A 2-Part Study Examining; Hepatitis B Vaccination Rates Among High-risk Adults and the Influence of Education on Knowledge and Awareness of Hepatitis B and the Use of Vaccines as a Safe, Preventative Measure Among University of MS Students.

by

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Dedication and Acknowledgements

This thesis is dedicated to my lovely grandmother Helen Dunn. I would also like to thank Dr. Hope King, Jim, Dr. Wayne L. Gray, Dr. Xin Dang, and Dr. Mervin Matthews for their contributions.

Table of Contents

List of Tables and Figures

Part 1:

Hepatitis B Vaccination among High-Risk Adults: Results from the National Health and Examination Survey (NHANES), 2011-2014

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Abstract

Background: Hepatitis B virus (HBV) can be prevented and controlled through vaccination. However, vaccination among high-risks adults in the U.S. is still low (50%). This poses serious threats for HBV transmission between infected individuals and high-risk individuals.

Objective: The specific aims of this research were to: (a) explore the prevalence of hepatitis B vaccination uptake from 2011-2014 (b) to examine intrapersonal, interpersonal, and organizational level factors associated with receiving hepatitis B vaccination among high-risk adults.

Methods: Data were analyzed from the National Health and Nutrition Examination Survey (NHANES) from 2011-2014 to: (1) asses the prevalence of hepatitis B vaccination and (2) examine the interpersonal, intrapersonal, and organizational level factors associated with receiving the hepatitis B vaccination among U.S. adults.

Results: Of the 5,379 participants, 464 (weighted 8.6%) were considered high-risk adults and 4,915 (weighted 91.4%) were considered non-high-risk adults. Overall, vaccination uptake for high-risk adults was (50.5%) and (53.7%) for non-high risk adults. There were statistically significant differences between high-risk and non-high-risk based on race, education, and previous reception of Hep A vaccination.

Discussion: This study illustrated that: (a) hepatitis B vaccination uptake among high-risk adults is improving, but is still less than optimal (b) individual, social, and environmental factors play a role in receipt of vaccination among high-risk adults. As a

result, these individual, social, and environmental factors could serve as a driving force to improve vaccination among high-risk adults.

Conclusion: Efforts to increase access and use of educational programs may significantly combat certain social and environmental factors that have been linked to low vaccination rates among high-risk populations. Additionally, the implementation of stricter ACIP vaccination recommendations should be considered by Federal associations as a means of increasing vaccination among the general population.

Introduction:

Hepatitis B is defined as chronic or acute inflammation of the liver caused by the hepatitis B virus (HBV). Hepatitis B infection is generally spread through percutaneous or mucosal exposure to infected blood or other bodily fluids (Center for Disease Control and Prevention, 2006). Due to the likelihood of transmitting HBV to others, individuals with chronic hepatitis B are considered primary reservoirs for continuous transmission. Although the development of chronic infection is most often seen in infants and young children, rates of new infections and acute hepatitis are highest among adults (Center for Disease Control and Prevention, 2006). Recent findings indicate that: a) 20% of all new HBV infections in the U.S. are among MSMs. b) 25.8% of new cases are among those that indicated use of some form of injection drug(s) c) 10% of people with HIV are co-infected with HBV (HIV and Viral Hepatitis, 2014, March), (Statistics and Surveillance, 2016, May 19). The increased probability of contracting Hepatitis B places injection drug users, men who have sex with men, and HIV positive patients at high-risk.

Since 1982, the hepatitis B vaccine has been recommended for high risk adults, such as those with a history of sexually transmitted disease (STDs), men who have sex with men, HIV infected persons, high-risk heterosexuals (e.g.,> multiple sex partners), and injection drug users. (IDUs) (Center for Disease Control and Prevention, 1982). Despite standing suggestions and access to universal vaccinations, an estimated 240 million people suffer from chronic hepatitis B globally (Statistics and Surveillance, 2016, May 19). Americans make up approximately 850,000- 2.2 million of the total cases worldwide (Roberts et al., 2015).

Past attempts to combat these numbers, include the 1991 endorsement of a national strategy to eliminate HBV by the Advisory Committee on Immunization Practices (ACIP) and other medical organizations (Center for Disease Control and Prevention, 1991). This strategy called for: 1) screening all pregnant women and immunizing infants and infected mothers to prevent perinatal transmission 2) universal vaccination of infants to prevent infections during childhood and at later ages 3) provision of catch up vaccinations for children and adolescents not previously vaccinated and 4) vaccination of high risk adults and adolescents. Furthermore, in December 2006, ACIP updated its recommendations to include the provision of hepatitis B vaccination in prevention service settings where there is active visitation from unvaccinated, high risk adults. These settings include: testing and treatment facilities for Human Immunodeficiency Virus and other Sexually Transmitted Diseases, drug abuse treatment and prevention settings, health care settings geared toward Injection Drug Users and Men who have Sex with Men, correctional facilities, chronic hemodialysis facilities and end stage renal programs, and institutions and nonresidential day care facilities for developmentally disabled persons (Center for Disease Control and Prevention, 2006).

There has been significant progress in vaccination rates and coverage among children (92%) and adolescents (67%). However, only 50% of high-risk adults in the United States (U.S.) have been vaccinated against HBV infection (Lu, Byrd, Murphy, & Weinbaum, 2011). Such low vaccination rates pose serious threats for the transmission of hepatitis B virus infection to others.

The specific aims of this research were to: (a) explore the prevalence of hepatitis B vaccination uptake from 2011-2014 (b) to examine intrapersonal, interpersonal, and

organizational level factors associated with receiving hepatitis B vaccination among high-risk adults.

Methods

Data were analyzed from the National Health and Nutrition Examination Survey (NHANES) from 2011- 2014 to: (1) assess the prevalence of hepatitis B vaccination uptake and (2) examine the intrapersonal, interpersonal, and organizational level factors that may be associated with receiving the hepatitis B vaccination among U.S. adults. A high-risk adult was defined as any adult reporting at least one of the following: a sexually transmitted infection in the past 12 month (e.g., herpes, chlamydia, gonorrhea, or genital warts), sex with another man is male, infection with HIV, or past or current injection drug use. All other adults were classified as non- high-risk. A literature review was performed to collect information regarding the correlation between high-risk individuals and vaccination rates and the factors that influence the two. Publications dates were limited to the year(s) 2011-2016.

Results

Table 1 shows the sample characteristics of adults, aged 18-49 years for the 2011 to 2014-time period. A total of 5,379 adults aged 18-49 years were interviewed. Of the 5,379 participants, 464 (weighted 8.6%) were considered high risk adults and 4,915 (weighted 91.4%) were considered non-high-risk adults. The majority of the sample was non-Hispanic White (58.7%), female sex (50.6%), between the ages 21-40 (61.2%), married (49.0%), had greater than a high school education (64.7%), lived at or above the poverty line (78.5%), and had health insurance (74.3%).

