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The Role Predictors of Socioeconomic Status Play in Receipt of the Shingles Vaccination in Adults Aged 50 Years of Age and Above in the United States

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The Role Predictors of Socioeconomic Status Play in Receipt of the Shingles Vaccination in Adults Aged 50 Years of Age and Above in the United States

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Abstract

Introduction: Vaccinations help to prevent deleterious diseases or lessen their side effects, saving millions in healthcare expenditures. While we associate most vaccinations with children, there are specific vaccinations that are indicated in the elderly. The shingles, or herpes zoster, vaccination is indicated in all adults over the age of 50 years of age to prevent the development of or lessen the severity of shingles – the re-emergence of chickenpox in the form of painful blisters on the body, however, statistics indicate that only around 20% of the indicated population has ever received that vaccination. Why have so few been vaccinated? This study examined what predictors of socioeconomic status affect vaccination rates as socioeconomic status is a key player in vaccination behavior in the United States.

Methods: A cross-sectional descriptive study using data from the National Health Interview Survey of 2013 was conducted using χ^2 tests to determine how some of the key determiners of socioeconomic status - income, education, and insurance - affect shingles vaccination rates among adults over the age of 50. Other variables examined were race, ethnicity, gender, marital status, history of chickenpox, and history of pneumonia vaccination.

Results: After conducting multiple cross-sectional analyses using χ^2 tests, results indicate that socioeconomic status as defined by income, education, and insurance coverage does influence shingles vaccination rates. As income and education increase, reported vaccination rates also increase.

Conclusion: Public health practitioners need to find ways to overcome the significant barriers in education and income that currently exist that are preventing adults from receiving the shingles vaccination in order to improve health outcomes.

Introduction

Vaccinations are an important part of maintaining good health and, while people often associate them with childhood immunizations, there are several vaccines that adults should get later in life.[1] The flu vaccination is one that is recommended annually for the majority of the adult population due to the nature of the illness, therefore making it a very familiar vaccine to most everyone. However, there are other vaccines given less frequently that are of great importance as a person ages. One vaccination many elderly patients are familiar with is the pneumonia, or pneumococcal, vaccination. All adults over ≥65 years are strongly encouraged to get the pneumonia vaccination and many qualify to receive it at an even younger age if they possess certain comorbidities. While it does not necessarily prevent pneumonia, it does lessen the severity of symptoms and improves both morbidity and mortality. About 65% of adults within this age group have received this vaccination, and widespread efforts are being made to improve this percentage.[2]

Another vaccination that is less well known is the shingles, or herpes zoster, vaccine, which was approved by the FDA in 2006. This vaccination works against the reactivation of the varicella zoster virus – the virus that causes chicken pox in children and herpes zoster, or shingles, in adults. Like the pneumonia vaccination, the shingles vaccination does not necessarily prevent shingles, but it does lessen the severity of symptoms and reduces morbidities associated with it. The CDC currently recommends that all adults over the age of 60 receive the shingles vaccination, regardless of whether they recall having had the chicken pox at any point in their life or not. Current research has shown that over 99% of adults ≥40 years of age have been exposed to the varicella zoster virus regardless of development of chicken pox in childhood and are therefore at risk of developing shingles.[3]

Despite this knowledge, in 2012 it was reported that only 20.1% of all adults in the United States ≥60 years of age reported having ever received the zoster vaccination.[4]

The potentially deleterious consequences of shingles warrant receipt of this vaccination. Among those who develop shingles, over one-third will develop serious complications.[5] Postherpetic neuralgia, a long-term pain resulting from viral damage to sensory nerves, occurs in 10% of patients aged 60-69 years who develop shingles, and in 20% of those over the age of 80.[6] In many patients, this remains a lifelong complication long after the virus has cleared.[5] Patients can also develop herpes zoster ophthalmicus, which is a complication occurring in 10 - 20% of cases and one that can involve the entire eye causing keratitis, scarring, and vision loss.[6, 7] Lastly, in immunocompromised patients who develop shingles, fatalities have occurred.[5] Shingles can leave patients debilitated long after the virus retreats, but getting vaccinated prior to the development of shingles can abate the more severe symptoms in those who do develop it, and for some patients even prevent any reactivation of the varicella zoster virus that causes shingles.

In order to increase vaccination rates in the population, it is important to understand the dynamics of the patients who are being vaccinated and those of who are not. For many years, positive health opportunities/outcomes have shown to be significantly affected by socioeconomic status (SES). While data has been collected on race and shingles vaccination rates, no data exists evaluating the impact that SES has on receipt of the shingles vaccination. One of the most recent reviews conducted that addresses the shingles vaccination comes from the Journal of the American Medical Association and identifies characteristics of patients most likely to get the vaccination. These characteristics include white women who have fewer chronic disease states and more outpatient doctor

visits.[4] However, this article is limited by the database used, which includes only insured patients within the managed care system of Kaiser Permanente. Additionally, it does not address certain determinants strongly associated with SES. While research on the shingles vaccination and it's association with SES could not be found, a few studies have evaluated this relationship with the influenza and pneumonia vaccines. This data suggests that vaccination rates are higher among white women and those with higher SES[8, 9] While this evidence can be used to make predictions concerning the shingles vaccination, there is a knowledge gap of the impact that various determinants of SES have on vaccination receipt. This information is particularly important because the shingles vaccination remains the most expensive on the market due to its relatively recent release.

