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Evaluating Parents Sociodemographic Factors and Childhood Vaccine Decisions

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EVALUATING PARENTS SOCIODEMOGRAPHIC FACTORS AND CHILDHOOD VACCINE DECISIONS

By

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Abstract

Vaccination is considered one of the most successful public health achievements of the 20th century. However, with increasing vaccine skepticism emerging over the past decades, there is a threat to the ongoing sustainment of vaccine coverage within all US communities. This study evaluated and compared parents' sociodemographic factors associated with childhood vaccine decisions. This study is a secondary analysis of 893 parents/guardians, age 18-55 years with child(ren) < 7 years living in the U.S.

Predictive analysis was conducted using multinomial logistic regression modeling was used to examine vaccine decisions (accept, hesitant, and refuse) in relation to parents' sociodemographic factors. Overall, (66.6%) of parents accepted recommended vaccines, while (23.6%) hesitated, and (9.7%) refused the recommended childhood vaccines. Males were more likely than females to refuse rather than accept vaccines (OR= 1.88, 95% CI 1.03-3.43). Parents with low income were more likely to refuse compared to middle-income parents (OR= 2.40, 95% CI 1.32-4.37). However, parents with high income were less likely to refuse vaccine when compared to parents with middle income (OR= 0.59, 95% CI 0.28-1.24).

To reduce the proportion of vaccine-hesitant parents and improve coverage, interventions should be tailored to specific groups of parents to identify potential barriers, address those barriers by implementing target specific interventions and programs, and monitor them to evaluate the effectiveness of these programs.

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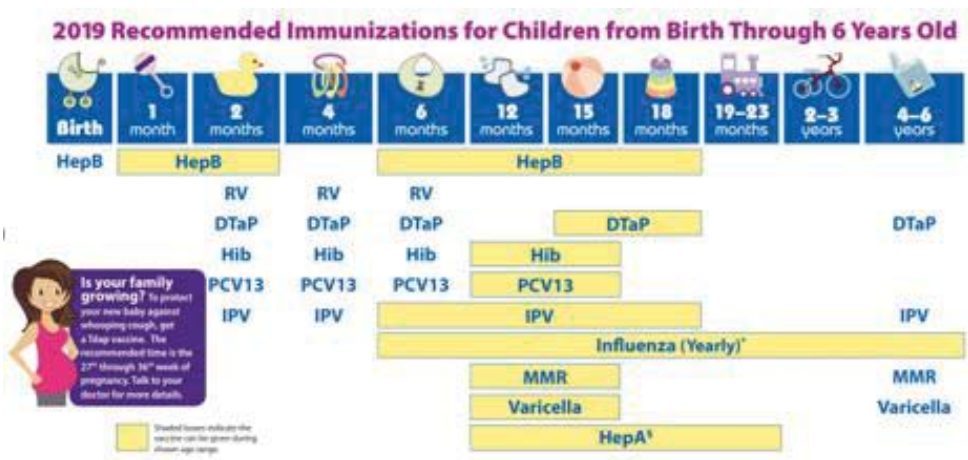
Chapter 1

Introduction

Vaccination is considered one of the most successful public health achievements of the 20th century (CDC, 1999). Owing to successful vaccination coverage rates that usher in broad herd immunity within communities, smallpox has been eradicated, and vaccination programs have increased coverage rates leading to significant prevention of vaccine-related morbidity and mortality in the United States (U.S) (Siddiqui, Salmon, & Omer, 2013). However, with increasing vaccine skepticism emerging over the past decades, there is a threat to the ongoing sustainment of vaccine coverage within all US communities (Frew et al., 2016). The emergence of vaccine refusal and intentional delay (spacing of vaccine receipt) during childhood has enormous implications for vaccine-preventable disease re-emergence. With the recent cluster outbreaks of measles, pertussis, and even meningococcal disease in geographic, social, and religious communities in the US, more attention has now been focused on vaccine receipt patterns and behaviors driving previously contained or eliminated diseases (Frew et al., 2016).

