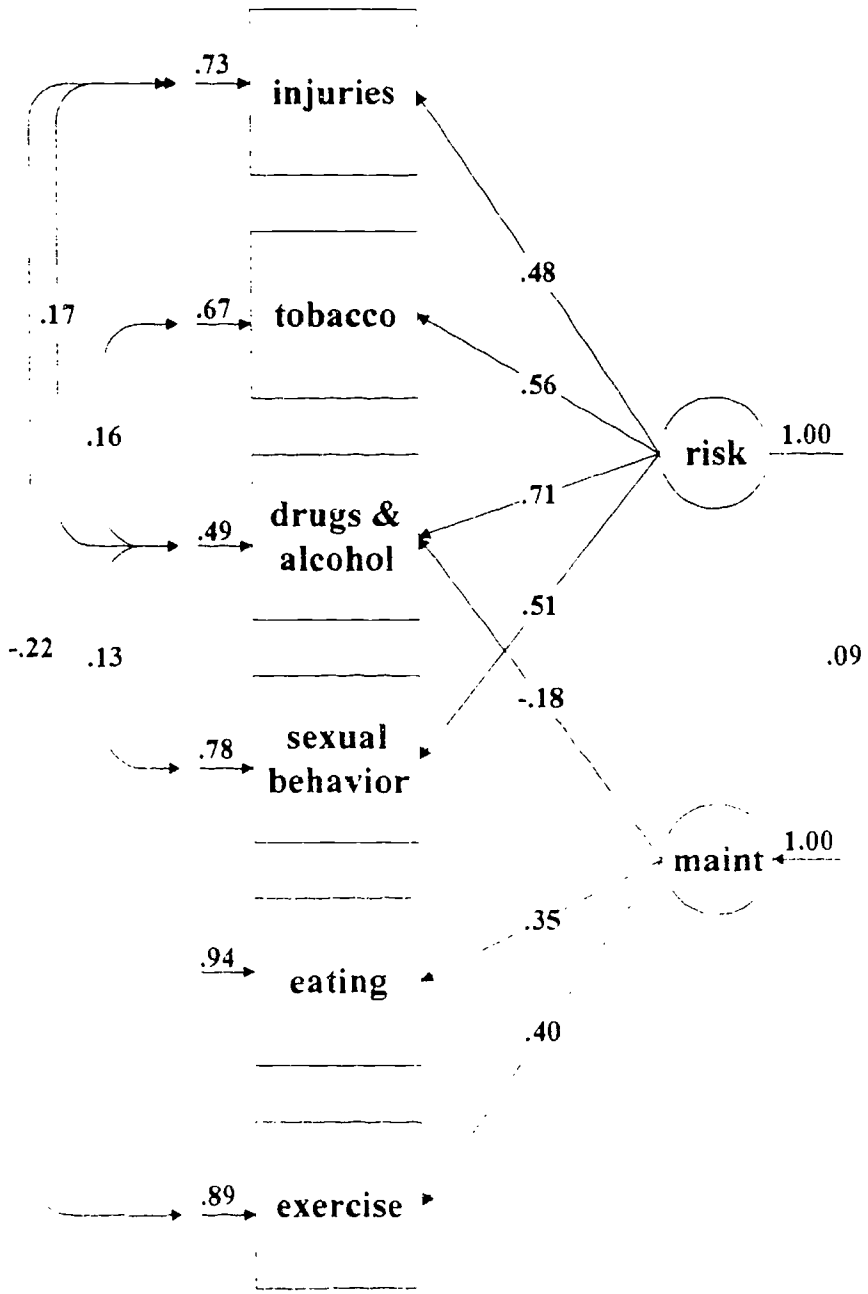

Figure 1. Model of college student behavior determined by CFA.

In interpreting the model, factors are represented by circles, and variables (in this case, the six scales) by square boxes. Arrows radiating from the factors indicate path coefficients which exist between the two endpoints. Arrows to the left of the variables indicate the correlation's among the error variances.

Examining the model, it is interesting to note that the two factors, risk and maintenance (maint) have an extremely low correlation (r = 0.09), which indicates that having "safe" practices in one behavior has no bearing on whether "safe" practices will be seen in the other. In other words, one can work very hard to exercise regularly and eat healthy foods and still take risks when it comes to sexual behavior or using drugs and alcohol.

The "risk" factor is positively correlated with the intentional and unintentional injuries, tobacco, drugs and alcohol, and sexual behavior variables. Table 4 indicated that these four variables were moderately to highly correlated with each other as well. This would suggest that a young person who is involved with one of these behaviors is likely to be involved in one of the others as well.

The "maintenance" factor is positively correlated with eating and exercise. However, the drugs and alcohol scale is negatively correlated with maintenance. This suggests that students who are healthy eaters and exercise regularly show a tendency not to be involved with drugs or alcohol.

It is interesting to note that the model indicates that drugs and alcohol are related to both factors -- positively to risk and negatively to maintenance. In fact, drugs and alcohol is the only variable with a path to both factors. This indicates the importance of targeting of drugs and alcohol in attempting to improve health consciousness and to reduce the risky behaviors of young adults.