Over 1 million new cases of shingles develop each year and the Agency for Healthcare Research and Quality recently estimated that an average of $566 million is spent annually on health care costs for shingles and its complications.[10] This study will explore how determinants of SES impact receipt of the shingles vaccine. Specifically, we examine whether there is a relationship between variables associated with income and education and the likelihood that a patient will have received the zoster vaccination. While little literature is available on the topic, we believe that, based on primary literature concerning similar vaccinations, SES serves as a predictor of receipt of the shingles vaccination. More specifically, we predict that those with associated with determinants predicting lower SES will have lower vaccination rates than those associated with determinants of higher SES. Identifying this gap in care will provide guidance to public health efforts aimed at improving vaccination rates among certain populations. In turn, this

redirection of efforts will hopefully improve the economic and medical burden of shingles within the United States.

Data Collection

The data for this study comes from the National Health Interview Survey (NHIS) of 2013. Since 1957, the NHIS has been conducted annually across the United States. The purpose of the NHIS is to monitor the health of today's population by collecting and analyzing data on a wide range of health topics.[11] Today, this survey is considered a cross-sectional household interview survey in which sampling and interviewing for the survey are ongoing throughout the year. The sampling plan of the NHIS is composed of two stages that identify a total expected sample size (completed interviews) of approximately 35,000 households containing around 87,500 persons. The NHIS has perfected what is called the "oversampling procedure" in order to ensure that minorities are equally represented in the survey sample.[11] Therefore, a major strength of our study design in utilizing this survey is that it reaches and identifies health characteristics spanning the entire U.S. population and associations can be made with both demographic and SES characteristics.

Data collection is obtained through face-to-face home interviews conducted by the U.S. Census Bureau utilizing the NHIS questionnaire. This questionnaire consists of a "Core" that has four main components: the Household Composition section, the Family Core, the Sample Child Core, and the Sample Adult core.[11]Each household address randomly selected for participation in the NHIS received a letter prior to the interviewer's visit detailing the purpose of the NHIS, the amount of time the interview would require, and the confidentiality associated with all information provided by the participants. Upon home arrival, the interviewer obtained verbal consent from the household members for

participation. For the year of 2013, the NHIS collected data on 41,335 households containing 104,520 persons in 42,321 families.[11]

Measurement

For this study, we used data from the 2013 National Health Interview Survey. To be eligible for use in our study, participants had to be 50 years of age or greater at the time of the interview. The age of 50 was chosen because in 2011 the FDA reduced the approval age fo the vaccination to 50 and above. The CDC, however, maintains its recommendation of vaccination only in those aged 60 years and above due to lack of data supporting its use in a younger population. While some insurance plans still do not cover the vaccination for patients younger than the age of 60, we felt it necessary to include all those eligible to receive the vaccination. Individuals were excluded who did not meet the inclusion criteria. Our final sample included 16505 participants. This study was waived by the University of Kentucky IRB due to the secondary nature of the data.

Separation by Medicare Eligibility

We separated the 16505 participants into two age categories - "50-64 years" and "65 years and above" - for our statistical analyses based on the age when most Americans become Medicare eligible. All Americans qualify for Medicare at the age of 65. Certain medical conditions do qualify patients for Medicare at a younger age. However, this is a very small percentage. We believed it was necessary to separate these groups in this manner because insurance coverage changed from 83.7% in those 50-64 years of age to 99.0% for those over the age of 65 - a difference which we predicted might have a significant impact on vaccination rates.

Variables

Whether or not individuals received the shingles vaccination was the dependent variable and was a dichotomous measure of yes and no responses. The independent variables used as predictors of SES were household income, ratio of family income to the poverty level, personal education, and family education. Income and education are two of the parameters most often utilized in national data as the primary predictors of SES. [12, 13, 14] Insurance coverage and type were also evaluated. All variables were evaluated as categorical data, as defined by the NHIS survey.

The NHIS reports household income through a series of prompted questions. We aggregated this data to our need of simple categorical ranges as defined by the survey. The income categories were $0-$34,999, $35,000-$74,999, $75,000-$99,999, and $100,000 and over. Ratio of family income to the national poverty level was also used to evaluate the relationship between income and vaccination and was re-categorized into "less than 1.00", "1.00-1.99", "2.00-3.99", and "4.00 and over" – 1.00 being equal to 100% the national poverty level. Personal education and highest education attained within the household were re-categorized into groupings ranging from "less than/equal to 8th grade" to "master's, professional, or doctoral degree." Health insurance status was described in two ways. We analyzed the dichotomous variable of "yes" or "no" response to having insurance. Additionally we categorized insurance information by type - private, Medicare, Medicaid, military, and not covered.

