Analysis of the Effects of Education on College Students' Immunization Beliefs

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Literature Review and Introduction

Immunizations have eliminated many dangerous diseases, such as polio, rubella and tetanus, from the average United States citizen's daily life[1]. But the common phrase 'vaccines are the victims of their own success' abounds in immunization related research. Public health scientists face the problem of informing a new generation who has never seen the devastation that these vaccine preventable diseases can cause. In wake of *The Lancet*'s Wakefield reports combined with other anti-vaccine campaigns lead by celebrities and a few scientists, immunization rates are declining.[2] This lack of immunization has been held responsible for measles and pertussis outbreaks in the United Kingdom and United States.[3] [4] [5] [6] Those who refuse immunization usually reside in the same geographic locations either because of lack of access to healthcare or a clustering of people with the same ideologies. [4] [5] This can create a veritable playground for a communicable disease resulting in epidemics.[4] [5] Research to understand why people are not immunizing themselves and their children has been increasing, but models to describe why do or why don't people undergo preventative health measures have been around since the seventies. It is first important to understand who is not getting immunized, then why they are not getting immunized and then implementing strategies to educate and inform.

To improve immunization, education is often suggested as a tool and there are many models that have been made to help educators best inform their audience. A model often used to describe people's use of preventative health measures, like immunization, is the Health Belief Model.[7] According to the Health Belief Model there are four main tenets that will determine whether or not a person undergoes a preventative health measure: perceived susceptibility, perceived severity, perceived benefits and perceived barriers. When this model is adapted to

immunizations, it very effectively categorizes the reasons people do not get immunized.[8] Perceived susceptibility shows how likely the person feels that they will contract the disease and the perceived severity shows how severe the person believes that disease to be. Both of these are can be affected by the prevalence of disease, which goes down when immunizations are effective. Perceived benefits shows how effective the person believes the immunization to be which can be decreased when the person feels that immunizations are unsafe or ineffective. The perceived barriers would be what prevents the person from receiving an immunization which often include fear of the safety of vaccines, lack of knowledge on where to get vaccines, lack of health care, a religion that does not support immunization and a philosophical opposition to immunization.[5 8 9] This model can give researchers and clinicians a framework in which to understand what lapses in understanding people have in relation to immunization, which can then help shape information campaigns about immunization.

Branching off of the perceived barriers described in the health belief model, there are two categories of barriers unimmunized people can be up against: physical and cognitive. Examples of physical barriers include expense of immunization and inability to find where the immunization is being given whereas, examples of cognitive barriers which can be anything from apathy towards immunization to refusal of immunization based on strong ideological opposition. The two categories each require a different type of understanding and education, and often are experienced by different groups of people.[4 8] A comprehensive framework has been discussed by Jacobson, Targonski and Poland in their article '*A taxonomy of reasoning flaws in the anti-vaccine movement*' which targets those who have cognitive barriers to immunization, specifically those who strongly oppose immunization.[10] This article, derived from a wider model by Gilovich has been fitted to describe immunization refusal.[11] They describe two flaws that

contribute towards anti-vaccination beliefs which are cognitive flaws and motivational/social flaws. The cognitive flaws mainly consist of the human need to find order in random data, preferably to fit our preconceived notions and the motivational/social flaws mainly target misinformation and miscommunication by the mass media and other sources.[10] Using this model, along with the health belief model to understand the barriers and misconceptions a person may have about an immunization and the disease it prevents could help health care providers and public health professionals provide more complete and targeted education.

Most of the research done on vaccine refusal has been done on parents because they are responsible for immunizing the next generation as well as handing down their perceptions of immunizations to their children. A study using data collected from the 2009 National Immunization Survey gave a new perspective on which parents were most likely to refuse of delay their child's immunization schedule. These parents tended to be above the poverty level, English speaking; non–Hispanic white married women who were older than 30, college educated and held private health insurance.[8] It is thought that those who have low health literacy generally will not be immunized, and it is usually assumed that those who have low health literacy are immigrants, non-white with marginal overall literacy skills.[12] This study shows that health illiteracy in immunization may not always be correlated with the usual groups associated with health illiteracy. Basically, just because one may be educated but does not necessary mean understanding the importance of preventative health behaviors.[2] [10] It is important to take into consideration that this article was targeted at those people who refuse immunizations, not necessarily those who cannot get it. Along those lines, an interesting study showed that Mexican immigrants who have undergone 'acculturation,' or assimilation into the United States culture, were more likely to refuse immunization based on concerns about vaccines, as opposed to having

a health care related barrier to immunization.[13] Combined, these two studies could show that there may be something about the United States culture that causes vaccine hesitancy and refusal. But barriers to health care when it comes to immunization should not be undervalued, other studies have shown that lack of access to health care can also plays an important role in creating an under immunized population.[4] These two groups demonstrate two important barriers to immunization. One, a physical barrier: not knowing how or where to get immunized and two, a cognitive barrier: not understanding the importance of getting immunized or holding ideologies that oppose it. Hopefully, by education improving health literacy, these two barriers may be overcome.