There are 10 recommended child immunizations schedules for children six years and under: Hepatitis B (Hep B); Rotavirus (RV); Diphtheria, Tetanus, and acellular Pertussis (DTaP); Haemophilus influenza type b (Hib); Pneumococcal (PCV); Inactivated Poliovirus (IPV); Measles, Mumps, Rubella (MMR); Varicella (chickenpox); Influenza (Flu); and Hepatitis A (Hep A) (CDC, 2019) (Figure 1). In the most recent CDC report, vaccine coverage was >90% in 2017 and remained high and stable overall among children aged 19 to 35 months (Hill et al., 2016). The proportion of children that did not receive any vaccine doses by age 24 month for indicated vaccines such as MMR, DTaP, Hep B, RV, and Hep A was small; however, this proportion increased from 0.9% in 2011 to 1.3% in 2015 (Hill et al., 2018).



Source: Centers for Disease Control and Prevention

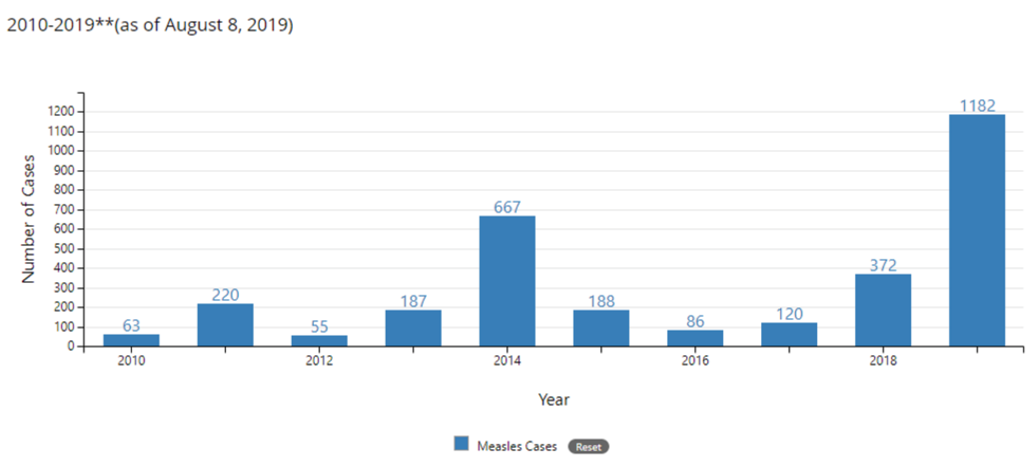
Figure 1. Recommended Immunizations by CDC from Birth to 6 Years Old, (CDC 2019)

Over the recent decades, immunization rates for school entry in the U.S. (e.g., children under the age 5) have also increased, exceeding the ≥ 90% recommendation for children entering Kindergarten (Seither et al., 2016). The recent median vaccination coverage in the 2017-2018 school year was 95.1% for state-required doses of DTaP, 94.3% for two doses of MMR, and 93.8% for two doses of varicella vaccine (Mellerson et al., 2018). However, the percentage of kindergartners with an exemption for at least one or more required vaccines increased from 2.0% in 2016-2017 to 2.2% in the 2017-2018 school year (Mellerson et al., 2018). Though a 0.2% increase in vaccination appears small, it represents a large number of children.

According to the World Health Organization (WHO), there are 25 known vaccine-preventable disease (VPDs) and there are 14 known VPDs specific to children. Worldwide, two to three million lives are estimated to be saved each year with vaccination (WHO, 2019).

However, the rates of VPDs have increased globally due to decreasing vaccination rates (Kestenbaum & Feemster, 2015). These outbreaks, including those occurring in the U.S., are linked to unvaccinated and under-immunized children and their vaccine-hesitant parents. Parents' decision to delay or refuse vaccination not only affects their child(ren)'s health but it can also weaken herd immunity and increase the number of VPDs (Salathe & Bonhoeffer, 2008).

In the U.S., mortality from vaccine-preventable disease has declined by 96-100% due to childhood vaccine recommendations (Weiner, Fisher, Nowak, Basket, & Gellin, 2015), and measles was declared eliminated in the year 2000. Unfortunately, this is no longer the case as of early 2019. Disease elimination for measles refers to the interruption of transmission to fewer than 100 cases annually. Based on nationally notifiable disease data, there was an average of 63 cases of measles per year from 2000 to 2007 in the U.S. (CDC, 2008). In 2018 alone, 372 cases of measles were confirmed, and from January 1 to April 26, 2019, 704 cases of measles were confirmed in 22 states. This is the highest number of measles cases reported in the U.S. since 1992 (CDC, 2019) (Figure 2).