Other demographics

Gender, race, ethnicity, marital status, and having ever had the chicken pox were included as covariates. Medicare Part D coverage and pneumonia vaccination receipt were

also evaluated. Gender was dichotomized into male or female. Race was re-categorized to white, African American/black, American Indian/Alaska Native, and Asian. Hispanic ethnicity and having ever had the chicken pox were variables dichotomized into "yes" and "no." Marital status was organized categorically. Medicare Part D coverage is an important covariate and was included because patients with Medicare do not automatically receive Medicare Part D coverage, but must purchase it. Medicare Part D covers most vaccinations and therefore could confound our data. Pneumonia vaccination receipt was dichotomized into "yes" and "no" and was included because we wanted to evaluate if any relationship existed between receiving it and having increased likelihood of receiving the shingles vaccination.

Analytic Plan

This study examined the relationship between SES and zoster vaccination rates in adults over the age of 50 using data from the 2013 National Health Interview Survey. We obtained descriptive statistics on all 16505 participants over the age of 50 in all categories described above (see table 1). These statistics were separated by age into the categories of "50 to 64" and "65 and above" due to participant eligibility for Medicare enrollment at the age of 65. A series of bivariate analyses were then conducted using χ^2 tests to examine the relationships between the independent variables and participants receipt of the shingles vaccination. Data was again stratified by the same age categories. P-value was set at $p \leq 0.05$. Analyses were performed using SPSS Statistical Software (IBM SPSS Statistics for Windows, Version 22.0). Any missing, unknown, or unreported data were excluded from the analyses.

Results

Participants

Of the 16505 participants over the age of 50, 53.2% were between the ages of 50-64. Of all participants, most identified as female (56.8%), white (78.7%), non-Hispanic (88.7%), and married (45.5%), with a significant portion of those greater than 65 identifying as widowers/widows (34.5%). Most participants and their family member with the highest education had a high school degree/equivalent or higher. Reported household annual incomes were different between age groups and ratio of family income to the poverty line differed between patients 50-64 years of age and those over the age of 65. More details can be found in Table 1. Most participants aged 50-64 had private insurance (62.7%), while 94.7% of those aged 65 and above had Medicare. 16.3% of 50-64 year olds reported not having insurance coverage, while only 1.0% of those aged 65 and above were uninsured. Of all participants with Medicare, only about half reported having Medicare Part D coverage (48.5%). Over 80% of all participants report having had the chickenpox, but only 8.9% of 50-64 year olds and 25% of those over 65 have ever had the shingles vaccination. Not surprisingly, more interview participants reported receiving the pneumonia vaccination (22.0% of 50-64 year olds; 58.8% of 65 years old and above)

Shingles Vaccination Data

The first χ^2 tests were conducted to evaluate the percentage of participants who have had the shingles vaccination cross-evaluated by each variable and separated by age groups. The results showed that of all 16,505 participants included, a larger proportion of women than men (18.1% vs. 14.4%, respectively; $df = 1$; $p < 0.001$) reported ever having received the zoster vaccination. Blacks/African Americans and those of Hispanic descent

reported lower vaccination rates (8.7%; $p < 0.001$ and 7.3%; $p < 0.001$, respectively). Both individual and family member education variables reflected vast differences in vaccination rates. In both age groups, those with a master's, professional, or doctoral degree reported vaccination rates around three times that of participants with less than a high school education. As income and ratio of family income to the poverty level increased, vaccination rates increased among all study participants. Those with any type of insurance coverage reported higher rates of receiving the shingles vaccination than those not covered (17.7% vs 3.9%, respectively; df =1; $p < 0.001$). In the 50-64 age group shingles vaccination rates were highest in those with private and military insurance coverage and for those aged 65 and above, the participants with the highest vaccination rates reported were those with Medicare. Of all 16505 participants, analyses also found that those who received the pneumonia vaccination more often reported receiving the zoster vaccination than those who had not received the pneumonia vaccination (29.5% vs. 8.2% respectively; df =1; $p <0.001$). In those participants with Medicare, another χ^2 test was conducted to evaluate the relationship between having Medicare Part D and receiving the herpes vaccination. No statistical difference was found to exist ($p = 0.958$).

Additional cross-sectional analyses using χ^2 tests were conducted to evaluate the relationships among our variable predictors of SES and receipt shingles vaccination. We evaluated participant education level and highest education level obtained by a family member in the household (two separate tables) by shingles vaccination rates and stratified by two measures of income and insurance coverage and separated by age groups (Tables 3 and 4).