As stated before, research about vaccine refusal is often focused on parents and their perceptions of immunization, but college students are a new group of interest. College students are going to be the next generation of educated parents, so it is important to understand what their views and knowledge of immunizations are before they get to the stage in their life where they are making the decisions to immunize their children. To determine college student's opinions on immunizations, the influenza immunization is often used as a model since this immunization is still relevant in their lives. College students are also at a higher risk for contracting communicable diseases, especially influenza, because of their close living quarters and other lifestyle factors and with H1N1, are at particular risk for complications.[15 18] Also, if college students contract influenza they are at risk for missing work or school, which could be detrimental for their academic performance.[16]

According to the research that has been done on college student's perceptions of immunizations, a few common trends have been demonstrated. One thesis that focused on college student's perceptions of immunization showed that college students were just generally

apathetic towards immunization; they simply did not care about the risk that influenza poses, nor about the benefits they could get from immunizations.[17] Studies have shown that college students do not see themselves at risk for contracting influenza, which may tie into their decision not to get immunized.[16 19] However, Ravert, Fu and Zimet made the distinction that college students exhibit unrealistic optimism in the face the H1N1 virus, meaning that though they may acknowledge the fact that college students as a population are at risk, but they do not necessarily see themselves at risk for contracting the virus.[14] A study done at Brigham and Young University showed that college students generally lacked a basic pathological understanding of influenza, which could be contributing to their low immunization rates.[16] It also demonstrated that students did not think that immunizations were too expensive and they did know where they could get immunized, showing that the main barriers for getting immunized for college students were cognitive as opposed to physical.[16]

Who people receive their immunization knowledge from can also play a role in whether or not a person gets immunized. Across both college students and parents surveyed, the largest purveyor of immunization knowledge was the health care providers that the respondents came into contact with, and if the respondent had a good relationship with their health care provider, they were more likely to get immunized.[16 20] A study also stated that college students cited their parents as where they learned about immunizations as well as health care providers.[16] When looking at parents to refused immunizations, Salmon, Moulton and Omer stated that those parents received most of their information from Complementary and Alternative Medicine CAM providers or anti-vaccination groups such as Dissatisfied Parents Together.[22]

Overall, there are informative models in literature to help public health officials create educational strategies to inform the general public on why to get immunized and there is an

starting to be understanding of why people do not get immunized. However, implementation of these strategies and knowledge is the most important or all of this research proves to be for naught. One long term study performed at Minneapolis Department of Veterans Affairs Medical Center demonstrated that increasing both education and availability of immunization for their patients increased the number of people immunized with the influenza and pneumococcal vaccines over a ten year period.[24] Another study, focusing on employees of long term health facilities determined that by having vaccines available at work and by providing education about the vaccine, they were able to increase immunization in their employees.[23] It may be possible for these interventions, and others like them, to be scaled up in the future and hopefully be evaluated for their effectiveness.

It is important for public health officials, when attempting to increase immunization rates, to take into account who makes up the targeted groups are and what barriers they are facing to getting immunized. By studying both parents and college students, two categories to immunization have been explored, physical and cognitive, along with many other models describing why people do not get immunized.

This study looks to explore the perceived cognitive barriers college students have and how if those barriers are altered at all by a fact sheet and/or a pro-immunization statement. This study also seeks to determine if a fact sheet is effective in educating college students on the influenza virus and vaccines.

Methods

Sample

The cohort for this study consisted of 2,000 University of Vermont undergraduates, first years to fourth years as of September 2012, who were selected randomly by the Office of Institutional Studies. Out of the 2,000 students contacted, 459 responded and those who did not complete the survey were excluded from the results leaving a total of 345 respondents, or a 17% response rate. The population of University of Vermont undergraduates is 10,192 and with a confidence interval of 5.5% and a confidence level of 90% this survey sample size can be generalized to the larger population. . Out of those completed surveys, 53 % received an ethics statement (N=183) and 47% did not receive an ethics statement (N=162).

Incentives

Two $50 ITunes gift cards were raffled off as an incentive for the students to take the survey.

Survey Design

Both groups were sent surveys (Appendix I) through the survey provider LimeSurvey to their University email. This survey consisted of two sets of questions, one before and one after looking an informational document on the influenza virus and vaccines. The questions in the survey asked the respondents about their general demographics, tested their knowledge on the influenza virus and vaccine and gained insight into their opinions on vaccines. In the informational document one group just received an informational ‘fact sheet’ on influenza, while the other group also received pro-vaccination statement along with their fact sheet.

The informational fact sheet (Appendix II), given to both groups, contained two parts. The first part consisted of a general influenza virus section which explained the general biology

of influenza, how the influenza virus mutated, symptoms of influenza, treatment of influenza and how to prevent influenza. The second part explored the inactivated and attenuated vaccines by explaining how they worked, the side effects and what groups of people should not be receiving them.

The pro-vaccination statement (Appendix III) focused on the argument that an individual gets vaccinated to protect the individuals around them from getting sick, not only to prevent the individual from getting sick.

