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James R. Koski for the degree of Master of Public Health in Public Health presented on May 13, 2003.

Title: Hepatitis A and B Vaccination in Matriculating College Students: Knowledge, Self-Perceived Risk, Health Risk Behaviors, and Theory of Planned Behavior Constructs.

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Rebecca J. Donatelle

At a state university in the Pacific Northwest, the authors surveyed 477 matriculating college students about their immunization status, knowledge, self-perceived risk, and health risk behaviors for hepatitis A and B vaccinations. Review of immunization records revealed that 10 % of these students were completely immunized for hepatitis A and 58.8 % were completely immunized for hepatitis B. Although their knowledge about hepatitis A and B was very good, there were no significant differences in immunization status or health risk behaviors based on their knowledge or their self-perceived risk of hepatitis A and B. About 66 % of students perceived they had no risk or low risk for hepatitis A and B and only 5 % felt they had a high risk. In spite of the low self-perceived risk, health risk behaviors for hepatitis A and B were common in this population of college students. In the past twelve months, 56.2 % of these students reported being sexually active (vaginal, oral, anal sex), including 20.5 % who had two or more sexual partners. Students with multiple sexual partners reported having unprotected sex at a high frequency: 61.3 % vaginal, 81.1 % oral-genital, and 13.2 % anal. The non-sexual health risk behaviors were also common in this population: 53.2 % had body piercing/tattoos, and 26.5 % traveled internationally to regions with intermediate to high rates of hepatitis A (Africa, SE Asia, Central/South America). These students who traveled internationally were more likely to be immunized for hepatitis A, although 70 % remained unimmunized. In addition,

students with multiple sexual partners or with a body piercing/tattoo were more likely to be immunized for hepatitis B. However, about one-third of these students with multiple sexual partners or body piercing/tattoo have not completed the hepatitis B series. The theory of planned behavior was applied to determine factors that are associated with college students' decision to be vaccinated for hepatitis A and B. For hepatitis A and B vaccinations, important attitude constructs identified were 'vaccine effectiveness, vaccine adverse effects, anticipation anxiety, inconvenience, and vaccine expense.' The subjective norm constructs with the greatest influence for college students were: 'parents, family doctor, and student health services staff'. The significant perceived behavioral constructs were 'parents reminder, student health services (SHS) reminder, and SHS hepatitis vaccine clinic.' In conclusion, there is still a sizable portion of unvaccinated college students who possess health risk behaviors for hepatitis A and B, such as multiple sexual partners, unprotected sexual behaviors, body piercing/tattoos, and international travel. With a greater understanding of college students' attitudes, subjective norms, and perceived behavioral control college health services could develop more effective strategies to educate unvaccinated college students about these risks and motivate them to be immunized.

Hepatitis A and B Vaccination in Matriculating College Students: Knowledge, Self-Perceived Risk, Health Risk Behaviors, and Theory of Planned Behavior Constructs

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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James R. Koski, Author

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DEDICATION

This thesis is dedicated to my late father, Art Koski, PhD, MPH. As a longstanding professor of Public Health at Oregon State University he was my role model, mentor, and inspiration to purse a career in medicine and public health.

Hepatitis A and B Vaccination in Matriculating College Students: Knowledge, Self-Perceived Risk, Health Risk Behaviors, and Theory of Planned Behavior Constructs

INTRODUCTION

In spite of massive efforts aimed at prevention, hepatitis A and B continue to be pervasive threats to the health of thousands of people in the United States (Centers for Disease Control and Prevention [CDC], 2002 October 9). Although there are several hepatitis types, Hepatitis A (HAV) and B (HBV) viruses are responsible for 87 % of all cases of viral hepatitis in the United States (CDC, 2002 October 9). Analysis of epidemiological data shows differences in incidence rates based on age [Table 1]. College students are within the age group with the highest incidence for hepatitis A and B. Adolescents and young adults between the ages of 15-39 years accounted for 43 % and 58 % of the reported cases of hepatitis A and B respectively in the year 2000 (CDC, 2002 June 14).

Both hepatitis A and B infections can result in significant morbidity and mortality. These diseases can be costly as the result of hospitalizations, lost work-time, and concomitant disability (Margolis et al., 1995; CDC, 1996). While hepatitis is typically self-limiting, about 2-6 % of adults with acute hepatitis B infection will

Table 1. Reported cases of hepatitis A and B by age group- U.S., 2000.

Age Group	Hepatitis A N = 13,397	Hepatitis B N = 8,036
	% (Cases)	% (Cases)
Ages < 15*	28.1 (3,772)	1.4 (118)
Ages 15-39	43.1 (5,782)	57.8 (4,722)
Ages > 40	27.8 (3,730)	38.3 (3,074)
Age Not Stated	1.0 (113)	1.5 (122)

*Reported cases may underestimate infants and children due to asymptomatic cases.

become chronic carriers. Persons with chronic infections have a 15-25 % risk of death from the complications of cirrhosis and liver cancer (CDC, 2002 May).

Although hepatitis A and B have caused significant morbidity and mortality, new infections are on a decline. Prior to introduction of both the hepatitis A and B vaccinations in the United States, hepatitis A and B viruses each consistently caused 200,000-300,000 new infections each year in the 1980's [Table 2] (CDC, 2002 October 9). In the year 2000, the incidence rate of hepatitis A in the United States reached an historically all time low (CDC, 2002 June 14). It is difficult to determine if this drop in hepatitis A cases was due to the cyclic nature of this disease or due to the implementation of the hepatitis A vaccination. In a recent study, the approach of vaccinating children appears to have decreased the hepatitis A incidence among both

Table 2. Vaccine milestones and estimated disease burden from hepatitis A and B in the U.S., 1980-2001.

Vaccine Milestones	Year	Hepatitis A Incidence*	Hepatitis B Incidence*
Hepatitis B Vaccine Licensed	1982	234,000	208,000
Hepatitis B Infant/child Immunization Recommendation	1991	288,000	193,000
Hepatitis A Vaccine Licensed	1995	356,000	113,000
Hepatitis B Adolescent Immunization Recommendation	1996	335,000	112,000
Hepatitis A Child Immunization Recommendation	1997	341,000	110,000
Hepatitis B Age 19 years or less Immunization Recommendation	1999	181,000	79,000
Vaccine for at Risk for Hepatitis (VFARH)	2002	93,000	78,000

*Estimated number of new cases per year by the CDC.

children and adults and controlled the disease in a community with recurrent epidemics (Averhoff et al., 2001). Similarly, the implementation of a series of hepatitis B immunization recommendations by the Advisory Committee on Immunization Practices (ACIP) are finally decreasing the disease burden of hepatitis B in the United States (CDC, 2002 June 28). Given the success of immunization recommendations targeting infants, children, and adolescents, the hepatitis A and B immunization strategies are now shifting toward high-risk adults.

The most recent recommendation by the CDC and the ACIP is to give the hepatitis A and B vaccination to all adults 19 years of age and older, who are at risk of infection [Table 3] (CDC, 2002 April, Goldstein et al, 2002). In the 1990's the transmission of hepatitis B occurred predominately in three major risk groups; 1) "high-risk" heterosexuals [40 %], 2) injection drug users [15 %] and 3) men who have sex with men [14 %] (Goldstein et al., 2002). Many opportunities to vaccinate for

Table 3. High-risk adults for hepatitis A and B infection.

- Heterosexual men and women who have multiple sexual partners (>1 in 6 months).
- Clients of STD clinics or a prior history of a sexually transmitted infection.
- Men who have sex with men (MSM) and bisexual men.
- Persons who inject drugs, and especially those who share needles or other drug "works."
- Persons attending drug treatment centers.
- Household contacts or sexual contacts of infected person with acute hepatitis A or chronic hepatitis B.
- Travelers (short or long term for A, long term for B) to countries with high and intermediate prevalence for hepatitis A or B.
- Inmates of long-term correctional facilities.
- Patients with blood clotting disorders or chronic liver diseases.

hepatitis A and B are missed when these high risk persons visit STD clinics, HIV counseling and testing sites, family planning centers, correctional facilities and drug treatment clinics (CDC, 2002 June 28). Although injection drug users, inmates of prisons, and men who have sex with men are clearly at high risk of viral hepatitis, there is also a significant segment of the college population that partake in high-risk heterosexual behaviors.

A large number of college students engage in a variety of sexual behaviors that increases their risk of hepatitis A and B infections. The National College Health Assessment indicates that a significant percentage of college students have had prior experience with three forms of sex: 74 % vaginal, 78 % oral, and 24 % anal (American College Health Association [ACHA], 2002). About 29 % of these students could be considered "high-risk" based on having more than one sexual partner in the past year. Of those regularly engaged in sexual activity, condoms were consistently used at a rate of only 43% with vaginal sex and 21 % with anal sex. The other two major risk groups for hepatitis B, injection or illicit drug users (cocaine, amphetamines, and other) and men who have sex with men are reported to be about 4 % and 1 % respectively at universities in the United States (ACHA, 2002). In summary, greater than thirty percent of all college students are at risk for hepatitis based on "high-risk" heterosexual behaviors, illicit drug use, and men who have sex with men.

To add further complexity to this problem, many college students engage in high-risk sexual behaviors under the influence of alcohol. Binge drinking has been identified as a significant problem on college campuses (Wechsler and Dowdall, 1998). Unfortunately, a small, but not insignificant portion of college students expose themselves to unprotected high-risk sexual behaviors while intoxicated with alcohol. The 2002 National College Health Assessment indicated that about 20 % of students in the past year had unprotected sex as the result of their drinking behaviors (ACHA, 2002). Given that college students participate in a variety of health risk behaviors, hepatitis A and B immunizations are the most effective method to protect these individuals from hepatitis.

The American College Health Association has recognized that college students participate in "risky" health behaviors and has strongly urged vaccination of all college students against hepatitis B (ACHA, 2003 March). The ACHA prematriculation recommendation for the hepatitis A vaccine follows CDC guidelines. The CDC recommends hepatitis A vaccine for adolescents through age 18 in states or regions with incidence rates (20 cases per 100,000) twice the national average (10 cases per 100,000) and high-risk groups (travelers to countries where hepatitis A is moderately or highly endemic, men who have sex with men, injecting and illicit drug users, persons who have clotting factor disorders, and persons with chronic liver disease).

Efforts have been made to determine the percentage of college students who have been immunized with hepatitis A and B vaccines. A few surveys have contributed to the collective knowledge base about the immunization rates of hepatitis A and B among college students. The immunization rates for hepatitis A among college students in the United States is still largely unknown. A census study involving a review of 2,714 immunization records submitted to the student health services at a large university in the Pacific Northwest in the fall of 2001 showed that only 12 % of matriculating students had received the hepatitis A vaccine. In addition, among these same students, 14 % had partially completed and 44 % completed the three shot hepatitis B series prior to enrollment (Koski [unpublished raw data from study] 2001). The National College Health Assessment in the Spring 2002 involving 29,000 students from 28 self-selected schools revealed that 65 % of college students reported being vaccinated against hepatitis B vaccine (ACHA, 2002).

Given that a sizable portion of the college student population may be at risk for hepatitis A or B, there is a need for further understanding about barriers and facilitating conditions that determine the likelihood college students will be vaccinated for hepatitis A and B. Prior literature has indicated that informational letters to college students and their parents had a small, yet influential impact in receiving a vaccine (Marron, et al., 1998). A few hepatitis vaccine clinics sponsored by college health services have been effective in recruiting 300-500 students per year for vaccination

(Hanson, 1998; Hurley, Turner, and Butler, 2001). Excessive cost of the vaccine has been repeatedly cited as a barrier for hepatitis B vaccination in college student populations (Ganguly, Marty, Herold, and Anderson, 1998; Marron et al., 1998; Pennie, O Connor, and Garvock, 1991). Other reasons for not obtaining the hepatitis B vaccination include no perceived risk for hepatitis, lack of time to get vaccination, not working in the healthcare field, not being aware of vaccine availability and information about hepatitis infection (Briggs & Thomas, 1994; Marron, et al., 1998; Spence & Dash, 1990). The student's inability to recall whether they have previously received a vaccine may be another significant contributing factor in a student's decision-making process for vaccination (Ganguly et al., 1998).

Besides barriers and facilitating conditions, attitudes about the vaccines can play a pivotal role in the likelihood of being immunized. Behavioral theories have been employed to evaluate attitudinal factors affecting the decision to be immunized for hepatitis B. Among nursing students in Taiwan, the multi-attribute utility (MAU) theory described predictors for hepatitis B immunization (Lin & Ball, 1997). Results indicated that the "personal value of hepatitis B vaccination", and in particular "concern about the efficacy of the hepatitis B vaccine", "fear of pain from repeated injections", "time", and "money" were the main determinants in relation to the uptake of the hepatitis B vaccination. Earlier studies applied the health belief model (HBM) to evaluate acceptance of hepatitis B vaccines among hospital workers and physicians and found similar reasons to explain the failure to be vaccinated (Murata & Young, 1993; Bodenheimer, Mai-Dalton, Marshall, and Beach, 1986). Application of behavioral theories related to the likelihood of being vaccinated for hepatitis A and B in the college population have been limited.

The theory of planned behavior (TPB) may be helpful to explain factors that contribute to the likelihood of being immunized with the hepatitis A and B vaccines. Ajzen expanded the theory of reasoned action (TRA) to create the TPB (Ajzen, 1991). The TPB is comprised of three major components: attitude, subjective norm, and perceived behavioral control. All three of these components interact to determine the behavioral intention to perform a specific behavior. Each of these components is

determined by two constructs. For example, attitude is comprised of the behavioral beliefs (outcomes of behavior) and the evaluation of behavioral outcomes. The normative beliefs (referents) and the motivation to comply determine the subjective norm. The control beliefs (barriers and facilitating conditions) and perceived power (influence of barriers or facilitating conditions) constructs create the perceived behavioral control component. Thus, the college student's intention to be vaccinated for hepatitis A and B would depend on their beliefs about the vaccine and its consequences, the opinion and influence of referents, and the effect of barriers on facilitating conditions for vaccination.

The theory of planned behavior (TPB) and the related theory of reasoned action (TRA) has been applied to a variety of health related behaviors (see review of literature for details about TPB and TRA). The TRA has been applied to predict condom use in groups with high-risk sexual behaviors (Jemmott & Jemmott, 1991; Wong & Tang, 2001). The TPB has been used to predict a person's intention to donate blood (Amponsah-Afuwape, Myers, & Newman, 2002; Giles & Cairns, 1995). In this study, we planned to determine if there was any differences in the constructs of the TPB based on college students' hepatitis A and B immunization status.

Statement of the Problem

About thirty percent of college students participate in health risk behaviors such as multiple sexual partners, unprotected sex, men who have sex with men, illicit drug use, international travel that places them at risk of contracting hepatitis A and B infections. Since ninety percent are not yet immunized against hepatitis A and thirty-five percent are not yet immunized against hepatitis B, many college students are still unprotected from these potentially harmful viruses. Although college students can prevent hepatitis A and B infections by being vaccinated, the behavioral action of being immunized involves a complex decision-making process. Thus, there is a great need to expand our understanding of college students' knowledge, perceived risks,

health risk behaviors, attitudes, norms, and barriers for hepatitis A and B immunization status.

Purpose of the Study

The primary purpose of this study is to increase our collective understanding about factors that might predict the likelihood that matriculating college students will be immunized with the hepatitis A and B vaccines. Our intention is to gain a clearer understanding about college students' immunization status and their hepatitis knowledge, perceived risk, health risk behaviors. In addition, by applying constructs from the theory of planned behavior we hope to determine if there are any differences in college student's attitude, subjective norm, perceived behavioral control constructs based on their hepatitis A and B immunization status. Understanding the factors associated with completing the hepatitis A and B vaccination will provide valuable information for improving educational and immunization strategies designed to protect college students from these vaccine preventable diseases.

Research Questions

1) Are there significant differences in college students' immunization status for hepatitis A and B based on their demographic characteristics (race/ethnicity, gender, marital status, age, parent's combined income, high school GPA, site of local residence, academic college, and religious preference)?
2) Are there significant differences in college students' self-reported hepatitis A and B immunization status and their actual immunization record?
3) Are there significant differences in college students' hepatitis A and B knowledge based on their hepatitis A and B immunization status?
4) Are there significant differences in college students' health risk behaviors for hepatitis A and B (number of sexual partners, type of sexual partner, body

piercing/tattoo, international travel to regions with hepatitis A risk, drug use) based on their hepatitis A and B knowledge?

5) Are there significant differences in college students' hepatitis A and B immunization status based on their health risk behaviors?
6) Are there significant differences in college students' hepatitis A and B immunization status based on their self-perceived risk for hepatitis A and B?
7) Are there significant differences in the health risk behaviors of unvaccinated college students based on their self-perceived risk for hepatitis A and B?
8) Are there significant differences in college students' attitude constructs about hepatitis A and B vaccines based on their hepatitis A and B immunization status?
9) Are there significant differences in college students' subjective norm constructs based on their hepatitis A and B immunization status?
10) Are there significant differences in college students' perceived behavioral control constructs based on their hepatitis A and B immunization status?

Justification of the Study

Since a significant portion of the college student population are still not vaccinated for hepatitis A and B, the results of this study could have application to many college health services around the country as they strive to promote hepatitis vaccinations on their campuses. This research will contribute substantially to be immunized against hepatitis A and B. The primary reason for selecting the matriculating university students for the study group was that their hepatitis immunization records were readily available at the student health services. Efforts to target freshman students for hepatitis A and B immunization have additional economic implications nationwide, as the adolescent doses (age 19 years or less) are typically less expensive than the adult doses. For example, the cost of the three shot hepatitis B series for an adolescent is about $75 compared to $120 for the adult series.

Delimitations

The scope of this study is delimited to a sample of convenience made up of students (true freshman and first-year transfer students) who matriculated to Oregon State University in the fall quarter, 2002 and enrolled in a student orientation class, Odyssey ALS 111 and ALS 112. The study is further delimited to a 91-item written survey that was administered to students who attended their Odyssey ALS classes. The design of the survey allows evaluation of the following concepts related to a college student's likelihood of being vaccinated for hepatitis A and B: 1) demographic characteristics, 2) knowledge about hepatitis A and B, 3) perceived risk for hepatitis A and B, 4) health risk behaviors, 5) attitudes about hepatitis vaccines, 6) subjective norm of referent individuals, and 7) perceived behavioral control of facilitating conditions and barriers.

Limitations

The following limitations apply to this study:

1) Sampling a convenience group of matriculating students may not be completely representative of the entire group of matriculating students.
2) Restricting the study group to just matriculating students may not allow generalization of the results to other segments of the student population.
3) Limiting the study to a single campus, Oregon State University, may not allow generalization of the results to other campuses in Oregon or the United States.
4) Studying the health risk behaviors of students in the Fall term of their first year at the university may not reflect their risks throughout their college life?
5) Including personal questions about health risk behaviors on a voluntary non-anonymous survey may have prevented students from participating in the study or answering the questions with complete honesty.

Assumptions

The following assumptions related to this study are:

1) The scales in the survey contain appropriate construct validity and reliability to appropriately evaluate the theory of planned behavior constructs of attitude, subjective norm and perceived behavioral control for hepatitis immunizations.
2) All participating subjects clearly understood the questions in the written survey and the manner in which they should respond.
3) The immunization records submitted to the Student Health Services are accurate and complete in regards to the student's hepatitis A and B immunizations.

Definition of Terms

Attitude: an opinion about performing a behavior.

Facilitating Conditions or Barriers: the environmental factors that may promote or impede an individual's decision for perform a specific behavior.

HAV: Hepatitis A Virus.

HBV: Hepatitis B Virus.

Complete Immunization: student who have completed a full series of an immunization-hepatitis B vaccine (3 shots) and hepatitis A vaccine (2 shots) or combined hepatitis A and B vaccine (3 three shots).

Partial Immunization: student who has received on a portion of the immunization series: hepatitis B (1 or 2 shots) and hepatitis A (1 shot) or combined hepatitis A and B vaccine (1 or 2 shots).

No Immunization: student who has not received any hepatitis A or B vaccines.

Matriculating: student enrolling in a school for the first time

MSM: men who have sex with men.

Perceived Behavior Control: the belief that barriers or facilitating conditions will exist and influence an individual's decision to perform a behavior.

Subjective norm: the influence referent individuals play in a person's decision to perform a behavior.

REVIEW OF LITERATURE

Overview of the Hepatitis A and B Risk in the College Population

Hepatitis A and B viruses are responsible for the vast majority of viral hepatitis cases in the United States. These infections can cause significant morbidity, economic burden, and risk of mortality especially among those who become chronic carriers of the hepatitis B virus. The development of safe and highly effective hepatitis A and B vaccines has permitted the Centers for Disease Control and Prevention (CDC) and the Advisor Committee on Immunization Practices (ACIP) to develop effective strategies to combat impact of these viruses on our society. Great achievements have been accomplished with implementation of these strategies as the incidence of hepatitis A and B is currently at historically all time lows. Now, the focus of the CDC and ACIP has shifted toward giving hepatitis A and B vaccines to all adults age 19 years or greater who are at risk for these hepatitis infections.

The three identified major risk groups for hepatitis A and B are "high-risk" heterosexuals, injection and illicit drug users, and men who have sex with men. College students are in the age group with the highest incidence of hepatitis A and B, and a significant portion of them engage in risky health behaviors. Consequently, they represent a group of adolescents and young adults who are potentially at risk for contracting hepatitis A and B viruses. Since hepatitis immunizations are not among pre-matriculation requirements at universities in the United States (Cook et al., 1993) a sizable portion of college students are not yet immunized for these diseases.

The American College Health Association (ACHA) recognized the risk of hepatitis B for college students and strongly urged all college students to get the hepatitis B vaccine (ACHA, 2003). Numerous university health services implemented informational campaigns and hepatitis vaccine clinics (Hanson, 1998; Hurley et al., 2001; Marron et al., 1998). Several researchers investigated possible barriers to receiving the hepatitis B vaccine within the college student population (Ganguly, Marty, Herold, and Anderson et al., 1998; Marron et al., 1998; Pennie, O Connor, and

Garvock, 1991). A few investigators have applied theories of health behavior to identify determinants that impact the receipt of the hepatitis B vaccination among students and workers in the healthcare professions (Bodenheimer, Mai-Dalton, Marshall, and Beach, 1986; Lin & Ball, 1997; Murata & Young, 1993). There is a great need for further understanding regarding factors affecting the likelihood that a student will be immunized for hepatitis A and B vaccines. This information will be valuable for improving educational, promotional, and other strategies designed to protect college students from these vaccine preventable diseases.

Hepatitis A

Hepatitis A infection in older children and adults occurs as an acute "flu-like" illness with loss of appetite, tiredness, muscle aches, joint pain, and stomach discomfort along with diarrhea, dark urine, and jaundice (CDC, 1999; Lednar et al., 1985). A symptomatic infection occurs in 80 % of adults while most children either have asymptomatic or unrecognized infections (CDC, 2002 May 10). The highest incidence of reported cases of hepatitis A occurs in adolescents and young adults, ages 15-39 years (CDC, 2002 June 14). One-third of the U.S. population has serologic evidence of prior infection of prior HAV infection, which increased directly with age and reaches 75 % among persons aged > 70 years. Hepatitis A rarely results in fulminant infection and death as the overall case-fatality rate reported by the CDC is 0.3 %. In persons over age 50, the rate increases to 1.8 % and persons with chronic liver disease are at even greater risk of fulminant hepatitis A (CDC, 1999). The vast majority of persons with hepatitis A infection usually completely recover from their illness in two to six months (Glikson et al., 1985).

The burden of costs associated with hepatitis A is substantial. Between 11 % and 22 % of persons who have hepatitis A are hospitalized (CDC, 1996). Persons with hepatitis A miss an average of 27 days from work. The direct and indirect costs associated with each case of adult hepatitis A ranges from $1,800 to $2,500 and for children less than age 18, $400 to $1,500. Health departments incur substantial costs

in providing post exposure prophylaxis to an average of eleven contacts per case. The annual direct and indirect costs to the United States are estimated to be about $300 million (CDC, 1999).

The primary mode of transmission for hepatitis A is the fecal-oral route either by person-to-person contact or by ingestion of contaminated food or water. Most U.S. cases of hepatitis A result from person-to-person transmission during community wide outbreaks. The most frequently reported source of infection (12-26 %) is by household contact or sexual contact with a person with hepatitis A. About 10 % of reported cases occur among users of injection and non-injection drugs, and among men who have sex with men (MSM). About 7 % of reported cases occur in international travelers (CDC, 2000 September). In addition, about one-half of persons with hepatitis A do not have an identified source for their infection (Bell, Shapiro, Alter et al., 1998; CDC, 1996; CDC, 1999).

Unlike other STDs, HAV-infected persons are infectious for only a relatively brief period of time. However, many sexual practices facilitate fecal-oral transmission of HAV, and unapparent contamination is commonly present during sexual intercourse. Measures typically used to prevent the transmission of other STDs, such as condoms, do not prevent HAV transmission. The most effective means of preventing HAV transmission is by vaccinating those persons at risk of sexual transmission of this virus and among persons who use injection and non-injection illegal drugs (CDC, 2000 May 10).