For all study participants, their highest personal education level obtained statistically significantly impacted their receipt of the shingles vaccination across all groupings of ratio of family income to the poverty level except those aged 50-64 with a ratio of family income to the poverty level of 2.00-3.99 ($p = 0.125$). In stratifying these same participants to total combined family income, all results were statistically significant except those aged 50-64 making either $35,000-$74,999 or $75,000-$99,999 ($p=0.149$ and $p=0.753$ respectively). For participants aged 50-64, personal education level obtained was statistically significantly associated with receipt of the shingles vaccination, regardless of type of insurance coverage if any, with the exception of the group covered under the military ($p = 0.064$).

In analyzing the highest education level obtained by a family member in the household, education was significantly associated with vaccination across both ratio of family income to the poverty level and total combined family income, except for those aged 50-64 falling in the 2.00-3.99 times the poverty line ($p = 0.122$), those aged 65 and above falling less than 1.00 of the poverty line ($p = 0.072$), and those aged 50-64 with combined family incomes falling between $35,000-$74,999 and $75,000-$99,999 ($p = 0.080$ and $p = 0.169$, respectively).

Our final bivariate analysis (Table 5) used χ^2 tests to evaluate the relationship between receipt of the pneumonia vaccination and receipt the shingles vaccination stratified by the two variables of education, two variables of income, and insurance coverage and separated by age groups. All results were statistically significant across all variables, showing that as income and education levels increased in those who did or did not have the pneumonia vaccination, shingles vaccination rates also increased.

Discussion

To the best of our knowledge, this is the first study examining the relationship between shingles vaccination rates and factors predictive of socioeconomic status (SES) in the United States using data from the NHIS. Our results suggest that a positive association exists between predictor variables of SES and receipt of the vaccination. More specifically, vaccination rates are influenced by combined family income, ratio of family income to the poverty level, highest personal education attained, and highest education attained by a family member living in the same household. Other variables we examined that also seem to have an influence on vaccination rates are insurance, gender, race, ethnicity, and receipt of the pneumonia vaccination.

In our bivariate analysis examining the predictor variables of SES and the percent of participants who received the zoster vaccination (Table 2), the evidence showed a statistically significant increase in percentage of participants vaccinated as highest education level - both personal and that attained by family member – combined family income, and ratio to the poverty level all increased. Additional analyses examining education stratified by income and ratio to the poverty level (Tables 3 and 4) suggested a statistically significant trend that higher education is associated with a higher likelihood of being vaccinated across most income levels and ratios to the poverty level. The exception were those in the age group of 50-64, making a family income between $35,000-$99,999 and living at 200-400% of the poverty level. These groups did not have a statistically significant association of education and shingles vaccination. A factor that may be playing a role is that while the vaccination is FDA approved at ≥ 50 years of age, the CDC does not agree with this and maintains their recommendation of vaccination at ≥ 60 years of age. As

a result, some insurance providers either do not provide assistance with the cost of the vaccine or require prior authorizations for patients aged 50-59. These are barriers to vaccination. Zostavax, the only available shingles vaccination on the US market at this time, has an out-of-pocket cost of around $200. This expense combined with discrepancies in age recommendations may be significant confounders for this age group. Additionally, there were certain cells that had expected counts less than 5 in our analysis due to the nature of income in relationship to education. For example, in Table 3 in the 65 and older age group, only a very small number of participants were living below the poverty level with Master's, Professional/Doctoral degrees. The same is true in Table 4. Also in table 4, very few participants had less than a high school degree with a combined income at or above $100,000 or were living at 400% or above the poverty level. These small groups can also have a confounding effect on our evaluation of our non-significant and significant p-values.

Our last data analyses (table 5) showed that reported shingles vaccination rates increased as income and education increased, regardless of whether the participant had ever received the pneumonia vaccination. This was contrary to our assumption, as we believed that receipt of the pneumonia vaccination, particularly in those above the age of 65, would actually serve as a moderator of the shingles vaccination. We expected that those with a positive history of the pneumonia vaccination would have reported similar rates of the shingles vaccination across all income and education levels. The pneumonia vaccination is indicated for all adults over the age of 65, and therefore, particularly in this age group, we assumed that if the participant had been recommended the pneumonia vaccination and had received it, they should have also at that same point in time been recommended the shingles vaccination. Therefore, for those saying "yes" to receiving the pneumonia

vaccination, we expected similar shingles vaccination rates across income and education. While participants reporting positive receipt of the pneumonia vaccination also reported higher shingles vaccination rates than those who had no history of receiving the pneumonia vaccination, receipt of the shingles vaccination was still statistically significantly associated with increases in income and education. This suggests that education and provider recommendations are incredibly important in vaccination receipt. We hypothesized that those with higher access to care, those who visit the doctor more often and therefore have more points of healthcare contact, are more likely to be asked about vaccination status and thus more likely to subsequently be vaccinated. But, our results also suggest that there is an educational gap when it comes to the shingles vaccination, in addition to a potential need for increased provider recommendations of the vaccination. Understanding this relationship would offer greater insight into how access to vaccination can be improved for patients. This variable needs further exploration in future studies.