Data Collection

Over a period of one month 2,000 University of Vermont were sent one initial email about the opening of the survey and 3 subsequent emails reminding them about the survey if they had not already completed it. Prior to sending out the survey, the study had been approved by University of Vermont's IRB under CHRBS: BB-029.

Data Analysis: Educational Impact of Fact Sheet

Before and after viewing an informational document on the influenza virus and vaccines, the respondents were given a set of ten questions to fill out. Four of these questions covered the respondent's general knowledge of the influenza virus such as what is the infectious agent, what is used to prevent the spread of influenza and how influenza spreads between hosts. The next six questions tested respondent's knowledge of the inactivated and attenuated influenza vaccine, specifically on what the risks and side effects are of each of the vaccines and what groups of people should receive the vaccines.

To analyze the amount the respondent learned by reading the informational fact sheet, the scores before the respondent viewed the fact sheet and the scores after the respondent viewed the informational aid were compared using a paired T Test to determine if the difference between them was significant.

To determine who improved the most based on their initial score, I compared the mean of the first score with the means of the change in scores, using the first score as the independent variable and the change as the dependent variable.

Data Analysis: Immunization Beliefs

To assess the respondent's immunization beliefs the respondents were asked seven questions before and after reading the informational document and, for one group, and the pro-vaccination statement.

The questions fell into one of two categories: immunization and the individual or immunization and the community. Under the immunization and the individual category respondents were asked a series of questions to one, determine if they perceived the influenza virus as a threat to their own health, two to determine if they believed the immunization was going to prevent them from getting the disease and three, to see if the respondents believed that the benefits of vaccination outweighed the risks. In the community and immunization category, respondents were asked questions to one, determine if they were concerned for other members of the community's health during flu outbreaks, two, determine if they believed that vaccines helped prevent the spread of disease in a community , three, to determine if they were concerned about transmitting the virus to other members of the community and four, to determine if they believed the benefits of immunization for the community outweighed the risks for the individual.

These questions were asked in a Likert scale format so the respondent could indicate if they strongly agreed, somewhat agreed, neither agreed nor disagreed, somewhat disagreed or strongly disagreed with the statement.

To assess the respondent's opinion of immunization two questions were taken from the individual category and two from were taken from the community category. The first question from each category demonstrated the respondent's views of the benefits versus the risks of immunization and the second question from each category demonstrated how the respondent viewed the effectiveness of vaccines. The Likert scale responses were first scored on a scale from -2 to 2, with 'strongly agree' being 2 and the rest following suite. Then, those four question's scores were compiled to create a score, ranging from -8 to 8, which reflected a respondent's overall opinions on vaccines. This scoring method was used to assess the respondents overall opinions on vaccines by running a paired T Test on the complied scores before and after the individual viewed the informational aid and/or the pro-vaccination statement.

The same concept of scoring was used to create opinion scores to demonstrate the respondent's views on how immunization affects the community as well as how immunization affects the individual. The same four questions that were used to create the overall opinion score were used to create the community and individual scores, but instead of compiling the scores of the community and individual categories, they were kept separate resulting in scores ranging from -4 to 4. To determine if the change in opinion at the community and individual level was significant, one paired T Test was performed on the community opinion scores before and after the informational document and another T Test was performed on the individual opinion scores before and after the informational document.

I then determined if the statement on why to get vaccinated had a significant effect on respondent's overall opinions on the influenza vaccine or if the change in respondent's overall opinion was solely related to reading the informational aid. The change in the overall opinion scores was expressed as a variable, and this variable was compared between the group that received only the informational aid and the group the received the informational aid and the statement on why to get vaccinated using a paired T Test to determine if there was a significant difference.

Data Analysis: Initial Perceptions of Influenza

I also wanted to evaluate how a respondent's initial perceptions on the influenza vaccine's ability to prevent disease in the community and the individual related their analysis of the risk versus benefits of immunization. Two questions, one that represented the respondent's opinion of how well the influenza vaccine prevented disease in an individual and one that represented the respondent's opinion of how well the influenza vaccine prevented disease from spreading in the community, were translated from their Likert scale into either agree or disagree. Those who neither agreed nor disagreed were excluded from this segment of the analysis. These questions were used as the independent variable when being compared against the respondent's benefit versus risk score using an independent sample T-Test.

Finally, I evaluated respondents' initial concerns for their own health, the health of the members of their community and about transmitting the influenza virus compared to their initial overall opinion score and their analysis of the risk versus benefits of immunization. The three questions that represented those concerns were translated from their Likert scale response into either concerned or unconcerned with those who responded "Neither agree nor disagree"

included in the unconcerned group. These questions were used as the independent variable when being compared against the respondent's initial opinion score and benefit versus risk score using an independent sample T-Test.

Results

Characteristics of the Study Population

The age range for this cohort was from 17 to 43 with a mean age of 20.1 and a standard deviation of 2.58. The respondents were 25% 4th years, 22% 3rd years, 29% 2nd years and 24% 1st years. The gender stratification of the respondents was 69% female and 31% male. Out of all of the respondents, 3% had never been immunized and 27% had never received a flu shot.