Source: Centers for Disease Control and Prevention

Figure 2. Number of Measles Cases Reported by Year, 2010-2019, (CDC, 2019)

To increase vaccine coverage and reduce the rate of vaccine-preventable diseases (VPDs), the CDC works with public health agencies and private partners by implementing vaccination laws. Depending on the state, there are different exemptions (i.e. philosophical, medical, and religious) (Siddiqui et al., 2013). Mississippi, West Virginia, California, Maine, and New York are the five states that permit only medical exemptions, while 30 states allow religious and medical exemptions, and 15 states allow philosophical exemptions due to personal, moral, and other beliefs in addition to religious and medical exemptions (NCSL, 2019). A study by Olive et al. (2018) showed a rise in nonmedical exemptions (NMEs) in 12 of the 17 states that allowed philosophical exemptions at the time of the study.

These state vaccination laws and/or requirements apply to children in daycare, private and public schools, college and university students, patients in certain facilities, and healthcare workers (CDC, 2017). In addition to exemptions for school vaccination, states can create an exclusion requirement for children with these exemptions in the event of an outbreak or emergency. For example, under Nevada state law, "whenever the State or local Board of Health determines that there is a dangerous contagious disease in a public school attended by a child for whom exemption from immunization is claimed pursuant to the provisions of NRS 392.437 or 392.439, the board of trustees of the school district in which the child is enrolled shall require either: that the child be immunized; or that the child remain outside the school environment and the local health officer be notified." (NCIV, 2018). These different types of exemptions play a significant role in the decreasing coverage rate. For example, Olive and colleagues (2018), examined the association between the NME rate and vaccine coverage and found that states with overall high NME rates have lower MMR vaccine coverage of kindergartners (Olive, Hotez, Damania, & Nolan, 2018). These exemption practices and policies have the potential to compromise the existing immunization safety net.

Background and Significance

Several public health researchers have shown that the public is losing confidence in vaccines, and as a result, the number of vaccine refusals and delays have increased in recent years. In 2000, a national study of parents reported that 19% of parents had 'concerns about vaccines', and this number increased to 50% in another survey in 2009 (Freed, Clark, Butchart, Singer, & Davis, 2010; Gellin, Maibach, & Marcuse, 2000). There is insufficient research on the core concerns that motivate vaccine refusal and delay, and the National Vaccine Advisory Committee (NVAC) has stressed the need for more research on vaccine-hesitant parents (Gilkey et al., 2016).

Based on several studies and surveys, a growing body of evidence suggests an increase in the number of U.S. parents who have delayed or refused childhood vaccines (Smith, Humiston, Parnell, Vannice, & Salmon, 2010). One in four parents expresses serious concern about recommended childhood vaccine schedules (Gust, Darling, Kennedy, & Schwartz, 2008; Opel et al., 2011). Vaccine hesitancy ranges from those who refuse all vaccines, which are rare, to those who delay or refuse specific vaccines. Freed and colleagues (2010) reported that 11.5% of parents nationally refused at least one recommended vaccine for their child, with 56% of parents refusing human papillomavirus vaccine and 32% of parents refusing varicella vaccine. In a study by Leask et al. (2012), parents were categorized into the following five groups: 'unquestioning acceptors,' 'cautious acceptors,' 'hesitant parents,' 'late or selective acceptors,' and 'refuse all vaccines.’ Experts believe that among those who refuse and delay childhood vaccines, many are part of the subset group of parents who are not firmly against vaccination (Gust et al., 2005; Leask et al., 2012). Parents in this group are more numerous than those who reject vaccines completely, and their attitudes towards vaccination are not extreme but could be improved (Gust et al., 2008; Smith, Chu, & Barker, 2004).

Some of the external factors that affect vaccine decision making are patient-provider relationships, school immunization requirements, social norms, and policies (Gowda & Dempsey, 2013). Although many factors influence parents’ decision to refuse or delay childhood vaccination, the most common reasons are the increased number of recommended vaccines, vaccine safety, and vaccine exemptions (Gowda & Dempsey, 2013). Parents are concerned about the short-term side effects of vaccination such as pain from injection, redness, swelling, and fever (Shui, Kennedy, Wooten, Schwartz, & Gust, 2005). In addition to these short-term side effects, parents are also concerned about the multiple childhood vaccine schedules that are recommended. Although the concerns are not supported by facts, parents believe that receiving many vaccines in a short period could harm their children due to the body’s inability to handle many different antigens in that period and the potential health risks that come with vaccination (Gowda & Dempsey, 2013). As stated by the American Academy of Pediatrics (AAP), two factors are used to schedule each vaccine: the age when the body’s immune system works best, and the earliest possible age to provide protection to infants and children (AAP, 2008). Besides, immunization schedules are also set up to match the routine doctor’s visit for infants and children.