Individuals of low SES have been shown to disproportionately share the burden of diseases versus those of higher SES.[15] Engaging in preventive health behaviors, such as immunization, is significantly related to SES.[16] While this study did not explore creating an index to measure SES, the multiple bivariate analyses revealed significant associations between income and education variables – predictors of SES - and shingles vaccination rates. Individuals with lower income and lower education attainment reported lower vaccination rates. Research studies on other vaccinations such as the flu and pneumonia vaccinations have also reported similar findings.[6, 17, 18]

One limitation of this study is that the information analyzed came from secondary data. This limitation prevented the inclusion of a commonly used predictor of SES – occupation.[13,14,15] Primary lifetime occupation data, either present occupation or past occupation for retirees, was not gathered in a usable manner in the NHIS. Another limitation is how the NHIS approaches combined family income. Much of the population in our study, particularly those over the age of 65, is most likely retired. The NHIS reports current combined family income, which as a retiree can be very different from what their income was as an employed person, and many times is less. While socioeconomic status can fluctuate, a person's lifetime average income is probably a more accurate predictor than that obtained in retirement. Another limitation of the NHIS is it did not include the right "access to healthcare" questions that could have been useful in our study, particularly when evidence has shown a significant relationship between receiving the pneumonia vaccination and having had the shingles vaccination. Low SES is also an important determinant of access to healthcare, but we were unable to evaluate this in our study. An additional limitation of this study is the NHIS did not ask when the participant received the shingles vaccination, which would have been useful information in understanding how CDC recommendations influence the age at which participants are getting vaccinated. A fifth limitation is effect size. With such a large sample, effect size was incredibly small for all variables included in Table 2. However, there were medium to large effect sizes for most all data presented in Tables 3, 4, and 5 strengthening the relationships between our SES predictors and vaccination rates. A last limitation is that this data comes from 2013, which is the most recently available data. This is prior to the complete installation of Obama Care, and therefore the data on shingles vaccination rates may be different now.

In order to gain a complete understanding of the role that SES plays in herpes zoster vaccination rates, a multivariate analysis with an SES index needs to be conducted. Unfortunately, there is no universal constructed measure for SES available. A consensus on how to logistically measure SES would be incredibly useful to conduct future research. Conducting a prospective longitudinal study that includes the variables we evaluated in addition to questions concerning occupation and access to healthcare would give a clearer picture of how SES influences vaccination rates in this patient population. Having a more complete understanding of patient interactions within the healthcare system concerning this vaccination will provide a springboard for exploring ways to improve vaccination rates.

The shingles vaccination is approved in all patients over the age of 50, yet according to our study, only 16.5% of this population has been vaccinated. All patients should receive the vaccination, regardless of ever having had chickenpox.[3] This study gives evidence of an association between education, income, and receipt of the shingles vaccination. Clinics, community health centers, and pharmacies need to increase their efforts to educate patients on the necessity of the vaccination in an attempt to improve vaccination rates. Pharmacists can actually serve as key players in boosting vaccination rates because they are so easily accessible to patients and interact with most on a monthly basis. A recent cross-sectional interventional study conducted in multiple pharmacies in Florida and Alabama assessed multiple variables concerning patients ≥ 60 years of age and the shingles vaccination. The study found that patients were more likely to be vaccinated if they received a recommendation from a provider or knew that shingles was recommended for their age group.[19] The most frequent reasons given for not being vaccinated were they

hadn't gotten around to it or forgot or they were not aware that it was needed, but after receiving education on the vaccine, the majority of patients were interested in discussing receipt of the vaccine.[18] This is only one of many examples of pharmacist driven intervention that has made a difference in vaccination rates.[20-23]

An additional avenue of intervention to improve vaccination rates could be lobbying for subsidies to vaccination in order to overcome the income disparities that exist with vaccination. Across all income variables in our study the evidence shows as income increases, vaccination also increases. The vaccination will continue to remain expensive for the life of the patent, and patients will continue to experience shingles and perhaps worse complications than they might have because they couldn't afford the vaccination unless we create avenues of affordability for patients.

Shingles is currently an overlooked viral disease by much of the older population that unfortunately can have unpleasant and sometimes permanent consequences. This study shows that vaccination rates are complicated by the major predictors of SES - income and education – and other variables. Efforts need to be made to improve vaccination rates and improve the economic and medical burden of this disease.