Table I: Characteristics of the Study Population

Characteristic	Percent	Number
Year		
1	24%	82
2	29%	101
3	22%	76
4	25%	86
Gender		
Female	69%	238
Male	31%	106
Immunizations Received		
Immunization	97%	334
No Immunizations	3%	11
Influenza Immunization	73%	251
No Influenza Immunization	27%	94

Educational Impact of Fact Sheet

For evaluation of the influenza fact sheet as a teaching tool I looked at all of the respondents. Overall, there was a significant difference between the scores on the quiz before the

respondents looked at the fact sheet and the scores on the quiz once the respondents looked at the fact sheet. I determined a high score to be greater than 10, or 75%. Before the respondents looked at the fact sheet, 58% of respondents had a high score, but after the respondents looked at the fact sheet, 72% of the respondents had a high score. The mean improvement seen was 5.5%, or .722. The percent of respondent that improved their score was 57%, the percent that maintained their score was 20% and the percent that lowered their score was 23%. The data also showed that the respondents that had a low initial score improved the most after seeing the fact sheet (Table II).

A high overall opinion score did not have a significant correlation with a high first test score, $r = .079$, $p > .05$.

Figure I: Knowledge Scores Before Fact Sheet

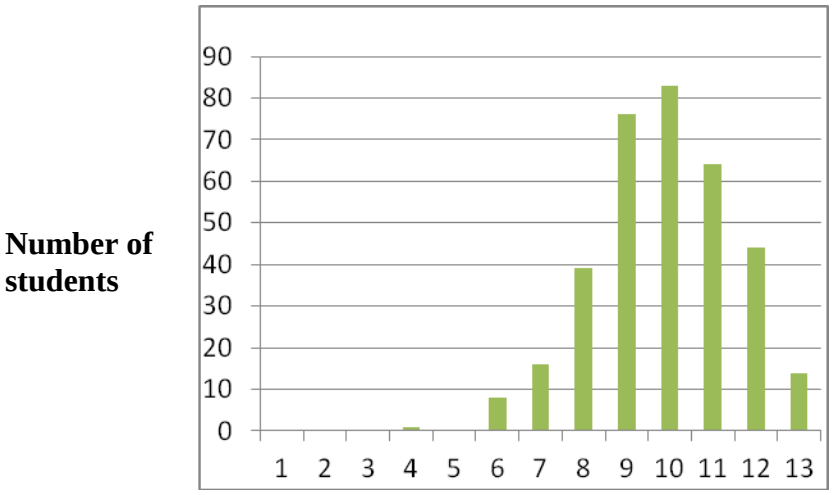

Figure II: Knowledge Scores after Fact Sheet

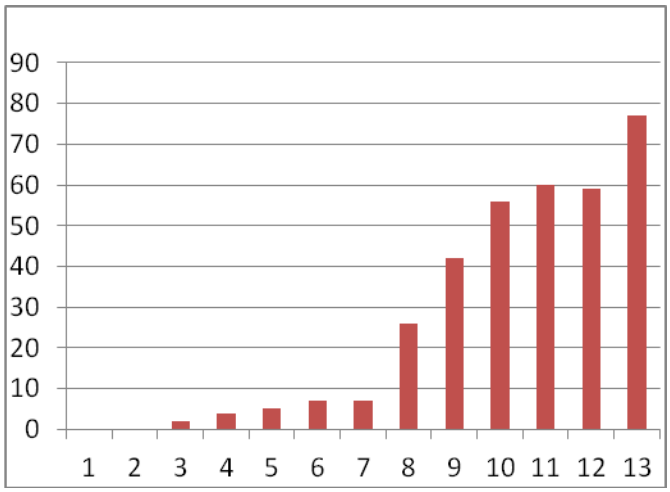

Table II: Changes in Score versus Initial Score

Initial Score	Mean Improvement
4	1.0000
6	3.5000
7	2.2500
8	.7692
9	1.1053
10	.8795
11	.1875
12	.0227
13	-1.1429

Impact of a Pro – Immunization Statement

To evaluate the effect of a pro-immunization statement on an individual's immunization beliefs, I first looked at the group (N = 183) that received the statement along with the fact sheet. Overall, the scores before respondents read the fact sheet and the pro-vaccination statement were

significantly lower than the scores after the respondents read the fact sheet and the pro-immunization statement. The respondents also scored significantly lower on questions related to the community and immunization before the fact sheet and statement than after. Finally, the respondents scored significantly lower on questions related to the individual and immunization before reading the fact sheet and pro-vaccination statement than after (Figure III) (Table III).

In the group that did not receive a pro-immunization along with their fact sheet, the overall opinion scores before reading the fact sheet were significantly lower than the overall opinion scores on the after reading the fact sheet. Similarly, the respondents scored significantly lower on questions related to community and immunization before reading the fact sheet then after. Though, when analyzing questions related to the individual and immunization, the scores before reading the fact sheet were not significantly different than the scores after reading the fact sheet. (Figure III) (Table III)

When the change in the opinion score before and after the informational document was compared between the group the received the statement (M = .65, SD = 0.13) and the group that did not receive the statement (M = .39, SD = 0.12) it was found that there was no significant difference $t(299) = 1.50$, $p > 0.05$.