Several goodness-of-fit indices are provided by LISREL VIII to examine how well the hypothesized model fits the data. The goodness-of-fit index (GFI) and the adjusted goodness-of-fit index (AGFI) provide the relative amount of variance and covariance jointly explained by the model. Both range from 0, indicating a total lack of fit, to 1, indicating a perfect fit for the model. The GFI and AGFI for the model were calculated to be 0.99 and 0.99, respectively, indicating a near-perfect fit.

The root mean square residual (RMR) indicates the relative amount of discrepancy between the hypothesized and sample covariance matrix elements. The RMR was calculated as being 0.029, indicating only a slight discrepancy.

Two subjective fit indices, the Bentler & Bonnett (1980) normed fit index (NFI), and the Tucker & Lewis (1973) non-normed fit index (NNFI) were calculated as 0.98 and 1.0, respectively, also indicating a near-perfect fit. The NFI and the NNFI both represent the proportion of the maximum lack of fit that has been reduced by the hypothesized model, although the NNFI is considered a more unbiased estimate.

All four of these fit indices indicate that this model is nearly perfect in predicting the behaviors of the college students who participated in the HRBS-U study. Table 6 presents a summary of the fit indices calculated for the model of student health risk behavior.

Table 6. Goodness-of-fit indices for model of college student behavior.

χ^2	df	p	GFI	AGFI	RMR	NFI	NNFI
8.39	9	0.50	0.99	0.99	0.029	0.98	1.0

As a method of validating the model, subsamples (N = 200) were randomly selected from males, females, Caucasians and minority groups. The model produced an adequate fit for three of the five subsamples -- males, females, and Caucasians. It did not meet the fit criterion for minorities.

SUMMARY AND CONCLUSIONS

The results of the study indicate that the six dimensions of the CDC health-risk construct are scalable. Certainly there is room for improvement but generally these results are very encouraging. Obvious advantages accrue considering this is a workable concept. First, comparative risk may be assessed across demographic groups (male/female, minority/non-minority etc.) Second, trends over time might be indexed in a comprehensive program evaluation. Third, norms can be developed so that comparative risk might be assessed for individuals and the concept of group variance incorporated into the CDC construct. In our thinking, this has been a critical omission in health risk behavior research to date. Finally, the scaling of health risk behavior permits examination of the covariances and testing of a latent trait model, a development which would help us understand the interactions in this highly complex construct.

In examining the intercorrelations among the scales, drug and alcohol use was found to be highly correlated with intentional and unintentional injuries, tobacco use, and sexual behavior, implying that those who are risky in one area might be risky in others as well. If this is true, then in determining how to best influence the risky behaviors of young adults, educators cannot assume that students will participate in risky behavior independently.

Virtually no relationship was found between eating and the other health-risk behaviors. Similarly, there was no relationship found between amount of physical activity a person participated in and whether they were risky with regard to tobacco use, drug and alcohol use, and sexual behavior. This finding was further substantiated by the health-risk behavior model developed which found that exercise and eating comprised a single factor (maintenance) that was only slightly related with the second "risk" factor.

The most significant finding of this research is that of a model that is nearly perfect in describing college student health-risk behavior (Figure 1). The fact that the two factors of the model -- maintainance and risk -- were barely correlated implies that whether a student is "safe" on one dimension has no bearing on whether he or she will be "safe" in the other. This suggests that a student might be heavily involved with drugs or alcohol and still practice healthy dietary habits and exercise regularly; or, students might be very safe with regard to drugs, alcohol, and/or sexual behavior and have unhealthy eating habits or not exercise regularly. For example, it is possible that, based on the model of student health-risk behavior found here, a typical college student could go on a binge drinking spree Friday night and jog five miles on Saturday.

Finding two essentially unrelated factors associated with college health-risk behavior is a significant finding from the standpoint of addressing the health and well-being of this population. It cannot be assumed that students are, in general, healthy or not. As this model implies, education must address both factors as students might be risky in one or the other area, or both.

Perhaps one explanation concerning why these factors are unrelated is the nature of the risk involved with each. The consequences of risky practices for those scales in the "risk" factor relate to behaviors such as carrying a weapon, cigarette smoking, excessive alcohol use, and having sex without a condom. These activities are perceived as having more

immediate adverse health consequences, which in some cases may prove deadly. The potential negative consequences associated with behaviors such as these are well known, and they can be seen in the present or near future.

However, it is possible, and may be likely, that with human nature we often fail to see the significance of healthy eating and exercise habits. The speculation is that the "payoffs" of having poor habits in these areas may not come until middle age or later in life (e.g., heart disease, stroke, obesity). The old adage "out of sight, out of mind" makes it difficult to pass up the fatty foods, or to get up an hour earlier to take a morning jog, because the benefits may not be readily visible. Just recently, the benefits of eating well and exercising regularly have become the focus of wellness and health campaigns. Thus, it is now being reinforced in our culture to watch your fat intake, eat fruits and vegetables daily, and to exercise regularly since the long-term benefits have become overwhelmingly evident. These data are the basis for why this factor was named "maintenance," since it involves maintaining a healthy lifestyle.

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