Hepatitis A Vaccine

Two forms of a highly effective inactivated hepatitis A vaccine, HAVRIX and VAQTA, have been available in the United States since 1995. The vaccine series consists of two doses given intramuscularly 6-12 months apart. Both the adult and adolescent vaccine doses elicited a protective immune response in greater than 94 % after the first dose and 100 % response after a booster dose 12 months later (CDC, 1999). If the booster dose was delayed 24 to 66 months after the primary

immunization, the anti-HAV titers were not detectable in 32 %. However, one month after receiving the booster 100 % elicited an immune response. Therefore, the two hepatitis A vaccine doses should be given six to twelve months apart. However, the second dose should be given no sooner than six months, but can be delayed for several years and still achieve an adequate immune response. Currently, the ACIP has not recommended any further interval booster doses beyond the initial immunization series as it is felt that immunity will last beyond twenty years and it is too early to determine if this primary immunization series will last a person's lifetime (CDC, 1999).

The hepatitis A vaccines are very safe, as they are well tolerated and no serious adverse reactions have been observed with immunization. The most common side effects for adults were soreness at the injection site (56 %), headache (14 %), and malaise (7 %). The vaccine is considered extremely safe as 65 million doses of the vaccine has been given worldwide with no serious complications attributed to the vaccine (CDC, 1999).

Hepatitis A Immunization Recommendations

After the licensure of the hepatitis A vaccines in the United States in 1995, the Advisory Committee on Immunization Practices (ACIP) recommendations initially focused on vaccinating persons in groups shown to be at risk for infection. This included travelers to countries with high to intermediate rates of hepatitis A, men who have sex with men, persons with chronic liver disease, injecting drug-users, and children living in communities with high rates of disease (CDC, 1996 December 27). However, new data about the epidemiology of hepatitis A indicated that continued implementation of this strategy would not result in immunization of populations with consistently elevated disease rates.

The ACIP then changed their focus in 1999 by recommending routine hepatitis A vaccination of children in those areas with twice the 1987-1997 national average rate (> 20 cases/100,000 population) and consideration of routine vaccination in those

areas exceeding the national average (> 10 cases but < 20 cases/100,000 population) (CDC, 1999). Hepatitis A disease burden, especially in the 17 states affected by the 1999 recommendations, has dramatically decreased to achieve a national historical low incidence rate (4.9/100,000) in the year 2000. Hepatitis A vaccination has been shown to be highly effective in preventing disease among recipients. In a recent study, the approach of childhood vaccination appears to have decreased hepatitis A incidence among both children and adults and controlled the disease in a community with a history of recurrent epidemics (Averhoff et al., 2001). Routine immunization of infants and children with the hepatitis A vaccine is being considered as part of an incremental strategy to further reduce this disease burden.

Hepatitis B

Hepatitis B, like hepatitis A, can cause an acute infection with clinical symptoms and signs that include anorexia, malaise, nausea, vomiting, abdominal pain, and jaundice. Hepatitis B has a long incubation period ranging from 45-180 days (mode 60-90 days) and the onset of acute disease is insidious or can be silent. Experiencing a clinical illness associated with an acute infection is age-dependent with jaundice occurring in less than 10 % of children under age 5 years and 30-50 % in older children and adults. The reported case-fatality rate for acute hepatitis B is approximately 1.0 %. The likelihood of becoming chronically infected is inversely related with the age at which infection occurs. Approximately 30 % to 90 % of young children and 2-10 % of adults develop chronic infections (CDC, 2001 July 25). Among persons with chronic HBV infection, the risk of death is 15-25 % as about 5,000 deaths occur annually from HBV-related cirrhosis and hepatocellular carcinoma. There are an estimated 1.25 million people in the United States who are chronically infected with HBV and serve as a reservoir for infection (CDC, 2002 October).

The estimated medical costs related to acute hepatitis B infections were evaluated in a 1993 economic analysis. Without a vaccination program the expected lifetime direct medical costs for adolescents and adults in the U.S. with acute hepatitis

B would be $27.9 million, with $17.2 million spent on the 12 % who are hospitalized. The associated work-loss costs of these persons with acute hepatitis B were estimated to be $46.8 million. The medical and work-loss cost associated with chronic hepatitis B infections are more difficult to accurately estimate due to the delay in the development of complications from chronic HBV (Margolis et al., 1995). For chronic hepatitis B the direct lifetime medical costs were estimated to be 13.4 million and work-loss costs 47.8 million based on 1993 dollar amounts.

HBV is efficiently transmitted by percutaneous or mucous membrane exposure to infectious body fluids including blood, saliva, semen, and vaginal fluids (CDC, 2001 July 25). The HBV is quite fastidious and has been documented to remain infectious on environmental surfaces for at least a month at room temperature (CDC, 1995). It is 100 times more infectious than HIV (CDC, 1991). It can enter the body through cuts, tears, or abrasions in the skin and through mucous membranes of the mouth, vagina, anus, and eyes. Sexual transmission among adults accounts for most HBV infections in the United States. In the 1990s, transmission among heterosexuals and men who have sex with men (MSM) accounted for about 40 % and 15 % of infections respectively. The other major risk group responsible for transmission of HBV is injection drug users who account for about 14 % of infections (Goldstein et al., 2002).

About one-third of those infected with HBV do not know the source of their infection. Some of these people may be exposed to the HBV by incidental contact with the blood or bodily fluids of an infected person. College students could be potentially exposed to the HBV is by exposure to the blood or body fluids of an infected person through contact sports, by contaminated needles used for tattooing or body piercing, by repeatedly sharing an infected person's razor, toothbrush, or earrings, and travel to countries with high rates of hepatitis B (ACHA, 2002 April).

Hepatitis B Vaccine

A plasma-derived hepatitis B vaccine was first licensed for use in the United States in 1981. Since the late 1980's, two recombinant DNA *hepatitis B* vaccines, RECOMBIVAX and ENERGIX, have been available as a series of three shots given intramuscularly over six months. The hepatitis B vaccine has an outstanding record of safety and effectiveness. Since becoming available, over one billion doses have been administered worldwide. The risk of the hepatitis B vaccine causing serious harm or death is extremely small. The most common reactions are soreness at the injection site [25 %], and mild to moderate fever [1 %] (CDC, 2001 July 11). Completing the series of three doses of hepatitis B vaccine induces a protective antibody response in 95 % infants, children, adolescents, and healthy younger adults (Koff, 2001). Currently there is no recommendation for additional booster as it yet to be determined if immunity will wane over time.

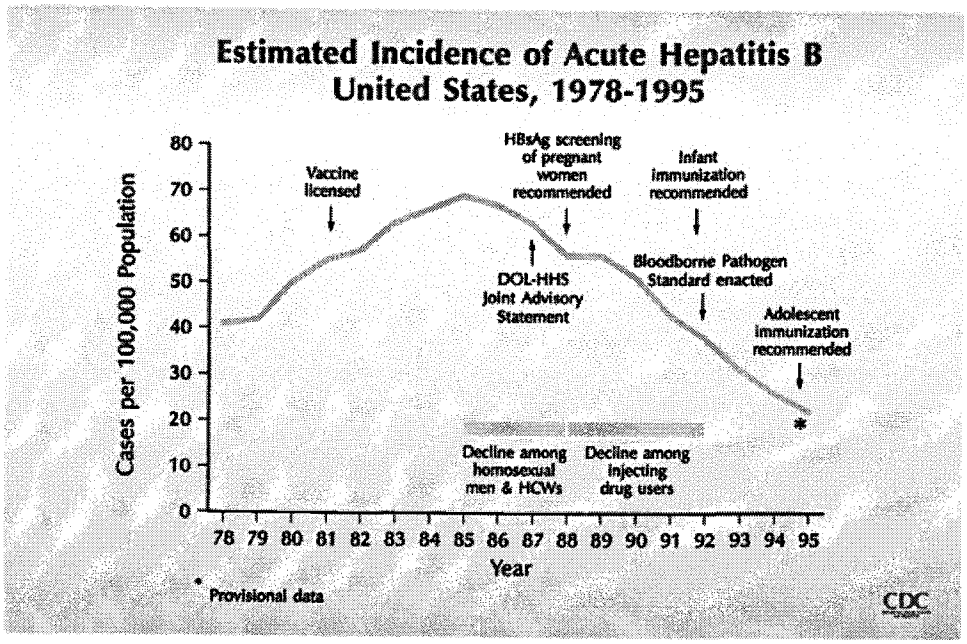
In the year 2001, a combined hepatitis A and B vaccine, TWINRIX, was approved for use in persons over the age of 18 years. Similar to the hepatitis B vaccines, this vaccine series involves three shots over six months. After one dose of TWINRIX, seroconversion to anti-HAV was seen in 94 % of recipients and protective anti-HBs concentrations in 31 %. After the second dose the protective antibody response occurred in 99 % for anti-HAV and 78 % for anti-HBs. With a complete immunization series the protective antibody response increased to 99.9 % and 98.5 % respectively. The efficacy is similar to the currently available single antigen hepatitis vaccines. The excellent safety and efficacy record of these vaccines make them an attractive addition to child and adult immunization recommendations (CDC, 2001 September 21).

Hepatitis B Immunization Recommendations

A succession of immunization recommendations has incrementally decreased the disease burden of hepatitis B in the United States since the hepatitis B vaccine was first introduced in late 1981 [Figure 1] (CDC, 1998 June 4). Initially immunizations

were targeted at high risk groups, including health care workers, hemodialysis patients, recipients of clotting factors for blood disorders, men who have sex with men (MSM), injection drug users (IDUs), populations with high rates of HBV infection, and inmates (CDC, 1982). However, the rates of new hepatitis B cases did not begin to significantly drop until after 1991 when the Advisory Committee on Immunization Practices (ACIP) recommended a comprehensive immunization strategy focused on universal childhood immunizations, prevention of perinatal HBV transmission, vaccinations of adolescents and adults in high risk groups and catch-up vaccinations for susceptible children in high-risk groups (CDC, 1991).

Figure 1. Estimated Incidence of Acute Hepatitis B – U.S., 1978-1995.



In an effort to immunize at risk adolescents the ACIP followed with two more recommendations, in 1995 to give routine vaccination of all adolescents aged 11-12 years who had not been previously vaccinated (CDC, 1995 August 4), then in 1999, to immunize all unvaccinated children aged < 19 years (CDC, 1999 January 22). Now the drop in hepatitis B rates have reached a plateau mainly due to three major risk

groups, heterosexuals, men who have sex with men (MSM), and injection drug users (IDUs), who are still inadequately protected from the virus. In response to this trend, in 2002 ACIP recommended giving the hepatitis A and B vaccination to all adults 19 years of age and older, who are at risk of infection [Table 3, p. 3] (CDC, 2002 April; Goldstein et al, 2002).

The need to immunize high-risk adults was recognized after a study showed that among persons with acute hepatitis B, up to 55.5 % reported treatment for a sexually transmitted disease or incarceration in a prison or jail prior to their illness (Goldstein et al., 2002). These cases represented missed opportunities to vaccinate at risk persons in settings where they could have been vaccinated (e.g. STD clinics, drug treatment programs, and correctional facilities). A 1997 survey of STD clinics demonstrated that hepatitis B vaccine was routinely offered in only 5 % of these settings (CDC, 2002 May 10). Among men who have sex with men (MSM) and injection drug-users (IDUs) who were seen in San Diego County STD clinics between 1998-2001, 16 % and 6 % respectively reported to have previously completed the hepatitis B series (CDC, 2002 July 19).

Health Risk Behaviors of College Students

University health centers, which provide services related to family planning, STD screening and treatment, as well as HIV counseling and testing, are another clinical setting to target high-risk adults for hepatitis A and B immunizations. College students partake in a variety of sexual health behaviors that increase their risk for hepatitis. The National College Health Assessment found that a significant percentage of college students have had prior experience with three forms of sex: 74 % vaginal, 78 % oral, and 24 % anal sex (ACHA, 2002).

The percentage of persons participating in anal intercourse corroborates with a survey of the general population and several other studies of American universities. In a 1992 survey of the representative of the general U.S. population, 23 % of those surveyed had previously engaged in heterosexual anal intercourse (Lauman et al,

1994). At the University of Maryland 3,400 undergraduate students surveyed reported having practiced heterosexual anal intercourse (Kotloff, Tacket, and Wassermann, 1991). A 1991 survey at a Midwestern university found that 17 % of male and 18 % of female students reported having anal sex (Reinisch, Hill, Sanders, and Ziemba-Davis, 1995). Of these college students practicing anal sex, 69 % of males and 49 % of female engaged in anal sex in the previous year, and 26 % and 17 % respectively within the past month. The more sexual partners the greater likelihood of practicing anal sex. A large sample of Canadian college students showed of those 40 % of males and 25 % of females who reported at least 5 partners, 21 % and 28 % had engaged in anal sex. For those with 10 or more partners, 27 % of males and 35 % of females reported having anal sex (MacDonald et al, 1990).

Because heterosexual anal intercourse is typically a stigmatized sexual practice, it is more common among young adults than the general public is aware (Halperin, 1999). In terms of absolute numbers, approximately seven times more women than homosexual men engage in unprotected receptive anal intercourse. Studies about heterosexual HIV transmission have consistently found anal intercourse to be a highly predictive risk factor for seroconversion. Anal intercourse also places them at risk of other STDs such as hepatitis A and B. Some reasons cited for engaging in anal sex were curiosity, pleasure, partner's pleasure, to maintain virginity, and contraception (Halperin, 1999).

Although anal sex carries a higher risk of transmission than vaginal sex, condom use with anal sex is traditionally much lower than with vaginal sex. In the 2002 National College Health Assessment revealed that of those who regularly engaged in sexual activity, condoms were consistently used at a rate of only 21 % with anal sex and 43% with vaginal sex. In a survey of unmarried students at a Midwestern college, 10.6 % reported using condoms every time they engaged in anal intercourse, compared to 18.6 % who used them regularly with vaginal intercourse (Ehde, Holm, and Robbins, 1995). Some reasons cited for not using condoms with anal sex were that, 1) the use of condoms for contraception is inherently associated with vaginal sex, 2) AIDS prevention messages have poorly conveyed the risk of anal intercourse to the

heterosexual population, 3) anal sex is hidden and stigmatized so women and heterosexuals are less likely to discuss or negotiate safer sex techniques for anal sex, and 4) condoms more frequently fail during anal sex with higher rates of breakage, slippage, or discomfort with this form of sexual activity (Halperin, 1999).

The 2002 National College Health Assessment showed that about 29 % of college students could be considered high-risk category based on having more than one sexual partner in the past year (ACHA, 2002). A significant number of adolescents and college students have engaged in sexual activity with multiple partners. A 1988 national survey of adolescents showed that 50 % of the 16-year-old males were sexually active with a mean number of 5.1 lifetime sex partners and 32 % of females were sexually active with a mean 3.3 lifetime partners. By age 19, 86 % of males and 75 % of females had their first heterosexual intercourse experience (CDC, 1998). If about 30 % of the 14.3 million college students in the United States have multiple partners in the past year, then about 4.3 million students could be considered high-risk heterosexuals.

The second largest risk group for hepatitis A and B in the United States are men who have sex with men. Even though only 1 % of the college population is reported to be men who have sex with men, they represent a group at higher risk for both hepatitis A and B due to their receptive anal intercourse practices. With only 1 % of the college population reportedly being MSM, they contribute only about 143,000 students to the risk pool. Fortunately, studies have shown that men who have sex with men are much more likely than heterosexuals to practice protective receptive anal intercourse through regular use of condoms. In a large national survey (NABS), approximately 60 % of homosexual and bisexual men always used condoms with anal sex. In marked contrast, a New Zealand study found of the 21 % of females who practice anal intercourse only 7 % consistently used condoms, while 71 % of homosexual men, 53 % of bisexual men, and 16 % of heterosexual men consistently used condoms with anal intercourse.

The third largest risk group for these two forms of viral hepatitis is illicit drug users (cocaine, metamphetamines, and other drugs). The 2002 National College

Health Assessment showed that 20 % of college students use marijuana, but about 4 % are reported to use illicit drugs more commonly associated with hepatitis A and B (cocaine, metamphetamines, and other drugs). If injection and illicit drug users represent 4 % of the college population, then about 570,000 persons would be at risk for hepatitis from this health behavior.

Besides sexual transmission there are other potential modes of transmission for the hepatitis A and B viruses among college students. International travel to countries endemic for hepatitis A, especially Africa, Asia, Central/South America, is responsible for 7 % of hepatitis A cases in the United States (CDC, 2000 September). Not infrequently, college students travel internationally or study abroad. Living or traveling abroad to countries with high endemic rates of hepatitis B for greater than 6 months is considered a secondary risk as well. Universities are densely populated environments and multiple students often share common bathrooms and living quarters. Given that hepatitis B virus is quite fastidious and highly infectious, individuals are potentially exposed to HBV through sharing razors, toothbrushes, washcloths, and earrings via nonsexual household contact with a person with acute or chronic hepatitis B (CDC, 2002 May). Although transmission of blood-borne pathogens, such as hepatitis B, can occur through body piercing and tattoos, infections attributed to these activities account for only a small percentage of reported cases (CDC, 2001 July). College students are at risk from hepatitis A and B based on the variety of lifestyle risks indicated, especially based on their sexual practices.

Hepatitis Vaccination Rates of College Students

Given that the average age of students at most institutions of higher education is 25 years, college students are among the age group at highest risk for hepatitis A and B infections. A significant portion of our nation's 14.3 million college student population has not yet been immunized for hepatitis A and B. Although no national data is available on the immunization rates for hepatitis A among college students, a study involving a review of immunization records submitted to the student health

services upon matriculation in the fall of 2001 at a large state land-grant university in the Pacific Northwest, only 12 % of these students had received the hepatitis A vaccine. Among these same students, 14 % had partially completed and 44 % completed the three shot hepatitis B series prior to enrollment (Koski [unpublished raw data from study] 2001). The National College Health Assessment in the Spring 2002 involving 29,000 students from 28 self-selected schools revealed that 65 % of college students self-reported being vaccinated against hepatitis B vaccine (American College Health Association, 2002).

There is a sizable portion of the college population in the United States that would meet the criteria of "high-risk adults" greater than 19 years who should be vaccinated against the hepatitis A and B virus as suggested by the 2002 immunization recommendation by the CDC and ACIP. Considering the college population is 14.3 million students and the current self-reported immunization rate for hepatitis B is 65 %, then currently 5 million students are still not immunized. If 30 % of this unprotected population is recognized as practicing "high-risk" heterosexual practices, then an estimated 1.5 million students could still be at risk for hepatitis B infection. These are probably conservative estimates given that 10-15 % of those students reported having the hepatitis B vaccine have only partially completed the three injection series.

Based on the data from the National College Health Assessment, there also would be an estimated 140,000 men who have sex with men, and 570,00 injection or illicit drug users within the college population. A study of men who have sex with men in a college town showed that 67 % were aware of the hepatitis B vaccine; yet only 22 % had received a full series of three injections. In addition, 30 % had received safer sex information from university health services, but only 14 % reported receiving hepatitis B vaccine information (Neighbors, Oraka, Shih, and Lurie, 1999).

Thus, it is critical to learn more about the college student population in regards to their knowledge, attitudes, behaviors, barriers and perceived risks related to hepatitis A and B vaccinations that play a role in a student's decision to be vaccinated against these viruses. In addition, colleges need to create effective strategies to

immunize the college student population for hepatitis A and B, in particular, the significant number of higher risk students.

Prior Literature on Hepatitis B in College Health

Because the American College Health Association (ACHA) has recognized that college students' lifestyle increase their risk for hepatitis, especially hepatitis B, they have suggested targeting high-risk groups and have strongly urged vaccination of all college students against hepatitis B. In addition, the ACHA has also recommended that all institutions develop hepatitis B educational programs on their campuses. Several schools have implemented interventions to increase student awareness of their risks for hepatitis B and the availability hepatitis B vaccines. A small private northeastern university evaluated the effect of a campus-wide hepatitis B educational campaign that was combined with an informational letter sent to students and their parents (n = 366) and compared to a control group (n = 366) who did not receive the informational letter. They found that those receiving the letter had significantly higher immunization rates of 10.7 % (n = 39) compared to the control group (1.9 %, n = 7). The informational letter was influential in at least a small portion of student's decision to get a hepatitis B vaccine, but the overall immunization rate was low (Marron et al., 1998). In the fall 1998, a southeastern private university organized a community-wide publicity effort emphasizing the need for the hepatitis B vaccination. This was followed a single day hepatitis vaccination clinic which attracted 389 individuals for a hepatitis B vaccination (Hanson, 1998). A large southern university informed first year students and their parents during their orientation session about the hepatitis B vaccination, and then followed this up with a campus-wide education and publicity campaign. Over a three-year period this program successfully recruited an average of 513 students per year to receive the hepatitis B vaccination (Hurley et al., 2001).

Cost of the vaccine is one of the more commonly cited barriers for starting the hepatitis B immunization series. Being immunized was related to the perception that the vaccine was affordable, although 95 % of students said that the cost was excessive

in a study at a large southern university. In this study group, the cost of the vaccine was paid by the student (35.5 %) or by parents (34.5 %) or employers (31 %) (Ganguly, Marty, Herold, and Anderson et al., 1998). In a study in a private northeastern university about one-quarter of the freshman students stated they were unable to afford the vaccine (Marron et al., 1998). In a university in Canada, students who perceived themselves as low risk for hepatitis B were least likely to pay the full retail price for the vaccine (Pennie, O Connor, and Garvock, 1991). Fortunately, in one study students at highest risk with a history of having three or more sexual partners in the last six months were most likely to get vaccinated irrespective of the cost issue (Marron et al., 1998).

Besides cost, other major reasons for not obtaining the hepatitis B vaccination, college student cited they were not at risk, had no time, and were not working in healthcare (Marron, et al., 1998). In other studies involving vaccination among healthcare workers several additional barriers were recognized. Identified barriers related to the hepatitis B vaccine were fear of side effects and organizational self-motivational factors such as being too busy, inertia, and inability to schedule an appointment. Failure to be vaccinated was related to awareness of the availability of vaccination and information about hepatitis infection (Briggs & Thomas, 1994; Spence & Dash, 1990). Another possible contributing factor in a student's decision-making process to get a vaccine is their inability to recall whether they have previously received a vaccine. One study discovered that nearly half the 505 students visiting a university student health service did not know their immunization status for hepatitis B (Ganguly et al., 1998).

Behavioral Theories for Health Behaviors

Before selecting a theoretical framework for identifying key variables in the decision-making process to be vaccinated against hepatitis A and B viruses, the literature was reviewed in regards to theoretical applications for a variety of health behaviors. Value expectancy theories such as the multi-attribute utility theory, health

belief model, theory of reasoned action, and theory of planned behavior have been applied to numerous health behaviors including obtaining vaccinations, pap smears, mammograms, condom use, and blood donation.

Multi-attribute Utility Theory

The multi-attribute utility (MAU) theory is used to predict behavior by estimating the person's evaluation of the relative importance of each outcome associated with performing and/or not performing a behavior (Glanz, Lewis, & Rimer, 1990). Thus, the MAU theory can permit evaluation of many *(multi-) attributes* or characteristics of a decision and to determine the *perceived value (utility)* to the person making the decision. The application of this theory requires intensive interviews to reveal behavioral consequences or outcomes related to performing a behavior. These factors are then arranged in a hierarchical structure to specify how they are interrelated or acted to determine behavior. Some models have used stringent mathematical calculations to weight consequence or outcomes for a particular behavior.

Among nursing students in Taiwan, the multi-attribute utility (MAU) theory described predictors for hepatitis B immunization (Lin & Ball, 1997). Results of this study indicated that the "personal value of hepatitis B vaccination", in particular for "concern about the efficacy of the hepatitis B vaccine", "fear of pain from repeated injections", "time", and "money" were the main determinants in relation to the uptake of the hepatitis B vaccination. These results were consistent with earlier findings based on the health belief model. Prior to this study on hepatitis B immunization, the MAU theory was used to investigate the determinants associated with the adoption of the influenza vaccine in the elderly (Carter, 1986).

The predominant disadvantage of applying this theory is that it typically requires in-depth interviews to build up the framework for the hierarchical structure for the study. This can be very time consuming and costly to perform, as a consequence this theory has not been widely used in the literature in recent years.

Health Belief Model

In the health belief model (HBM), it is believed that individuals will take action to ward off, to screen for, or to control an ill-health condition if they regard themselves as susceptible to the condition, if they believe it to have potentially serious consequences, if they believe that the course of action available to them would be beneficial in reducing either their susceptibility to or the severity of the condition, and if they believe that the anticipated barriers to (or costs of) taking action are outweighed by it benefits (Glanz, Lewis & Rimer, 1997). The likelihood of behavior change is determined by the relationship of the four core concepts of the model -- *perceived susceptibility, severity, benefits, and barriers.* The perceived threat of disease is modified by cues to action, and other variables such as sociodemographic factors, particularly a person's knowledge and educational level. Self-efficacy or one's confidence in one's ability to take action also plays an important role in the likelihood of behavioral change. The dimension of *perceived susceptibility* measures an individual's subjective perception of his or her risk of contracting a health condition. *Perceived severity* addresses feelings concerning the seriousness of contracting an illness or of leaving it untreated. The *perceived benefits* refer to one's opinion of the efficacy of the advised action to reduce the risk or seriousness of impact. *Perceived barriers* are defined as one's opinion of the tangible and psychological costs of the advised action. Cues to action are cues that trigger action or strategies to activate one's readiness to perform a behavior. Finally, self-efficacy is defined as the "conviction that one can successfully execute the behavior required to produce the outcomes" (Bandura, 1977).