One of the well-known reasons for parent’s negative views is related to the belief that vaccines cause long-lasting complications that lead to neurological conditions (Opel et al., 2012).

The 1998 publication by Andrew Wakefield, which supposedly linked the MMR vaccine with autism, has been very controversial (Opel et al., 2012). Despite the fact that the paper was retracted and Wakefield lost his medical license, some parents are still misled by the information that is being circulated in the media and on the internet by anti-vaccination activists (Dube, Vivion, & MacDonald, 2015). Numerous studies have examined the influence that the MMR-autism link has had on vaccine decision-making, particularly among parents who are considered "fence-sitters" (Gust et al., 2005), and found that the effects continue to endure.

For many parents, healthcare providers are the main source of information regarding their children's health. This information might play a significant role in their decision making (Gellin et al., 2000; Gust et al., 2004; Gust et al., 2005; Gust et al., 2008). For example, Salmon and colleagues (2008) compared primary care providers of fully vaccinated children with primary care providers of children with vaccine exemptions from school. They found that primary care providers of exempt children had increased concern regarding the safety and perceived benefits of vaccines. Gowda and Dempsey (2013) also discussed the important role trust plays in separating complete vaccine refusers from vaccine-hesitant parents (VHPs), and the close similarities between VHPs and vaccine acceptors especially due to the willingness of VHPs to listen to their physicians' vaccine recommendations (Benin, Wisler-Scher, Colson, Shapiro, & Holmboe, 2006; Lantos et al., 2010).

With the appropriate intervention, strategy, and approach, this subset of VHPs might be willing to reconsider their decision or receive more information on vaccination before they make a final decision. Since parents are the primary decision-makers for their child(ren)'s health, it is important to identify who the moderate VHPs are and intervene appropriately.

Vaccine decisions can be affected by gender (i.e., socially constructed norm that is associated with being female or male) and sex (i.e., biological and physiological differences between female and male). In some cases, 'gender' and 'sex' are used interchangeably; however, when examining the association with vaccination rate, these two terms are defined differently. In the study by Pulcini, Massin, Launay & Veger (2013), which focused on sex (biological difference), they reported that females are less likely to accept, or intend to receive vaccines than males. Since females develop higher antibody response (Klein & Pekosz, 2014) and more frequent severe adverse reactions to vaccines, they are more likely to report side effects (Cook, Barr, Hartel, Pond, & Hampson, 2006; Klein & Pekosz, 2014; Poland, Ovsyannikova, & Jacobson, 2009). In contrast, however, Chambers et al. (2018) showed that though there is a biological difference in response to a vaccine, females (29%) had higher flu vaccination coverage than males (23%) overall in terms of gender.

In addition to reported differences in vaccination coverage by gender, there is also coverage difference by age group. As people age, the immune system gets weaker thus reducing the ability to fight off infections. For this reason and other risk factors that come with aging, we see that older adults tend to get vaccinated to get protection from diseases and improve their health. According to the CDC (2017), flu vaccination coverage increased with increasing age during the 2016-17 season, and the coverage was higher in females than males. It was estimated that the proportion of each age group that got influenza vaccination for the 2016-17 season were (33.6%), (45.4%), and (65.3%) for the age groups 18-49 years, 50-64 years, and 65 years and older, respectively.

According to Gowda and Dempsey (2013), individual-level factors such as race, educational levels and socioeconomic status (SES) are some of the factors that impact how an individual view the benefit and risk of vaccines. A high distrust of the medical community, vaccine safety concerns, and less belief in vaccine efficacy and necessity have been linked with parents that have less formal education (Gust et al., 2003; Opel et al., 2011; Prislin, Dyer, Blakely, & Johnson, 1998; Shui, Weintraub, & Gust, 2006). In a study by Gust and colleagues (2005), little knowledge of vaccination information was found in parents that had less than 12 years of education compared with parents with some graduate school education. In contrast, however, Opel et al. (2011) reported that compared to parents with lower educational level, those with a higher level of education were around four times as likely to be concerned about vaccine safety. Correspondingly, a study by Smith and colleagues (2004) showed that in unvaccinated children, all childhood vaccine refusal was seen in parents with a college education, compared to parents with a lower level of education. Conversely, under-vaccinated children tend to have a younger mother who is not married, does not have a college degree, and lives near the poverty level compared to fully vaccinated children (Smith et al., 2004). Also, Luman and colleagues (2003) found that children were less likely to be fully vaccinated if their mothers were 19-29 years of age, had less than a college education, were unmarried, and lived near or below poverty level.