Table 1 Sample Characteristics of Adult, Aged 18-49 Years, NHANES 2011-2014

		High-Risk vs Non-High-Risk	
		Sample N [Weighted col % (95%CI)]	
Factors	**Among All-Adults**	**High-Risk (n=584)**	**Non-High-Risk (n=5909)**
Overall	5379 [100.0 (. -.)]	464 [100.0 (.-.)]	4915 [100.0 (. -.)]
HB3Dose			
complete 3 doses	2924 [53.4 (51.4 -55.4)]	250 [50.5 (45.1 -55.9)]	2674 [53.7 (51.6 -55.8)]
no doses	2455 [46.6 (44.6 -48.6)]	214 [49.5 (44.1 -54.9)]	2241 [46.3 (44.2 -48.4)]
Gender			
Male	3163 [49.4 (48.1 -50.7)]	265 [47.1 (40.8 -53.5)]	2898 [49.7 (48.2 -51.1)]
Female	3330 [50.6 (49.3 -51.9)]	319 [52.9 (46.5 -59.2)]	3011 [50.3 (48.9 -51.8)]
Age Grp			
18-20	875 [10.1 (8.7 -11.7)]	45 [5.5 (3.5 -8.4)]	830 [10.6 (9.2 -12.2)]
21-25	1025 [16.5 (14.5 -18.6)]	93 [15.8 (11.4 -21.4)]	932 [16.6 (14.6 -18.7)]
26-30	918 [14.8 (13.1 -16.6)]	86 [14.6 (11.4 -18.5)]	832 [14.8 (13.0 -16.7)]
31-40	1955 [29.9 (28.3 -31.6)]	170 [28.2 (23.6 -33.3)]	1785 [30.1 (28.3 -32.0)]
41-49	1720 [28.7 (26.3 -31.3)]	190 [35.9 (30.3 -41.8)]	1530 [27.9 (25.4 -30.5)]
Race			
NH-White	2335 [58.7 (53.0 -64.2)]	280 [69.9 (63.3 -75.8)]	2055 [57.4 (51.6 -63.0)]
NH-Black	1455 [12.6 (9.8 -16.1)]	154 [13.1 (9.1 -18.5)]	1301 [12.6 (9.9 -16.0)]
Mexican American	901 [11.7 (9.0 -15.2)]	50 [6.5 (4.4 -9.6)]	851 [12.4 (9.4 -16.1)]
Others	1802 [16.9 (14.7 -19.2)]	100 [10.5 (8.0 -13.7)]	1702 [17.6 (15.4 -20.1)]
Edu			
<=High school	2280 [35.3 (31.7 -39.0)]	196 [34.8 (28.6 -41.6)]	2084 [35.3 (31.8 -39.0)]
>High school	3561 [64.7 (61.0 -68.3)]	352 [65.2 (58.4 -71.4)]	3209 [64.7 (61.0 -68.2)]
Marital			
Married	2687 [49.0 (45.7 -52.3)]	186 [38.7 (31.8 -46.1)]	2501 [50.3 (47.2 -53.3)]
widowed/divorced/separated	616 [10.5 (9.4 -11.7)]	70 [13.1 (10.2 -16.6)]	546 [10.2 (8.9 -11.6)]

		High-Risk vs Non-High-Risk	
		Sample N [Weighted col % (95%CI)]	
Factors	**Among All-Adults**	**High-Risk (n=584)**	**Non-High-Risk (n=5909)**
Never married	2540 [40.5 (36.6 -44.5)]	292 [48.2 (41.1 -55.4)]	2248 [39.5 (35.8 -43.4)]
Poverty			
<=1	1736 [21.6 (18.1 -25.4)]	164 [19.9 (15.2 -25.5)]	1572 [21.8 (18.3 -25.6)]
1-4.99	3302 [57.4 (53.9 -60.8)]	306 [58.3 (50.9 -65.4)]	2996 [57.3 (54.0 -60.5)]
>=5	952 [21.1 (17.8 -24.7)]	86 [21.8 (16.2 -28.7)]	866 [21.0 (17.7 -24.6)]
INSURANCE			
Yes	4549 [74.3 (71.8 -76.7)]	421 [77.8 (71.7 -83.0)]	4128 [73.9 (71.3 -76.3)]
No	1935 [25.7 (23.3 -28.2)]	161 [22.2 (17.0 -28.3)]	1774 [26.1 (23.7 -28.7)]
CarePlace			
clinic or health center	1196 [21.3 (18.6 -24.3)]	98 [20.7 (14.0 -29.6)]	1098 [21.4 (18.9 -24.1)]
doctor office or HMO	3285 [71.0 (67.8 -74.0)]	324 [71.8 (62.9 -79.3)]	2961 [70.9 (67.8 -73.8)]
hospital emergency room	288 [4.7 (3.8 -5.8)]	31 [4.6 (2.8 -7.5)]	257 [4.7 (3.8 -5.8)]
hospital outpatient department	68 [1.1 (0.8 -1.5)]	6 [0.6 (0.2 -1.5)]	62 [1.2 (0.8 -1.6)]
some other place	100 [1.9 (1.4 -2.7)]	12 [2.2 (1.3 -3.8)]	88 [1.9 (1.4 -2.7)]
CareTime			
None	1426 [21.3 (19.7 -23.0)]	81 [12.8 (10.4 -15.7)]	1345 [22.3 (20.5 -24.2)]
one time	1520 [23.6 (22.2 -25.2)]	117 [19.9 (16.2 -24.3)]	1403 [24.1 (22.4 -25.8)]
2-3 time	1778 [29.9 (28.6 -31.4)]	159 [31.5 (26.8 -36.5)]	1619 [29.8 (28.3 -31.3)]
4-9 time	890 [15.4 (14.4 -16.5)]	110 [21.0 (17.0 -25.6)]	780 [14.8 (13.6 -16.0)]
>=10 time	554 [9.7 (8.7 -10.8)]	71 [14.8 (11.5 -18.9)]	483 [9.1 (8.1 -10.2)]
HEPADose			
1-2 doses	2610 [44.9 (43.0 -46.8)]	229 [45.5 (39.7 -51.3)]	2381 [44.8 (42.6 -47.0)]
no doses	2840 [55.1 (53.2 -57.0)]	257 [54.5 (48.7 -60.3)]	2583 [55.2 (53.0 -57.4)]

Table 2 shows the factors associated with hepatitis B vaccination vaccine uptake greater than three doses for ages 18-49 years for the 2011-2014 time period. Overall, vaccination uptake for high-risk adults was (50.5%) and (53.7%) for non-high risk adults. There was statistical significance differences seen between high-risk and non-high risk by race, education, and previous reception of hepatitis A vaccination. There was no statistical significance differences seen between high-risk and non-risk by race, age group, gender, marital status, socioeconomic status, insurance, care place or care time.

TABLE 2 – Factors Associated with Hepatitis B Vaccination Uptake by High-Risk Status and Individual, Intrapersonal, and Organizational Characteristics, NHANES, 20011-2014

	High-Risk		**Non-High-Risk**		
	High-Risk with Sample N [Weighted % (95%CI)]		**Non-High-Risk with Sample N [Weighted % (95%CI)]**		
Factors	**N(col%)**	**Uptake>=3 dose n(row%)**	**N(col%)**	**Uptake>=3 dose n(row%)**	**P-value**
Overall	464 [100.0 (. -.)]	250 [50.5 (45.1 -55.9)]	4915 [100.0 (. -.)]	2674 [53.7 (51.6 -55.8)]	0.268
Gender					
Male	205 [46.4 (39.6 -53.3)]	102 [43.6 (35.5 -52.1)]	2413 [49.5 (47.8 -51.3)]	1210 [48.8 (46.1 -51.4)]	0.225
Female	259 [53.6 (46.7 -60.4)]	148 [56.5 (49.1 -63.6)]	2502 [50.5 (48.7 -52.2)]	1464 [58.6 (55.7 -61.4)]	0.550
Age Grp					
18-20	35 [5.8 (3.5 -9.5)]	27 [84.4 (60.2 -95.0)]	692 [10.8 (9.3 -12.6)]	543 [78.3 (72.9 -82.8)]	0.488
21-25	76 [17.0 (12.6 -22.6)]	53 [67.6 (53.7 -79.0)]	766 [16.1 (14.2 -18.3)]	549 [72.7 (67.9 -77.0)]	0.464
26-30	63 [14.0 (10.6 -18.3)]	36 [55.0 (39.5 -69.7)]	684 [14.6 (12.8 -16.7)]	412 [64.2 (59.6 -68.6)]	0.254
31-40	136 [28.7 (23.8 -34.3)]	68 [45.7 (37.5 -54.2)]	1464 [29.7 (27.9 -31.6)]	685 [46.5 (43.5 -49.5)]	0.862
41-49	154 [34.5 (29.0 -40.4)]	66 [38.5 (27.3 -51.1)]	1309 [28.7 (26.0 -31.5)]	485 [35.8 (32.2 -39.6)]	0.646
Race					
NH-White	220 [70.2 (63.1 -76.4)]	107 [47.3 (40.6 -54.0)]	1737 [58.3 (52.5 -63.9)]	941 [54.4 (51.7 -57.1)]	0.0463*