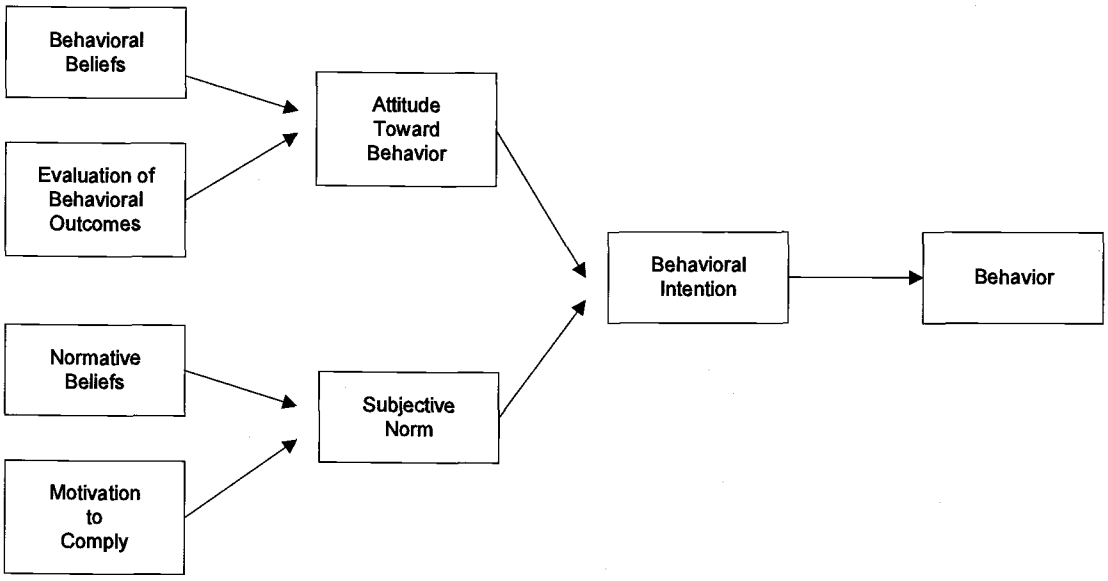
Two prior studies applied the health belief model (HBM) to evaluate acceptance of hepatitis B vaccines among hospital workers and physicians (Bodenheimer, Mai-Dalton, Marshall, and Beach, 1986; Murata & Young, 1993). These studies found that the strongest determinant was the "concern about the side-effects of vaccine. Other determinants that played a role in being vaccinated against hepatitis B were concern about the "efficacy of the hepatitis B vaccine", "time" and "cost."

The health belief model has been evaluated and its limitations have become evident. Some of its components are not well understood or have low predictive value. For instance, the concept of perceived severity has been shown to be of low predictive value. The 'cue to action' has not systematically studied and deserves further experimental manipulation. The HBM doesn't explore the role of fear and how it may foster cognitive and behavioral change (Glanz et al, 1997). The HBM is not capable of rigorous quantification of behaviors as has been achieved with the theory of reasoned action. Despite these limitations, components of the health belief model are useful to supplement studies using theory of reasoned action and theory of planned behavior, as these theories don't recognize emotional fear-arousal elements such as perceived perceptibility to illnesses (Mullen, Hersey, and Iverson, 1987).

Theory of Reasoned Action

The theory of reasoned action was created to describe the relationship between attitudes and behavior [Figure 2] (Ajzen & Fishbein, 1980). A person's *behavioral intention*, the most important determinant of the theory, is driven by the *attitude* toward performing the behavior and the *subjective norm* associated with the behavior. Attitude is influenced by the sub concepts of *behavioral beliefs* and *evaluation*. The behavioral belief is defined as the individual's belief that behavioral performance is associated with certain outcomes or attributes. This belief is then weighted by evaluation or the value attached to the outcomes or attributes. Thus, a positive or negative attitude toward a behavior will be determined by whether a person holds strong beliefs that mostly positively valued or negatively valued outcomes respectively will result from performing a behavior.

Figure 2. Theory of Reasoned Action



Similarly a person's subjective norm is determined by *normative beliefs* – whether important referent individuals approve or disapprove of performing the behavior, weighted by his *motivation to comply* with those referents. Thus, a positive or negative subjective norm in a motivated person will be influenced by whether a person believes that certain referents think he should or should not respectively perform a behavior. A person will have a relatively neutral subjective norm if they are less motivated to comply with the referents.

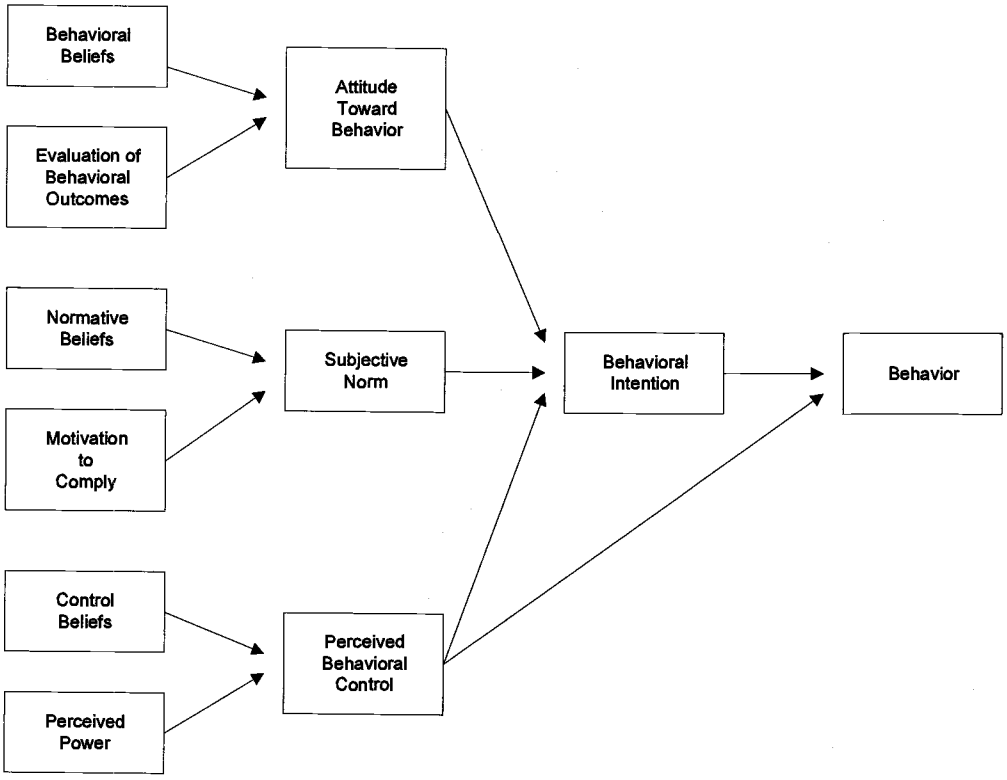
The theory of reasoned action assumes a casual chain: behavioral beliefs and normative beliefs are linked to behavioral intention and behavior via attitude and subjective norm. The primary purpose of the TRA is to explain behavioral intention regardless of whether the behavior is under volitional control (that is, occurring in situations where individuals can exercise a large degree of control over the behavior). If the behavior is under high volitional control, then motivation measured by intention and its attitudinal and normative determinants is expected to be the main determinant of behavior. However, it is felt that when volitional control is reduced or incomplete

then the TRA components are not sufficient for predicting behaviors. For example, a person who has high motivation to perform a behavior may not actually perform that behavior due to the presence of environmental conditions or barriers. Thus, Ajzen and colleagues developed the Theory of Planned Behavior (TPB) to predict behaviors over which persons have incomplete volitional control (Ajzen, 1991).

Theory of Planned Behavior

The theory of planned behavior (TPB) is an extension of the theory of reasoned action (TRA) [Figure 3]. Ajzen added perceived behavioral control to the theory of reasoned action in an effort to account for factors outside the individual's control that

Figure 3. Theory of Planned Behavior



may affect his intention and behavior. This extension was based in part on the idea that behavioral performance is determined jointly by motivation (intention) and ability (behavioral control). If a person perceives that his behavioral control is high, then that person will expend more effort to perform a behavior. *Perceived control* is determined by *control beliefs* concerning the presence or absence of resources for and impediments to behavioral performance, weighted by the *perceived power or* impact of each resource and impediment to facilitate or inhibit the behavior. Thus, a person who holds strong control beliefs about the existence of factors that facilitate or impede the behavior will have either high or low perceived control over the behavior.

The theory of planned behavior has been applied to high STI risk groups to predict condom use. Researchers used this theory to do a prospective study to identify and understand the factors affecting the likelihood of condom use among persons who are at higher risk than the general population of contracting HIV. The results showed that attitude and perceived control contributed the most to predicting condom use with both their regular and casual partner (Glanz et al, 1997). The TPB has also been applied to predict a person's intention to donate blood. One study examined perceived behavioral control and determined it has an important impact on a person's behavioral motivation (Giles, and Cairns, 1995). That is, a person was more likely to donate blood if they had control over the impediments or barriers to donating blood. TPB was created as an extension of TRA especially for behaviors where volitional control is incomplete. Like condom use and blood donation, receiving a hepatitis A and B vaccine has incomplete volitional control, as an individual has to overcome a variety of barriers to actually perform the behavior. Therefore, we plan to evaluate if there are differences in specific constructs of the theory of planned behavior based on college students' hepatitis A and B vaccination status.

Hepatitis A and B infections are potentially serious viral infections of the liver that occurs most frequently in people ages 15-39 years. Sizable numbers of college students are still unvaccinated for hepatitis A and B, thus are unprotected against these infections. In addition, health risk behaviors for hepatitis A and B are commonly found in this population. These health risk behaviors include a prior history of STDs,

multiple sexual partners, and high-risk sexual practices, such as vaginal, oral genital, and anal sex. The primary purpose of this study is to increase our collective understanding about factors that are associated with the likelihood that matriculating college students will be immunized with the hepatitis A and B vaccines. Our intention is to gain a clearer understanding of matriculating college students' hepatitis knowledge, perceived risk, health risk behaviors and their immunization status. We hope to determine if there are any significant differences in college students' attitude, subjective norm, and perceived behavioral control constructs based on their hepatitis A and B immunization status. Understanding the factors associated with completing the hepatitis A and B vaccination will provide valuable information for improving existing educational, and immunization strategies designed to protect college students from these vaccine preventable diseases.

RESEARCH DESIGN AND METHODS

Target Population

The target population was drawn from Oregon State University (OSU), a comprehensive, public, Research I university and a member of the Oregon University System (OUS). It is the state's land grant, sea-grant and space-grant institution with an enrollment of 18,879 for fall 2002. This includes 4,154 new undergraduate students comprised of true freshman and transfer students. As first year undergraduate students were the focus of a Student Health Services (SHS) sponsored campaign to immunize students for hepatitis A and B, this group was selected as the study population for this research.

Sampling Method

The sampling method utilized was a convenience sample from the Odyssey ALS (Academic Learning Skills) 111 and 112 classes. About one-third of all first year undergraduate students were enrolled in a total of seventy sections of ALS 111/112 in the fall term of 2002. The Odyssey course was an elective student orientation class for first year undergraduate students. The purpose of this course was to assist new students to become better connected to the university by informing them about campus resources, policies, and study skills in an effort to enhance their academic performance and retention in school. The demographic characteristics of gender, race/ethnicity, age, high school GPA, academic college, and campus residence were used to compare the Odyssey students with rest of the general first year student population at Oregon State University (see Table 4 in Results section).

Permission to contact the Odyssey instructors was obtained from the Co-Director of the Student Orientation and Retention Programs (see attached letter of support). An email was sent to all the instructors of the Odyssey sections briefly describing the study and asking for permission to administer a survey to their students

(see attached copy of email letter). If instructors were unable to provide class time to complete surveys, the surveys were distributed to students in class. In these instances, students were asked to complete the surveys outside of class time and return them to their instructor the following week.

Students from the recruited Odyssey sections met the following criteria to be included in the study:

A. Enrolled in Odyssey ALS 111 or 112 for fall term 2002.

B. Must be age 18 years or older; and

C. Have read and signed the informed consent form.

The investigator and two other staff members from the Student Health Services, who had completed the training in the ethical use of human subjects, administered the surveys to the recruited Odyssey sections (see attached administration script). The research proposal was reviewed and approved by the university's Institutional Review Board (IRB) prior to starting the survey sampling. The sampling period occurred during the first eight weeks of fall term 2002 between September 30th-November 22nd.

Sample Size

From the seventy sections of ALS 111/112, fifty-one sections were successfully recruited to participate in the study. Of the 746 students who attended these ALS sections, 477 students completed the survey for an overall participation rate of 63.9 %. This represents an 11.5 % sampling of the first year undergraduate students enrolled (n = 4,154) in the fall 2002 at Oregon State University. An estimated minimum sample size of 320 subjects was needed (assuming a medium effect size, $\alpha = .05$ and a power of .80) to evaluate the eight independent variables (see research design) using descriptive and univariate statistical methods.

Informed Consent Process

Prior to completing the survey, each subject was asked to read and sign two copies of the informed consent document (see appendix). If subjects voluntarily chose to participate in the study they were instructed to keep one signed copy of the consent document and the other copy was returned to the investigator.

The informed consent document emphasized important points related to confidentiality. This document explained to the student that the study was not an anonymous study as they were asked to place their name and student identification number (social security number) on the answer sheet. Study participants were informed that by signing the informed consent document they were giving permission to the study investigator to review their immunization record at the Student Health Services. None of the data collected from the survey was added to the study participant's medical records at the Student Health Services. Given that the survey contained six sensitive questions about their personal risk behaviors, the subjects were informed that they could decline to respond to a particular question or withdraw from the study. To ensure confidentially, all sensitive survey materials and data files were kept in a locked filing cabinet. In addition, the databases were not kept on any shared drives on the study investigator's computer. Subjects were informed that all individual data was to be tabulated and only reported as grouped data so there would no breach of confidentiality.

The only potential risk from participation in this study was the possibility of inducing a fear about hepatitis or causing personal anxiety as the result of answering questions about their personal health risk behaviors such as unprotected vaginal, oral-genital, anal sex. If they needed to discuss issues related to this survey they were informed that they could obtain counseling from a professional at either University Counseling and Psychological Services (UCPS) or Student Health Services (SHS).

As an incentive to the study participants, they were given a coupon for a free slice of pizza from Woodstock's Pizza. In addition, the each subject's name was entered into a drawing for a chance to win one of three prizes. There were $25 gift certificates to American Dream Pizza, Hollywood Video Store, and the OSU

Bookstore. The three winners of the drawing prizes were notified by phone by December 6, 2002.

By participating in this study, subjects potentially benefited from enhanced awareness of hepatitis A and B and their protective vaccines. Observations noted from this study might be useful for improving efforts by the Student Health Services to promote the benefits of hepatitis A and B immunizations to college students. The general study results will be posted on the Oregon State University Student Health Services website at http://oregonstate.edu/dept/student_health/ by August 2003.

Research Design

The research design was a cross-sectional observational study. Since matriculating students were asked to respond to a written survey during the first eight weeks of fall term, 2002, the study provided a cross-sectional sampling of college students at the time they began their college experience at Oregon State University. The intention of this study was to evaluate relationships between multiple independent variables and current immunization status for the hepatitis A and B vaccines.

The Theory of Planned Behavior (TPB) provided the framework for identifying several of these independent variables. TPB is used to describe health behaviors that involve the complex interaction of several factors that impact a person's intention to perform a specific health behavior. This theory hypothesizes that if this behavioral intention is strong enough, a person will decide and actually perform the specified behavior. The behavioral intention is driven by the interaction of a person's attitude, subjective norm (influence of others), perceived behavioral control of facilitating or barrier conditions. These concepts of the theory are determined by a product of the behavioral, normative, control beliefs and the person's perceived importance or control over these beliefs (See Chapter II- Review of Literature for more details).

Awareness or knowledge and perceived risk- concepts of the Health Belief Model (HBM)- can play a significant role in a person's belief and likelihood they will

act upon that belief. A person's belief about a behavioral outcome implies that they have some knowledge about the health behavior and its potential risks and benefits. Given that being immunized is a preventive behavior, a person needs to perceive they are at risk of contracting the illness before they might act on performing that behavior. Thus, additional questions were included in the survey to assess college student's knowledge about hepatitis A and B, their perceived risk, and their personal health risk behaviors for hepatitis A and B.

There were a total of seven independent variables in this research study. These include one set of demographic characteristics, three variables related to student knowledge, perceived risk, and health risk behaviors for hepatitis A and B, and three additional variables related to the main constructs of the theory of planned behavior.

To summarize, the *independent variables* for this research study were:

1) College students' *demographic characteristics* (race/ethnicity, gender, marital status, age, parent's combined income, high school GPA, site of local residence, academic college, and religious preference).
2) College students' *self-reported immunization status* for hepatitis A and B.
3) College students' hepatitis A and B *knowledge*.
4) College students' self-*perceived risk* for hepatitis A and B.
5) College students' *health risk behaviors* for hepatitis A and B.
6) College students' *attitude* about hepatitis A and B vaccines.
7) College students' *subjective norm* for hepatitis A and B vaccines.
8) College students' *perceived behavioral control* for receiving hepatitis A and B vaccines.

This study examined two dependent variables:

1) Current immunization status for hepatitis A among matriculating students at Oregon State University in fall 2002.

2) Current immunization status for hepatitis B among matriculating students at Oregon State University in fall 2002.

The data for the dependent variables was obtained by reviewing each subject's immunization record at the Student Health Services. Although measles, mumps, rubella are the only immunizations in which documentation is required, the hepatitis A and B immunization are typically found on these same immunization records. These records may include photocopies of their pediatrician/family physician, school, county health department, or military immunization records. Thus, for the purposes of this study the Student Health Services immunization records were felt to be the most reliable source for determining the hepatitis A and B immunization status of the study participants.

The two dependent variables were subdivided into three categorical groups based on their degree of completing the hepatitis A and B immunization series. These three categories are defined as:

1) A *complete immunization* series was defined as completing the recommended full vaccine series of three shots for hepatitis B and two shots for hepatitis A.
2) A *partial immunization* series was defined as receiving only a portion of the recommended vaccine series by receiving only one or two shots for hepatitis B and one shot for the hepatitis A.
3) *No immunization* was defined as not receiving any of the hepatitis A and B vaccines.

Hypotheses

Given that there are few prior studies in the college student population looking at variables that determine hepatitis A and B immunization status, the null hypothesis was chosen to describe the relationship between the independent and dependent variables in this study. The research hypothesis were:

1) There are no significant differences in college students' hepatitis A and B immunization status based on their demographic characteristics (race/ethnicity, gender, marital status, age, parent's combined income, high school GPA, site of local residence, academic college, and religious preference).
2) There are no significant differences in college students' self-reported hepatitis A and B immunization status and their actual immunization record.
3) There are no significant differences in college students' hepatitis A and B immunization status based on their hepatitis A and B knowledge.
4) There are no significant differences in college students' health risk behaviors for hepatitis A and B (number of sexual partners, type of sexual behavior, body piercing/tattoo, international travel to regions with hepatitis A risk, drug use) based on their hepatitis A and B knowledge.
5) There are no significant differences in college students' hepatitis A and B immunization status based on their health risk behaviors.
6) There are no significant differences in college students' hepatitis A and B immunization status based on their self-perceived risk for hepatitis A and B.
7) There are no significant differences in the health risk behaviors of unvaccinated college students based on their self-perceived risk for hepatitis A and B.
8) There are no significant differences in college students' attitude constructs about hepatitis A and B vaccines based on their hepatitis A and B immunization status.
9) There are no significant differences in college students' subjective norm constructs based on their hepatitis A and B immunization status.
10) There are no significant differences in college students' perceived behavioral control constructs based on their hepatitis A and B immunization status.

Survey Instrument

The written survey consisted of an 11 x 17 stapled bifold, eight-page instrument containing 91 items. All the items on the survey were created to have five or less responses so that the participants could transpose their answers to a general-purpose bubble answer sheet. The front page included some general instruction on how to complete the survey. Then, the remaining seven pages contained the survey questions. The survey was given to each subject in a white 9 x 12 standard white envelope stamped with the study investigators return address and a CONFIDENTIAL stamp. Other items included in the survey packet were two copies of the informed consent document, a # 2 pencil, a general-purpose bubble answer sheet, a coupon for a free slice of pizza from Woodstock's, and a reminder card about the Student Health Services hepatitis vaccine clinic.

Several portions of the written survey tested the student's knowledge, perceived risk, and health risk behaviors for hepatitis A and B. The first section, items 1-8, contained eight true-false items to test the student's general knowledge of the hepatitis A and B viruses. Students responded using a five-point Likert scale on items 29-30 and 43-52 to rate their perceived risk to hepatitis A and B and the relative risk of these two viruses compared to other common sexually transmitted infections (STIs). Items 75-82 provided information about a variety of health risk behaviors commonly found among a college student population.

A scale of construct variables was developed to test each of the concepts of the theory of planned behavior (TPB)- attitude, subjective norm, and perceived behavioral control. Content validity was confirmed by several methods. An extensive review of literature provided a solid foundation for important variables to include each scale. Expert opinion was obtained from medical providers at the university student health services. Important feedback about the scale content was obtained from the group of undergraduate students who participated in the pilot study. All the variables were organized using a five-point bipolar Likert scale with responses ranging from very high (A) to very low (E), with don't know for (C). The responses were recoded as a bipolar scale + 2 to –2 for data analysis.

The *attitude scale* consisted of eight variables each with two questions to test the behavioral belief and evaluation of the behavioral belief constructs. A potential outcome (variable) of receiving the hepatitis A and B vaccines was paired with two questions that evaluated: 1) a belief that a specific outcome of being vaccinated would occur (behavioral belief items 14, 16, 18, ...28), and 2) the amount of influence that a belief would have on their decision to be vaccinated (evaluation of the behavioral belief items 13, 15, 17, ...27). The outcomes of hepatitis A and B vaccination that were included in the attitude scale were physical pain, efficacy, adverse effects, anxiety, inconvenience, cost, reducing disease risk, and compromising religious/philosophical beliefs.

The *subjective norms scale* comprised of six referents each with two questions to test the normative beliefs and motivation to comply constructs. These questions tested a subject's belief that a referent would: 1) support their decision to be vaccinated (normative belief items 31, 33, ...41), and 2) the influence of this person's opinion (motivation to comply items 32, 34, ...42). The referents included in the subjective norms scale were parents, family doctor, close friend, partner/spouse, student health services staff, and residence hall staff.

The *perceived behavioral control scale* was comprised of eleven variables with two questions for each variable to test the control beliefs and perceived power constructs. A situation (facilitating conditions or barriers) for being vaccinated for hepatitis A and B was paired with two questions that evaluated: 1) how likely a subject that this situation would occur (control belief items 58, 60, 62, ...74), and 2) how likely that this situation would influence a subject's decision to get vaccinated for hepatitis A and B (perceived power items 57,59,61, ...73). The variables included in this scale relate to vaccine availability, expense, convenience, and reminders for vaccination.

The last section of the survey collected demographic data on the study population. These questions asked about the subject's gender, current relationship status, current age, parents/guardians combined income, cumulative high school GPA, current local residence, academic college they are enrolled, and religious preference.

The question regarding racial/ethnic identity, variable 83, contains the most current version recommended by the National Institutes of Health.

Pilot Testing

Prior to implementing the survey, pilot testing was undertaken to evaluate the reliability and validity of the survey. A group of 22 undergraduate students employed by Oregon State University's summer orientation program were recruited to complete the survey, and then provide feedback via a focus group discussion to confirm the content validity. As an incentive to participate in the pilot student each student was given five dollars in cash. The time required for subjects to complete the survey ranged from 15-25 minutes.

The instrument contained three sections of questions related to the concepts of the Theory of Planned Behavior- attitude, subjective norm, and perceived behavioral control. The internal reliability or internal consistencies of these three concept scales were examined by measuring the Cronbach's alpha coefficient on the data from the pilot study. Using SPSS 11.5 Statistical package for Windows, correlation coefficients were calculated for all the variables in each scale and the Cronbach's alpha represents the internal consistency between the variables in the scale. The Cronbach's alpha for each scale in the pilot study was as follows: *attitude* .64, *subjective norms* .86, and *perceived behavioral control* .90. Since a Cronbach's alpha greater than .65 was considered acceptable, minor revisions in the order and formatting of the survey instrument were made in an attempt to improve the internal consistency. After making these formatting changes the survey instrument was again reviewed and approved by the university's IRB. The reliability of the final instrument was calculated after collection of all surveys in the study (see Results section).

Data Analysis

After the end of the sampling period on November 22, 2002 each survey packet was checked to confirm that it included a signed informed consent document that corresponded with the participant's general-purpose bubble answer sheets. Each bubble answer sheet was inspected to verify that the necessary name and identification number was included and that the participant provided legitimate answers for the survey items. Subject's who failed to meet these inclusion criteria were eliminated from the data analysis. The answer sheets for eleven subjects had to be eliminated due to the lack of a signed informed consent form, name, or identification number. An additional five answer sheets were eliminated due to respondents fabricating answers with responses that clearly failed to correspond to answer options. The bubble answer sheets were then scanned by the university's computer testing center and the raw data was compiled into a data file on a floppy disc. The raw data file was imported into the SPSS 11.5 Statistical package for Windows.