Figure III: Changes in Opinion Scores

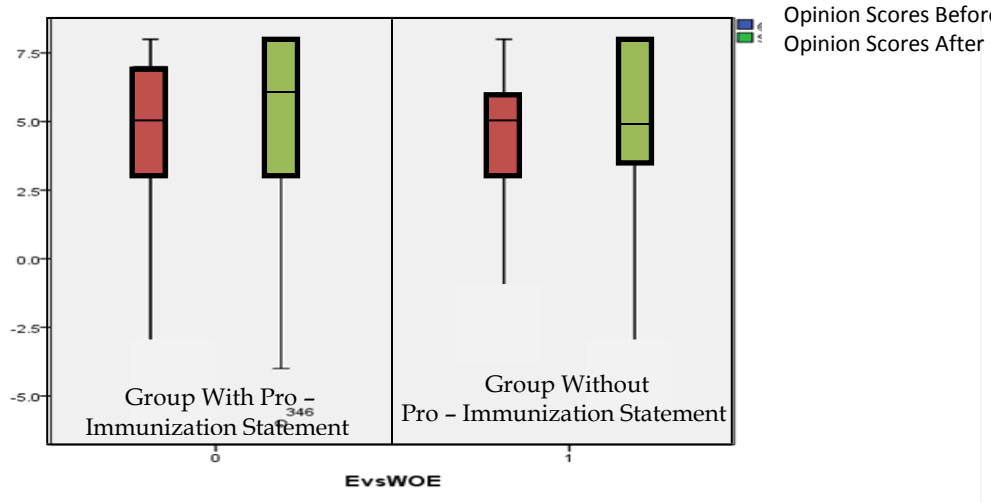

Table III: Changes in Opinion Scores

Topics	Pre Opinion Score	Post Opinion Score	*P* value
With Pro-Immunization Statement			
Community	2.24	2.64	<0.001
Individual	2.08	2.35	<0.001
General	4.32	5.00	<0.001
Without Pro-Immunization Statement			
Community	2.31	2.51	0.01
Individual	2.19	2.32	>0.05 (*NS*)
General	4.50	4.83	0.005

Initial Opinions and Knowledge: Gender and Immunization History

There was no statistically significant difference between males and females in opinions on vaccines. Furthermore there was no significant difference between scores on the initial test and final test for males and females.

Respondents who had never been immunized had a lower opinion of vaccine than those who had been immunized. Also, those who had never been immunized showed a lower initial knowledge of the influenza vaccine than those who had been immunized. Similarly, respondents who had never received the influenza vaccine had a lower opinion of vaccines than those who had received the influenza vaccine. But unlike those who had never been immunized, the people who had not received the influenza vaccine, did not vary significantly from the respondents who had received the influenza vaccine. (Table IV)

Table IV: Initial Opinions and Knowledge: Gender and Immunization History

Immunizations Received	Opinion Score	Knowledge Score
Immunizations	4.47	9.90
No Immunizations	2.45	8.73
P value	0.007	0.017
Influenza Immunization	5.01	10.07
No Influenza Immunization	2.78	9.79
P value	<0.001	>0.05 (*NS*)

Perceptions of Influenza Related to Immunization Beliefs

I also wanted to evaluate how a respondent's initial perceptions on the influenza vaccine's ability to prevent disease in the community and the individual related their analysis of the risk versus benefits of immunization. First, I compared those who believed that immunization helps prevent the spread of disease in a community, 88% of the respondents, to the respondents who did not. The respondents who did not believe that immunization helps prevent the spread of disease in a community generally did not agree that the benefits of vaccines out weighted the risks (M = -.27, SD = 2.05), while those who did believe that immunization helps prevent the spread of disease in a community generally agreed that the benefits of vaccines out weighted the risks (M = 1.93, SD = 1.78), $t(319) = -10.14$, $p < 0.001$.

I then compared the respondents that believed immunization prevented disease in an individual, 91% of the respondents, to those that did not. The respondents who did not believe immunization prevented disease in an individual generally did not agree that the benefits of vaccines out weighted the risks (M = -.86, SD = 1.4) compared to those who did believe immunization prevented disease in an individual, who generally agreed that the benefits of vaccines out weighted the risks (M = .92, SD = 1.05), $t(14) = -4.86$, $p < 0.001$ (Table II).

I also looked at those who were not concerned about their health during influenza outbreaks, 38% of the respondents, to those who were concerned about their health during flu outbreaks, 62% of the respondents. Those who were concerned about their health had a significantly higher (M = 5.48, SD = 5.48) opinion of vaccines than the respondents who were not concerned about their health during flu season (M = 2.69, SD =2.91) $t(236) = -9.31$, $p < .001$. Also those who were not concerned about their health during influenza outbreak tended to believe that the risks of influenza outweighed the benefits.

Then, I compared those who were concerned for other community member's health, 75 % of respondents, to the respondents who were not concerned about other community member's health, about 25% of respondents. Those who were not concerned about other community member's health, tended to have a lower opinion of immunization overall (M = 2.81, SD = 3.12), and not believe that the benefits of immunization outweighed the risks. On the other hand, those who were concerned about other community member's health had a significantly higher opinion of immunization (M = 5.00, SD = 2.62) and tended to believe that the benefits of immunizations outweighed the risks, $t(343) = -6.34$, $p < .001$.