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Table 1: Descriptive Characteristics of Participants in the National Health Interview Survey Aged 50 and Above and Stratified by Age When Eligible for Medicare

Variable	Percentage			p-value
	Age 50-64	Age 65 +	All age 50+	
Participants	53.2 (8,773)	46.8 (7,732)	100 (16505)	
Gender				
Male	45.8	40.3	43.2	p< 0.001
Female	54.2	59.7	56.8	
Race				
White	76.9	80.8	78.7	p< 0.001
Black/African American	17.2	13.7	15.6	
Indian (American), Alaska Native	1.1	1.1	1.1	
Asian	4.8	4.5	4.7	
Ethnicity				
Hispanic	12.5	9.9	11.3	p< 0.001
Marital status				
Married	48.9	41.6	45.5	p< 0.001
Widowed	6.0	34.5	19.4	
Divorced	23.7	15.3	19.7	
Separated	4.0	1.5	2.8	
Never married	13.3	5.8	9.8	
Living with partner	4.2	1.3	2.8	
Education (personal)				
Less than a high school education	14.0	22.3	17.9	p< 0.001
High school graduate/ equivalent	26.8	30.4	28.5	
Some college/associate's degree	30.6	24.4	27.7	
Bachelor's degree	17.8	13.0	15.5	
Master's, professional, doctoral degree	10.7	9.9	10.3	
Highest education attained within family				
Less than a high school education	9.4	16.7	12.8	p< 0.001
High school graduate/equivalent	22.3	27.2	24.6	
Some college/ associates degree	32.3	27.2	29.9	
Bachelor's degree	21.0	15.2	18.3	
Master's, professional, doctoral degree	14.9	13.8	14.4	
Household (family) income, $				
0 -34,999	37.4	53.5	44.8	p< 0.001
35,000 -74,999	30.8	30.4	30.6	
75,000 - 99,999	10.9	6.7	9.0	
100,000 and over	20.9	9.4	15.6	
Ratio of family income to the poverty level				
Less than 1.00	15.6	15.3	15.5	p< 0.001
1.00-1.99	16.3	25.3	20.3	
2.00-3.99	26.6	31.0	28.6	
4.00 and over	41.5	28.5	35.7	
Health Insurance Coverage				
Yes	83.7	99.0	90.9	p< 0.001
No	16.3	1.0	9.1	
Health Insurance Type				
Private	62.7	3.0	34.5	p< 0.001
Medicare	10.5	94.7	50.4	
Medicaid	6.8	0.7	3.9	
Military	3.4	0.6	2.1	
Not covered	16.6	1.0	9.2	
Those with Medicare who have Medicare Part D Coverage				
Yes	56.4	47.6	48.5	p< 0.001
Ever had chickenpox				
Yes	80.9	80.2	80.5	p = 0.274

Ever had the zoster (shingles) vaccination				
Yes	8.9	25.0	16.5	p< 0.001
No	91.1	75.0	83.5	
Ever had the pneumonia vaccination				
Yes	22.0	58.8	39.2	p< 0.001
No	78.0	41.2	60.8	

Table 2: Percent of Participants That Have Had the Shingles Vaccination By Independent Variables and Stratified by Age

Variables	% of participants who have had the zoster/shingles vaccination		
	Age 50-64	**Age 65 and up**	**Total**
Participants	53.2 (8,773)	46.8 (7,732)	
Sex			
Male	7.3	23.5	14.4
Female	10.3	26.1	18.1
	p < 0.001	*p = 0.009*	*p < 0.001*
Race			
White	9.5	27.4	18.1
Black/African American	6.5	11.9	8.7
Indian (American), Alaska Native	11.8	20.5	15.8
Asian	7.9	22.4	14.3
	p = 0.002	*p < 0.001*	*p < 0.001*
Ethnicity			
Hispanic Yes	4.7	11.0	7.3
Hispanic No	9.5	26.6	17.6
	p < 0.001	*p < 0.001*	*p < 0.001*
Marital Status			
Married	10.6	29.5	18.7
Widowed	10.3	21.6	19.7
Divorced	7.5	23.3	13.2
Separated	3.9	13.1	6.2
Never Married	7.1	21.4	11.0
Living with partner	5.6	24.0	9.6
	p < 0.001	*p < 0.001*	*p < 0.001*
Education (Personal)			
Less than high school education	4.9	12.8	9.5
High school graduate /equivalent	7.0	21.7	14.3
Some college / Associate's degree	8.7	28.3	16.8
Bachelor's degree	10.1	35.6	19.9
Master's, professional, doctoral degree	17.8	41.5	28.4
	p < 0.001	*p < 0.001*	*p < 0.001*
Highest education attained within family			
Less than high school education	3.9	12.5	9.1
High school graduate/ equivalent	6.8	19.5	13.4
Some college / Associate's degree	8.2	26.3	15.9
Bachelor's degree	9.7	32.3	18.4
Master's, professional, doctoral degree	15.9	40.6	27.0
	p < 0.001	*p < 0.001*	*p < 0.001*