For the 477 subjects included in the study, the raw data was examined to identify missing or invalid responses. For these responses, the subject's bubble answer sheet was inspected to determine if the scanner had incorrectly read the bubble response. Incorrectly read answers were corrected in the database. From the 477 subjects, the mean percentage of missing data points for each survey item was 1.77 % (range 0.4-6.7 % missing data points per item). No missing data patterns were identified.

All students are required to submit their immunization record to the Student Health Services upon matriculating to the university. These records were felt to be the most reliable source to determine the students' immunization status. After reviewing the immunization record, each subject's hepatitis A and B immunization data was entered into the database. For sixteen subjects the immunization records were not located.

Descriptive frequency statistics and chi-square tests were use to evaluate the six null hypothesis regarding demographic characteristics, knowledge, perceived risk, and health risk behaviors in relation to hepatitis A and B immunization status. The

frequency statistics are reported in form of percentages. Chi-square tests were used to test the null hypotheses for the relationship between two individual independent variables or between an independent variable and a dependent variable. Since the chi-square tests can only be performed if less than 20 % of the cells in a contingency tables have an expected frequency less than 5, several of the independent variable categories were further collapsed to permit analysis. For 2 x 2 contingency tables, the Pearson chi-square value, degrees of freedom, sample size, and the p value were reported. If the expected frequencies were too small, either a cell with an expected frequency less than 1 or more than 20 % of cells with less than 5, the alternative Fisher's exact test was calculated. The chi-square test or Fisher's exact test was considered significant at a p value $< .05$. For larger 2 x 3, or 3 x 3 contingency tables, only the chi-square test was calculated. For all significant chi-square tests the strength of the relationship was measured using fourfold point correlation coefficient/Cramer's V statistic. The Cramer's statistic can range from 0 to 1.00, where a value of 0 indicates no relationship and a value of 1.00 indicates a perfect relationship.

Descriptive frequency statistics were generated for survey items regarding the demographic characteristics (items 83-91). Several categories within the demographic characteristics were collapsed when the frequencies were low. For example, with the characteristic of religious preference the response of Jewish was collapsed with the other category. The demographic characteristics where low frequency categories were collapsed were age, cumulative high school GPA, current local residence, and current relationship status. Chi-square tests were performed between each demographic variable and the two dependent variables to test the null hypothesis that there are no significant differences in college students' hepatitis A and B immunization status based on their demographic characteristics.

Descriptive frequency statistics were calculated for the two dependent variables of hepatitis A and B immunization status. Each of these dependent variables was tabulated into the three categories of immunization status- complete immunization, partial immunization, and no immunization. A comparison was made between the immunization status based on review of the subject's immunization

record (at Student Health Services) and the subject's recall of their immunization status (items 9-10). A chi-square test was used to test the null hypothesis that there are no differences in college students' self-reported hepatitis A and B immunization status and their actual immunization record.

Descriptive frequency statistics were also reported for survey items related to hepatitis A and B knowledge (items 1-8). For the knowledge items the dichotomous true-false responses were recoded into +2 for correct responses, and 0 for incorrect responses. The four knowledge questions related to hepatitis A were grouped together to obtain a composite hepatitis A knowledge score. Similarly, the four hepatitis B questions were grouped to get a composite hepatitis B knowledge score. The knowledge scores were divided into two groups, 1) poor to fair for a score of 0-4 (0-2 correct answers), and 2) good to excellent for a score of 5-8 (3-4 correct answers). Chi-square tests were calculated to test the null hypothesis that there are no significant differences in college students' hepatitis A and B base on their hepatitis A and B knowledge. In addition, chi-square tests were performed to evaluate if there were any significant differences in health risk behaviors based on hepatitis A and B knowledge questions (items 75-82). For example, we evaluated if there were any differences in unprotected oral-genital sex based on their knowledge about fecal-oral transmission mode for hepatitis A.

Descriptive frequency statistics were determined for eight specific health risk behaviors associated with hepatitis A and B infection (items 75-82). The students were asked to answer how many sexual partners (vaginal, oral-genital, and anal sex) they have had in the past 12 months. The number of sexual partners was grouped into three categories- none, one, or two or more sexual partners. The percentage of students who had a prior diagnosis of an STI was reported for those students who have been sexually active in the past 12 months. The frequency of the three forms of unprotected sex (vaginal, oral-genital, and anal) was reported for two categories of students: 1) one sexual partner, and 2) those with two or more partners. The percentage of students who have the non-sexual health risk behaviors was also reported. These non-sexual health risk behaviors include body piercing and tattoos, international travel to country

endemic with hepatitis A, and use of injection drugs or amphetamines. In addition, chi-square tests were computed to test the null hypothesis that there were no significant differences in college students' hepatitis A and B immunization status based on their health risk behaviors.

Descriptive frequency statistics were compiled for questions related to perceived risk for hepatitis A and B (items 29-30). The questions that specifically asked subjects about their perceived risk to hepatitis A and B were recoded into the groups of high risk, neutral, low risk, and no risk. The frequency of these four risk groups was determined for the entire group. Chi-square tests were also performed to test the null hypothesis that there were no significant differences in college students' hepatitis A and B and immunization status based on their perceived risk for hepatitis A and B. By selecting all unvaccinated students in the database, we tested the null hypothesis that there were no significant differences in specific health risk behaviors based on their perceived risk for hepatitis A and B. The purpose of this analysis was to determine what percentage of unvaccinated students with specific health risk behaviors perceived themselves to be a low risk for hepatitis A and B.

Subjects were asked to evaluate their perceived risk to hepatitis A and B in relation to three other viral sexually transmitted infections (items 50-52). The respondents were asked to rank these infections from most concerning, to second and third most concerning. Frequency data in the form of percentages was reported for the most concerning viral STI. Then, a composite frequency was tabulated for all the responses for the three most concerning viral STIs. This composite frequency provided insight on the level of concern for hepatitis A and B compared to the other viral sexually transmitted infections. The items 43-49 were not used in the data analysis as it was felt that these questions were redundant of items 29-30 and 50-52.

The three main components of the theory of planned behavior are attitude, subjective norm, and perceived behavioral control. A separate scale was created to evaluate each of these theoretical components. Each scale is comprised of variables representing the two constructs of that particular theoretical component. For example, attitude is determined by the combination of the behavioral beliefs (items 14, 16, 18,

....28) and the evaluation of the behavioral beliefs (items 13, 15, 17, ...27). The subjective norm is determined by normative beliefs (items 31, 33, ...41) and motivation to comply variables (items 32, 34, ...42). The perceived behavioral control component is derived from control beliefs (items 58, 60, 62, ...74) and perceived power (items 57,59,61, ...73). All the variables were organized using a five-point bipolar Likert scale with responses ranging from very high (A) to very low (E), with don't know for (C). The responses were recoded as a bipolar scale + 2.00 to –2.00 for the data analysis.

Descriptive and univariate statistical methods were used to describe the effects of the constructs in the theory of planned behavior. To demonstrate the effect of each construct variable in the scale we reported a mean score and standard deviation. The mean scores for each variable were calculated by summing all the subjects' responses then dividing by the number of responses. So, if the mean score for a variable was + 2.00, then that variable would have a very high likelihood of having an effect on their immunization status. In contrast, a mean score of – 2.00 indicates that this particular variable will have a very low likelihood of being a determinant of the immunization status. The one-way analysis of variance (ANOVA) was used to determine if there were significant differences in the means scores for each construct based on the three categories of immunization status ('no', 'partial', 'complete'). Analysis of variance is used to compare two or more means to see if there are any reliable differences among groups. If the ANOVA test was considered significant if the F statistic had a p value $< .05$. A Bonferroni post hoc test was performed to determine which groups in the ANOVA test obtained statistical differences. For each ANOVA test, we reported the F statistic, the degrees of freedom, sample size, and the p value of the Bonferroni post hoc test if found significant.

RESULTS

Characteristics of the Sample

From a convenience sample of 746 surveys that were distributed to first year students enrolled in Advanced Learning Skills classes (ALS 111/112), a total of 477 were returned, for a 64 % response rate. The gender distribution in the respondent group included more females (64.8 %) than males (35.2 %). The subjects identified themselves as White, not of Hispanic origin (81.9 %), Asian/Pacific Islander (11.7 %), Hispanic (2.8 %), Interracial (1.9 %), American Indian/Native American (1.3 %), and Black non-Hispanic (0.4 %). Ninety one percent of subject's were ages 18 and 19 years while the remaining subjects were 20 years and older. The participant's predominately lived on campus (80.8 %) and enrolled with a high school GPA of 3.00 or greater (91.3 %). Compared to the entire group of matriculating students at the university, the respondents had a disproportionately higher number of females, 18 year olds, and fewer engineering majors than in the general university population. The basic characteristics for the respondents and all first year students are summarized in Table 4.

Hepatitis A and B Immunization Status

All students at this large state land-grant university are required to submit immunization records to the Student Health Services upon matriculation. The submitted records may include photocopies of their pediatrician/family physician, school, county health department, or military immunization records. Although measles, mumps, rubella are the only immunizations in which documentation is required, the hepatitis A and B immunization are typically found on these same immunization records. For the purposes of this study the Student Health Services immunization records were felt to be the most reliable source for determining the

Table 4. Characteristics of the respondents and first year students in fall term 2002.

	Respondents			First Year Students		
Characteristics	N	n	%	N	n	%
Gender	460			4154		
Female		298	64.8		2080	50.1
Male		162	35.2		2074	49.9
Race/Ethnicity	463			3914		
American Indian/Native Amer.		6	1.3		47	1.2
Asian/Pacific Islander		54	11.7		343	8.8
Black, not of Hispanic Origin		2	0.4		48	1.2
Hispanic		13	2.8		154	3.9
Interracial		9	1.9		96	2.5
White, not of Hispanic Origin		379	81.9		3226	82.4
Current Age	459			4065		
18		327	71.2		2357	58.0
19		92	20.1		623	15.3
20 and older		40	8.7		1085	26.7
High School GPA	459			3578		
2.49 or below		7	1.5		65	1.9
2.50-2.99		33	7.2		459	12.8
3.00-3.49		163	35.5		1305	36.5
3.50 or higher		256	55.8		1749	48.8
Academic College	457			4154		
Business		79	17.3		555	13.3
Engineering		39	8.5		891	21.5
Liberal Arts		83	18.2		621	14.9
Science		106	23.2		676	16.3
Other		150	32.8		1411	34.0
Campus Residence	459			4154		
Residence Hall/Co-op		371	80.8		3290	79.2
Fraternity/Sorority		30	6.6		287	6.9
Off Campus Housing		58	12.6		577	13.9
Current Relationship Status	460					
Single		271	59.0		NA	NA
Committed Dating Partner		184	40.0		NA	NA
Married/Previously Married		5	1.0		NA	NA
Parent /Guardian Income	457					
Less than $20,000		25	5.5		NA	NA
$20,000 to less than $60,000		90	19.7		NA	NA
$60,000 to less than $120,000		145	31.7		NA	NA
$120,000 or greater		77	16.8		NA	NA
Don't Know		120	26.3		NA	NA
Religious Preference	449					
Catholic		85	18.9		NA	NA
Protestant		84	18.7		NA	NA
Other		130	30.0		NA	NA
No religious preference		150	33.4		NA	NA

hepatitis A and B immunization status of the study participants. Based on review of these records, we found that 10 % of students have completed the hepatitis A immunization series compared to 58.8 % of students completing the hepatitis B series. An additional 10 % and 13 % of subjects have partially completed the hepatitis A and B immunization series respectively. Thus, the hepatitis A and B immunization series has not been started in about 80 % and 28 % of subjects respectively.

Hepatitis A and B Health Risk Behaviors

College students possess a variety of sexual and non-sexual health risk behaviors for hepatitis A and B [Table 5]. Within the study population, 56.2 % of

Table 5. Frequency of health risk behaviors.

Health Risk Behavior	Sample N	Percent %	Frequency n
Sexual Risk Behaviors			
Number of Sexual Partners in past 12 months	464		
None		43.8	203
1 partner		35.7	166
2 or more partners		20.5	95
Prior diagnosis of sexually transmitted infection			
1 or more partners in past 12 months	163	4.7	7
2 or more partners in past 12 months	90	7.8	7
History of unprotected vaginal sex			
1 partner in past 12 months	159	42.8	68
2 or more partners in past 12 months	93	61.3	57
History of unprotected oral-genital sex			
1 partner in the past 12 months	159	68.6	109
2 or more partners in the past 12 months	90	81.1	73
History of unprotected anal sex			
1 partner in the past 12 months	160	6.3	10
2 or more partners in the past 12 months	91	13.2	12
History of unprotected anal sex by gender	22		
Female		45.8	10
Male		54.2	12
Non-sexual Risk Behaviors			
International travel to region endemic with hepatitis A	464	26.5	123
Body piercing and/or tattoo	464	53.2	247
History of injection or illicit drug use	462	1.1	5

students had been sexually active (vaginal, oral, anal sex) in the past twelve months, including 20.5 %who had two or more sexual partners. The frequencies of unprotected vaginal sex and oral-genital were significantly different in those with one sex partner in the past twelve months compared to those with two or more sex partners. We found significant differences in the likelihood of unprotected vaginal sex in those students with one sex partner (42 %) compared to those with two or more sex partners (61.3 %), X^2 (1, N = 252) = 8.054, p = .006 [Table 7]. Therefore, if a student has multiple sexual partners they are more likely to participate in unprotected vaginal sex compared to those students with only one sexual partner.

We also found a significant difference in the frequency of unprotected oral-genital sex (68.6 %) in students with only one partner compared to those with two or more partners (81.1 %), X^2 (1, N = 249) = 4.608, p = .037 [Table 6]. Thus, unprotected oral-genital sex is more likely to occur in students who have multiple sexual partners compared to those with only one sexual partner.

Table 6. The frequency of unprotected vaginal sex and oral-genital sex based on the number of sexual partners in past twelve months.

Number of sex partners in the past 12 months	Unprotected vaginal sex n (%) N = 252		Unprotected oral-genital sex n (%) N = 249	
	Yes	No	Yes	No
1	68 (42.8)	91 (57.2)	109 (68.6)	50 (31.4)
2 or more	57 (61.3)	36 (38.7)	73 (81.1)	17 (18.9)

Although we did not find a statistically significant difference, the frequency of unprotected anal sex was higher in persons with two or more sexual partners (13.2 %) compared to those students with only one partner (6.3 %). Of the twenty-two students who reported to have engaged in unprotected anal sex, there was nearly equal participation among females (45.8 %) and males (54.2 %). A prior diagnosis of a sexually transmitted infection (STI) was more common in students with multiple

sexual partners in the past twelve months (7.8 %) compared to students with only one sexual partner in the past twelve months (4.7 %).

International travel to countries where hepatitis A is endemic is considered a non-sexual health risk behavior associated with hepatitis A. In these cases, the disease is typically transmitted via ingestion of contaminated food and water sources. College students frequently travel and study abroad as part of their college experience. Among our study of matriculating students, 26.5 % already gave a history of international travel to regions endemic with hepatitis A (Africa, Asia, Central & South America, and Eastern Europe). Only 30 % of these students who traveled to these high-risk regions have been partially or completely immunized for hepatitis A.

Another non-sexual health risk behavior for hepatitis B is receiving a tattoo and/or body piercing. A person can potentially be infected with the hepatitis B virus in process of getting a tattoo and body piercing. Tattoos and body piercing are commonly found on matriculating college students as 53.2 % self-reported that they possess a body piercing and/or tattoo.

In the general population, intravenous drug or non-injecting elicit drug users represent a significant risk group for hepatitis A and B. Fortunately, in our study population only 1.1 % (n = 5) self-reported that they have had used an injection drug or illicit drugs like methamphetamines.

Self-Perceived Risk for Hepatitis A and B

Perceived risk is a component in the health belief model that determines that likelihood that a person will adopt a health behavior. In our study, we asked student's to rate their perceived risk for hepatitis A or B as high risk, neutral, low risk, or no risk [Table 7]. Overall, only about 5 % of students perceived themselves to be at high risk for hepatitis A and B. About two-thirds of the students perceived they are either at no risk or low risk for hepatitis A and B.

Table 7. Self-perceived risk for hepatitis A and B.

Hepatitis Risk Category	Self-Perceived Risk N = 471	
	n	%
Hepatitis A		
High Risk	24	5.1
Neutral	139	29.5
Low Risk	233	49.5
No Risk	75	15.9
Hepatitis B		
High Risk	23	4.9
Neutral	117	24.8
Low Risk	229	48.6
No Risk	102	21.7

The students were asked to identify the viral sexually transmitted infection (STI) that they believe would have the greatest impact on their lives if they contracted an infection. We asked the students which viral STI that concerns them the most, the second most, and third most from a list of five common viral STIs. The students were by far most concerned about HIV/AIDS (80.4 %), and much less concerned about genital herpes (11.4 %), genital warts (3.0 %), hepatitis A (2.8 %), and hepatitis B (2.4 %).

Demographic Characteristics and Immunization Status

Research hypothesis # 1: There are no significant differences in college students' hepatitis A and B immunization status based on their demographic characteristics (race/ethnicity, gender, marital status, age, parent's combined income, high school GPA, site of local residence, academic college, and religious preference).

We found significant differences in hepatitis A and B immunization status based on the student's age. There was a significant difference in the percentage of a 18-19 year old students (61.9 %) with a complete hepatitis B immunization series compared students 20 years and older (29.7 %), X^2 (2, N = 444) = 15.140, p = .001

[Table 8]. Thus, among matriculating students the younger students, ages 18-19 years, were more likely to be completely immunized for hepatitis B compared to older students, ages 20 years and older.

Table 8. Hepatitis B immunization status based on age.

	Hepatitis B Immunization Status n (%) N = 444		
Age	No	Partial	Complete
18-19 years	104 (25.6)	51 (12.5)	252 (61.9)
20 years and older	19 (51.4)	7 (18.9)	11 (29.7)

Self Reported Immunization Status versus Immunization Record

Research hypothesis # 2: There are no significant differences between college students' self-reported hepatitis A and B immunization status and their actual immunization record.

A medical provider at our college health service has two primary sources to acquire information about a college student's hepatitis A and B immunization status. First, a student can provide the medical provider with their self-reported immunization status. Second, all new students are required to submit photocopies of their childhood and adolescent immunization records to the Student Health Services. We compared the accuracy of the student's self-reported immunization status to their actual immunization records submitted to the Student Health Services upon matriculation. The ability of a student to accurately recall his or her own immunization status was not as accurate as reviewing the immunization record, as 37.3 % and 24.0 % respectively stated they could not recall their hepatitis A and B immunization status [Table 9]. Students were generally less accurate at recalling their hepatitis A immunization status compared to their hepatitis B immunization status.

Table 9. Comparison of hepatitis A and B immunization status by student self-report and their actual Student Health Services immunization records.

Immunization Series	Immunization Status (%) N = 461			
	No	Partial	Complete	Do Not Recall
Hepatitis A				
Student Self-Report	18.1	9.7	34.8	37.3
Immunization Record	79.8	10.2	10.0	NA
Hepatitis B				
Student Self-Report	10.1	12.8	53.1	24.0
Immunization Record	28.0	13.2	58.8	NA

We found a statistically significant difference between student self-reported immunization status and actual immunization record for both hepatitis A, X^2 (6, N = 459) = 126.981, p = .000 [Table 10]. For hepatitis A immunization, there was a significant difference in the student's recall of their immunization status compared to their actual immunization record. For example, 66.3 % of the students who thought they had completed the hepatitis A immunization series had no evidence of receiving a hepatitis A vaccination on their Student Health Services immunization record.

Table 10. Self-reported hepatitis A immunization status to actual Student Health Services hepatitis A immunization record.

Student Self-Reported Immunization Status	Hepatitis A Immunization Record n (%) N =459			
	No	Partial	Complete	Totals
Do not recall	156 (92.9)	5 (3.0)	7 (4.2)	168 (100.0)
Have not started series	78 (95.1)	4 (4.9)	0 (0.0)	82 (100.0)
Partially completed series	24 (52.2)	21 (45.7)	1 (2.2)	46 (100.0)
Completed Series	108 (66.3)	17 (10.4)	38 (23.3)	163 (100.0)

There was also a statistically significant difference between student self-reported immunization status and actual immunization record for hepatitis B, X^2 (6, N = 459) = 218.339, p = .000 [Table 11]. College students have difficulty in recalling

their hepatitis B immunization status as there was a definite difference in the student's self reported immunization status and their actual immunization status. For example, 36.8 % of students who could not recall their immunization status had actually completed the hepatitis B immunization series.

Table 11. Self-reported hepatitis B immunization status to actual Student Health Services hepatitis B immunization record.

Student Self-Reported Immunization Status	Hepatitis B Immunization Record n (%) N = 459			
	No	Partial	Complete	Totals
Do not recall	54 (50.9)	13 (12.3)	39 (36.8)	106 (100.0)
Have not started series	37 (78.7)	3 (6.4)	7 (14.9)	47 (100.0)
Partially completed series	15 (25.4)	28 (47.5)	16 (27.1)	59 (100.0)
Completed Series	22 (8.9)	17 (6.9)	208 (84.2)	247 (100.0)

Hepatitis A and B Knowledge and Immunization Status

Research hypothesis # 3: There are no significant differences in college students' hepatitis A and B knowledge based on their hepatitis A and B immunization status.

Knowledge is an important factor that contributes to a person's behavioral beliefs and ultimately to their attitude about a behavior. Therefore, knowledge about hepatitis A and B was assessed through responses to a series of eight questions with four questions each dedicated to hepatitis A and B. The subject's knowledge for hepatitis A or B was rated as poor, fair, very good, or excellent depending whether they answered 1 to 4 questions correctly. Overall the sample group's knowledge about hepatitis A and B was rated as very good (3 out of 4 correct answers). For hepatitis A, 68.9 % of students answered three of four hepatitis A questions correctly, while 77.3 % answered three of four hepatitis B questions correctly. In our study, we found there were no significant differences in hepatitis A and B knowledge based on a student's immunization status to hepatitis A and B.

Respondents were particularly accurate at identifying the correct answer to four of the knowledge questions. For hepatitis A, students best recognized that 1) unprotected anal sex is a risk factor for hepatitis A and 2) hepatitis A immunization is highly recommended before travel to countries such as Eastern Europe, Africa, Central and South America, and Southeast Asia. For hepatitis B, the student's most readably identified that 1) hepatitis B can lead to a chronic liver infection, cirrhosis, and liver cancer, and 2) hepatitis B can be transmitted in the process of getting a tattoo or body piercing.

Hepatitis A and B Knowledge and Health Risk Behaviors

Research question # 4: There are no significant differences in college students' hepatitis A and B knowledge based on their health risk behaviors for hepatitis A and B (number of sexual partners, type of sexual behavior, body piercing/tattoo, international travel to regions with hepatitis A risk, drug use).

Despite the participant's very good knowledge about hepatitis A and B, this did not deter participation in a variety of hepatitis A and B health risk behaviors such as unprotected oral-genital sex, vaginal sex, and anal sex. Among the first year students who have had unprotected vaginal sex (n = 125), 74 % knew that hepatitis B is commonly transmitted via unprotected sexual intercourse. Among those students that have partaken in unprotected anal sex (n = 22), 71 % were aware that anal sex was a risk factor for hepatitis A.

Sometimes the lack of knowledge may also play a facilitating role in a person's likelihood of partaking in a risky sexual behavior. We found a significant difference in a student's ability to accurately recognize that the fecal to oral mode of transmission for hepatitis A based on whether student participated in unprotected anal sex, X^2 (1, N = 443) = 6.371, p = .013 [Table 12]. Those who have participated in unprotected anal sex were less likely to correctly answer that the mode of transmission for hepatitis A is via the fecal to oral route. For example, of those students who

participated in unprotected anal sex (n = 21), 57.1 % did not know that the mode of transmission for hepatitis A is fecal to oral. In comparison, those who have not participated in unprotected anal sex (n = 422), only 30.8 % did not recognize that hepatitis A is transmitted by the fecal to oral route.

Table 12. Knowledge about fecal to oral mode of transmission for hepatitis A and unprotected anal sex.

Knowledge about hepatitis A fecal to oral transmission	Unprotected anal sex n (%) N = 443	
	Yes	No
Incorrect	12 (57.1)	130 (30.8)
Correct	9 (42.9)	292 (69.2)
Totals	21 (100.0)	422 (100.0)

Health Risk Behaviors and Hepatitis A and B Immunization Status

Research question # 5: There are no significant differences in college students' hepatitis A and B immunization status based on their health risk behaviors.

The hepatitis A and B vaccinations are recommended for adults who are at high risk for hepatitis A and B. Therefore, we investigated whether those students who possess health risk behaviors are more likely to be immunized to hepatitis A and B compared to those student who are not considered high risk. We found a statistically significant difference in the hepatitis B immunization status for those students who have been sexually active in the past twelve months with two or more sexual partners compared to those with only one partner, X^2 (2, N = 253) = 8.153, p = .017 [Table 13]. Thus, students who were sexually active in the past 12 months with two or more sex partners were more likely to be completely vaccinated for hepatitis B than those with only one sexual partner.

Table 13. Hepatitis B immunization status and the number of sexual partners in the past twelve months.

Number of sexual partners in the past 12 months	Hepatitis B Immunization Record n (%) N = 253			
	No	Partial	Complete	Totals
1	54 (33.8)	20 (12.5)	86 (53.7)	160 (100.0)
2 or more	16 (17.2)	16 (17.2)	61 (65.6)	93 (100.0)

There were significant differences in the immunization status for hepatitis B based on whether students were comparing students with and without a body piercing/tattoo, X^2 (2, N = 448) = 9.565, p = .008 [Table 14]. Therefore, if a student had a body piercing/tattoo they were more likely to have been completely vaccinated for hepatitis B compared to those students who did not have those forms of body art.