Finally, I compared those who were not concerned about transmitting influenza within the community when they were infected, 13 % of respondents, to those who were concerned about transmitting the influenza virus to other community members, 87% of respondents. Those who were concerned about transmitting the influenza virus had a higher opinion of vaccines overall (M = 4.82, SD = 2.67), and generally believed that the benefits of vaccines outweighed the risks. Whereas those who were not concerned about transmitting the influenza virus to other community members had a lower overall opinion of vaccines (M = 1.55, SD = 2.97) and

generally did not believe that the benefits of vaccines outweighed the risks, $t(343) = -7.52$, $p < .001$ (Table V).

Table V: Initial Perceptions of Immunizations

Questions	Agree	Opinion Score	Disagree	Opinion Score	*P* value
Vaccines help to prevent the spread of disease in a community.	88 %	1.98	22%	-.27	<0.001
Vaccines help prevent an individual from getting a disease.	91%	0.92	9%	-.89	<0.001
I am concerned for my own health during outbreaks.	62%	5.48	48%	2.69	<0.001
I am concerned for other members of the community's health during flu outbreaks.	75%	5.00	25%	2.81	<0.001
When I catch the flu, I am concerned about transmitting the virus to other people.	87%	4.82	13%	1.55	<0.001

Analysis

Using this cohort of 345 undergraduate students, this study showed that an informational fact sheet on the influenza vaccines is useful as a teaching aid as well as being instrumental in improving the respondent's opinions of vaccines. It was also determined that the use of a pro – immunization statement did not did not significantly contribute to the change in opinion that was seen. Finally, this helped gain insight into college student's opinions on the influenza immunization and the influenza virus.

Gender and Immunization History in Relation to Initial Opinions and Knowledge

In this segment of the analysis I was interested in determining the relationship of gender and immunization history to initial knowledge and opinions of immunization.

I was interested in determining if gender was related to more initial knowledge on influenza and if they were related to the changed in score when presented with a fact sheet. As expected, there was no significant difference between men and women on either initial knowledge or increase in knowledge, suggesting that neither group needs to be targeted for teaching than the other. When initial knowledge was related to overall immunization history, the respondents who had never had a vaccine had a significantly lower initial knowledge of the influenza vaccine compared to those who had. A possible explanation is that those who have never been vaccinated have a decreased exposure to vaccines, therefore resulting in a lower initial knowledge. Another possible explanation would be that those people who had learned about immunizations, from influences such as their community or family, then chose to get immunized. Further research would be needed to flush out to what degree which of these explanations played a role in the respondent's decision to get immunized, especially determining what role family or community immunization history plays in the individual's decision to get vaccinated.

When initial knowledge was related to influenza immunization history, those who had not received the influenza vaccine had no significant difference from those who did receive the influenza vaccine. Those who had never received an influenza vaccine may still have received other vaccines, since the influenza vaccine is not as widespread (voluntary vaccine? College students chose to get it, often not paying attention), school so theoretically, they would have had exposure to vaccines resulting in the same initial knowledge as those who had received an influenza vaccine

Gender and immunization history were also analyzed in relation to initial opinion on influenza immunization. When initial opinion of males and females were compared there was no

significant difference, suggesting immunization opinions are not related to gender. But when immunization history was analyzed in respect to opinions there was a significant difference. Those respondents who had either never received an immunization at all or who had never received an influenza immunization had a significantly lower opinions of vaccines than their immunized counterparts. This confirms the hypothesis that those who have a lower opinion of immunization are less likely to get vaccinated overall. Therefore, it is possible if people's opinions on vaccines are changed then they will be more likely to get vaccinated, though further research would be needed to confirm this.

Though this study focused mainly on gender and immunization history, other demographics would be informative and interesting to look at in future studies. Possible suggestions for a study with college students or the general public would be demographics like political and religious affiliations, hometown, profession, family vaccination history and socioeconomic status. These would allow for a more accurate profile of people who agree or disagree with immunizations which would allow for a more targeted approach for education.

In conclusion, it was found that gender was not related to either knowledge or opinions of immunizations. However, complete immunization history was related to knowledge and options of immunizations because those who had never been immunized had a significantly lower initial knowledge and opinion of immunization compared to those who had been immunized. Finally, it was found that history of influenza immunization was related to opinions of immunization, but not knowledge. Those who had never received an influenza immunization had a significantly lower opinion of immunization, but no difference in initial knowledge compared to those who had received an influenza immunization.

Educational Impact of a Fact Sheet

This portion of the study attempted to determine if this fact sheet was an effective teaching tool. What percent improved and what percent decreased was examined.

Overall, fact sheet demonstrated that it was an effective teaching tool for the influenza vaccines and virus because there was a significant improvement between the scores on the before and after tests, with a mean improvement of 5.5%.