The purpose of this study was to evaluate and compare parents' sociodemographic factors associated with childhood vaccination decisions.

Chapter 2

Methodology

Study Aim and Hypothesis

To address characteristic differences among vaccine refusers, vaccine-hesitant and vaccine acceptors, this study compared parents who accepted vaccination to those who refused and hesitated by age, gender, race, education level, marital status, and income.

The aims of this study and the corresponding hypotheses were as follows:

1. **To compare parents who accept vaccines for their children to those who refuse based on parental age, gender, race, education level, marital status, and income.**

   H0: There are no significant parental age, gender, race, education level, marital status, or income differences between parents who accept vaccines for their children and those who refuse

   HA: There are significant parental age, gender, race, education level, marital status, or income differences between parents who accept vaccines for their children and those who refuse

2. **To compare parents who accept vaccines for their children to those who hesitate based on parental age, gender, race, education level, marital status, and income.**

   H0: There are significant parental age, gender, race, education level, marital status, or income differences between parents who accept vaccines for their children and those who hesitate

HA: There are significant parental age, gender, race, education level, marital status, or income differences between parents who accept vaccines for their children and those who hesitate

Study design

The study used data from a previous cross-sectional study that assessed the Emory Vaccine Confidence Index (EVCI). The survey was collected by Qualtrics in Fall 2016, and U.S. parents were drawn from market research panels. The study was reviewed by Emory University and the University of Las Vegas Institutional Review Board and determined to be exempt from human subjects' research. Further details are fully explicated in published materials (Frew et al., 2019).

Study Participants

The study by Frew et al. (2019) attempted to survey 1,502 participants (Figure 3). Participants were excluded if: they were parents with children aged >7 years, parents aged <18 or >55, and survey responses were incomplete or invalid. The final participants included English speaking parents/guardians, age 18 - 55 years with child (ren) < 7 years living in the U.S. The final sample size after the application of exclusion criteria was N = 893. For this study, we used the participants who completed the survey responses and our final analytic sample consisted of 893 parents.

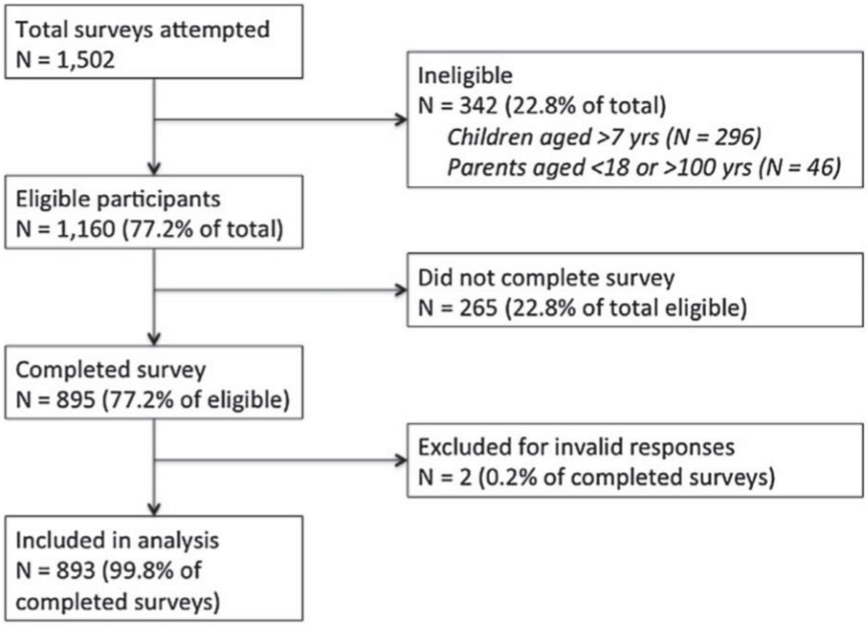


Figure 3. Participant Flow Diagram, (Frew et al., 2019)