Table 14. Hepatitis B immunization status and body piercing and/or tattoos.

Body piercing and/or tattoos	Hepatitis B Immunization Record n (%) N = 448			
	No	Partial	Complete	Totals
Yes	52 (22.0)	29 (12.3)	155 (65.7)	236 (100.0)
No	73 (34.4)	28 (13.2)	111 (52.4)	212 (100.0)

We found a significant difference in the hepatitis A immunization status in students who have traveled internationally to regions of hepatitis A risk compared to those students who have not traveled to those regions, X^2 (2, N = 448) = 11.313, p = .003 [Table 15]. Students who have traveled to regions of hepatitis A risk were more likely to be partially or completely immunized for hepatitis A compared to those students who have not traveled to countries where hepatitis A is endemic.

Table 15. Hepatitis A immunization status and travel to regions of hepatitis A risk.

Travel to regions of hepatitis A risk	Hepatitis A Immunization Record n (%) N = 448			
	No	Partial	Complete	Totals
Yes	83 (69.7)	17 (14.3)	19 (16.0)	119 (100.0)
No	276 (83.9)	28 (8.5)	25 (7.6)	329 (100,0)

We found no significant differences hepatitis A or B immunization status based on other health risk behaviors (unprotected vaginal, oral-genital, anal sex, prior history of STI, injection drug use).

Self-Perceived Risk and Hepatitis A and B Immunization Status

Research hypothesis #6: There are no significant differences in college students' hepatitis A and B immunization status based on their self-perceived risk for hepatitis A and B.

For many health behaviors, a person's self-perceived risk for a health condition is not the sole determinant for adopting a preventive health behavior. In our study, there were no statistically significant differences in a participant's hepatitis A and B immunization status (no immunization, partial immunization, complete immunization) based on their self-perceived risk for hepatitis A and B (high risk, neutral, low risk, no risk).

Self-Perceived Risk and Health Risk Behaviors

Research hypothesis # 7: There are no significant differences in the health risk behaviors of unvaccinated college students based on their self-perceived risk for hepatitis A and B.

Students who are unvaccinated (no immunization) for hepatitis A and B remain vulnerable to acquiring these viral infections. A person's self-perceived risk may or may not be consistent with their actual risk. Naturally, one would think that a person who felt they were low-risk for hepatitis A and B would not possess health risk behaviors or would have been vaccinated against hepatitis A or B. Therefore, we investigated whether the health risk behaviors of unvaccinated students differed based on whether they self-perceived themselves as no/low risk, neutral risk, or high risk for hepatitis A and B. We found no statistically significant differences in the health risk behaviors of unvaccinated students based on their self-perceived risk for hepatitis A and B. In other words, the unvaccinated students who felt they were no/low risk, neutral risk, and high-risk showed no significant differences in their health risk behaviors.

We found that large percentages of unvaccinated students who have health risk behaviors for hepatitis A and B actually perceive themselves to be at no/low risk for hepatitis A and B. To emphasize this point we report the percentages of students with various health risk behavior who perceived themselves to be at no/low risk for hepatitis A and B [Table 16]. In students unvaccinated for hepatitis A and who also had participated in unprotected vaginal, oral-genital, and anal sex, 52 %, 57%, and 50 % respectively felt they were at no/low risk for hepatitis A. Likewise for hepatitis B, 57 %, 62 %, and 50 % of unvaccinated students with a history of unprotected vaginal, oral-genital, and anal sex respectively felt they were at no/low risk for hepatitis B.

More than one-half of the unvaccinated students with a history of multiple sexual partners in the past twelve months perceived they were at no/low risk for hepatitis A and B. Nearly 57 % of unvaccinated students for hepatitis A who have traveled to regions with high endemic rates of hepatitis A perceived they are at no/low risk for hepatitis A. About 69 % of unvaccinated students with a body piercing/tattoo perceived they were at a no/low risk for hepatitis B.

Table 16. Percentages of unvaccinated students with specific health risk behaviors with self-perceived 'no risk/low risk' for hepatitis A or B.

Health Risk Behaviors	Hepatitis A Risk N = 355		Hepatitis B Risk N =126	
	Unvaccinated Students with Health Risk Behavior	Self Perceived No/Low Risk	Unvaccinated Students with Health Risk Behavior	Self Perceived No/Low Risk
	N	% (n)	N	% (n)
Two or more sex partners	61	59.0 (36)	15	53.3 (8)
Prior diagnosis of STI	11	36.4 (4)	4	100.0 (4)
Unprotected vaginal sex	107	52.3 (56)	37	56.8 (21)
Unprotected oral-genital sex	159	57.2 (91)	55	61.8 (34)
Unprotected anal sex	20	50.0 (10)	6	50.0 (3)
Body piercing and/or tattoo	NA	NA	52	69.2 (36)
Travel to an endemic region	83	56.6 (47)	NA	NA
Injection or illicit drug use	4	50.0 (2)	2	50.0 (1)

Summary of Knowledge, Perceived Risk & Health Risk Behaviors

From our sample, matriculating college students are much more likely to have completed the hepatitis B immunization series (58.8%) compared to the hepatitis A series (10 %). There were small portions of students that had partially completed these vaccine series (12 %). A notable segment of students had not started the hepatitis A series (80 %) and hepatitis B series (30 %). We also found that students 18-19 years were more likely to be immunized for hepatitis B compared to students 20 years and older.

There were also significant differences in the students' ability to recall their hepatitis A and B immunization status when comparing self-reported immunization status with their actual Student Health Services immunization record. For example, 37.3 % and 24.0 % of students stated they could not recall their hepatitis A and B immunization status. Furthermore, 66.3 % of the students who thought they had completed the hepatitis A immunization series had no evidence of receiving a hepatitis A vaccination on their Student Health Services immunization record.

In our study, matriculating college students possess a variety of health risk behaviors for hepatitis A and B. More than half of these students were sexually active

in the past twelve months (56 %). Among these sexually active students many reported having multiple sexual partners (20 %). The students with multiple sexual partners were more likely to partake in risky sexual behaviors such as unprotected vaginal (61 %), oral-genital (81 %), and anal sex (13 %). In addition, non-sexual risk behaviors such as body piercing/tattoos (53 %), and history of international travel to regions endemic with hepatitis A (27 %) were also common.

We found significant differences in college students' immunization status based on their health risk behaviors. Students with a history of international travel to regions of hepatitis A risk were more likely to be immunized for hepatitis A. Students were more likely to be immunized for hepatitis B if they had two or more sex partners, or had a body piercing/tattoos.

Within our study population, there were no significant differences in college students' hepatitis A and B immunization status based on their knowledge and self-perceived risk for hepatitis A and B. Although matriculating college students' knowledge about hepatitis A and B was very good based on a short series of basic questions, there were no significant differences between immunization status based on their hepatitis A and B knowledge. The vast majority (66 %) of students perceived they were at no risk or low risk for hepatitis and very few (2.5 %) were concerned that hepatitis A or B would negatively impact their lives. We found that among unvaccinated students who participated in high-risk sexual (multiple sexual partners, unprotected sex) and non-sexual health behaviors (body piercing/tattoo, international travel) more than 50 % self-perceived they were at no/low risk for hepatitis A and B.

To summarize, we evaluated the differences in immunization status based on hepatitis A and B knowledge, self-perceived risk, and health risk behaviors among convenience sample of matriculating college students at a large land-grant state university. However, to obtain a greater understanding about hepatitis A and B vaccinations in matriculating college students we also investigated if there were differences in college students' attitude, subjective norms, and perceived behavioral control based on their hepatitis A and B immunization status.

Theory of Planned Behavior Construct Analysis

The three main components of the theory of planned behavior: *attitude*, *subjective norm*, and *perceived behavioral control* represented independent variables. We created a separate scale comprised of a series of constructs or variables that were designed to evaluate each theoretical component (see survey instrument in appendix). For example, attitude is determined by the combination of the behavioral beliefs (items 14, 16, 18, ...28) and the evaluation of the behavioral beliefs (items 13, 15, 17, ...27). The subjective norm is determined by normative beliefs (items 31, 33, ...41) and motivation to comply variables (items 32, 34, ...42). The perceived behavioral control component is derived from control beliefs (items 58, 60, 62, ...74) and perceived power (items 57,59,61, ...73). All the variables were organized using a five-point bipolar Likert scale using the following responses: (A) very high, (B) high, (C) don't know, (D) low, and (E) very low. For the data analysis, the responses were recoded as a bipolar scale with +2.00 (A- very high), +1.00 (B- high), 0.00 (C- Don't know), –1.00 (D- low), and –2.00 (E- very low).

The dependent variable for this study was the immunization status for hepatitis A and hepatitis B vaccines. The immunization status was divided into three categories- no immunization, partial immunization, and complete immunization. The subject's responses to the survey questions were tabulated according to their category of immunization status. In other words, the responses for all subjects with complete hepatitis A immunization were grouped together, and responses for all subjects with partial immunization were grouped together, and so forth. To demonstrate the effect of each construct variable in the scale, we reported a mean score, standard deviation, and 95 % confidence intervals for each category of hepatitis A and hepatitis B immunization status [Table 17]. If the mean score for a specific variable was + 2.00, then that variable was believed to have a very high likelihood of effecting immunization status. If the mean score for a specific variable were – 2.00, then that variable would have a very low likelihood of being a determinant of immunization status.

As a separate step in the analysis, we then investigated if there were any significant differences in the mean scores of each construct based on their immunization status ('no', 'partial', and 'complete'). The one-way analysis of variance (ANOVA) was used to determine if there were statistically significant differences among the mean scores of each constructs based on the three categories of immunization status [Table 17]. The ANOVA test was considered significant if the F statistic had a p value < .05. If a statistically significant F test was found, then a Bonferroni post hoc test was performed.

Although we found statistically significant differences in mean scores for selected constructs based on immunization status, the students in each category of immunization status held similar beliefs. For example, for the behavioral belief construct of vaccine effectiveness [Table 17] there was a significant difference between the mean scores for the students in the hepatitis A vaccine partially vaccinated group (+ 1.55) and the no immunization group (+ 1.14). However, both had a positive mean score indicating that both groups believed there was a high likelihood the hepatitis A vaccine is effective.

Attitude Constructs of the Theory of Planned Behavior

Research hypothesis # 8: There are no significant differences in college students' attitude constructs about hepatitis A and B vaccines based on their hepatitis A and B immunization status.

The attitude scale contained two variables stated as positive behavioral beliefs and six variables stated as negative behavioral beliefs. The variables of "vaccine effectiveness" and "decrease fear of hepatitis" were the positive beliefs. The other six variables in the attitude scale were negative beliefs (pain from injection, anticipation anxiety, vaccine adverse effects, inconvenience, expense, compromise religious beliefs). The *behavioral belief* questions asked the student how likely they thought that specific outcomes of receiving the vaccine would occur. The *evaluation of the*

behavioral belief questions asked the student how likely they thought that behavioral belief would influence their decision to be vaccinated for hepatitis A and B. The Cronbach's alpha for the eight items in the attitude scale was 0.74.

The behavioral belief construct mean scores for each of the three groups of hepatitis A immunization status ('no', 'partial', and 'complete') are reported in Table 17. The most important findings regarding behavioral beliefs is that partially immunized students were more likely to believe the vaccine would be effective, $F(2, 456) = 4.44$, $p = .012$, and less likely to cause adverse effects, $F(2,457) = 4.63$, $p = .008$, than their unimmunized counterparts. In addition, the partially vaccinated students were less likely to believe they would experience anticipation anxiety, $F(2,457) = 5.15$, $p = .005$, than the unimmunized and completely immunized students.

To clarify, for hepatitis A vaccination, the behavioral beliefs appear to play the most important role for partially immunized students. These students were more likely to believe the vaccine was effective, and unlikely to cause adverse effects or anticipation anxiety than their unimmunized counterparts. Overall, the students from all hepatitis A immunization status groups believed that the positive behavioral beliefs (vaccine is effective and will decrease the fear of hepatitis) would have a high likelihood of occurring. The students from all immunization groups believed that the negative behavioral beliefs (pain from injection, vaccine adverse effects, anticipation anxiety, inconvenience, expense) would have a low likelihood of occurring.

See Table 17 on next page.

Table 17. Behavioral beliefs based on hepatitis A immunization status ('no', 'partial', and 'complete').

Behavioral Beliefs Constructs	Hepatitis A Immunization Status: No N = 368			Partial N = 47			Complete N = 46			ANOVA
	M	SD	95 % CI	*M*	SD	95 % CI	*M*	SD	95 % CI	F (df, n), p-value
Pain from injection	-.04	1.13	-.16 to .08	-.37	1.31	-.76 to .02	.09	1.26	-.29 to .47	F (2,453) = 2.05, p = .129
Vaccine effectiveness	1.14*	.95	1.04 to 1.24	1.55*	.65	1.36 to 1.75	1.29	.84	1.04 to 1.54	F (2,456) = 4.44, p = .012
Vaccine adverse effects	-.39*	.94	-.48 to -.29	-.83*	.93	-1.10 to -.55	-.39	.13	-.64 to -.14	F (2,457) = 4.63, p = .008
Anticipation anxiety	-.34*	1.25	-.47 to -.22	-.96*	1.13	-.1.29 to -.62	-.28*	1.34	-.68 to .12	F (2,457) = 5.15, p = .005
Inconvenience of vaccine	-.74	1.05	-.85 to -.64	-1.02	1.15	-1.36 to -.68	-.85	1.13	-1.18 to -.51	F (2,458) = 1.50, p = .224
Vaccine expense	-.31	1.05	-.42 to -.20	-.17	1.27	-.54 to .20	-.48	1.07	-.80 to -.16	F (2,458) = 0.95, p = .387
Decrease fear of hepatitis	.45	1.08	.34 to .56	.47	1.06	.16 to .78	.46	1.33	.06 to .85	F (2,457) = 0.01, p = .994
Limits religious belief	-1.35	1.00	-1.45 to -1.25	-1.50	1.01	-1.80 to -1.20	-1.09	1.03	-1.39 to -.78	F (2,456) = 5.04, p = .131

* ANOVA test showed a significant difference in the means of these two groups at a p value < .05.

The 'evaluation of behavioral beliefs' construct mean scores for each of the three groups of hepatitis A immunization status ('no', 'partial', and 'complete') are reported in Table 18. The partially immunized students were more likely to be influenced by knowing the vaccine is effective, $F(2,454) = 4.92$, $p = .018$, and less likely to be influenced by anticipation anxiety, $F(2,454) = 7.30$, $p = .000$, than the unvaccinated students.

To summarize, for hepatitis A vaccination the partially immunized students were influenced by several behavioral belief constructs. These students were more likely to be influenced by their belief that the vaccine was effective and that anticipation anxiety was unlikely to occur than the unimmunized students. Overall, the students from all hepatitis A immunization status groups believed that the positive behavioral beliefs (vaccine is effective and will decrease the fear of hepatitis) would likely influence their decision to be vaccinated. The students from all immunization groups believed that the negative behavioral beliefs (pain from injection, vaccine

See Table 18 on next page.

Table 18. Evaluation of behavioral beliefs based on hepatitis A immunization status.

Evaluation of Behavioral Beliefs Constructs	Hepatitis A Immunization Status: No N = 368			Partial N = 47			Complete N = 46			ANOVA
	M	SD	95 % CI	*M*	SD	95 % CI	*M*	SD	95 % CI	F (df, n), p-value
Pain from injection	-.66	1.28	-.80 to -.53	-1.09	1.14	-1.43 to -.75	-.67	1.35	-1.07 to -.26	F (2,445) = 2.26, p = .105
Vaccine effectiveness	1.37*	.81	1.29 to 1.45	1.70*	.55	1.54 to 1.86	1.59	.65	1.39 to 1.78	F (2,454) = 4.92, p = .018
Vaccine adverse effects	-.28	1.11	-.39 to -.16	-.60	1.10	-.93 to -.27	-.57	1.00	-.86 to -.27	F (2,452) = 2.79, p = .063
Anticipation anxiety	-.56*	1.29	-.69 to -.42	-1.30*	.81	-1.55 to –1.06	-.57*	1.33	-.96 to -.17	F (2,454) = 7.30, p = .000
Inconvenience of vaccine	-.94	1.08	-1.05 to -.83	-1.28	.97	-1.56 to -.99	-.96	1.19	-1.31 to -.60	F (2,458) = 1.99, p = .137
Vaccine expense	-.30	1.16	-.42 to -.18	-.60	1.19	-.95 to -.25	-.65	1.14	-.99 to -.31	F (2,455) = 2.84, p = .059
Decrease fear of hepatitis	.57	1.18	.45 to .69	1.00	1.06	.69 to 1.31	.67	1.27	.30 to 1.05	F (2,453) = 2.79, p = .062
Limits religious belief	-1.44	.99	-1.55 to -1.34	-1.76	.71	-1.97 to –1.55	-1.37	.97	-1.66 to -1.08	F (2,453) = 2.47, p = .086

* ANOVA test showed a significant difference in the means of these two groups at a p value < .05.

adverse effects, anticipation anxiety, inconvenience, expense) would have a low likelihood of influencing their decision to be vaccinated.

The behavioral belief construct mean scores for each of the three groups of hepatitis B immunization status ('no', 'partial', and 'complete') are reported in Table 19. The completely immunized students believed that the hepatitis B vaccine was more likely to be effective, $F(2,456) = 3.64$, $p = .039$, and less likely to be inconvenient, $F(2, 458) = 4.04$, $p = .015$, than their unimmunized counterparts. The partially immunized students felt there was a lower likelihood that adverse effects, $F(2,457) = 3.63$, $p = .024$, and anticipation anxiety would occur, $F(2,457) = 4.01$, $p = .019$, than the unimmunized students.

To paraphrase, with hepatitis B vaccination several behavioral beliefs were significantly more important for the completely and partially immunized students than their unimmunized counterparts. The completely vaccinated students were more likely to believe that the hepatitis B vaccine is effective and that it would not be inconvenient to be immunized. The partially vaccinated students were less likely to believe the vaccine will cause adverse side effects or anxiety anticipating the shot than their unvaccinated counterparts. Overall, the students from all hepatitis B immunization status groups believed that the positive behavioral beliefs (vaccine is effective and will decrease the fear of hepatitis) would have a high likelihood of occurring. The students from all immunization groups believed that the negative behavioral beliefs (pain from injection, vaccine adverse effects, anticipation anxiety, inconvenience, expense) would have a low likelihood of occurring.

See Table 19 on next page.

Table 19. Behavioral beliefs based on hepatitis B immunization status.

Behavioral Beliefs Constructs	Hepatitis B Immunization Status: No N = 129			Partial N = 61			Complete N = 271			ANOVA
	M	SD	95 % CI	*M*	SD	95 % CI	*M*	SD	95 % CI	F (df, n), p-value
Pain from injection	-.04	1.06	-.23 to .15	-.15	1.25	-.47 to .17	-.05	1.20	-.19 to .10	F (2,453) = 0.21, p = .811
Vaccine effectiveness	1.02*	.94	.85 to 1.18	1.31	.90	1.08 to 1.54	1.26*	.91	1.15 to 1.37	F (2,456) = 3.64, p = .039
Vaccine adverse effects	-.33*	.91	-.49 to -.17	-.72*	.98	-.97 to -.46	-.42	.94	-.53 to -.30	F (2,457) = 3.63, p = .024
Anticipation anxiety	-.18*	1.21	-.39 to .03	-.72*	1.25	-1.04 to -.39	-.43	1.27	-.59 to -.28	F (2,457) = 4.01, p = .019
Inconvenience of vaccine	-.57*	1.00	-.75 to .40	-.74	1.06	-1.01 to -.47	-.89*	1.09	-1.02 to -.76	F (2,458) = 4.04, p = .015
Vaccine expense	-.31	1.03	-.49 to -.13	-.48	1.06	-.75 to -.20	-.27	1.11	-.41 to -.14	F (2,458) = 0.86, p = .422
Decrease fear of hepatitis	.35	1.10	.16 to .54	.38	1.08	.10 to .65	.52	1.11	.38 to .65	F (2,457) = 1.14, p = .322
Limits religious belief	-1.40	.97	-1.57 to -1.23	-1.53	.81	-1.74 to -1.32	-1.26	1.06	-1.39 to –1.14	F (2,456) = 2.09, p = .125

*ANOVA test showed a significant difference in the means of these two groups at a p value < .05.

The 'evaluation of behavioral beliefs' construct mean scores for each of the three groups of hepatitis B immunization status ('no', 'partial', and 'complete') are reported in Table 20. For hepatitis B immunization, significant differences were found for three of the variables in the behavioral belief scale based on immunization status. The completely immunized students were less likely to be influenced by anticipation anxiety, $F(2,454) = 4.53$, $p = .018$, inconvenience, $F(2,455) = 3.73$, $p = .020$, or vaccine expense, $F(2,455) = 9.21$, $p = .008$ than the unimmunized students.

There were significant differences in how much completely immunized students were influenced by behavioral beliefs compared to unimmunized students. These completely immunized students were less likely to be influenced by their belief that the getting the vaccine will create anticipation anxiety, inconvenience, or be expensive compared to unimmunized students. Overall, the students from all hepatitis B immunization status groups believed that the positive behavioral beliefs (vaccine is effective and will decrease the fear of hepatitis) would likely influence their decision to be vaccinated. The students from all immunization groups believed that most of the negative behavioral beliefs (pain from injection, vaccine adverse effects, anticipation anxiety, inconvenience) would have a low likelihood of influencing their decision to be vaccinated. The only exception was that the unimmunized students were neutral on construct that the vaccine expense will influence their decision to be vaccinated.

See Table 20 on next page.

Table 20. Evaluation of behavioral beliefs based on hepatitis B immunization status.

Evaluation of Behavioral Beliefs Constructs	Hepatitis B Immunization Status: No N = 129			Partial N = 61			Complete N = 271			ANOVA
	M	SD	95 % CI	*M*	SD	95 % CI	*M*	SD	95 % CI	F (df, n), p-value
Pain from injection	-.56	1.25	-.78 to -.34	-.85	1.24	-1.17 to -.52	-.75	1.29	-.90 to -.59	F (2,445) = 1.38, p = .254
Vaccine effectiveness	1.30	.78	1.17 to 1.44	1.46	.79	1.26 to 1.66	1.48	.78	1.38 to 1.57	F (2,454) = 2.18, p = .114
Vaccine adverse effects	-.20	1.03	-.38 to -.02	-.54	1.04	-.81 to -.27	-.36	1.14	-.50 to -.22	F (2,452) = 2.04, p = .132
Anticipation anxiety	-.35*	1.33	-.58 to -.12	-.82	1.28	-1.15 to -.49	-.73*	1.22	-.87 to -.58	F (2,454) = 4.53, p = .018
Inconvenience of vaccine	-.77*	1.10	.96 to -.57	-.97	1.08	-1.24 to -.69	-1.08*	1.07	-1.21 to -.95	F (2,455) = 3.73, p = .020
Vaccine expense	.00*	1.16	-.20 to .20	-.54*	1.10	-.82 to -.26	-.51*	1.15	-.64 to -.37	F (2,455) = 9.21, p = .008
Decrease fear of hepatitis	.42	1.21	.21 to .63	.69	1.03	.43 to .95	.71	1.20	.56 to .85	F (2,453) = 2.66, p = .071
Limits religious belief	- 1.52	.97	-1.69 to -1.35	-1.57	.89	-1.80 to -1.34	-1.42	.98	-1.54 to -1.30	F (2,453) = 0.84, p = .434

*ANOVA test showed a significant difference in the means of these two groups at a p value < .05.

Subjective Norm Constructs of the Theory of Planned Behavior

Research hypothesis # 9: There are no significant differences in college students' subjective norm construct based on their hepatitis A and B immunization status.

Normative beliefs and *motivation to comply* are the constructs for the subjective norm component of the theory of planned behavior. The normative belief questions ask the subject how likely they think that an important person in their life would support their decision to be vaccinated for hepatitis A and B. The motivation to comply questions asked the subjects how likely a referent would influence their decision to be vaccinated. Like the other scales, a positive score (+ 2.00) refers to a very high likelihood and a negative score (-2.00) refers to a very low likelihood. The Cronbach's alpha for the six items in the subjective norm scale was .90.

The normative belief construct mean scores for each of the three groups of hepatitis A immunization status ('no', 'partial', and 'complete') are reported in Table 21. We found no statistically significant differences in the normative beliefs based on hepatitis A immunization status.

For hepatitis A vaccination, there were no statistically significant differences in the students' normative beliefs regardless of their immunization status. Students from the three immunization groups believed that all the referents in the normative beliefs scale (parents, family doctor, close friend, partner/spouse, Student Health Services, residence hall staff) would likely support their decision to be vaccinated. Overall students believed that their parents (*M* range 1.54 to 1.76) and family doctor (*M* range 1.53 to 1.60) would most likely be supportive of their decision to be vaccinated, and the residence hall staff (*M* range .26 to .79) least likely.

See Table 21 on next page.

Table 21. Normative beliefs based on hepatitis A immunization status.