The results for these respondent showed that those who scored the lowest initially ended up improving the most. This tread shows that those who had the lowest initial knowledge of the influenza virus and vaccine benefited the most from this informational aid. This trend could also be because those who had a low score had the greatest room to improve, therefore could have a larger mean of improvement. The respondents who initially scored the highest either did not improve their score or they decreased their score and, overall, 23 % of the respondents lowered their score. This decrease in score was unexpected though they could be due to the survey being too long causing people to stop paying attention or the informational aid may have confused some.

Future research could be done to test the respondent's retention of knowledge over time because although the fact sheet may improve knowledge initially, respondents may lose the knowledge if not constantly exposed to it. Another consideration would be where would be the best place to expose the students to the fact sheets and if the fact sheets would still be effective if the students were not reading them in a survey format. Also, research could be done to determine what sections respondents struggled with, be it the actually influenza virus or the two vaccines.

In summary, this informational aid is proven to be useful for teaching, especially to people who do not have high initial knowledge. I also found that those who had never been immunized had a lower initial knowledge, as opposed to those who had been immunized, but I found that this trend did not continue when just related to influenza immunizations.

Impact of a Pro-Immunization Statement

Our study was also used to determine if either a pro – immunization statement and/or an informational fact sheet had an effect on people's opinions on the influenza immunization. I was also interested in what the effect of statement and /or fact sheet was on respondent's community related immunization opinion questions and their individual related immunization opinion questions.

The group that received a pro – immunization statement along with their fact sheet increased their opinion of immunizations from before reading the informational document to after. When the respondent's change in opinion was analyzed in relation to the community related opinions and individual related opinions, there was a significant change in both. This increase in opinion was expected, since the respondents encountered a pro – immunization statement along with their fact sheet. The data proves that a fact sheet including a pro – immunization statement is effective in increasing people's opinions on influenza immunizations overall as well as on both the community and individual level.

The group that did not receive a pro – immunization statement along with their fact sheet did in fact see an overall increase of their opinion on influenza immunizations from before reading the fact sheet to after reading the fact sheet, which was unexpected. Though the overall change in opinion was increased, the changes in individual related immunization opinion

questions were not significantly increased, but the community related immunization opinion questions were significantly increased. This shows that by solely increasing people's knowledge of the influenza virus and vaccines that people's opinions on influenza immunization can be improved, specifically community related immunization beliefs.

When the pro – immunization statement and fact sheet group's change in overall immunization opinion was compared to the fact sheet's group's change in overall immunization opinion there was no significant difference. This was also true when the two group's community and individual related opinions were compared. This analysis shows that the pro - immunization statement had no significant impact on respondent's opinion on influenza immunizations. Consequently that means that the fact sheet was the main effector in changing people's opinions on the influenza immunizations. This result implies that, among college students, education may be the best way to change student's opinions on the influenza immunization, not strictly a pro – immunization campaign. This may be due to the cognitive nature of the barriers college students face when determining whether or not to get immunized. It seems that both apathy and irrational optimism can be resolved with education alone.

The fact sheet was written with the intention of being an objective purveyor of information on the influenza virus and vaccine. Though, as always, bias is impossible to avoid and the fact sheet's author does have an admitted pro – immunization bias; therefore the fact sheet may have unintentionally shown vaccines in a more positive light than intended, resulting in the change in opinion seen in both groups. A possible avenue for further research would be to evaluate an anti – vaccination statement's effect on the respondent's change in opinion, either along with a fact sheet or by itself.

Another possibility for future research would be determining if the respondent's improvement in opinion of influenza immunization was tied to acting on getting an influenza vaccine, either that season or the season following.

Initial Opinions and Knowledge: Gender and Immunization History

In this segment of the analysis I was interested in determining the relationship of gender and immunization history to initial knowledge and opinions of immunization.

When gender was examined as an independent variable, there was no significant difference between men and women on either initial knowledge or increase in knowledge, suggesting that neither group needs to be targeted for teaching than the other. When initial opinion of males and females were compared there was no significant difference, suggesting immunization opinions are not related to gender.

When initial knowledge was related to overall immunization history, the respondents who had never had a vaccine had a significantly lower initial knowledge of the influenza vaccine compared to those who had. A possible explanation is that those who have never been vaccinated have a decreased exposure to vaccines, therefore resulting in a lower initial knowledge. Another possible explanation would be that those people who had learned about immunizations, from influences such as their community or family, then chose to get immunized. A study at Brigham Young University noted that parents were a main source of information for college students on immunization, so perhaps if the parent had little knowledge of immunization then their child would subsequently have less knowledge about immunization. [16] Further research would be needed to flush out to what degree which of these explanations played a role in the respondent's

decision to get immunized, especially determining what role family or community immunization history plays in the individual's decision to get vaccinated.

When initial knowledge was related to influenza immunization history, those who had not received the influenza vaccine had no significant difference from those who did receive the influenza vaccine.

When immunization history was related to initial opinion, those respondents who had either never received an immunization at all or who had never received an influenza immunization had a significantly lower opinions of vaccines than their immunized counterparts. This suggests that those who have a lower opinion of immunization are less likely to get vaccinated overall. A study Therefore, it is possible if people's opinions on vaccines are changed then they will be more likely to get vaccinated, though further research would be needed to confirm this.