Income			
$0-$34,999	6.4	17.1	12.3
$35,000-$74,999	8.9	30.1	18.6
$75,000-$99,999	8.3	35.3	17.5
$100,000 and over	13.3	42.3	21.3
	p < 0.001	*p < 0.001*	*p < 0.001*
Ratio of family income to the poverty level			
Less than 1.00	4.8	11.2	7.6
1.00-1.99	7.0	15.5	11.7
2.00-3.99	8.3	27.1	17.4
4.00 and over	11.6	38.1	21.0
	p < 0.001	*p < 0.001*	*p < 0.001*
Insurance Coverage			
Yes	9.9	25.2	17.7
No	3.9	4.2	3.9
	p < 0.001	*p < 0.001*	*p < 0.001*
Insurance			
Private	10.3	25.2	10.9
Medicare	10.3	25.5	23.8
Medicaid	3.6	6.0	3.8
Military	13.6	6.8	12.7
Not covered	3.9	4.2	3.9
	p < 0.001	*p < 0.001*	*p < 0.001*
Ever had the pneumonia vaccination			
Yes	17.2	34.6	29.5
No	6.6	11.6	8.2
	p < 0.001	*p < 0.001*	*p < 0.001*
Those with Medicare who have Medicare Part D Coverage			
Yes	9.2	26.0	23.9
No	11.4	25.2	23.9
	p = 0.292	*p = .435*	*p = 0.958*

Table 3: Percent of Participants Who Have Had the Shingles Vaccination by Highest Personal Educational Level Obtained Stratified by Two Measures of Income, Insurance Coverage and Separated by Age Groups.

Variables		Education Level Attained					
		Less than high school graduate	High school graduate/ equivalent	Some college/ associate's degree	Bachelor's degree	Masters, professional/ doctoral	p- value
Ratio of family income to the poverty level	**Ages 50- 64**						
	Less than 1.00	3.6	5.2	4.6	11.8	5.3	0.047
	1.00-1.99	5.4	6.7	6.2	9.8	20.0	0.005
	2.00-3.99	7.1	7.3	8.2	9.5	14.0	0.125
	4.00 and above	6.0	8.2	10.6	10.0	19.0	<0.001
	Age 65 and above						
	Less than 1.00	9.0	12.4	15.3	20.5	0.0	0.027
	1.00-1.99	10.9	15.8	18.4	24.4	36.7	<0.001
	2.00-3.99	19.3	24.5	30.7	32.3	33.6	<0.001
	4.00 and above	12.7	28.2	37.5	42.3	47.1	<0.001
Total combined family income ($)							
	Ages 50- 64						
	0-34,999	4.3	6.0	6.8	9.8	17.4	<0.001
	35,000-74,999	5.9	8.6	9.1	9.2	12.8	0.149
	75,000-99,999	7.3	6.8	8.0	8.8	11.0	0.753
	100,000 and above	4.7	5.0	12.3	11.4	21.7	<0.001
	Age 65 and above						
	0-34,999	11.6	17.7	21.0	23.6	30.8	<0.001
	35,000-74,999	17.8	27.7	32.9	36.1	35.5	<0.001
	75,000-99,999	10.5	22.2	35.8	42.0	46.4	<0.001
	100,000 and above	3.4	22.8	44.7	46.2	51.4	<0.001
Type of Insurance Coverage for 50-64 year olds							
	Ages 50-64						
	Private	6.6	7.3	9.8	10.4	17.6	<0.001
	Medicare	5.9	9.9	11.4	16.2	24.1	0.008
	Medicaid	4.5	3.2	1.5	15.8*	0.0*	0.034
	Military	0.0*	16.7	10.8	9.5	28.6	0.064
	No Coverage	2.2	3.8	4.5	4.3	11.3	0.029

Medicare Coverage those 65 +							
	Age 65 and above						
	Medicare	13.4	21.9	28.4	36.5	42.5	<0.001
*Number of participants in category is less than 50							

Table 4: Percent of Participants Who Have Had the Shingles Vaccination by Highest Educational Level Obtained by a Family Member Stratified by Two Measures of Income and Insurance Coverage and Separated by Age Groups.