Normative Beliefs Constructs	Hepatitis A Immunization Status: No N = 368			Partial N = 47			Complete N = 46			ANOVA
	M	SD	95 % CI	*M*	SD	95 % CI	*M*	SD	95 % CI	F (df, n), p-value
Parents	1.54	.81	1.45 to 1.62	1.75	.67	1.55 to 1.94	1.59	.65	1.39 to 1.78	F (2,458) = 1.51, p = .221
Family Doctor	1.53	.83	1.45 to 1.62	1.60	.83	1.35 to 1.84	1.57	.72	1.35 to 1.78	F (2,457) = 0.14, p = .873
Close Friend	.76	1.03	.66 to .87	.94	1.22	.58 to 1.30	.59	.91	.32 to .86	F (2,457) = 1.31, p = .272
Partner/Spouse	1.02	1.07	.91 to 1.13	1.23	1.05	.93 to 1.54	1.04	.89	.78 to 1.31	F (2,447) = 0.84, p = .433
Student Health Staff	1.22	1.02	1.12 to 1.33	1.43	.96	1.15 to 1.72	1.09	.96	.80 to 1.37	F (2,454) = 1.43, p = .240
Residence Hall Staff	.44	1.18	.31 to .56	.79	1.16	.45 to 1.13	.26	1.10	-.07 to .59	F (2,452) = 2.57, p = .078

*ANOVA test showed a significant difference in the means of these two groups at a p value < .05.

The 'motivation to comply' constructs mean scores for each of the three groups of hepatitis A immunization status ('no', 'partial', and 'complete') are reported in Table 22. The Student Health Services was the only motivation to comply construct to show statistically significant differences based on hepatitis A immunization status. The students completely immunized were more likely to be influenced by the Student Health Services staff in their decision to be vaccinated for hepatitis A, $F(2,454) = 4.20$, $p = .029$, than unimmunized students.

For hepatitis A vaccination, the completely immunized students were significantly more likely to be influenced by the Student Health Services staff than their unimmunized counterparts. Overall, students from the three immunization status groups believed they would likely be influenced by all the referents on the normative belief scale with the exception of the residence hall staff member. Although there were no significant differences in the motivation to comply constructs based on immunization status, college students believed they would be most likely influenced by their parents and family doctor.

See Table 22 on next page.

Table 22. 'Motivation to comply' based on hepatitis A immunization status.

Motivation to Comply Constructs	Hepatitis A Immunization Status									
	No N = 368			Partial N = 47			Complete N = 46			ANOVA
	M	SD	95 % CI	*M*	SD	95 % CI	*M*	SD	95 % CI	F (df, n), p-value
Parents	1.03	1.20	.91 to 1.15	1.11	1.20	.75 to 1.46	1.35	.90	1.08 to 1.62	F (2,458) = 1.53, p = .219
Family Doctor	1.07	1.27	.95 to 1.18	1.30	.98	1.01 to 1.58	1.33	.79	1.09 to 1.56	F (2,457) = 1.92, p = .148
Close Friend	.14	1.18	.02 to .26	.11	1.20	-.25 to .46	.48	1.11	.15 to .81	F (2,457) = 1.80, p = .166
Partner/Spouse	.72	1.21	.59 to .85	.89	1.11	.57 to 1.22	.65	1.06	.34 to .97	F (2,447) = 0.56, p = .571
Student Health Staff	.31*	1.24	.18 to .44	.61	1.14	.27 to .95	.80*	1.02	.50 to 1.11	F (2,454) = 4.20, p = .029
Residence Hall Staff	-.30	1.14	-.42 to -.19	-.19	1.17	-.54 to .15	-.26	1.25	-.63 to .11	F (2,453) = 0.22, p = .807

*ANOVA test showed a significant difference in the means of these two groups at a p value < .05.

The normative belief construct mean scores for each of the three groups of hepatitis B immunization status ('no', 'partial', and 'complete') are reported in Table 23. The normative belief about parents was the only statistically significant finding based on the three categories of hepatitis B immunization status. The students who were completely immunized were more likely to believe that their parents would be supportive of their decision to be vaccinated for hepatitis B, $F(2,458) = 5.61$, $p = .004$, than unimmunized students.

For hepatitis B vaccination, one normative belief had a significantly more important role in the completely immunized students than the unimmunized students. The completely immunized students were more likely to believe their parents would be supportive. Even though statistically significant differences were not found for the other referents based on immunization status, the students believed that all the other referents (family doctor, close friend, partner/spouse, and Student Health Services staff, residence hall staff) would be supportive of their decision to be vaccinated.

See Table 23 on next page.

Table 23. Normative beliefs based on hepatitis B immunization status.

Normative Beliefs Constructs	Hepatitis B Immunization Status: No N = 129			Partial N = 61			Complete N = 271			ANOVA
	M	SD	95 % CI	*M*	SD	95 % CI	*M*	SD	95 % CI	F (df,n), p-value
Parents	1.37*	.87	1.22 to 1.52	1.64	.66	1.47 to 1.81	1.64*	.75	1.55 to 1.73	F (2,458) = 5.61, p = .004
Family Doctor	1.46	.80	1.32 to 1.61	1.38	1.02	1.12 to 1.64	1.62	.76	1.53 to 1.71	F (2,457) = 3.04, p = .074
Close Friend	.65	1.06	.46 to .83	1.03	1.03	.77 to 1.30	.76	1.03	.64 to .88	F (2,457) = 2.87, p = .058
Partner/Spouse	.94	1.02	.76 to 1.12	1.12	1.11	.83 to 1.40	1.08	1.05	.95 to 1.21	F (2,447) = .857, p = .425
Student Health Staff	1.21	.94	1.04 to 1.38	1.23	1.09	.95 to 1.51	1.24	1.02	1.12 to 1.36	F (2,454) = 0.05, p = .953
Residence Hall Staff	.44	1.09	.25 to .64	.67	1.36	.32 to 1.02	.41	1.17	.27 to .55	F (2,452) = 1.24, p = .290

*ANOVA test showed a significant difference in the means of these two groups at a p value < .05.

The 'motivation to comply' constructs mean scores for each of the three groups of hepatitis B immunization status ('no', 'partial', and 'complete') are reported in Table 24. In the motivation to comply scale, there were three variables that demonstrated statistically significant differences based on hepatitis B immunization status. The completely immunized students were more likely to be influenced by: 1) parents, $F(2,458) = 5.975$, $p = .003$, 2) family doctor, $F(2,457) = 9.78$, $p = .000$, and 3) Student Health Services staff, $F(2,454) = 6.32$, $p = .001$, than unimmunized students.

Several motivation to comply constructs were significantly more influential in students completely immunized for hepatitis B than their unimmunized counterparts. The completely immunized students were more likely to be influenced by their parents, family doctor, and the Student Health Services staff.

See Table 24 on next page.

Table 24. 'Motivation to comply' based on hepatitis B immunization status.

Motivation to Comply Constructs	Hepatitis B Immunization Status: No N = 129			Partial N = 61			Complete N = 271			ANOVA
	M	SD	95 % CI	*M*	SD	95 % CI	*M*	SD	95 % CI	F (df,n), p-value
Parents	.80*	1.25	.59 to 1.02	.95	1.26	.63 to 1.27	1.22*	1.10	1.09 to 1.35	F (2,458) = 5.98, p = .003
Family Doctor	.79*	1.18	.58 to .99	1.03	1.14	.74 to 1.32	1.29*	.99	1.17 to 1.41	F (2,457) = 9.78, p = .000
Close Friend	-.01	1.09	-.20 to .18	.16	1.27	-.16 to .49	.25	1.18	.11 to .39	F (2,457) = 2.12, p = .121
Partner/Spouse	.61	1.20	.40 to .82	.73	1.18	.43 to 1.04	.78	1.19	.64 to .93	F (2,447) = 0.91, p = .402
Student Health Staff	.07*	1.17	-.13 to .28	.43	1.30	.09 to .76	.53*	1.20	.39 to .68	F (2,454) = 6.32, p = .001
Residence Hall Staff	-.46	1.05	-.65 to -.27	-.26	1.26	-.59 to .06	-.22	1.17	-.36 to -.08	F (2,453) = 2.57, p = .146

*ANOVA test showed a significant difference in the means of these two groups at a p value < .05.

Perceived Behavioral Control Constructs in the Theory of Planned Behavior

Research hypothesis # 10: There are no significant differences in college students' perceived behavioral control construct based on their hepatitis A and B immunization status.

The theory of planned behavior component of perceived behavioral control is comprised of the *control beliefs* and *perceived power* constructs. The control belief questions asked the subjects how likely they thought barriers or facilitating conditions for vaccination would occur. The perceived power questions asked how likely they thought this barrier or facilitating condition would influence their decision to be vaccinated. Similar to the other construct scales, a positive score (+2.00) refers to a very high likelihood and a negative score (-2.00) refers to a very low likelihood. All the questions in this scale were written as facilitating conditions, so if the mean score was positive, then there was a high likelihood that the facilitating condition would be present. If the mean score was negative, then there was a low likelihood that the facilitating condition would occur. The Cronbach's alpha for the eleven items in the perceived behavioral control scale was .94.

The control belief construct mean scores for each of the three groups of hepatitis A immunization status ('no', 'partial', and 'complete') are reported in Table 25. We found significant differences in three positive control beliefs based on hepatitis A immunization status. The most important findings were that the partially immunized students were more likely to believe that they would receive reminders about getting a hepatitis A vaccination from: 1) their parents, $F(2,453) = 3.98$, $p = .050$, and 2) Student Health Services staff, $F(2,453) = 2.95$, $p = .048$, than their unimmunized counterparts. The partially immunized students were more likely to believe that a Student Health Services hepatitis vaccine clinic would be available, $F(2,254) = 3.55$, $p = .025$, than unimmunized students. To clarify, for hepatitis A the several control beliefs were significantly more important for partially immunized

Table 25. Control beliefs based on hepatitis A immunization status.

Control Beliefs Constructs	Hepatitis A Immunization Status: No N = 368			Partial N = 47			Complete N = 46			ANOVA
	M	SD	95 % CI	*M*	SD	95 % CI	*M*	SD	95 % CI	F (df,n), p-value
SHS hepatitis vaccine clinic	.52	1.10	.41 to .64	.79*	1.23	.43 to 1.15	.17*	1.10	-.15 to .50	F (2,254) = 3.55, p = .025
Vaccine available at SHS	.30	1.05	.19 to .41	.36	1.11	.04 to .69	.26	1.00	-.04 to .56	F (2,454) = .11, p = .895
Vaccine available on campus	-.11	1.07	-.22 to .00	.09	1.02	-.21 to .38	.16	1.07	-.16 to .48	F (2,451) = 1.77, p = .172
Vaccine at discounted price	.47	1.17	.35 to .59	.36	1.26	-.01 to .73	.50	1.22	.14 to .86	F (2,452) = .19, p = .824
Vaccine paid by insurance	.44	1.17	.32 to .56	.51	1.14	.18 to .85	.50	1.28	.12 to .88	F (2,453) = .11, p = .894
Educational handout	.24	1.04	.14 to .35	.30	1.20	-.05 to .65	.22	1.15	-.13 to .56	F (2,453) = .07, p = .930
Finding time for vaccine	-.06	1.15	-.18 to .06	-.02	1.24	-.39 to .34	-.46	1.09	-.78 to -.13	F (2,453) = 2.50, p = .083
Parent's reminder	-.04*	1.19	-.17 to .08	.40*	1.31	.02 to .79	.28	1.20	-.08 to .64	F (2,453) = 3.98, p = .050
SHS staff reminder	.16*	1.11	.04 to .27	.57*	1.16	.24 to .91	.24	1.10	-.09 to .57	F (2,453) = 2.95, p = .048
Reminder call/card/email	.02	1.10	-.09 to .14	.38	1.21	.03 to .74	-.09	1.01	-.40 to .22	F (2,452) = 2.60, p = .076
School newspaper ad	-.18*	1.10	-.29 to -.07	-.15	1.06	-.46 to .16	-.62*	.96	-.91 to -.33	F (2,451) = 3.45, p = .030

*ANOVA test showed a significant difference in the means of these two groups at a p value < .05.

students than unimmunized students. The partially immunized students were more likely to believe that their parents and Student Health Services staff would remind them about getting the hepatitis A immunization. Partially immunized students also were more likely to believe that they would be able to get a hepatitis A vaccination at a Student Health Services than their unimmunized counterparts. Although we found no significant differences in other control beliefs based on immunization status, students believed that most of these facilitating conditions would likely occur except, finding time in their busy schedule to get a vaccine and seeing an ad about the hepatitis vaccines in the school newspaper. Compared to the behavioral and normative beliefs, the control beliefs mean scores were closer to a neutral score (0.0).

The perceived power constructs mean scores for each of the three groups of hepatitis A immunization status ('no', 'partial', and 'complete') are reported in Table 26. There were no statistically significant differences in any of the perceived power constructs based on hepatitis A immunization status.

We found no significant differences in any of the perceived power constructs based status hepatitis A immunization status. However, as an overall group college students believed that most of the facilitating conditions were likely to influence their decision to be vaccinated. They were most likely to be influenced by having the vaccine paid for by insurance (*M* range .72 to 1.02) or having the vaccine available at a discounted price (*M* range .67 to .86). Students believed there was a low likelihood that they would be influenced by an ad in the school newspaper (*M* range -.13 to -.42).

See Table 26 on next page.

Table 26. Perceived power based on hepatitis A immunization status.

Perceived Power Constructs	Hepatitis A Immunization Status: No N = 368			Partial N = 47			Complete N = 46			ANOVA
	M	SD	95 % CI	*M*	SD	95 % CI	*M*	SD	95 % CI	F (df,n), p-value
SHS hepatitis vaccine clinic	.59	1.18	.47 to .71	.68	1.20	.33 to 1.03	.52	1.19	.17 to .87	F (2,454) = .22, p = .806
Vaccine available at SHS	.52	1.10	.40 to .63	.49	1.08	.17 to .81	.59	.96	.30 to .87	F (2,453) = .11, p = .896
Vaccine available on campus	-.02	1.16	-.14 to .10	.19	1.24	-.17 to .56	.17	1.08	-.15 to .50	F (2,451) = 1.10, p = .334
Vaccine at discounted price	.86	1.16	.74 to .98	.77	1.34	.37 to 1.16	.67	1.23	.31 to 1.04	F (2,452) = .61, p = .545
Vaccine paid by insurance	.98	1.15	.86 to 1.10	1.09	1.18	.74 to 1.43	.72	1.26	.34 to 1.09	F (2,452) = 1.33, p = .266
Educational handout	.15	1.14	.03 to .27	.19	1.24	-.17 to .56	.33	1.25	-.04 to .70	F (2,452) = .50, p = .610
Finding time for vaccine	.07	1.24	-.06 to .20	-.23	1.29	-.61 to .14	.00	1.21	-.36 to .36	F (2,452) = 1.28, p = .280
Parent's reminder	.19	1.23	.06 to .32	.53	1.23	.17 to .89	.39	1.31	.00 to .78	F (2,452) = 1.96, p = .141
SHS staff reminder	.33	1.22	.21 to .46	.57	1.21	.22 to .93	.33	1.21	-.03 to .69	F (2,452) = .829, p = .437
Reminder call/card/email	.22	1.24	.09 to .35	.64	1.24	.27 to 1.00	.13	1.22	-.23 to .50	F (2,451) = 2.63, p = .073
School newspaper ad	-.32	1.10	-.44 to -.21	-.13	1.36	-.53 to .27	-.42	1.08	-.75 to -.10	F (2,450) = .86, p = .424

*ANOVA test showed a significant difference in the means of these two groups at p value < .05.

The control belief construct mean scores for each of the three groups of hepatitis B immunization status ('no', 'partial', and 'complete') are reported in Table 27. There were no statistically significant differences in control beliefs based on hepatitis B immunization status.

To summarize, we found no significant differences in control beliefs regardless of the students' hepatitis B immunization status. However, as an overall group college students believed there was a low likelihood that having the vaccine available at other campus sites (*M* range -.15 to 0.0), finding time in a busy schedule (*M* -.17 to -.07), and seeing an ad in the school newspaper about the vaccine (*M* -.20 to -.25) would occur. The students believed that three facilitating conditions were most likely to occur: 1) having the vaccine available at a Student Health Services hepatitis vaccine clinic (*M* range .49 to .59), 2) having the vaccine available at a discounted price (*M* range .32 to .54), and 3) having the vaccine paid by insurance (*M* range .31 to. 51).

See Table 27 on next page.

Table 27. Control beliefs based on hepatitis B immunization status.

Control Beliefs Constructs	Hepatitis B Immunization Status: No N = 129			Partial N = 61			Complete N = 271			ANOVA
	M	SD	95 % CI	*M*	SD	95 % CI	*M*	SD	95 % CI	F (df,n), p-value
SHS hepatitis vaccine clinic	.54	1.11	.35 to .74	.59	1.12	.30 to .88	.49	1.14	.35 to .62	F (2,454) = 0.26, p = .772
Vaccine available at SHS	.19	1.07	.00 to .38	.30	.99	.04 to .55	.36	1.05	.23 to .49	F (2,454) = 1.14, p = .321
Vaccine available on campus	.00	1.13	-.20 to .20	-.15	1.09	-.43 to .13	-.08	1.03	-.20 to .05	F (2,451) =0.43, p = .650
Vaccine at discounted price	.32	1.21	.11 to .54	.39	1.16	.10 to .69	.54	1.17	.40 to .68	F (2,452) = 1.55, p = .212
Vaccine paid by insurance	.31	1.24	.09 to .53	.51	1.03	.25 to .77	.51	1.18	.37 to .65	F (2,453) = 1.37, p = .257
Educational handout	.27	1.00	.09 to .44	.15	1.08	-.13 to.42	.26	1.10	.13 to .39	F (2,453) = 0.30, p = .738
Finding time for vaccine	-.17	1.16	-.37 to .04	-.08	1.17	-.38 to .22	-.07	1.16	-.21 to.07	F (2,453) = 0.31, p = .734
Parent's reminder	.02	1.19	-.19 to .23	-.02	1.27	-.34 to .31	.05	1.21	-.09 to .20	F (2,453) =0.09, p = .915
SHS staff reminder	.08	1.14	-.12 to .28	.21	1.13	-.08 to .50	.27	1.10	.14 to .40	F (2,453) = 1.28, p = .280
Reminder call/card/email	-.07	1.14	-.27 to .13	.10	1.08	-.18 to .37	.09	1.10	-.04 to .23	F (2,452) = 1.02, p = .361
School newspaper ad	-.25	1.15	-.45 to -.05	-.27	.92	-.50 to -.03	-.20	1.10	-.33 to -.06	F (2,451) = 0.17, p = .842

*ANOVA test showed a significant difference in the means of these two groups at a p value < .05.

The perceived power constructs mean scores for each of the three groups of hepatitis B immunization status ('no', 'partial', and 'complete') are reported in Table 28. There were no statistically significant differences in the perceived power variables based on hepatitis B immunization status.

Based on hepatitis B immunization status we found no statistically significant differences in the likelihood that the facilitating conditions would influence college students' decision to be vaccinated for hepatitis B. However, as a group all subjects believed that having the vaccine available at a discounted price (*M* range .78 to .87) or reimbursed by insurance (*M* range.93 to 1.10) would most likely influence their decision to be vaccinated. These students also believed that seeing an ad in the school newspaper about the vaccine (*M* range -.25 to -.43) would least likely influence their decision to be vaccinated.

See Table 28 on next page.

Table 28. Perceived power based on hepatitis B immunization status.

Perceived Power Constructs	Hepatitis B Immunization Status: No N = 129			Partial N = 61			Complete N = 271			ANOVA
	M	SD	95 % CI	*M*	SD	95 % CI	*M*	SD	95 % CI	F (df,n), p-value
SHS hepatitis vaccine clinic	.53	1.19	.32 to .74	.69	1.13	.40 to .98	.60	1.19	.46 to .74	F (2,454) = 0.40, p = .672
Vaccine available at SHS	.38	1.12	.18 to .57	.64	1.00	.38 to .90	.56	1.08	.43 to .69	F (2,453) = 1.65, p = .193
Vaccine available on campus	-.04	1.16	-.24 to .16	.15	1.17	-.15 to .45	.03	1.16	-.11 to .17	F (2,451) = 0.54, p = .585
Vaccine at discounted price	.78	1.27	.56 to 1.00	.80	1.22	.49 to 1.11	.87	1.14	.73 to 1.01	F (2,452) = 0.26, p = .771
Vaccine paid by insurance	.97	1.15	.77 to 1.17	1.10	1.15	.80 to 1.39	.93	1.17	.79 to 1.07	F (2,452) = 0.51, p = .603
Educational handout	.10	1.13	-.10 to .30	.05	1.18	-.25 to .35	.23	1.17	.09 to .37	F (2,452) = 0.91, p = .405
Finding time for vaccine	-.05	1.20	-.26 to .16	.13	1.27	-.19 to .46	.05	1.26	-.10 to .20	F (2,452) = 0.47, p = .623
Parent's reminder	.20	1.22	-.02 to .41	.18	1.27	-.15 to .51	.28	1.24	.13 to .43	F (2,452) = 0.30, p = .738
SHS staff reminder	.20	1.28	-.02 to .43	.31	1.19	.01 to .62	.44	1.19	.30 to .59	F (2,452) = 1.67, p = .189
Reminder call/card/email	.04	1.25	-.18 to .26	.30	1.22	-.02 to .61	.35	1.23	.20 to .50	F (2,451) = 2.72, p = .067
School newspaper ad	-.43	1.10	-.62 to -.23	-.35	1.12	-.64 to -.06	-.25	1.14	-.39 to -.11	F (2,450) = 1.07, p = .343

*ANOVA test showed a significant difference in the means of these two groups at a p value < .05.

Summary of Attitude, Subjective Norm, and Perceived Behavioral Control

There were significant differences in attitude constructs based on the immunization status for both hepatitis A and B vaccines. For hepatitis A we found significant differences in several behavioral beliefs based on immunization status. We found that partially immunized students were more likely to believe that the hepatitis A vaccine would be effective and less likely to cause adverse side effects or anticipation anxiety than their unimmunized counterparts. These behavioral beliefs were further reinforced by the fact that the partially immunized students compared to unimmunized students felt they were more likely to be influenced by believing the vaccine is effective and that it was unlikely they would experience anxiety anticipating the immunization.

Based on hepatitis B immunization status, there were significant differences in selected behavioral beliefs. Similar to hepatitis A, completely vaccinated students were more likely to believe that the vaccine is effective than their unimmunized counterparts. These students were also less likely to believe that being vaccinated is inconvenient. The partially immunized group believed they were less likely to have adverse effects or anticipation anxiety from being vaccinated than the unimmunized students. The students who have completed the hepatitis B vaccination were less likely to be influenced by anticipation anxiety, inconvenience, or vaccine expense.

We found significant differences in subjective norm constructs based on hepatitis A and B immunization status. For hepatitis A immunization, we found no differences for any of the normative beliefs based on the three immunization groups. For the motivation to comply constructs, the completely immunized students were more likely to be influenced by the Student Health Services staff than the unimmunized students. For hepatitis B, completely immunized students compared to unimmunized students were more likely to believe that their parents would support their decision, and they were more likely to be influenced by their parent's opinion. The completely immunized students were also more likely to be influenced by their family doctor and the Student Health Services staff.

Based on hepatitis A and B immunization status, there were significant differences in several of the perceived behavior control constructs. We found significant differences for only a two of the control beliefs. For hepatitis A, the partially immunized students more likely believed that they would receive a reminder about the vaccination from their parents or the Student Health Services staff than their unimmunized counterparts. There were no significant differences in the perceived power variables based on hepatitis A immunization status. In addition, we found no significant differences in control beliefs and perceived power variables based on hepatitis B immunization status. Although significant differences were not found for most of the control belief and perceived behavioral control variables, there are some important observations. As an overall group, college students would be more likely to believe and be influenced by having the vaccine paid by insurance and available at a discounted price or at Student Health Services hepatitis vaccine clinic. They believed that an ad in the school newspaper about the vaccinations would least likely influence their decision to be vaccinated for hepatitis A or B.

DISCUSSION

Knowledge, Perceived Risks, Health Risk Behaviors, & Immunization Status

In the United States great achievements have been made in immunizing infants, children, and adolescents for hepatitis B. From 1993 to 2000 the national hepatitis B immunization rate among children ages 19-35 months increased from 16 % to 90 % and the coverage rate for U.S. adolescents ages 13-15 years increased from near zero to 67 % [CDC, 2002 June 28]. The 2002 National College Health Assessment showed that 65 % of undergraduate and graduate college students have been immunized for hepatitis B (ACHA, 2002). Among our sample of matriculating students, 58.8 % have completed the hepatitis B immunization series and an additional 13.2 % have partially completed the series. In the Fall of 2001, a census survey of hepatitis A immunization rates in a large state university in the Pacific Northwest showed that 12 % of matriculating college students had completed the hepatitis A immunization series [Koski, 2001]. In this study of matriculating students, we found that 10 % had completed the hepatitis A immunization series. An additional 10.2 % of students have a partially completed hepatitis A vaccination series.

The higher immunization rate for hepatitis B is a reflection that this vaccine has been available since the early 1980's compared to the release of the hepatitis A vaccine in 1996. In addition, a series of CDC and ACIP recommendations for hepatitis B immunization have succeeded in reaching a significant portion of the infant, children, and adolescent populations. In our study, student's ages 18-19 years were significantly more likely to be immunized for hepatitis B than students 20 years and older. Over thirty states now currently have state laws requiring adolescent immunization for entry into middle school, so within the next three years greater than 90 % of matriculating college students in these states will probably be immunized for hepatitis B. In 1997, the CDC recommended routine hepatitis A vaccination for children in 17 states due to having a hepatitis A incidence twice the national average.