Measurement

The survey was designed to assess childhood vaccine confidence-related concepts and decisions of parents with children under seven years old on childhood vaccination, as this age group is primarily affected by CDC's vaccination schedule and school entry law/mandates. To evaluate vaccination decisions, parents were asked whether their youngest child had received all doses of the CDC recommended vaccines scheduled for infants and children (i.e. DTap, MMR, HBV, rotavirus, PCV, flu, chickenpox, HiB, HAV, and IPV); however, the survey did not include combination administration. The questionnaire was comprehensive and included items beyond those that were assessed in this study, including insurance provider, source of information, perceived benefits of vaccines, trust in vaccine and personal values.

Variables and Recoding

Independent Variable

We examined the sociodemographic measures of parental age, gender, race (6 levels), income (11 levels), education levels (8 levels), and marital status (6 levels), as well as the youngest child's age. For this study and analysis, these variables were recoded and categorized as such: gender, race, education, age, and marital status into dichotomies, and income into three levels as defined below and in Table 1.

Age

Age of parents was asked at the time of the survey and represent how old they were in the year 2016. The definition of what constitutes a young adult or older adult varies. For example, according to Erikson's stages of psychosocial development young adults are those between the age of 21-39, and older adults 40-65 years (Erikson, 1959); however, according to CDC those between the age of 15-24 years are considered adolescents and young adults (CDC, 2017). Due to the lack of official definition or cut point, we used the median age (30 years) of our participants to categorize parents as young adults and older adults. We considered those between the age of 18-30 years as young adults and those 31-55 years as older adults. For analysis young adults were taken as a reference group (Table 1).

Race

The data on race had 6 categories: White, African-American or black, American Indian, Asian, Native Hawaiian or other Pacific Islander, and other. Preliminary examination of race indicated that whites were predominant and the frequency for other races was very small. For this reason, we aggregated races other than white as one group. We recoded and categorized race into dichotomies as white versus other race (African-American or black, American Indian, Asian, Native Hawaiian or other Pacific Islander, and other). For analysis, whites were taken as a reference group (Table 1).

Education level

The data on education level represented the total number of years attended and had eight levels: K- 8th grade, 9th-11th grade, high school graduate/GED, some college credit but no degree, Technical/ Vocational or Associates degree, Bachelor's degree, Master's degree, and Doctorate. We recoded and categorized education level into two categories. We categorized education level as 'no college degree' and 'college degree', and we used no college degree as a reference group (Table 1). This type of categorization was appropriate because it included a sufficient number of parents in each education level category.

Annual household income

Income level in the data represented the annual household income of the family. There is no definite cut off point or official definition to categorize people into low, middle, and high-income groups. This is because the definition of these income groups differ based on the state they live in and the number of people in the household. For example, an income of $25,000-$100,000 a year is what most would consider as a middle-class income. However, a family of 4 earning $60,000 a year qualifies as low- income in New York, while the same is considered as middle-income household in Nevada (HUD, 2019). For analysis we categorized income level into three levels: Low income (< $20,000), Middle income ($20,001 - $80,000), and High income ($80,001 or more).

Marital status

The data on relationship status had 6 levels: single/not married, divorced, widowed, married, domestic partner, and separated. Marital status was further categorized into 'Married' and ‘Not married’, and included a sufficient number of parents in each category. For analysis married was taken as a reference group (Table 1).

Missing data

We used cross-tabulation while recoding to ensure all variables were categorized appropriately. We only had a missing data on the age group of parents (6.2%), which was less than 10%, and hence not considered largely contributory to the results; those with missing data were removed in the analysis.

Table 1. Sociodemographic Characteristics of Survey Respondents, N = 893

		N	%
Child’s age (years)	Mean [standard deviation]	2.8 [1.7]	-
	Median [Q1, Q3]	2.8 [1.3, 4.3]	-
Parent age (years)	Mean [standard deviation]	31.3 [6.7]	-
	Median [Q1, Q3]	30 [26, 35]	-
	Young adult (18- 30)	449	50.28
	Older adult (31-55)	389	43.56
	Missing	55	6.16
Gender	Female	732	81.97
	Male	161	18.03
Race	White	698	78.16
	Other race	195	21.84
Marital status	Not married	351	39.31
	Married	542	60.69
Education	No college degree	549	61.48
	College degree	344	38.52
Household income	Low income (< $20,000)	120	13.44
	Middle income ($20,001 - $80,000)	546	61.14
	High income ($80,001 or more)	227	25.42