Though this study focused mainly on gender and immunization history, other demographics would be informative and interesting to look at in future studies. Possible suggestions for a study with college students or the general public would be demographics like political and religious affiliations, hometown, profession, family vaccination history and socioeconomic status. These would allow for a more accurate profile of people who agree or disagree with immunizations which would allow for a more targeted approach for education.

In conclusion, it was found that gender was not related to either knowledge or immunization beliefs. However, complete immunization history was related to knowledge and immunization beliefs because those who had never been immunized had a significantly lower initial knowledge and immunization beliefs compared to those who had been immunized. Finally, it was found that history of influenza immunization was related to immunization beliefs,

but not knowledge. Those who had never received an influenza immunization had a significantly lower opinion of immunization, but no difference in initial knowledge compared to those who had received an influenza immunization.

Initial Beliefs: Perceptions of Immunization

For this segment of the analysis, questions were asked that demonstrated respondent's views on how effective the intervention of immunization was in preventing influenza in the community or an individual and the perceived seriousness of influenza within the community as well as in the individual. A question was also asked to determine how the respondents felt about their role in the transmission of influenza within the community. All of these responses were then compared to either the respondents overall opinion of immunization and/or their agreeability with the statement that the benefits of immunization outweigh the risks. I also suggest that the health belief model categories can also be extended to encompass the individual's perception of the disease and how it affects the community, not just on the individual.

First, respondents were asked if they believed that immunization helped prevent the spread of disease in the community as well as if they believed that immunization helped prevent disease in the individual. This question was supposed to represent the respondent's perceived effectiveness of the preventative intervention both on the community and individual level and it would fall under the perceived benefits categories of the health belief model. This question was then compared to the respondent's agreeability to the statement that the benefits of immunization outweigh the risks of immunization. As expected, those who believed that immunizations helped prevent disease in an individual and help prevent the spread of disease in a community believed

that the benefits of vaccines outweighed the risks. According to the health belief model, those who perceive that the benefits of an intervention outweigh the risks, they are more likely to get vaccinated.[7] One of those benefits is that immunization prevents the disease, both in the community and individual, so to improve people's perception of the benefits of immunizations a focus in a pro-immunization campaign could be how they prevent disease not only in the individual, but also in the community.

Respondents were also asked about how concerned they were about their individual health as well as community member's health during influenza outbreaks. This question was used to determine the respondent's perception of their and community member's susceptibility to the disease as well as the seriousness of the disease. As expected, those who were concerned about their health and community member's health during influenza outbreaks had more favorable opinions of immunization. This shows that those who have been exposed to the consequences of influenza are more likely to agree with immunization, which could suggest that focusing on teaching what influenza does as a disease could be an effective method for helping people understand why it is important to get vaccinated. Also, more people were concerned about community member's health than their own, which would be expected in college aged students. But unfortunately certain types of influenza can be more detrimental to college aged students, and college aged students are more likely to get influenza due to their living conditions, so educating college students about their risks when getting influenza might be help to increase immunization in this population.

Respondents were also asked a question about whether they were concerned about transmitting influenza when they were infected with the virus which was to determine how the respondent perceived their role in spreading the virus in the community. Those who were not

concerned about transmitting the influenza virus generally did not believe that the benefits of vaccines outweighed the risks and had an overall lower opinion of vaccines. This shows that those who are not concerned with transmission, or maybe not aware of the contagiousness (low ID) of influenza, are less likely to agree with immunization. Possibly, if education of how easy it is to infect other people with the virus was used then people's opinions of vaccinations would increase which would hopefully in turn increase immunization.

An interesting trend that was seen across these questions, with the exception of the question which related to preventing the disease in an individual, was that after reading the informational document those who answered 'neither agree nor disagree' decreased. An explanation for this would be that by just getting those people who do not normally come in contact with information about immunization to start thinking and learning about them caused those respondents to form an opinion about immunization. This phenomenon was described in both Gust et al. and Kennedy, Basket and Sheedy as 'fence sitters' who often do not necessarily disagree with immunization or agree, but when educated will choose to immunize.[20 25] This group is particularly important because they are equally susceptible to anti-immunization education as they are pro-immunization education.

Future research would be helpful in determining how education on the basis of each of these perceptions, prevention of the disease in the individual and community, concern about health of the community and individual and transmission, affects people's opinions on immunization and willingness to get an immunization.

Limitations

The limitations of this study mainly lie in their demographics. Vermont has a notoriously low opinion of immunization which could have led to the high amount of people disagreeing with immunization. Also, the population was only of college students from a college campus that is not very ethnically diverse. Overall, these findings would not be generalizable to the rest of the United States, though the methodology could be.

Summary

This study shows that not only is an informational fact sheet an effective teaching tool, it also shows that education is paramount for changing individual's opinions on immunization. To be most effective on changing an individual's opinion on influenza, education on how immunization not only prevents disease in the individual, but also in the community, on the consequences for individuals and communities after being infected by the virus and on how transmittable the virus is from person to person.

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