Variables		Family Education Level Attained					
		Less than high school graduate	High school graduate/ equivalent	Some college/ associate's degree	Bachelor's degree	Masters, professional/ doctoral	p- value
Ratio of family income to the poverty level	**Ages 50- 64**						
	Less than 1.00	2.9	5.9	3.8	11.5	4.3**	0.008
	1.00-1.99	5.5	6.6	6.0	8.6	16.4	0.035
	2.00-3.99	6.1	7.6	7.7	9.3	13.2	0.122
	4.00 and above	2.3**	8.2	9.8	9.9	16.9	<0.001
	Age 65 and above						
	Less than 1.00	9.2	11.8	15.3	15.8	0.0**	0.072
	1.00-1.99	10.8	15.8	17.8	18.3	27.9	0.006
	2.00-3.99	19.9	23.6	28.4	33.5	29.7	0.003
	4.00 and above	15.6	24.3	33.2	39.7	46.8	<0.001
Total combined family income ($)							
	Ages 50- 64						
	0-34,999	3.8	6.3	6.7	8.8	14.7	<0.001
	35,000-74,999	5.4	8.2	8.4	9.2	13.2	0.080
	75,000-99,999	0.0*	7.1	6.1	9.9	11.4	0.169
	100,000 and above	0.0*	3.8	12.4	10.5	18.0	< 0.001
	Age 65 and above						
	0-34,999	11.5	17.1	20.7	21.7	26.6	<0.001
	35,000-74,999	19.7	24.8	30.9	35.9	33.2	<0.001
	75,000-99,999	0.0*	18.5	30.5	36.3	46.6	<0.001
	100,000 and above	0.0*	13.6	34.0	42.3	49.6	<0.001
Type of Insurance coverage for 50-64 years olds							
	Ages 50 – 64						
	Private Coverage	3.7	7.1	9.1	10.2	16.2	<0.001
	Medicare	4.3	10.0	10.8	16.8	17.4	0.011
	Medicaid	5.0	3.7	1.4	7.7	0.0*	0.251
	Military	0.0*	17.2	11.1	11.3	20.5	0.409
	No Coverage	2.4	3.3	4.6	3.3	10.1	0.030

Medicare Coverage Age 65+							
	Age 65 and above						
	Medicare	13.0	19.9	26.5	32.9	41.5	<0.001
* Number of participants in category is less than 20 ** Number of participants in category is less than 50							

Table 5: Percent of Participants Who Have Had the Herpes Shingles Vaccination by Receipt of the Pneumonia Vaccination Stratified by Education, Income, and Insurance Coverage and Separated by Age Groups

Variable		Percent of Participants who have or have not received the Pneumonia Vaccination Who Have Received the Herpes Zoster Vaccination					
		Ages 50-64			Age 65 and above		
		Yes	No	p-value	Yes	No	p-value
Highest personal education level achieved	Less than high school graduate	11.2	2.8	<0.001	19.4	6.0	<0.001
	High school graduate/ equivalent	13.2	5.4	<0.001	30.2	9.5	<0.001
	Some college/ associate's degree	16.2	6.5	<0.001	37.2	14.2	<0.001
	Bachelor's degree	20.1	7.8	<0.001	46.0	20.4	<0.001
	Masters, professional/ doctoral	35.1	12.9	<0.001	53.7	18.7	<0.001
Highest Educational Level Achieved by Family Member	Less than high school graduate	9.6	1.9	<0.001	18.5	6.4	<0.001
	High school graduate/ equivalent	12.8	5.1	<0.001	28.0	7.8	<0.001
	Some college/ associate's degree	15.5	6.0	<0.001	34.9	12.9	<0.001
	Bachelor's degree	19.4	7.4	<0.001	41.7	19.3	<0.001
	Masters, professional/ doctoral	31.7	11.7	<0.001	53.9	17.3	<0.001
Total Combined Family Income ($)	0-34,999	13.3	4.0	<0.001	24.4	7.8	<0.001
	35,000 – 74,999	16.0	6.9	<0.001	39.5	15.7	<0.001
	75,000 – 99,999	16.3	6.3	<0.001	50.6	11.9	<0.001
	100,000 and up	28.0	10.4	<0.001	56.0	21.2	<0.001
Ratio of family income to the poverty level	Less than 1.00	11.1	2.5	<0.001	19.1	4.0	<0.001
	1.00 – 1.99	15.0	4.2	<0.001	22.2	7.2	<0.001
	2.00 – 3.99	14.6	6.5	<0.001	35.8	13.8	<0.001
	4.00 and above	22.7	9.0	<0.001	49.9	18.4	<0.001
Insurance coverage type	Private	20.9	7.8	<0.001			
	Medicare	14.8	6.5	<0001	34.7	12.0	<0.001
	Medicaid	6.3	2.6	0.038			
	Military	20.9	9.7	0.011			
	No coverage	8.6	3.3	=0.001			

Biographical Sketch

Lesley Marie Williams is a 2010 graduate from Furman University where she received her Bachelor of Arts in Music, specifically focusing on vocal performance. After taking a year after graduating to finish prerequisites, Lesley was accepted into and currently attends the University of Kentucky College of Pharmacy and is working towards her Doctor of Pharmacy degree. She will graduate with this degree in May of 2015. Lesley will successfully complete her Master of Public Health degree and graduate from the College of Public Health in May of 2015. After graduation, Lesley will be getting married. In July of 2015, Lesley, her husband, and their dog will move to Billings, Montana where Lesley will begin her Post-Graduate Year 1 Pharmacy Residency Program at Billings Clinic.

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