	High-Risk		Non-High-Risk		
	High-Risk with Sample N [Weighted % (95%CI)]		Non-High-Risk with Sample N [Weighted % (95%CI)]		
Factors	**N(col%)**	**Uptake>=3 dose n(row%)**	**N(col%)**	**Uptake>=3 dose n(row%)**	**P-value**
NH-Black	129 [14.0 (9.6 -19.9)]	76 [57.4 (46.1 -68.0)]	1130 [13.1 (10.2 -16.6)]	649 [56.7 (52.4 -60.8)]	0.897
Mexican American	37 [5.9 (3.9 -8.7)]	17 [46.7 (32.1 -61.8)]	665 [11.6 (8.7 -15.2)]	292 [43.2 (37.4 -49.2)]	0.688
Others	78 [10.0 (7.5 -13.3)]	50 [65.8 (55.2 -75.0)]	1383 [17.1 (15.0 -19.4)]	792 [56.1 (52.6 -59.6)]	0.0834
Edu					
<=High school	150 [34.6 (28.3 -41.5)]	76 [50.8 (41.0 -60.6)]	1715 [34.8 (31.0 -38.8)]	703 [41.1 (38.0 -44.4)]	0.0423*
>High school	286 [65.4 (58.5 -71.7)]	153 [48.3 (41.3 -55.5)]	2685 [65.2 (61.2 -69.0)]	1567 [57.7 (55.0 -60.4)]	0.0113*
Marital					
Married	143 [37.1 (30.2 -44.6)]	70 [45.5 (33.9 -57.6)]	2057 [49.9 (46.6 -53.1)]	981 [48.1 (44.7 -51.5)]	0.648
widowed/divorced/separated	59 [13.7 (10.4 -17.8)]	28 [37.3 (22.6 -54.7)]	462 [10.4 (9.1 -11.9)]	216 [43.3 (36.7 -50.1)]	0.505
Never married	234 [49.2 (42.1 -56.3)]	131 [55.3 (46.0 -64.3)]	1884 [39.7 (35.9 -43.7)]	1074 [59.1 (54.8 -63.2)]	0.422
Poverty					
<=1	132 [20.3 (15.5 -26.1)]	68 [51.1 (38.6 -63.4)]	1303 [21.7 (18.2 -25.6)]	754 [58.4 (53.8 -62.9)]	0.216
1-4.99	238 [57.8 (50.5 -64.8)]	133 [51.1 (43.5 -58.8)]	2492 [57.2 (53.8 -60.6)]	1327 [51.6 (49.0 -54.2)]	0.906
>=5	71 [21.9 (16.5 -28.4)]	35 [47.9 (34.3 -61.9)]	725 [21.1 (17.7 -24.9)]	397 [55.5 (51.4 -59.6)]	0.254
INSURANCE					
Yes	333 [76.8 (70.1 -82.4)]	186 [52.4 (45.0 -59.7)]	3449 [74.1 (71.4 -76.6)]	2002 [56.7 (54.4 -59.0)]	0.265
No	131 [23.2 (17.6 -29.9)]	64 [44.2 (34.3 -54.7)]	1463 [25.9 (23.4 -28.6)]	671 [45.0 (41.1 -49.0)]	0.875
CarePlace					
clinic or health center	77 [20.6 (12.9 -31.2)]	49 [54.4 (43.2 -65.1)]	915 [21.1 (18.3 -24.2)]	481 [51.6 (47.0 -56.2)]	0.631
doctor office or HMO	264 [72.1 (61.4 -80.7)]	145 [51.5 (42.0 -60.8)]	2500 [71.2 (67.7 -74.5)]	1454 [56.4 (53.9 -58.9)]	0.276

	High-Risk		Non-High-Risk		
	High-Risk with Sample N [Weighted % (95%CI)]		Non-High-Risk with Sample N [Weighted % (95%CI)]		
Factors	**N(col%)**	**Uptake>=3 dose n(row%)**	**N(col%)**	**Uptake>=3 dose n(row%)**	**P-value**
hospital emergency room	26 [5.1 (2.9 -8.8)]	12 [39.1 (22.8 -58.1)]	217 [4.7 (3.6 -6.0)]	109 [49.6 (43.2 -55.9)]	0.316
hospital outpatient department	5 [0.7 (0.2 -1.8)]	4 [62.0 (13.8 -94.3)]	51 [1.1 (0.7 -1.6)]	30 [63.9 (49.6 -76.1)]	0.943
some other place	7 [1.6 (0.8 -3.1)]	4 [48.5 (17.4 -80.8)]	74 [1.9 (1.4 -2.8)]	43 [55.4 (42.8 -67.4)]	0.736
CareTime					
None	67 [14.2 (11.4 -17.6)]	25 [36.6 (25.1 -49.8)]	1098 [21.9 (20.2 -23.7)]	519 [46.7 (42.7 -50.8)]	0.1400
one time	92 [20.8 (15.9 -26.8)]	55 [53.6 (40.2 -66.5)]	1162 [23.9 (22.1 -25.8)]	643 [53.7 (49.8 -57.7)]	0.981
2-3 time	122 [29.6 (24.7 -35.0)]	69 [52.0 (42.2 -61.6)]	1342 [29.7 (28.0 -31.5)]	749 [54.2 (50.9 -57.3)]	0.674
4-9 time	88 [20.3 (16.1 -25.2)]	52 [61.3 (48.0 -73.0)]	651 [15.0 (13.6 -16.6)]	374 [58.6 (53.2 -63.7)]	0.710
>=10 time	60 [15.1 (11.6 -19.4)]	32 [46.2 (31.5 -61.5)]	413 [9.4 (8.4 -10.5)]	246 [59.0 (52.8 -65.0)]	0.1147
HEPADose					
1-2 doses	200 [44.5 (38.5 -50.7)]	172 [80.7 (72.9 -86.7)]	2181 [44.1 (41.7 -46.5)]	1960 [89.2 (87.3 -90.7)]	0.0116*
no doses	232 [55.5 (49.3 -61.5)]	64 [29.0 (22.7 -36.3)]	2433 [55.9 (53.5 -58.3)]	516 [23.8 (21.3 -26.4)]	0.1657

Discussion

Hepatitis B can be prevented through vaccination. Among high risk adults the prevalence of hepatitis B vaccination had a slight increase from 47.0% in 2007-2010 to 51.0% in 2011-2014. This study illustrated that hepatitis B vaccination uptake among high-risk adults is getting better but is still less than optimal. Although hepatitis B vaccination uptake was relatively low, this study illustrated that individual, social, and environmental

factors play a role in receipt of vaccination among high-risk adults. As a result, these individual, social, and environmental factors could serve as driving forces to improve vaccination coverage among high-risk adults. Thus strategies to promote education about hepatitis B vaccination among high risk adults could assist with increasing vaccination rates.

Conclusion

Programs established by public health officials to be implemented in local health departments, educational environments (i.e. high-schools or universities), and specific areas where high-risk populations are prominent should be strongly considered. Efforts to increase access and use of educational programs may significantly combat certain social and environmental factors that have been linked to low vaccination rates among high-risk populations. In addition to educational efforts, updated ACIP recommendation strategies that call for stricter vaccination practices among the general population may also lead to an overall increase in the rate of Hepatitis B vaccination uptake.

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Part 2:

The Influence of Education on Knowledge and Awareness of Hepatitis B and the Use of Vaccines as a Safe, Preventative Measure Among University of Mississippi Students.

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Abstract:

Background: Hepatitis B is a completely preventable disease. However, the rise in highly educated, middle class, anti-vaccine communities has increased the fear of government officials that infectious diseases that could be potentially eradicated will reappear or rise in prevalence.

Objective: The purpose of this study was to determine the degree of the influence of education on:

1. hepatitis B knowledge and awareness regarding the general understanding of the infection, hepatitis B preventability, and hepatitis B transmission.
2. vaccine use as a preventative measure for hepatitis B and other life threatening, preventable diseases.
3. beliefs regarding parental decisions to vaccinate children

Methods: Data were analyzed to determine the existence of a correlational relationship between education and (a) knowledge and awareness regarding the general understanding of the infection, hepatitis B preventability, and hepatitis B transmission (b) vaccine use as a preventative measure for hepatitis B and other life threatening, preventable diseases (c) beliefs regarding parental decisions to vaccinate

Results: The total sample consisted of sixteen freshmen, (13.01%), twenty-six sophomores (21.14%), thirty juniors (24.39%), thirty-three seniors (26.83%), and eighteen graduate students (14.63%). There were statistically significant differences between familiarity with hepatitis B based on classification and some evidence that science majors may be more knowledgeable of hepatitis B.