This recommendation along with the availability of the combined hepatitis A/B vaccine should lead to a gradual increase in the rates of hepatitis A immunization among matriculating college students.

Since only about 10 % and 65 % of college students are currently immunized for hepatitis A and B, college health services should encourage students to be vaccinated. However, to effectively promote hepatitis immunizations in this population having accurate information about college students' immunization status is important. Therefore, we investigated whether college students can reliably recall their hepatitis A and B immunization status. We found that about one-third to one-fourth of students could not recall their immunization status to hepatitis A and B respectively. We found that the immunization record that students submitted to the Student Health Services upon matriculation was the most reliable source for immunization status. For example, 66 % of students who thought they had completed the hepatitis A immunization series had no evidence of this vaccination on their immunization record. Furthermore 37 % of student who couldn't recall their hepatitis B immunization status had actually completed the series.

The inability to recall immunization status can have important implications. If students are unable to remember if they received a vaccine they are less likely to respond to newsletter or advertisement prompting them to be vaccinated. The college student's inability to accurately recall their immunization status also reinforces the importance of college health care providers to obtain immunization records for hepatitis A and B. Fortunately, matriculating students at most universities submit a copy of their childhood immunization record to provide required documentation of their measles immunizations. These records typically contain quite accurate information about their hepatitis A and B vaccinations as well. Colleges and universities should strongly encourage matriculating students to submit copies of all immunization records so that college health providers can effectively prompt unvaccinated students to be immunized for hepatitis A and B.

Unvaccinated students are particularly at risk for contracting an infection if they possess health risk behaviors for hepatitis A and B. Among our sample of matriculating students, health risk behaviors for hepatitis A and B were very common. As a group more than half of these students had been sexually active in the past 12 months. More than 20 % of the currently sexually active students have had two or more partners. This is consistent with the 2002 American College Health Association (ACHA) survey showing that 25 % of sexually active students had two or more partners [ACHA, 2002]. We found in our study that 92 % and 34 % of students with multiple sexual partners had either no immunization or a partial immunization series for hepatitis A and B respectively.

Having multiple sexual partners has long been considered a risk factor for sexually transmitted diseases including hepatitis A and B. Our data supports the notion that persons with multiple sexual partners are indeed at higher risk of these diseases. We found that the likelihood of higher risk sexual health behaviors such as unprotected vaginal (61 %), oral-genital (81 %), or anal sex (13 %) significantly increases if a student has had multiple sexual partners. In addition, these higher-risk students did not perceive they are at risk for hepatitis A and B. In those students who participated in high risk-sexual behaviors or had multiple sexual partners, we found that more than 50 % perceived they were at no or low risk for hepatitis A and B. This relatively high frequency of multiple sexual partners and unprotected sexual health risk behaviors in concert with low perceived risk helps to explain why hepatitis A and B infections are most common in the age group of 15-39 years.

In addition to sexual health risk behaviors, non-sexual risk factors for hepatitis A and B are commonly found in the college population. More than one-quarter of matriculating students have already traveled to countries that have endemic rates of hepatitis A. Among these travelers to regions of hepatitis A risk, 57 % perceived themselves to be at no or low risk for hepatitis A. We found that these international travelers are more likely to be immunized for hepatitis A than those students who have not traveled. However, only 30 % of these travelers have completed or partially

completed the hepatitis A immunization series. Many students will travel or study abroad during their college experience. More organized efforts with campus study abroad coordinators or student groups planning travel to regions of hepatitis A risk could facilitate a higher immunization rate among this group of susceptible students.

Students who get body piercing/tattoos are also potentially susceptible to contracting the hepatitis B virus. About 53 % of our matriculating students reported they already had a body piercing or tattoo. Many additional new college students will get a body piercing and/or tattoo as they experience a newly found freedom from their parental guidance. Fortunately, in our study we found that students with a body piercing and/or tattoo were more likely to be immunized for hepatitis B than students without these forms of body art. We also found that 84 % of students were aware that the hepatitis B virus could be transmitted in the process of getting a body piercing and/or tattoo. Despite this knowledge, about 70 % of the unvaccinated students who have received a body piercing or tattoo perceived they were at no/low risk for hepatitis B.

Overall, the matriculating students knowledge about hepatitis A and B was very good. In fact, more than two-thirds of the respondents answered hepatitis A and B knowledge questions with 75 % accuracy. This finding is not really surprising given that the study sample represents an educated segment of the general population. Having knowledge about hepatitis A and B however does not translate into being more likely to be immunized for hepatitis A and B. In this study, there were no significant differences in the hepatitis A and B immunization rates based on their knowledge about these diseases. Thus, having good knowledge about hepatitis A and B does not necessarily reduce the likelihood that students will engage in high-risk sexual behaviors. Although further education of students about hepatitis A and B maybe helpful, many other theoretical factors such as attitudes, perceptions, norms, barriers, or facilitating conditions may also play a role in a decision to be vaccinated.

For example, perceived risk of negative outcome is often an important factor in motivating personal risk reduction for selected problems. In our study, around 70 %

of matriculating college students perceived they were at no/low risk for hepatitis A and B and only five percent of students described themselves as high-risk for these forms of hepatitis. Students were asked to compare their concerns about the impact of acquiring five viral sexually transmitted infections. Students were much less concerned about the impact of acquiring a hepatitis A or B infection compared to a human immunodeficiency virus (HIV) infection. Only 2.5 % of students were concerned about the negative outcome of a hepatitis A or B infection compared to greater than 80 % of students who were concerned about HIV/AIDS infection. This is not surprising given that human immunodeficiency virus/acquired immunodeficiency disease syndrome (HIV/AIDS), genital herpes (HSV), and genital warts (HPV) have received a lot more attention in the media.

In contrast, the recognition of hepatitis A as a sexually transmitted infection is overlooked and underestimated. Public awareness campaigns and direct educational efforts are often provided at a much lower rate than for HIV and other STIs. Consequently, the likelihood of students actively protecting themselves from hepatitis A may not be as great. About half of the students in our study who have participated in unprotected anal or oral-genital sex failed to recognize that the primary mode of transmission for hepatitis A is fecal-oral. The 2002 MMWR Sexually Transmitted Diseases Treatment Guidelines states that household or sexual contact with a person with hepatitis A is the most frequently reported known source of infection (12-26 %). In addition, the source of infection cannot be identified in 50 % cases of hepatitis A. The fecal-oral transmission of the hepatitis A virus (HAV) can be facilitated by many sexual practices (anal, oral-anal, oral-genital). Unapparent fecal contamination can also commonly occur during vaginal sexual intercourse. "Unlike other STDs, use of condoms and good personal hygiene do not prevent HAV, so vaccination is the most effective means of prevention of hepatitis A" (CDC, 2002 May 10).

The best method for preventing hepatitis A and B infections is to complete the hepatitis A and B immunization series. Fortunately, our study indicates that some higher risk students for hepatitis A and B are being immunized. For instance, students

that traveled to regions of hepatitis A risk were more likely to be immunized for hepatitis A. Students with body piercing and tattoos more likely received the hepatitis B vaccination. Furthermore, we also found that students with multiple sexual partners were more likely to be vaccinated for hepatitis B. Despite these small successes in immunizing higher-risk students, there are still substantial numbers of higher-risk students who have not completed the hepatitis A and B immunization series. For example, about 34 % of students with multiple sexual partners or body piercing/tattoos have not completed the hepatitis B immunization series. Of those students who have traveled to regions of hepatitis A risk, 70 % have not received any hepatitis A vaccinations.

In April 2002 the Advisory Committee on Immunization Practices (ACIP) and the Centers for Disease Control and Prevention (CDC) posted a bulletin encouraging that all high-risk adults older than 19 years be vaccinated for hepatitis A and B. They strongly recommended integrating these immunizations when high-risk individuals encounter public facilities such as STD clinics, HIV testing locations, family planning clinics, drug treatment programs, and correctional facilities. College health services routinely provide some of these services such as family planning and STD/HIV screening and treatment. About 20-25 % of the college student population has multiple sexual partners that frequently engage in high-risk sexual behaviors. In addition college students are at risk for hepatitis A and B due to international travel and body piercing/tattoo health risk behaviors. Therefore, college health services should look for ways to more effectively integrate hepatitis A and B immunization in the college student population.

Several university college health services have promoted the hepatitis B vaccination by organizing a campus educational campaign and hepatitis vaccine clinic. Perhaps collective cooperation between health promotion and clinical staff at college health services can design and implement new methods to education and promote the hepatitis A and B vaccinations to the college student population. These efforts can be supplemented by increasing the emphasis of assessing the need for hepatitis A and B

vaccination at all sexual health related visits. Family planning, HIV testing, STI screening, gynecology, and men's health visits could each provide opportunities for review of the need for hepatitis A and B vaccinations.

Acquiring complete immunization records, including hepatitis A and B, from all matriculating students will assist college health services in identifying those who are still susceptible to these diseases. Implementing a computerized immunization database or a computerized medical record could facilitate the health care providers in identifying, tracking, and reminding students in need of the hepatitis vaccinations. The most effective method to achieve maximum immunization rates is to mandate a vaccination by state law. Perhaps in another five years colleges could implement a pre-matriculation requirement to immunize those students who missed the middle school hepatitis B requirement currently present in over 30 states.

This study has provided us with a greater understanding of the hepatitis A and B knowledge, perceived risk, and health risk behaviors in matriculating college students. However, we felt it was important to also learn more about the attitudes, subjective norms, and perceived behavioral controls that might influence a college students' likelihood of being vaccinated for hepatitis A and B.

Attitudes About Hepatitis A and B Vaccination

According to the theory of planned behavior, attitudes about hepatitis A and B would be based on behavioral beliefs and evaluation of how much those beliefs might influence their decision to be vaccinated. The belief that the hepatitis A and B vaccines are effective appeared to contribute the most to supporting a positive attitude about the vaccine. The partially or completely vaccinated students were significantly more likely to believe that vaccine is effective compared to the unvaccinated students. In general, all students regardless of immunization status believed hepatitis vaccines were effective and would influence their decision to be vaccinated. Promoting the effectiveness of these vaccines might encourage more students to be immunized.

One attitude that discourages students from being vaccinated is their fear of needles and the anxiety associated with thinking about getting a shot. Anticipation anxiety particularly refers the "needle phobia" or the fear that stems from thinking about getting a vaccine injection. For many people anxiety associated with getting a shot produces "flight or fight" reaction with sweaty palms, racing heart, hyperventilation, and even fainting. In our study we found that there were significant differences in anticipation anxiety based on the immunization status for hepatitis A and B. The unvaccinated students were more likely to believe this form of anxiety would occur and influence their decision to be vaccinated. For hepatitis A, the partially vaccinated students were much less likely to feel or be influenced by anticipation anxiety. Recently vaccinated students may have a transient reduction in their anxiety as the result of having recent success in receiving an injection. Dealing with this anxiety or needle phobia can be challenging, however, health care providers can provide reassurance to students.

Another attitude that might potentially impact immunization among college students is the lack or priority or time to get a vaccination. In general, college students in our study believed getting a hepatitis vaccination would not inconvenience them. However, for the hepatitis B vaccination, the unimmunized students were more likely to feel and be influenced by the prospect of being inconvenienced. Getting a vaccination is generally a low priority for college students compared to their academic and social pursuits. The hepatitis B series is given as a three dose series over a minimum of six months. The process of starting and completing the series requires some commitment and organizational planning on the part of the student. Informational letters to college students and their parents had a small yet influential impact in receiving a hepatitis B vaccination (Marron, et. al., 1998).

Besides time, attitudes about costs of the hepatitis vaccinations could influence a person's decision to be immunized. The full adult hepatitis A immunization series typically costs $50-75 and the adult hepatitis B series costs $120-150. We found that the unvaccinated students for hepatitis B were more likely to be influenced by the

expense of the vaccine. This corroborates numerous other studies that have identified that cost as a barrier to being vaccination (Ganguly, Marty, Herold, and Anderson, 1998; Marron et al., 1998; Pennie, O Connor, and Garvock, 1991).

If college health services aggressively promote the hepatitis B immunization to matriculating students there could be significant cost savings. Most first year students are eligible for the adolescent dose of hepatitis A and B vaccines since they usually only 18-19 years old. The adolescent dose can confer significant cost savings as it costs about 40-50 % less than the adult dose. Several universities have successfully recruited hundreds of students to participate in organized special hepatitis vaccine clinics (Hanson, 1998; Hurley, Turner, and Butler, 2001). At our school we promote the hepatitis vaccines especially to the matriculating students and offered discounted hepatitis vaccines by waiving the administration fee typically associated with an injection.

Vaccines can potentially cause adverse reactions, although the hepatitis A and B have an excellent safety record (CDC, 2001 September 21). In general, all students believed the hepatitis vaccines would have a low likelihood of causing adverse effects. The partially vaccinated student were less likely to believe that hepatitis A and B vaccines would cause adverse effects then their unvaccinated counterparts. Perhaps once a person has had a least one successful vaccination they are less likely to be concerned about side effects. The process of starting a vaccination series requires some inertia to overcome a set of negative beliefs or attitudes about being vaccinated. Providers can reassure patient that the hepatitis A and B vaccines are safe.

Adopting a preventive behavior such as receiving a vaccination might reduce the fear of contracting the disease the vaccine is intended to prevent. We asked student whether they believed getting the hepatitis vaccines would reduce their fear of contracting these infections. In general, all students believed that getting the hepatitis A and B vaccines would reduce their fear of contracting these viruses. The students partially vaccinated for hepatitis A were more likely to get the hepatitis A immunization knowing that it would decrease their fear of getting hepatitis A. This

could be explained by the fact that the hepatitis A vaccine is most frequently given to protect against hepatitis A prior to international travel to regions with a high incidence of hepatitis A. In these situations, the vaccine was intentionally obtained for protection for a specific event, thus reducing their fear of contracting the hepatitis A virus during travel. Given that many college students travel internationally for pleasure or for study abroad programs, college health services need to get the message out about the importance of getting the hepatitis B vaccination prior to travel. In addition, the hepatitis B vaccine should be recommended for students who work or study abroad for greater than six months.

Subjective Norm for Hepatitis A and B Vaccination

As with many decisions, people are influenced by the opinions of a variety of important persons in their life. In the theory of planned behavior, the subjective norm for hepatitis A and B vaccination is based on the normative beliefs and the motivation to comply with the referents opinion. In our study, the matriculating students reported there was a high likelihood that the opinion of parents and the family doctor would influence their decision to be vaccinated for hepatitis B.

Prior to enrolling in college, students' parents and family doctors were probably the most influential persons in their lives when it came to medical care decisions. We found for hepatitis B vaccination, the completely vaccinated students were more likely to be influenced by the belief that their parents and family doctor would support their decision to be vaccinated for hepatitis B. This is a reflection of the fact that most of these matriculating students had completed the hepatitis B series prior to entering college while they were still under the care of their parents and family doctor. Even though most first year college students are living away from their parents, they still rely on their parent's opinion for important decisions. When students are asked if they wish to be vaccinated, they frequently respond by saying " I need to

check with my parents" to confirm their immunization status, get permission to spend money, or simply get their approval.

Once students enter college, they begin to rely more on the Student Health Services staff for advice regarding their healthcare decisions. For both hepatitis A and B vaccinations, our study showed that the completely vaccinated students were more likely to be influenced by the opinion of the Student Health Services staff than their unvaccinated counterparts. This effect may have resulted from the pre-matriculation letter we sent out to prospective students about our recommendation to get the hepatitis A and B vaccinations at the Student Health Services. Even though parents and family doctor provide a great source of influence, college health services have the potential impact on a student's decision to be vaccinated for hepatitis A and B during their years in college.

Facilitating Conditions for Hepatitis A and B Vaccination

The perceived behavioral control in the theory of planned behavior involves the barriers and facilitating conditions that might impact the decision to be vaccinated for hepatitis A and B. The control beliefs and the perceived power constructs both contribute to the perceived behavioral control. The control belief refers to the belief that a barrier or facilitating condition will occur. The perceived power refers to the influence these barriers or conditions will influence their intention to perform a behavior.

For many people, just remembering that you need a vaccine or that a vaccine dose is due can be a challenge. We were interested in determining if reminder might facilitate a college student in their likelihood of being vaccinated for hepatitis A and B. For hepatitis A vaccination, we found that the partially vaccinated students were more likely to believe that they would receive a reminder from their parents and the Student Health Services staff. Each year the Student Health Services sends an

informational letter to prospective students and their parents about the hepatitis vaccine clinic offered by the Student Health Services (SHS) during Fall term.

Several universities have organized hepatitis vaccination clinics or programs to encourage more students to be immunized (Hanson, 1998; Hurley et al., 2001; Marron et al., 1998). We investigated whether students felt that a Student Health Services hepatitis vaccine clinic was possible or would influence their decision to be vaccinated. We found that for hepatitis A vaccination, the partially vaccinated students were significantly more likely to believe they could receive a vaccination at a Student Health Services vaccine clinic. In general, we found that all students believed both the hepatitis A and B vaccines would be available at Student Health Services and that this would likely influence their decision to be vaccinated.

Marketing the availability of hepatitis vaccines on college campuses can occur in a variety of ways. One common method to communicate with students is by placing advertisements in the school newspaper. An interesting finding in our study was that students reported they were unlikely believe that such an ad would occur or would influence their decision to be vaccinated for hepatitis A or B. This observation has important implications when college health services create marketing strategies for immunizations. Perhaps first year students do not read the school newspaper or do not consider it as a reliable source of information. Maybe student were more likely to be influence by people's opinions, such as parents or health care providers, than by an advertisement. This suggests that further investigation is needed to identify the most effective ways to communicate health issues to college students.

Beside awareness of the vaccine, the expense of the immunization series can be a barrier for many students. Although we found no significant differences student beliefs about vaccine expense based on their immunization status, the student reported that having the vaccine paid for by their insurance or available at a discounted price would likely influence their decision to get a vaccination. As mentioned earlier the adolescent doses ($25/dose) of hepatitis A and B vaccines cost 40-50 % less than the adult dose ($40/dose). Thus, college health services should consider promoting the

vaccinations to freshman students who are predominately 18-19 years old. Despite interventions such as this, vaccine cost will probably be a barrier for students with low financial resources.

Finally, the lack of time has been previously cited as a barrier for hepatitis B vaccination. In our study, we asked students how likely would find time in their busy schedule to get a hepatitis vaccine. Although we found no significant differences in this control belief based on immunization status, students in general felt it was unlikely they would find time in their schedule for a hepatitis vaccination. Getting a hepatitis vaccine is generally a low priority for college students. They are less likely to make a special visit just for a hepatitis vaccine especially if they do not believe they are susceptible to hepatitis. It would be crucial to promote the vaccine when student make visits to the health care provider for other reasons. The persons who are at greatest risk for hepatitis are those with two or more sexual partners and participate in high-risk sexual behaviors. Vaccinating students when they make visits for family planning, gynecology visits, HIV testing, STD testing, or men's health visits could be an effective method to target higher risk students.

CONCLUSION

College students are fairly knowledgeable about hepatitis A and B but this knowledge fails to increase the likelihood that they will reduce their risk behaviors or be immunized for hepatitis A and B. We found that college student generally have very good knowledge about some basic facts about hepatitis A and B. However, we found no differences in their immunization status based their hepatitis A and B knowledge. In addition, there were no differences in their health risk behaviors based on their knowledge. Thus, there appears to be a disconnection between knowledge and prevention behaviors such as being immunized or reducing health risk behaviors for hepatitis A and B

The lack of self-perceived risk for hepatitis A and B might help explain this disconnection between knowledge and adopting immunizations or low risk health behaviors. We found that about 66 % of college students perceived themselves to be at no risk or low risk for hepatitis A and B, and only 5 % felt they were high risk. The concern about the impact of hepatitis A and B infection was remotely in their mind compared to HIV. In this study, there were no differences in the college students' immunization status based on their self-perceived risk. Thus, students who perceived themselves to be high-risk were no more likely to be immunized than those who perceived themselves to be at no or low risk. We also found that a large percentage of unvaccinated students who possess specific health risk behaviors perceived they were at no or low risk for hepatitis A or B.

Despite the college students' perception that they are not susceptible to hepatitis A and B, we found they really do have a variety of health risk behaviors for hepatitis A or B. These risk behaviors include unprotected sex (vaginal, oral-genital, anal), body piercing/tattoo, multiple sex partners, prior diagnosis of a sexually transmitted infection, and international travel to regions of hepatitis A risk. About 20 % of students who have been sexually active in the past twelve months have had two

or more sexual partners. We also found that persons with multiple sexual partners were more likely to engage in high-risk sexual behaviors such as unprotected vaginal, oral-genital, or anal sex. Non-sexual health risk behaviors were also common. In particular, 27 % of these matriculating students have traveled internationally to regions of hepatitis A risk, and 53 % already had a body piercing or tattoo.

Fortunately, students with several of these health risk behaviors for hepatitis A and B are being immunized. For example, we found that persons with a history of international travel were more likely to be immunized for hepatitis A. Students with two or more sexual partners, and a body piercing/tattoo were also more likely to be immunized for hepatitis B. However, there are still sizable portions of students who have these and other health risk behaviors and yet are not completely vaccinated for hepatitis A and B. Our results showed that 70 % of student who traveled to region with hepatitis A risk have yet to receive any hepatitis A vaccination. About one-third of student with multiple sexual partners or body piercing/tattoos have not completed a hepatitis B immunization series.

College health providers need access to reliable information about college students' hepatitis A and B immunization status to effectively promote the vaccines to those who are yet to be completely immunized. We found that college students had difficulty recalling their immunization status. There were significant differences in recollection of their immunization status compared to the immunization records they submitted to the Student Health Services. Although these records are not perfect they provide the health care provider with a fairly reliable source for a student's hepatitis A and B immunization status.

Beside knowledge and perceived risk, we sought to learn if attitudes, subjective norms, and perceived behavioral control construct play a role in college students' decision to be vaccinated for hepatitis A and B. We sought to determine if there were significant differences in the theory of planned behavior constructs based on the students' immunization status. In addition, we found that specific constructs were important to college students in regards to their decision to be vaccinated.

We discovered significant differences in several attitude constructs based on the college students' immunization status. The behavioral belief that the hepatitis A and B vaccines are effective seemed to be the most important to all students. The students who have received hepatitis A and B vaccinations were more likely to believe the vaccine was effective than unvaccinated students. Anticipation anxiety and vaccine adverse effects were also important behavioral beliefs for college students. The unimmunized students were also more likely to experience and be influenced by anxiety from anticipating a shot. In addition, these students were more likely to believe that adverse effects from the hepatitis A and B vaccine could occur. For the hepatitis B vaccination, unimmunized students were more likely to believe that getting hepatitis vaccines would inconvenience them by taking time from other commitments and that the vaccines were expensive. For students who were vaccinated for hepatitis A before their international travel about were more likely to experience a reduction in their fear of contracting the virus.

A person's decision to adopt a health behavior is often shaped by the opinions of important people in his or her life. By evaluating the subjective norms we asked students which people would most likely support and influence their decision to receive the hepatitis A and B vaccinations. For the hepatitis B vaccination, we found that the completely vaccinated students were more likely to be influenced by the opinions of their parents and family doctor. Parents and the family doctor play a critical role is a student's health care decision prior to entering college. However, once a student enrolls in college they begin to rely more on the advice of the health care providers at the Student Health Services. We found that for both hepatitis A and B vaccinations, the completely immunized students were more likely to be influence by the Student Health Services than their unimmunized counterparts.

Barriers and facilitating conditions may influence a person's decision to be vaccinated. We evaluated constructs of perceived behavioral control to determine if important factors encourage students to be vaccinated for hepatitis A and B. We found that for hepatitis A vaccinations, the partially vaccinated students were more

likely to believe they would receive reminders from their parents and the Student Health Services staff to get their immunization. For both the hepatitis A and B vaccinations, the partially vaccinated students believed that the vaccines would be available at the Student Health Services (SHS) hepatitis vaccine clinic. Other perceived behavioral control constructs that seemed to have an impact for college students were: 1) vaccine paid for by insurance, 2) vaccine available at a discounted price, and 3) lack of time for vaccine.

Based on our observations in this sample of matriculating college students we suggest that college health services consider the following recommendations pertaining to hepatitis A and B vaccination:

- Request that matriculating students should submit copies of all immunization records to their Student Health Services, so that health care providers can identify those students in need of hepatitis A and B vaccinations.

- Implementing immunization databases or electronic medical records to help facilitate health care providers in identifying, tracking, and reminding students in need of the hepatitis vaccinations.

- Collaborate with campus study abroad coordinators or student groups to facilitate immunization of students planning travel to regions of hepatitis A risk.

- Integrate hepatitis A and B immunizations within their routine family planning, HIV/STI screening and treatment, gynecology, and men's health clinic visits.

- Sponsoring hepatitis vaccine clinics to promote the less expensive adolescent hepatitis A and B immunization series for freshman less than 20 years of age.

- Mailing informational letters about hepatitis A and B risks and vaccinations to parents and prospective students to encourage greater immunization rates in matriculating students.

- Implementing a state mandated pre-matriculation requirement for hepatitis B in the year 2008 in those states that currently requiring middle school hepatitis B immunizations.