Discussion: An increase in the number of U.S. parents and educated individual expressing opposition to vaccinations against Hepatitis B and other infectious diseases poses a significant threat of the re-introduction of infectious diseases among non-vaccinated populations.

Conclusion: A lack of knowledge and awareness of hepatitis B infection and transmission and vaccine use among highly educated students indicates the need for the implementation of specific educational programs at the University of MS directed towards; (a) increasing knowledge and awareness of preventable diseases, such as hepatitis B, (b) minimizing social stigmas associated with these topics, and (c) encouraging and increasing the use of strong educational backgrounds, specifically in science related subjects, to motivate others to consider the risk side of infectious diseases even when the symptoms are not visible.

Introduction:

In 2014, there were an estimated 19,200 new hepatitis B virus infections in the United States. In the United States, an estimated 850,000-2.2 million persons have chronic hepatitis B. Globally, chronic hepatitis B affects approximately 240 million people and contributes to an estimated 786,000 deaths each year (Centers for Disease Control and Prevention, 2016). Most people who are diagnosed with chronic hepatitis B were infected at birth or during early childhood. It is reported that approximately 90% of infected infants will develop a chronic infection (Centers for Disease Control and Prevention, 2016). Although the risk goes down as a child gets older approximately 25%–50% of children infected between the ages of 1 and 5 years will develop chronic hepatitis. (Centers for Disease Control and Prevention, 2016). Children with chronic hepatitis B may display no physical signs or symptoms of chronic infection making it very difficult to detect. These children are at increased risk for developing serious liver problems like cirrhosis or liver cancer. (Children's Hospital of Philadelphia, 2013).

Since 1982, the hepatitis B vaccine has been recommended for high risk adults, such as those with a history of sexually transmitted disease (STDs), men who have sex with men (MSMs), HIV infected persons, high-risk heterosexuals (e.g.,>multiple sex partners), and injection drug users (IDUs) (Centers for Disease Control and Prevention, 1982). In 1991 the Advisory Committee on Immunization Practices (ACIP) endorsed a national strategy to eliminate HBV (Centers for Disease for Control and Prevention, 1991). This strategy called for: 1) screening all pregnant women and immunizing infants

and infected mothers to prevent perinatal transmission 2) universal vaccinations for children and adolescents not previously vaccinated and 3) vaccination of high risk adults and adolescents. In 1995, ACIP recommended the routine vaccination of adolescents 11-12 years who had not been vaccinated previously and in 1999, ACIP recommended that all unvaccinated children aged <19 years be vaccinated (Centers for Disease Control and Prevention, 2002). Furthermore, in December 2006, ACIP updated its recommendations to include the prevision of hepatitis B vaccination in prevention service settings where there is active visitation from unvaccinated, high risk adults. These settings include: testing and treatment facilities for Human Immunodeficiency Virus and other Sexually Transmitted Diseases, drug abuse treatment and prevention settings, health care setting geared toward injection drug users and men who have sex with men, correctional facilities, chronic hemodialysis facilities and end stage renal programs, and institutions and nonresidential day care facilities for developmentally disabled person (Centers for Disease Control and Prevention, 2006).

Nonetheless, the ACIP vaccination strategies for children and adolescents have been implemented successfully in the United States, and hepatitis B is now considered part of the routine childhood vaccination schedule (Centers for Disease Control and Prevention, 2002). During the years 1993-2000, the national coverage rates for hepatitis B vaccine among children 19-35 months increased from 16% to 90% and the coverage rate for U.S. adolescents aged 13-15 years increased from near zero to 67%. (Centers for Disease Control and Prevention, 2002). The rate of this success of modern ACIP recommendations is often associated with: (a) the enactment of the national program, Vaccines for Children, in 1994, which purchases ACIP- recommended vaccines for

eligible children aged <19 years, (b) the enactment of laws mandating hepatitis B vaccination for children entering elementary school and childcare centers in forty-four states and requiring vaccinations for adolescents in middle school in thirty-four states. (Centers for Disease Control and Prevention, 2002)

In July of 2016, The Centers for Disease Control and Prevention's National Center for Immunization and Respiratory Diseases updated its original statement that the best protection against hepatitis B is by getting the hepatitis B vaccine (Centers for Disease Control and Prevention, 2014). Doctors recommended that all parents vaccinate their child/children to: (a) protect their child/children against hepatitis B (b) protect other people from the disease because children with hepatitis B usually don't have symptoms, but they often pass the disease to others without anyone knowing they were infected. (c) prevent their child from liver disease and cancer from hepatitis B. and (d) keep their child from missing school or childcare (Centers for Disease Control and Prevention, 2014). According to the Centers for Disease Control and Prevention, the hepatitis B vaccine is very safe and effective at preventing hepatitis B; like any medicine, the vaccine, can have side effects. However, no serious side effects are known to be caused by the hepatitis B vaccine (Center for Disease Control and Prevention, 2014). To further address parental concerns regarding the vaccination of their infant(s), the National Center for Immunization released the following statement,

"It's hard to imagine putting your newborn through the pain of a shot. But a little stick early in life is an important first step to protecting your baby against a deadly disease. All babies should get the first shot of hepatitis B vaccine before they leave the hospital. This shot acts as a safety net, reducing the risk of getting the disease from moms or family members who may not know they are infected with hepatitis B. When a

mom has hepatitis B, there's an additional medicine that can help protect the baby against hepatitis B, called the hepatitis B immune globulin (HBIG). HBIG gives a baby's body a "boost" or extra help to fight the virus as soon as he/she is born. This shot works best when the baby gets it within the first 12 hours of his/her life. The baby will also need to complete the full hepatitis vaccination series for best protection". (Centers for Disease Control and Prevention, 2014)

Despite standing ACIP and CDC recommendations, laws, and recent statistical findings that support the notion of hepatitis B vaccination among infants, an increasing number of U.S. parents are expressing opposition to current hepatitis B vaccine regulations. Parents across the U.S. have contacted the National Vaccine Information Center (NVIC) to report their opposition to hepatitis B regulations being enacted by their state health departments officials. (National Vaccine Information Center, 1998). Previously reported reasons for parental opposition include: **(a) Hepatitis is B not highly contagious (b) Hepatitis B is not a killer disease for most (c) Hepatitis B is low in the U.S. (d) Federal health officials give state health officials money to force hepatitis B Vaccination (e) The pharmaceutical industry also funds forced hepatitis B vaccination (f) Pharmacist now vaccinate (g) Families are now being penalized for refusing hepatitis B vaccine (h) Hepatitis B vaccine is licensed by the FDA without adequate proof of long term safety (i) Hepatitis B efficacy has been questioned (j) The Institute of Medicine report reveals lack of adequate scientific studies (k) Medical literature cites immune system/brain damage and (l) Vaccine injuries have been reported at the National Vaccine Information Center.** (National Vaccine Information Center, 1998). As a result of parental opposition, an increasing number of schools and employers are pressured from government health officials to require

individuals to provide proof of hepatitis B vaccination before being allowed to enter work places or schools. This rise in opposition by educated parents may lead to a rise in U.S. parents who choose to use religious or health related exemptions that permit attendance in public/private schools systems without few or all recommended vaccines.

The Centers for Disease Control and Prevention has discovered certain communities with a large population of parents who either do not vaccinate their children or pick and choose which vaccines to permit and how they are scheduled (Public Broadcasting Service, 2014). The 2015 Frontline Public Broadcasting Service (PBS) documentary, The Vaccine War, highlights a cluster of Americans in Ashland Oregon, a community of financially advantaged, educated individuals, who strongly oppose the vaccination of their young children. Since 2010, parents from the Ashland community have gradually increased their dismissal of vaccine use. Because of the existence of vaccine exemptions, some 28% of Ashland's kids are allowed to attend public schools lacking some or all of their required vaccinations (Public Broadcasting Service, 2014). As a result, it now has one of the lowest vaccination rates in the country. The rise in highly educated, middle class anti-vaccine communities like Ashland has increased fears of government officials that diseases like hepatitis B and many others that could be potentially eradicated will reappear (Public Broadcasting Service, 2014).

According to previous findings by the Centers for Disease Control and Preventions Division of Viral Hepatitis, individual, social and environmental factors may play a role in the uptake of hepatitis B vaccinations and hepatitis B vaccine opposition (Centers for Disease Control and Prevention, 2016). In addition, these findings also indicate that

strategies to promote education about hepatitis B vaccination could assist with reducing opposition and decreasing the influence of negative stigmas regarding hepatitis B vaccination.

The purpose of this study was to determine the degree of the influence of education on:

4. hepatitis B knowledge and awareness regarding the general understanding of the infection, hepatitis B preventability, and hepatitis B transmission.
5. vaccine use as a preventative measure for hepatitis B and other life threatening, preventable diseases.
6. beliefs regarding parental decisions to vaccinate children

Methods:

Data were analyzed to determine the existence of a correlational relationship between education and (a) knowledge and awareness regarding the general understanding of the infection, hepatitis B preventability, and hepatitis B transmission (b) vaccine use as a preventative measure for hepatitis B and other life threatening, preventable diseases (c) beliefs regarding parental decisions to vaccinate. All subjects were eighteen or older and currently enrolled as part-time or full-time students at one of six University of Mississippi campuses. Recruitment for sample participants involved the use of social media (i.e. posting flyers on specific class social media pages), email distribution, in class announcements to students, posting flyers on club and organization newsfeeds, and a randomized sampling collection by the University of Mississippi's Institutional Review Board.

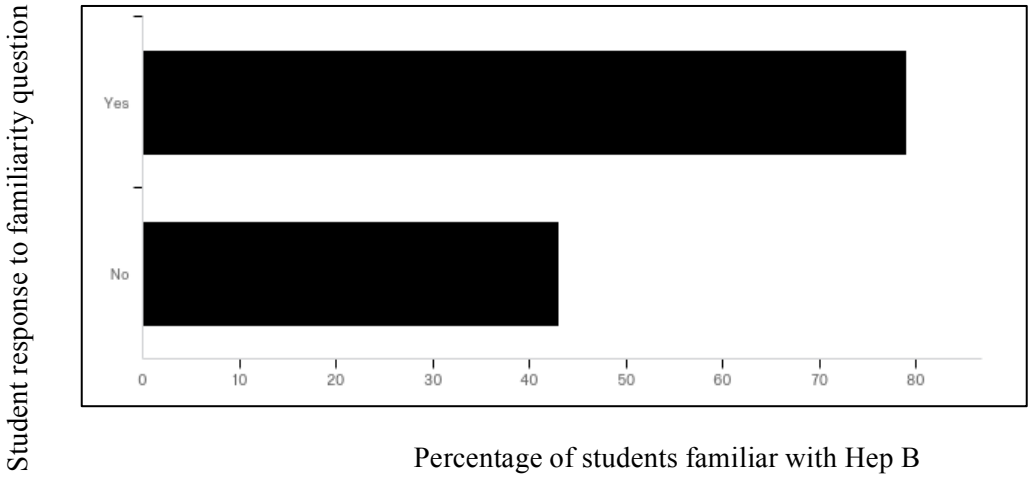
Tables 1 and 2 were classified using a 2-way classification table and tables 1, 2, 3, 5, and 6 were evaluated using a 95% conference interval. Sample proportions for classification tables 2, 3, 5, and 6 were assessed using a sample tests for equality of proportions with continuity correction and table 1 was assessed using a sample test for equality of proportions without continuity correction. A 10% significance level was used during the analysis of table 1 to account for any possible limitations associated with population size. Lastly, table 4 was assessed using a Fisher's exact test for count data.

Results:

Knowledge and Awareness of Hepatitis B and Vaccine Uptake Among University of Mississippi Students

Graph A

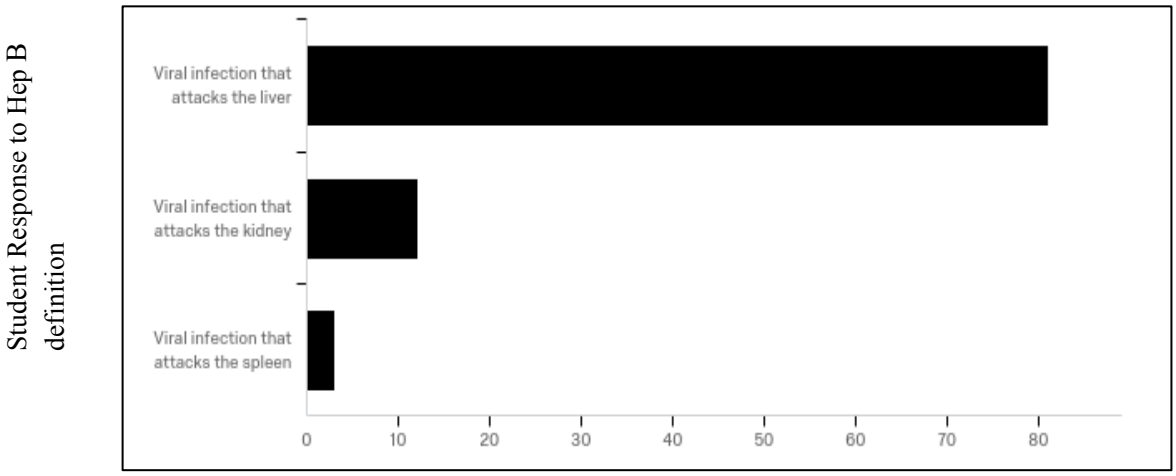
Q: Are you familiar with Hepatitis B?



The graph above illustrated the overall familiarity of hepatitis B among University of Mississippi students. Seventy-nine respondents (64.75%) reported they were familiar with Hepatitis B and forty-three respondents (35.25%) reported they were not familiar with hepatitis B.

Graph B

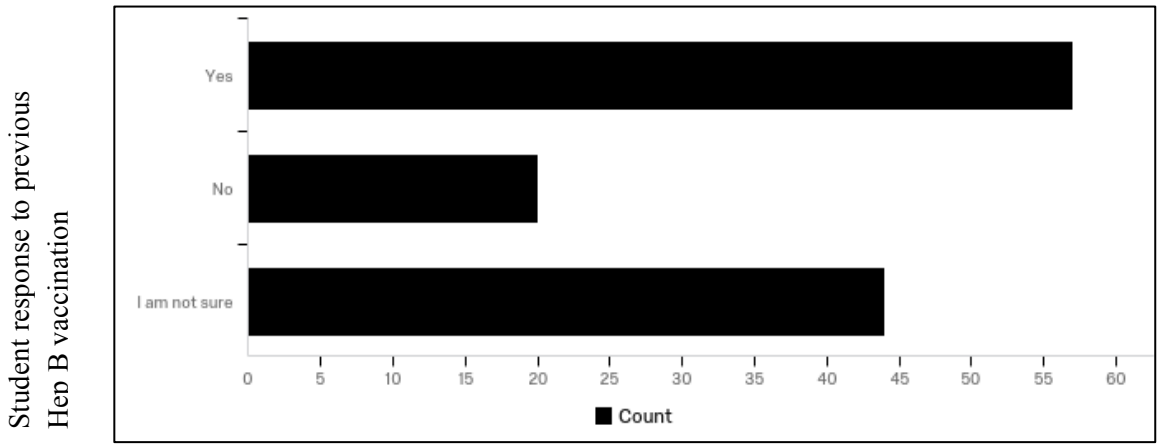
Q: If familiar, which of the following best aligns with your definition of Hepatitis B?



The graph above illustrates students' responses to the definition of hepatitis B. Eighty-one students (84.38%) chose the correct response, hepatitis B is a viral infection that attacks liver, twelve students (12.50%) responded hepatitis B is a viral infection that attacks the kidneys, three students (3.13%) reported hepatitis B is a viral infection that attacks the spleen.

Graph C

Q: Have you previously received any vaccination against the Hepatitis B Virus?