- Investigate which social marketing strategies are most effective to communicate hepatitis A and B risks to college students and the availability of safe and effective vaccines.

- Find funding for hepatitis A and B vaccinations in those students with no insurance or limited financial resources.

Future studies could evaluate in greater detail the factors that led three groups of students (students with multiple sex partners, or body piercing/tattoos, or travel to regions with hepatitis A risk) to be immunized at a higher frequency. Future research on hepatitis A and B vaccinations could focus on further refining the validity and reliability of the variables used in the attitude, subjective norm and perceived behavioral control scales. To better test the application of the theory of planned behavior, future studies could limit the study population to the unvaccinated and include assessment of person's intention to be vaccinated. Designing a study with random sampling of several different college populations could enhance the generalization of the results. In addition, researchers could describe and evaluate the effectiveness of various strategies used to immunize students for hepatitis A and B in the college health setting.

There are several significant limitations of this study. Since this was an observational study based on a convenience sample at one university, one needs to be careful generalizing these results to other populations. Given that this sample of matriculating students included predominately white (82 %) female students (65 %) of ages 18-19 years (91 %), the results will not necessarily be reflective of other populations at our university or other universities. The immunizations records at Student Health Services may not contain completely accurate hepatitis A and B immunization records for all subjects included the study. The inter-item reliability coefficients for the attitude, subjective norm, and perceived behavioral control scales were high. However, without the use of in depth elicitation interviews or focus groups appropriate salient beliefs may have been excluded or non-salient beliefs may have been included in the scales used in this study. Finally, the length of the survey and the large number variables used in the attitude and perceived behavioral control scales possibly caused a "boredom and fatigue" effect for some of the respondents.

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APPENDIX

October 1, 2002

Office of Budgets & Institutional Research
510 Kerr Administration Building
Corvallis, OR 97331-2125

RE: Dr. James Koski
Hepatitis A/B Survey

This letter is to confirm my support for the A/B Hepatitis Survey that Dr. Jim Koski wishes to administer in the ALS 111-OSU Odyssey and ALS 112-Footsteps courses. I have reviewed his survey and distribution plans. I can offer the needed support and instructor information for successful data collection. Each OSU Odyssey instructor will be allowed to make his or her own decision on whether or not to administer the survey during class time.

This valuable information may assist our new student in personal health matters.

If you have any questions, feel free to contact me at 737-2382.

Sincerely,

Jackie Balzer

Jackie Balzer
Co-Director, Student Orientation and Retention
Coordinator, First Year Experience (OSU Odyssey)

Dear Odyssey Instructor:

As a fellow Odyssey instructor, I would like to enlist your participation in a study that will provide students with a key opportunity to learn about their risks for a group of "often ignored" but potentially dangerous infectious diseases. As you may know, I am currently working on my Master's thesis in the Department of Public Health. As part of my thesis, I am interested in finding out essential information about OSU students' risks and awareness surrounding Hepatitis A and B. I am asking that you allow me to administer a brief survey in your Odyssey class sometime between September 30-November 22, 2002.

The purpose of this study it to learn about matriculating university student's knowledge, attitudes, perceived risk, and barriers to receiving hepatitis A and B vaccinations. I will be correlating their responses with their immunization status based on a review of their immunization record submitted to the Student Health Services. Although the survey will not be anonymous, strict confidentiality will be kept.

Although hepatitis A and B vaccination is not a pre-matriculation requirement at OSU, it is highly recommended. Our data shows that among the 2001 matriculating students only 6 % have completed the hepatitis A vaccine series and 42 % of have completed the hepatitis B vaccine series. Now, there is a single combined hepatitis A and B vaccine. The American College Health Association survey shows that only 30 % of college students regularly use condoms and that 75 % have had sexual intercourse. In addition, both hepatitis A and B can be transmitted by anal and oral-genital sexual practices, which are not that uncommon among the student population. College students are at risk of acquiring these viral hepatitis infections especially through their sexual contacts. Because most new cases of hepatitis B occur in the 19-39 age group and the most common method of transmission is via sexual intercourse, I think you can understand why we are so interested in making sure that our students understand this risk and take the necessary actions for prevention.

This six-page survey instrument contains 91 items and will take about 30 minutes of your class time. A staff member from Student Health Services will administer the survey. As an incentive to students, they will be given a coupon for a free slice of pizza at Woodstock's Pizza and an opportunity to win one of three $25 gift certificates in a drawing. As an incentive to instructors, Student Health Services can provide a staff member from the SHS clinical staff or health promotion staff to discuss college health issues or discuss services provided by Student Health Services. You might be interested in having an entire session devoted to this survey and followed up with an explanation of available services and questions from students about various health promotion activities on campus.

This research study has been approved by the IRB-Human Subject's Committee and is being supervised by my professor Rebecca J. Donatelle, PhD in the

Department of Public Health, and has been supported by Jackie Balzer, Director of the Odyssey programs.

Please let me know if you wish to have your class participate in the research survey on hepatitis A and B by emailing me at James.Koski@orst.edu or calling me at 737-7579.

Sincerely,

James R. Koski, MD

Staff Physician, Student Health Services

Informed Consent Document

A. Title of Research Project.

"Hepatitis A and B Vaccination: Knowledge, Attitudes, and Perceived Barriers in Matriculating University Students"

B. Investigators.

Rebecca J. Donatelle, PhD, Associate Professor, Dept. of Public Health
James R. Koski, MD, Staff Physician, Student Health Services

C. Purpose of the Research Project

Many unvaccinated students are susceptible to the health complications of a hepatitis A and B virus infection. The purpose of this survey is to learn more about first year OSU students in regards to their knowledge, attitudes, and perceived barriers to receiving the hepatitis A and B immunizations. The information will be useful to the Student Health Services in their efforts to provide the hepatitis A and B immunizations to future OSU students.

D. Procedures.

1. Pre-study Screening.

Your Odyssey class has been selected to participate in this study on hepatitis A and B immunizations. In order, for you to participate you must be enrolled in this section of Odyssey ALS 111 and ALS 112 you must be 18 years of age or older.

2. What participants will do during the study.

We are requesting you to complete six pages of survey questions that will take about 30 minutes of your class time. You are asked to answer question in the survey regardless of whether you have or have not previously received the hepatitis A and B immunizations. Most questions ask about your opinion on a variety of issues related to hepatitis A and immunizations. There are a couple of questions that inquire about your personal health risk behaviors (i.e. sexual activity). You may choose to decline to answer any questions for any reason.

For this study we need to verify your actual immunization status for hepatitis A and B by reviewing your immunization record that you sent to the OSU Student Health Services upon enrollment. Therefore, you will be asked to put your name and student identification number (social security number) on the answer sheet provided with the survey. By signing this consent form you give the study investigators permission to review your current immunization record. All your responses will be kept strictly confidential and your responses to this survey will not be added to your Student Health Services medical record.

In the next few years, there is a possibility we will want to perform a follow-up or longitudinal study of all subjects that have participated in this study, thus you maybe contacted again in the future.

E. Risk and Benefits.

3. Foreseeable risks or discomforts

One potential risk of participating in this study is emotional stress associated anxious thoughts that might arise as the result of answering questions about your personal health or if the confidentiality safeguards are breached. If you need to discuss emotional or medical issues related to this survey you can schedule an appointment with a professional at Student Health Services (SHS), 737-9355, or University Counseling and Psychological Services (UCPS), 737-2131

4. Benefits to be expected from the research.

By participating in this study, you will benefit from enhanced awareness of hepatitis A and B and their protective vaccines. The results gained from this study will improve the efforts of the Student Health Services to promote the benefits of hepatitis A and B immunizations to college students. The survey results will be posted on the Oregon State University Student Health Services at http://oregonstate.edu/dept/student_health/ in March 2003.

As a token of appreciation for your willingness to participate in this research study you will be given a coupon for a free slice of pizza from Woodstock's Pizza. In addition, your name will be entered into a drawing for a chance to win one of three prizes. There will be $25 gift certificates to Woodstock's Pizza, Hollywood Video Store, and the OSU Bookstore. The three winners of the drawing prizes will be notified by phone call, email, or letter by December 1, 2002.

F. Confidentiality.

Although this survey is not anonymous, the answers you provide are strictly confidential. Special precautions have been established to protect the confidentiality your responses. Your responses will not be added to your Student Health Services medical record. Once I verify your current hepatitis A and B immunization status from the immunization record, your completed answer sheet will be destroyed and your name and social security number will be eliminated from the data summaries. All your responses will be tallied for group statistical analysis and no individual data will be reported in any data summary or publications.

G. Voluntary Participation Statement

Your participation in this study is completely voluntary. You have the right to either refuse to participate or withdraw from the study at any time without penalty or loss of benefits to which you are otherwise entitled.

H. If You Have Questions

If you have any questions about the research study or specific procedures they should be directed to James R. Koski, MD, 201 Plageman Building, 737-7579 or Rebecca J. Donatelle, PhD, 318 Waldo Hall 737-3839. If you have questions about my rights as a research subject, you should contact the IRB coordinator, OSU Research Office, 737-3437.

My signature below indicates that I have read and that I understand the procedures described above and give my informed and voluntary consent to participate in this study. I understand that I will receive a signed copy of this consent form.

_____ _____

Signature of Subject Name of Subject

Date Signed _____

Study on Hepatitis A and B Immunizations in First-Year Undergraduate Students at Oregon State University, Fall 2002

Thank you for your willingness to participate in this written survey on the topic of hepatitis A and B immunizations. Your honest responses to all the questions and items are vital to our study results. Remember you may decline to provide an answer to any question for any reason. Please read each question carefully and if you have questions you may ask the survey administrator.

Before you begin the survey, completely **read the informed consent document and sign at the bottom of the reverse side of both copies provided**. You are to keep one of the signed copies and return the other with your survey booklet and answer sheet.

Before starting the survey **fill in your name, student identification number (social security number) and Odyssey section number on the bubble answer sheet** with the number 2 pencil provided in your survey packet. Your name and ID number are used to verify your current immunization status for hepatitis A and B by reviewing your immunization record submitted to the Student Health Services. Please be assured that all your responses will be kept confidential.

When answering the survey questions, **mark the response for each item on the corresponding number on the bubble answer sheet.** If you do not mark up the survey booklet, we will be able to reuse them for another survey administration.

After completing your survey responses, please remain seated until the survey administrator collects all surveys.

Finally, inside your survey packet you should find a coupon for a free slice of pizza compliments of Woodstock's Pizza. There is also an informational card about how to get a hepatitis A or B vaccine at the Student Health Services during the hepatitis vaccine clinic during the week of October 21st-25th, 2002 or with other visits to the Student Health Services.

Sincerely,

James R. Koski, MD
Study Investigator

For each of the following statements about hepatitis A and B, please state whether you think the following statements are True (A) or False (B).

	True	False
1) Hepatitis B is commonly transmitted by unprotected sexual intercourse.	(A)	(B)
2) Hepatitis A is not considered sexually transmitted infection preventable by vaccine...	(A)	(B)
3) Hepatitis B virus can remain infectious for at least thirty days on environmental surfaces at room temperature.	(A)	(B)
4) Hepatitis B can lead to a chronic liver infection, cirrhosis, and liver cancer.	(A)	(B)
5) Participating in unprotected anal sex is not a risk factor for acquiring hepatitis A .	(A)	(B)
6) Hepatitis A vaccine is highly recommended before travel to countries such as Eastern Europe, Africa, Central and S. America and SE Asia.	(A)	(B)
7) Hepatitis B can be transmitted in the process of getting a tattoo or body piercing. ...	(A)	(B)
8) The method of transmission for hepatitis A is described as *"fecal to oral."*	(A)	(B)

9) What is your current immunization status for **Hepatitis A** at the time of starting classes at Oregon State University?

(A) I can not recall whether I have received the hepatitis A vaccine series.
(B) I have not started the hepatitis A vaccine series.
(C) I have started but not completed the hepatitis A vaccine series (1 of 2 shots in series).
(D) I completed the hepatitis A vaccine series (2 of 2 shots in series).

10) What is your current immunization status for **Hepatitis B** at the time of starting classes at Oregon State University?

(A) I can not recall whether I have received the hepatitis B vaccine series.
(B) I have not started the hepatitis B vaccine series.
(C) I have started but not completed the hepatitis B vaccine series (1 or 2 shots of the 3 shot series).
(D) I have completed the hepatitis B vaccine series (3 of 3 shots in series).

11) Every Fall term the OSU Student Health Services (SHS) offers a hepatitis vaccine clinic for the hepatitis A and B immunizations. Were you aware of this prior to receiving this questionnaire?

(A) Yes
(B) No

12) If you haven't already completed the hepatitis A and B vaccine series, are you planning to get a hepatitis vaccine at the OSU Student Health Services? **(You may skip to question 13 if you have already completed both the hepatitis A and B vaccine series).**

(A) Yes
(B) No
(C) Uncertain

The following statements are possible outcomes of receiving the hepatitis A and B vaccines. There are <u>two responses</u> associated with each outcome statement.

With the <u>first response</u>, please rate how likely the outcome <u>will influence</u> your decision to get hepatitis A and B vaccines.

With the <u>second response</u>, please rate how likely you think that particular outcome <u>will occur</u> as the result of getting hepatitis A and B vaccines. Please rate each item with a level of likeliness.

<u>First Response</u> How likely do you think this outcome <u>will influence</u> your decision to get a vaccine?					**<u>Second Response</u> How likely do you think this outcome of receiving the hepatitis vaccine <u>will occur</u>?**				
<u>Level of Likeliness</u>					**<u>Level of Likeliness</u>**				
Very High (A)	**High (B)**	**Don't Know (C)**	**Low (D)**	**Very Low (E)**	**Very High (A)**	**High (B)**	**Don't Know (C)**	**Low (D)**	**Very Low (E)**

Receiving a hepatitis A and B vaccine **involves pain or physical discomfort or pain from the injection.**

13) (A) (B) (C) (D) (E) **14)** (A) (B) (C) (D) (E)

Receiving a hepatitis A and B vaccine **is effective in protecting me from hepatitis A and B infection.**

15) (A) (B) (C) (D) (E) **16)** (A) (B) (C) (D) (E)

Receiving a hepatitis A and B vaccine **may make me sick with possible adverse side effects.**

17) (A) (B) (C) (D) (E) **18)** (A) (B) (C) (D) (E)

Receiving a hepatitis A and B vaccine **creates anxiety from anticipating the shot.**

19) (A) (B) (C) (D) (E) **20)** (A) (B) (C) (D) (E)

Receiving a hepatitis A and B vaccine **is inconvenient as it takes time away from my other commitments.**

21) (A) (B) (C) (D) (E) **22)** (A) (B) (C) (D) (E)

Receiving a hepatitis A and B vaccine **is expensive.**

23) (A) (B) (C) (D) (E) **24)** (A) (B) (C) (D) (E)

Receiving a hepatitis A and B vaccine **decreases my fear of getting hepatitis A or B from my intimate relationships.**

25) (A) (B) (C) (D) (E) **26)** (A) (B) (C) (D) (E)

Receiving a hepatitis A and B vaccine **would make me compromise my religious or philosophical beliefs.**

27) (A) (B) (C) (D) (E) **28)** (A) (B) (C) (D) (E)

How do you rate your personal risk of contracting the hepatitis A and B virus? Please respond on a scale ranging from Very High Risk (A) to No Risk (E).

	Very High Risk	High Risk	Neutral	Low Risk	No Risk
29) My personal risk of getting hepatitis A is....(A)		(B)	(C)	(D)	(E)
30) My personal risk of getting hepatitis B is... (A)		(B)	(C)	(D)	(E)

The following people may have an opinion about you receiving the hepatitis A and B vaccines. There are <u>two responses</u> associated with each of the following listed persons.

With the <u>first response</u>, please rate how likely you think the following pers ons <u>will support</u> your decision to receive hepatitis A and B vaccines.

With the <u>second response</u>, please rate how likely you think the following person's opinion <u>will influence</u> your decision whether to get a hepatitis A and B vaccines.

Please rate each item with a level of likeliness. Carefully mark answer sheet with proper number.

	<u>First Response</u> How likely do you think this person will <u>support</u> your decision to get a vaccine?					**<u>Second Response</u> How likely do you think this person's opinion will <u>influence</u> your decision to get a vaccine?**				
	<u>Level of Likeliness</u>					**<u>Level of Likeliness</u>**				
	Very High (A)	**High (B)**	**Don't Know (C)**	**Low (D)**	**Very Low (E)**	**Very High (A)**	**High (B)**	**Don't Know (C)**	**Low (D)**	**Very Low (E)**
My Parents.....										
31)	(A)	(B)	(C)	(D)	(E)	**32)** (A)	(B)	(C)	(D)	(E)
My Family Doctor										
33)	(A)	(B)	(C)	(D)	(E)	**34)** (A)	(B)	(C)	(D)	(E)
My Close Friend.....										
35)	(A)	(B)	(C)	(D)	(E)	**36)** (A)	(B)	(C)	(D)	(E)
My Partner/Spouse.....										
37)	(A)	(B)	(C)	(D)	(E)	**38)** (A)	(B)	(C)	(D)	(E)
The OSU Student Health Services Staff.....										
39)	(A)	(B)	(C)	(D)	(E)	**40)** (A)	(B)	(C)	(D)	(E)
My Residence Hall or Living Unit Staff.....										
41)	(A)	(B)	(C)	(D)	(E)	**42)** (A)	(B)	(C)	(D)	(E)

Please rate your level of concern about contracting these infections as the result of your contacts with other people?

	Very High Concern	High Concern	Neutral	Low Concern	No Concern
43) Chlamydia.....	(A)	(B)	(C)	(D)	(E)
44) Gonorrhea	(A)	(B)	(C)	(D)	(E)
45) Genital Herpes	(A)	(B)	(C)	(D)	(E)
46) Genital Warts.....	(A)	(B)	(C)	(D)	(E)
47) Hepatitis A	(A)	(B)	(C)	(D)	(E)
48) Hepatitis B	(A)	(B)	(C)	(D)	(E)
49) HIV/AIDS.....	(A)	(B)	(C)	(D)	(E)

Please pick the top three viral sexually transmitted infections that concerns you the most in regards to how it might impact yo ur overall personal health (physical, sexual, emotional) if you contracted one of these infections. Choose from the five following viral sexually transmitted infections (STIs): (A) Genital Herpes, (B) Genital Warts, (C) Hepatitis A, (D) Hepatitis B, and (E) HIV/AIDS.

50) The viral STI that concerns me **the most** is.....	(A)	(B)	(C)	(D)	(E)
51) The viral STI that concerns me **the second most** is.....	(A)	(B)	(C)	(D)	(E)
52) The viral STI that concerns me **the third most** is.....	(A)	(B)	(C)	(D)	(E)

The following situations may impact a person's decision to get a hepatitis A and B vaccines. There are two responses associated with each situation. Ple ase rate each item with a level of likeliness. Carefully mark answer sheet with proper number.

With the first response, please rate how likely you think the following situations will influence your personal decision whether to get a hepatitis A and B vaccines.

With the second response, please rate how likely you think the following situations will occur.

First Response How likely do you think this situation will influence your decision to get a vaccine?					**Second Response** How likely do you think this situation will occur?				
Level of Likeliness					**Level of Likeliness**				
Very High (A)	**High (B)**	**Don't Know (C)**	**Low (D)**	**Very Low (E)**	**Very High (A)**	**High (B)**	**Don't Know (C)**	**Low (D)**	**Very Low (E)**

A situation that may impact your decision to get a vaccine is **being able to get vaccine at a hepatitis vaccine clinic at the Student Health Services (SHS).....**

53) (A) (B) (C) (D) (E) **54)** (A) (B) (C) (D) (E)

A situation that may impact your decision to get a vaccine is **being able to get the vaccines when I come to SHS for other reasons** .....

55) (A) (B) (C) (D) (E) **56)** (A) (B) (C) (D) (E)

How likely do you think this situation will influence your decision to get a vaccine?					How likely do you think this situation will occur?				
Level of Likeliness					Level of Likeliness				
Very High (A)	High (B)	Don't Know (C)	Low (D)	Very Low (E)	Very High (A)	High (B)	Don't Know (C)	Low (D)	Very Low (E)

A situation that may impact your decision to get a vaccine is **being able get the vaccine at other locations on campus besides SHS**.....

57) (A) (B) (C) (D) (E) **58)** (A) (B) (C) (D) (E)

A situation that may impact your decision to get a vaccine is **being able get the vaccine at a discounted price**.....

59) (A) (B) (C) (D) (E) **60)** (A) (B) (C) (D) (E)

A situation that may impact your decision to get a vaccine is **being able get my insurance company to pay for the vaccine**.....

61) (A) (B) (C) (D) (E) **62)** (A) (B) (C) (D) (E)

A situation that may impact your decision to get a vaccine is **being able read an educational handout about the hepatitis vaccines**.....

63) (A) (B) (C) (D) (E) **64)** (A) (B) (C) (D) (E)

A situation that may impact your decision to get a vaccine is **being able find time in my busy schedule to go to SHS for my vaccine**.....

65) (A) (B) (C) (D) (E) **66)** (A) (B) (C) (D) (E)

A situation that may impact your decision to get a vaccine is **being able get a reminder from my parents about receiving the hepatitis vaccines at SHS**.....

67) (A) (B) (C) (D) (E) **68)** (A) (B) (C) (D) (E)

A situation that may impact your decision to get a vaccine is **being able get a personal reminder from nurses, doctors, and other staff when I visit SHS**.....

69) (A) (B) (C) (D) (E) **70)** (A) (B) (C) (D) (E)

A situation that may impact your decision to get a vaccine is **being able get a reminder call, email, or postcard, about the hepatitis vaccine clinic at SHS**.....

71) (A) (B) (C) (D) (E) **72)** (A) (B) (C) (D) (E)

A situation that may impact your decision to get a vaccine is **being able get a reminder by seeing ad in school newspaper**.....

73) (A) (B) (C) (D) (E) **74)** (A) (B) (C) (D) (E)

The next couple of questions ask about some personal information about your risk behaviors for hepatitis A and B. Although this information is vital to our study and will be kept confidential, you may choose not to answer any question. Please answer all questions honestly.

75) How many different sexual partners (vaginal, oral, anal sex) have you had in the last 12 months? Choose the most appropriate response.

(A) None
(B) 1
(C) 2
(D) 3
(E) 4 or more

Please indicate whether or not you have experienced each of the following. Respond with (A) Yes or (B) No, or (C) Decline to Respond.

	Yes (A)	No (B)	Decline to Respond (C)
76) I have had body piercings and/or tattoos	(A)	(B)	(C)
77) I have traveled to one of the following regions: Africa, Asia, Central/S. America, Eastern Europe.	(A)	(B)	(C)
78) I have used injection drugs or methamphetamine	(A)	(B)	(C)
79) I have had a sexually transmitted infection	(A)	(B)	(C)
80) I have had unprotected vaginal sex (without condom)....	(A)	(B)	(C)
81) I have had unprotected oral genital sex.	(A)	(B)	(C)
82) I have had unprotected anal sex.	(A)	(B)	(C)

Demographic Data

83) Which best describes your racial/ethnic identity? (Choose all that Apply) If you decline to respond leave answer blank.

(A) **American Indian or Alaskan Native** (A person having origins in any of the original peoples of North America, and who maintains cultural identification through tribal affiliation or community recognition).
(B) **Asian or Pacific Islander** (A person having origins in any of the original peoples of the Far East, Southeast Asia, the India subcontinent, or the Pacific Islands. This area includes, for example, China, India, Japan, Korea, the Philippine Islands and Samoa).
(C) **Black, not of Hispanic Origin** (A person having origins in any of the black racial groups of Africa).
(D) **Hispanic** (A person of Mexican, Puerto Rican, Cuban, Central or South America or other Spanish culture or origin, regardless of race).
(E) **White, not of Hispanic Origin** (A person having origins in any of the original peoples of Europe, North Africa, or the Middle East).

84) What is your gender? (Select One)

(A) Female
(B) Male

85) What best describes your current relationship status? (Select One)

(A) Single, No committed partner
(B) Engaged or committed dating relationship.
(C) Married or domestic partner
(D) Separated or divorced
(E) Widowed

86) What is your current age? (Select One)

(A) 18
(B) 19
(C) 20
(D) 21
(E) 22 or older

87) What was the combined income of your parent(s) or guardian last year? (Select One)

(A) Less than $20,000
(B) $20,000 to less than $60,000
(C) $60,000 to less than $120,000
(D) Greater than $120,000
(E) Don't know

88) What was your cumulative high school GPA? (Select One)

(A) 1.99 or below
(B) 2.00-2.49
(C) 2.50-2.99
(D) 3.00-3.49
(E) 3.50 or higher

89) Where is your current local residence? (Select One)

(A) Residence hall or co-op house
(B) Fraternity or sorority house
(C) Off-campus house or apartment
(D) Parents house
(E) Other

90) What academic college are you enrolled in at OSU? (Select One)

(A) Business
(B) Engineering
(C) Liberal Arts
(D) Science
(E) Other

91) What is your religious preference? (Select One)

(A) Catholic
(B) Protestant
(C) Jewish
(D) Other
(E) No religious preference

Thanks for completing survey!!!

Please return your pencil, answer sheet, survey booklet, and one copy of the signed informed consent form to the survey administrator. You may keep the other copy of the consent form. Be sure to take your coupon for Woodstock's Pizza. You will be notified by December 1, 2002 if you have won one of the drawing gift certificates.