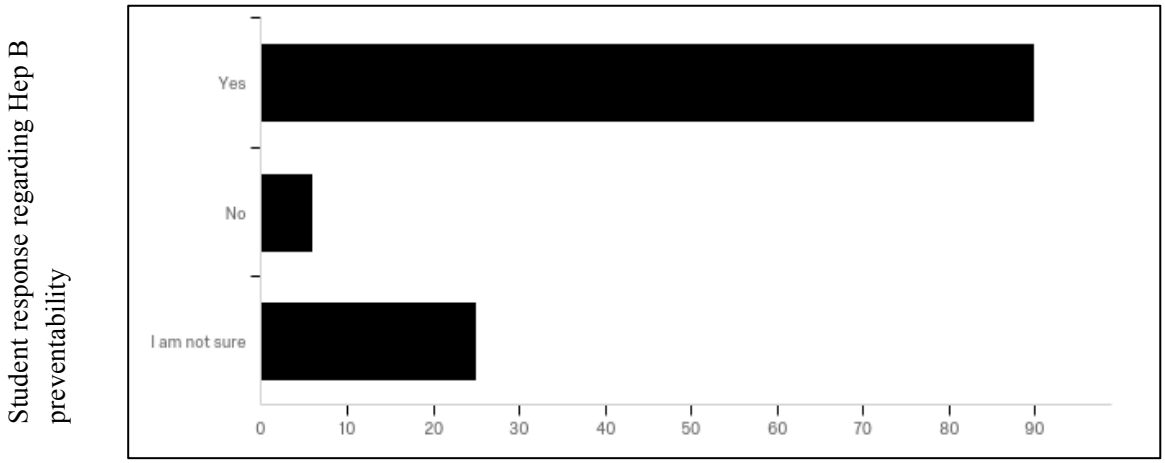


Percent of students knowledgeable of previous Hep B Vaccination

The graph above illustrates the number of individual who are aware of their current hepatitis B vaccination status. Fifty-seven students (47.1%) reported they had previously received the hepatitis B vaccine, twenty students (16.5%) reported they had not previously received the hepatitis B vaccine, and forty-four (36.4%) reported they were unaware of their hepatitis B vaccination status.

Graph D

Q: Based on your knowledge, is Hepatitis B a preventable disease?

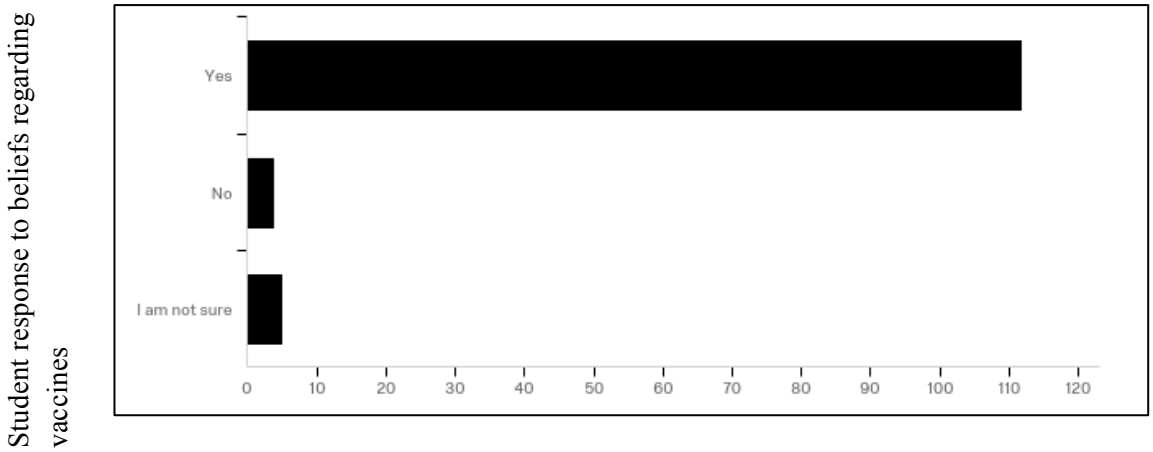


Percentage of students knowledgeable of Hep. B preventability

The graph above depicts the number of students who are aware that hepatitis B is a preventable disease. Ninety students (74.4%) reported hepatitis B is a preventable disease, six students (4.96%) reported hepatitis B was not a preventable disease, and twenty-five students (20.66%) reported they were unsure if hepatitis B was preventable.

Graph E

Q: Do you believe that vaccines are a safe method to prevent disease(s)?

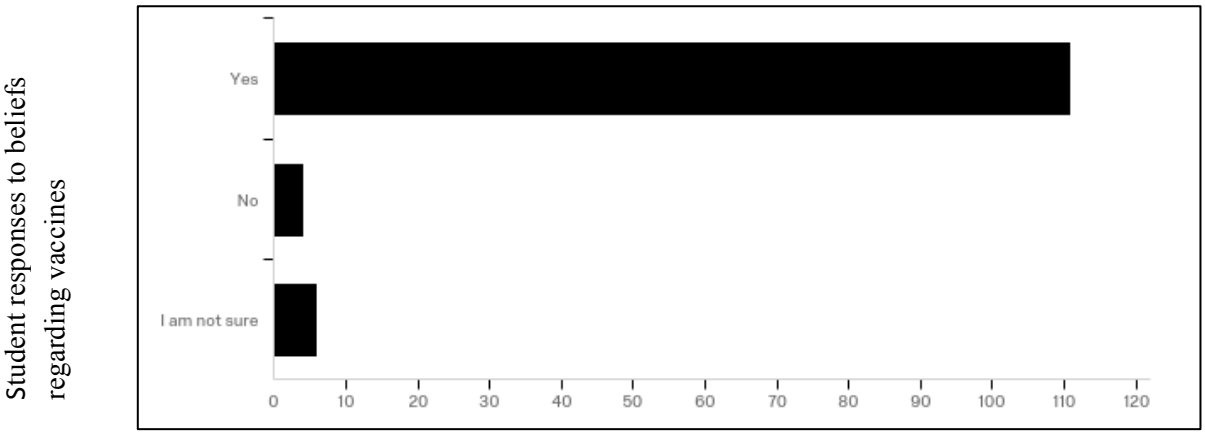


Percentage of students based on beliefs regarding vaccine use

The graph above illustrates the belief that vaccines are a safe method to prevent disease(s). 112 students (92.56%) responded they do believe that vaccines are a safe method to prevent diseases, four students (3.31%) responded they did not believe vaccines are a safe method to disease prevention, and five students (4.13%) responded they were unsure if vaccines were a safe method to disease prevention.

Graph F

Q: Do you believe that vaccines are safe and beneficial to disease prevention?



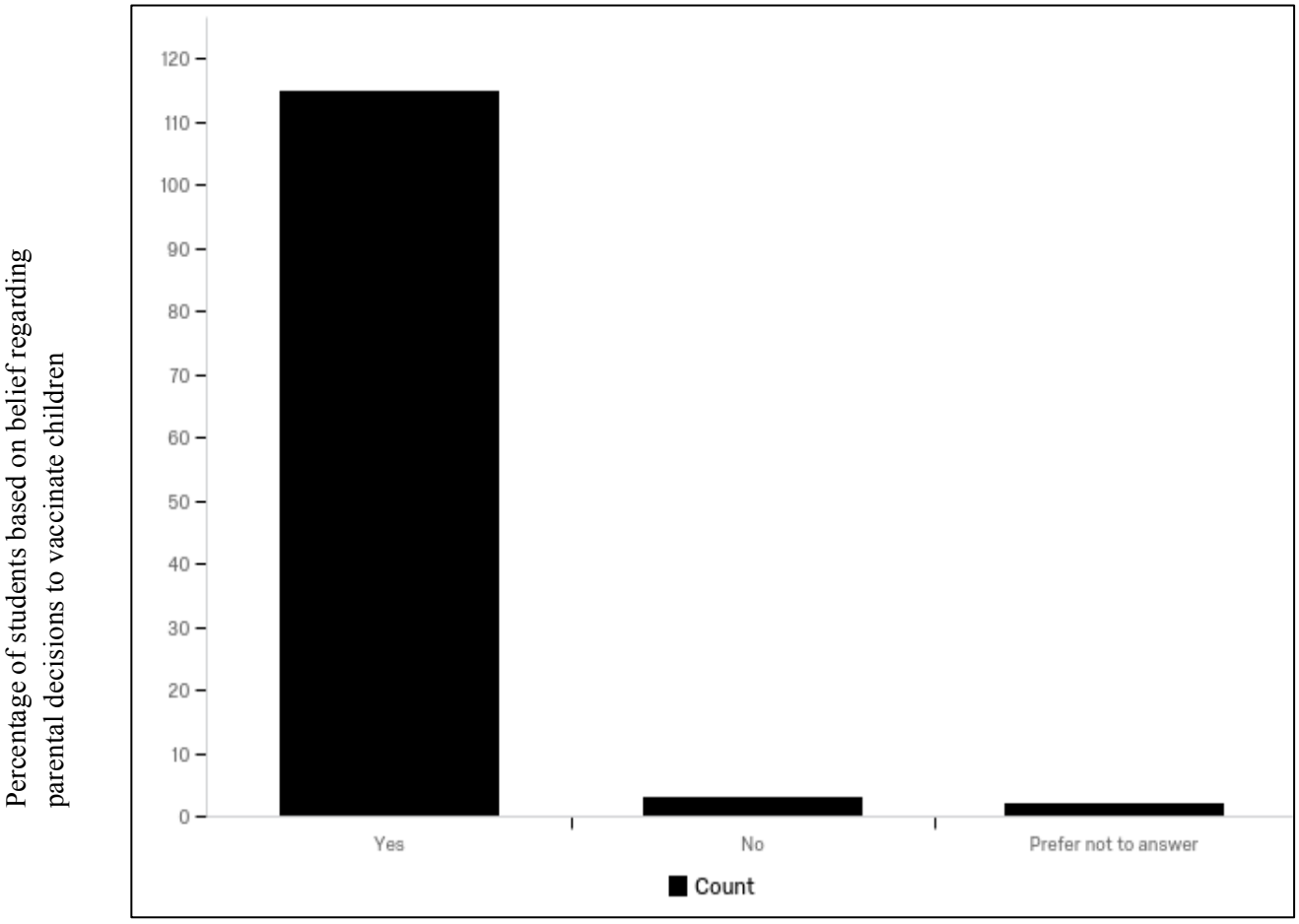
Percentage of students based on beliefs regarding vaccine safety and benefit to disease prevention

The graph above depicts the belief that vaccines are safe and beneficial to disease prevention. One hundred and eleven students (91.74%) responded they believe vaccines are a safe and beneficial to disease prevention, four students (3.31%) responded they do not believe vaccines are safe and beneficial to disease prevention, and six students

(4.96%) responded they were unsure if vaccines are safe and beneficial to disease prevention.

Graph G

Q: Do you believe parents should vaccinate their child/children?



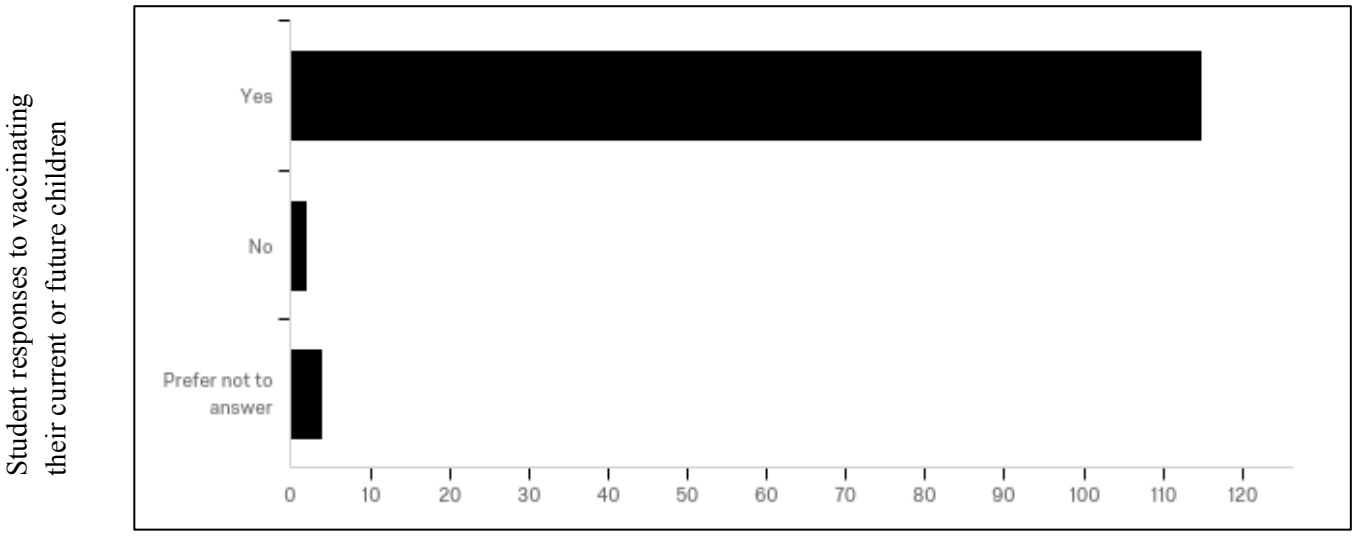
Student responses to beliefs regarding parental decision to vaccinate children

The graph above illustrates students' belief that parents should vaccinate their child/children. 115 students (95.83%) reported they believe parents should vaccinate

their children. Three students reported they do not believe parents should vaccinate their children, and two students preferred not to answer.

Graph H

Q: As a parent, would you vaccinate your child/children?



Percentage of students based on willingness to vaccinate their current or future children

The graph above illustrates whether or not a student would vaccinate his or her child/children.

115 students (95.04%) responded they would vaccinate their child/children, two students (1.65%) reported they would not vaccinate their child/children, and four students (3.31%) reported that they preferred not to answer.

Table 1A
Hepatitis B familiarity based on classification

Q: Are you familiar with Hepatitis B?

Classification	No	Yes	Sample proportions	[Weighted col % (95%CI)]
Freshman	6.0	9.0	.4000000	(.1520774-.6479226)
Sophomore	14.0	12.0	.5384615	(.3468372-.7300859)
Junior	8.0	22.0	.2666667	(.1084215-.4249119)
Senior	11.0	21.0	.3437500	(.1791851-.5083149)
Graduate Student (in pursuit of Masters or Ph.D.)	3.0	15.0	.1666667	(-.00501784-.338835117)

The two- way classification table above reports hepatitis B familiarity based on classification. The total sample consisted of fifteen freshmen, (12.40%), twenty-six sophomores (21.49%), thirty juniors (24.48%), thirty-two seniors (26.44%), and eighteen graduate students (14.88%). Of the fifteen students classified as freshman, six (40%) reported that they were not familiar with hepatitis B and nine (60%) reported that they were familiar with hepatitis B. Of the twenty-six students classified as sophomores, fourteen (53.8%) reported that they were not familiar with hepatitis and twelve (46.2%) reported that they were familiar with hepatitis B. Of the thirty students classified as juniors, eight (26.7%) responded they were not familiar with hepatitis B and twenty-two (73.3%) reported they were familiar with hepatitis B. Of the thirty-three students classified as seniors, eleven (34.4%) reported they were not familiar with hepatitis B and twenty-one (65.6%) reported they were familiar with hepatitis B. Lastly, of the eighteen

students classified as graduate students, three (16.7%) responded they were unfamiliar with hepatitis B and fifteen (83.3%) reported they were familiar with hepatitis B.

Table 1B (Data)
* 10% significance level with a p-value =.098

x-squared	df	p -value
7.8303	4.0	.098

Using a five sample test for equality of proportions without continuity correction at a 10% significance level, the p-value of .098 illustrates that the proportion of students familiar with hepatitis B differs by classification.

Table 2A
Hepatitis B familiarity based on gender

Gender	No	Yes	Sample proportion	[Weighted col % (95%CI)]
Female	27.0	57.0	0.3214286	(-.3045798-.1141036)
Male	15.0	21.0	0.4166667	

The two-way classification table above reports hepatitis B familiarity based on gender using a two sample test. The total sample consisted of thirty-six males (30%) and eighty-four females (70.00%). Of the thirty-six male participants, fifteen (41.7%) reported they were not familiar with hepatitis B and twenty-one (58.3%) reported they were. Of the eighty-four female participants, twenty-seven (32.1%) reported they were unfamiliar with hepatitis B and fifty-seven (67.9%) reported they were familiar with hepatitis.

Table 2B (Data)

x-squared	df	p-value
0.62960	1.0	.4275

A 2-sample test for equality of proportions with continuity correction recorded a p-value of .4275, which indicates that gender is not a significant factor on the influence of hepatitis B familiarity.

Table 3A

Hepatitis B Familiarity based on major (science vs. non-science)

Major	No	Yes	Sample Proportions	[Weighted col % (95%CI)]
Non-Science	18.0	25.0	0.4186047	(-0.05779725 - 1.00000000)
Science	24.0	54.0	0.3076923	

The two-way classification table above reports hepatitis B familiarity based on majors. The total sample consisted of eighty participants (65.04%) with science or applied science majors and forty-three participants (34.96%) with non-science majors. Of the forty-three non-science majors, eighteen (41.9%) were unfamiliar of hepatitis B and twenty-five (58.1%) were familiar with hepatitis B. Of the eighty students with science or applied science majors, twenty-four (30.8%) were unfamiliar with hepatitis B and fifty-four (69.1%) were familiar with hepatitis B.

Table 3B (Data)

x-squared	df	p-value
1.055	1.0	.1522

A two-sample test for equality of proportions with continuity correction recorded a p-value of .1522, which illustrates some evidence that science majors may be more knowledgeable of hepatitis B, but there is no significance.

Table 4

Beliefs regarding vaccine safety and benefit(s) to disease prevention based on classification

Q: Do you believe that vaccines are safe and beneficial to disease prevention?

Classification	Yes	No	I am not sure	p-value
Freshman	14.0	1.0	0.0	.9472
Sophomore	25.0	1.0	0.0	
Junior	25.0	1.0	4.0	
Senior	29.0	1.0	2.0	
Graduate Student (in pursuit of Masters or Ph.D.)	18.0	0.0	0.0	

The two- way classification table above reports beliefs regarding vaccine safety and benefit(s) to disease prevention based on classification. The total sample consisted of fifteen freshmen, (13.01%), twenty-six sophomores (21.14%), thirty juniors (24.39%), thirty-three seniors (26.83%), and eighteen graduate students (14.63%). Of the fifteen freshman respondents, fourteen (93.4%) believed that vaccines are safe and beneficial to disease prevention, 1(6.6%) did not believe vaccines are safe and beneficial to disease prevention, and zero (0%) were unsure of their belief. Of the twenty-six students classified as sophomores, twenty-five (96.2%) believed that vaccines are safe and beneficial to disease prevention, one (3.8%) did not believe vaccines are safe and

beneficial to disease prevention, and zero (0%) were unsure of their belief. Of the thirty students classified as juniors, twenty-five (83.3%) believed that vaccines were safe and beneficial to disease prevention, one (3.3%) did not believe vaccines were safe and beneficial to disease prevention, and four (13.3%) were unsure of their belief.
Of the thirty-three students classified as seniors, twenty-nine (90.6%) believed that vaccines are safe and beneficial to disease prevention, one (3.1%) did not believe vaccines were safe and beneficial to disease prevention, and two (6.3%) were unsure of their beliefs. Lastly, of the eighteen students classified as graduate students, eighteen students (100%) believed that vaccines are safe and beneficial to disease prevention, zero students (0.0%) did not believe vaccines are safe and beneficial to disease prevention, and zero students (11.1%) were unsure of their belief.

Based on the p-value (.9472) determined by the fisher's exact test, classification is an important factor for beliefs on vaccine safety and benefit to disease prevention.

Table 5A
Beliefs regarding vaccine safety and benefit(s) to disease prevention based on gender

Gender	Yes	No	I am not sure	Sample Proportions	[Weighted col % (95%CI)]
Female	75.0	4.0	5.0	0.9493671	(-.11959458-.01832876)
Male	35.0	0.0	1.0	1.00000	

The- two-way classification table above reports beliefs regarding vaccine safety and benefit(s) to disease prevention based on gender. The total sample consisted of 36 males (29.27%) and 86 females (69.92%). Of the eight-four females who responded to this question, seventy-five (89.3%) believed vaccines are safe and beneficial to disease

prevent, four (4.8%) did not believe vaccines are safe and beneficial to disease prevention, and five (5.9%) were unsure of their beliefs. Of the thirty-six male participants, sixteen (97.2%) believed vaccines are safe and beneficial to disease prevention, zero (0%) did not believe vaccines are safe and beneficial to disease prevention, and one (2.8%) were unsure of their belief.

Beliefs regarding vaccine safety and benefit(s) to disease prevention based on gender

Table 5B (Data)

x-squared	df	p-value
0.64553	1.0	.4217

Based on the p-value (.4217) determined by a two-sample test for equality of proportions with continuity correction, gender is not a factor for beliefs regarding vaccine safety and benefit(s) to disease prevention.

Table 6A

Beliefs regarding vaccine safety and benefit(s) to disease prevention based on major

Major	Yes	No	I am not sure	Sample proportions	[Weighted col % (95%CI)]
Non-science	37.0	1.0	5.0	0.9736842	-0.06677037-0.09206087
Science	74.0	3.0	1.0	0.9610390	

Of the forty-three students with non-science majors, thirty-seven (86.0%) believed that vaccines are safe and beneficial to disease prevention, one (14.0%) did not believe vaccines are safe and beneficial to disease prevention, and five (11.6%) were unsure of their belief. Of the seventy-eight students with science majors seventy-four

(94.8%) believe that vaccines are safe and beneficial to disease prevention, three (3.8%) did not believe vaccines are safe and beneficial, and one (1.3%) were unsure of their beliefs.

Table 6B Data

x-squared	df	p-value
$2.7246e^{-30}$	1.0	1.0

Based on the p-value of .9788, determined by a 2-sample test for equality of proportions with continuity correction, majoring in science/ applied science or non-science is not a factor in beliefs regarding vaccine safety and benefits (s) to disease prevention.

Discussion:

Considering the 1995 ACCIP recommendations and the University of Mississippi's current vaccine requirements, the final results of the study are difficult to explain. Potential explanations for the findings of this study are; (a) the distribution of vaccines generally occurs during early childhood/ infancy, so students may be unaware of their vaccination status (b) the presence of a deficit in educational efforts to increase awareness of vaccine use, hepatitis B, and other preventable diseases (c) the presence and strength of various social stigmas regarding hepatitis B infection, hepatitis B transmission, and vaccine use limits their discussion (d) the presence of an age gap limiting the opportunity to witness the effects of preventable diseases prior to the creation and wide spread distribution of vaccines (e) a lack of a clear incentive associated with the knowledge and awareness of hepatitis B and vaccine use among University of Mississippi students and (f) the strength of the beliefs in which an individual uses

to identify his/herself. Although the population of this study was comprised of non-high risk college students, the results illustrate the influence of educational, social, and environmental factors on the knowledge and awareness of hepatitis B and vaccine use as a safe preventative measure- even among educated individuals. An influx of educated individuals that are unaware of hepatitis B and vaccine use as preventative measure for deadly infectious microbes poses a threat to current eradication of preventable infectious diseases. Thus, it is reasonable to develop strategies that incorporate education of hepatitis B, hepatitis B transmission, and vaccine safety and use, while also working to minimize the effects of social scrutiny.

Conclusion

As seen in other parts of the world, once an infectious disease is introduced to a non-vaccinated population it could spread very rapidly." (Flag Wars). An increase in the number of U.S. parents and educated individual expressing opposition to vaccinations against Hepatitis B and other infectious diseases poses a significant threat of the re-introduction of infectious diseases among non-vaccinated populations. A lack of knowledge and awareness of hepatitis B infection and transmission and vaccine use among highly educated students indicates the need for the implementation of specific educational programs at the University of MS directed towards; (a) increasing knowledge and awareness of preventable diseases, such as hepatitis B, (b) minimizing social stigmas associated with these topics, and (c) encouraging and increasing the use of strong educational backgrounds, specifically in science related subjects, to

motivate others to consider the risk side of infectious diseases even when the symptoms are not visible.

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