Dependent variable

The computation of vaccine decision was based on 11 items with a three-level outcome from the questionnaire which assessed the youngest child’s vaccination status for the CDC recommended vaccines: DTap, MMR, HBV, rotavirus, PCV, flu, chickenpox, HiB, HAV, and

IPV. The three response options were: “yes, s/he has received this vaccine”, “no, s/he has not received this vaccine”, and “not sure if s/he has received this vaccine.” For this study and analysis, responses were recoded as: ‘Accept’, ‘Hesitant’, and ‘Refuse’. These three recoded outcome variables were computed using the 2019 CDC recommended immunizations schedule for children from birth through six years old, and by stratifying by the child’s age. We used less than 25% as ‘refuse’, 26% - 74% as ‘hesitant’, and above 75% as ‘accept’. A child’s age was also recoded and categorized into three age groups (<60 days, ≥60 and <365 days, and ≥365 days) to match the age group when children are recommended to receive different vaccines (Table 2). For example, a parent with a child who is (≥60 and <365 days) and received ≥5 vaccines are considered an ‘accepter’, and if received >2 but <5 ‘hesitant’, and if received ≤2 a ‘refuser’.

Table 2. Vaccine Decisions Stratified by Child’s Age and CDC's Vaccine Recommendation

Child’s age group	Number of CDC Vaccine Recommendation	Vaccine Decision			
		Decision	Number of Vaccines	N	%
Less than 2 month	1	Accept	1	22	68.75
		Refuse	0	10	31.25
2 month & above to less than 12 month	6	Accept	≥ 5	45	32.37
		Hesitant	>2 and <5	52	37.41
		Refuse	≤ 2	42	30.22
12 month to 6 years	10	Accept	≥ 8	528	73.13
		Hesitant	>3 and <8	159	22.02
		Refuse	≤ 3	35	4.85

Statistical analyses

Descriptive statistics were calculated to describe and summarize the basic features of the data for this study. We conducted a predictive analysis using multinomial logistic regression modeling and calculated vaccine decisions (accept, hesitant, and refuse) in relation to our predictors. We wanted to understand whether factors such as age, gender, race, education level, income, and marital status affect parents' vaccine decision. Significance tests were conducted under a two-tail assumption with alpha = 0.05. All analyses were conducted in SAS version 9.4.

Chapter 3

Results

As described in Table 1, the median age of the respondents was 30 years old. The majority of parents were female (82%), white (78%), and married (61%). The majority of the respondents had no college degree (61%), and are considered middle-income households (61%). The median child's age was 2.8 years old with the youngest being 11 days old, and the oldest being 6 years old.

Overall Vaccine Decision

The respondents' vaccine decision by child's age is presented in Table 2. Out of 32 parents with a child under the age of 2 months, 69% accepted the recommended vaccine, while 31% refused all. For parents with a child above the age of 2 months and less than 12 months (139 parents), (32.4%) accepted at least 5 vaccines, and (37.4%) were hesitant by receiving 2 to 4 vaccines, while (30.2%) refused by receiving less than 2 out of the 6 vaccines recommended for this age group. Out of 722 parents with a child age 12 months and above, (73%) are considered accepters by receiving at least 8 of the 10 recommended vaccines. (22%) were hesitant by receiving 4 to 7 vaccines, and only (5%) refused by receiving 3 or less recommended vaccines for this age group.

Model selection

Three models were constructed to determine the best fit model for these data. The first model included age, gender, race, education level, marital status, and income. The second model included the interaction between gender and age in addition to the first model. Finally, for the third model, three variables with $p < 0.10$ were selected from the first model and tested.

The three types of model and overall significance of the likelihood ratio is presented in Table 3. Model 1 was determined to be the most parsimonious to report the odds ratio and 95% Confidence Interval (CI) results in this study. To decide which model is the best fit, we examined the p-value associated with the specified Likelihood Ratio Chi-Square statistic for each model. The null hypothesis is that there is no relationship between any of the predictor variable and the outcome. All three models were determined to be significant ($p < 0.05$). To directly compare the three competing models, we used the Akaike information criterion (AIC) (Burnham & Anderson, 2011). The model with the smallest AIC is considered most parsimonious, which was Model 1 that includes age, gender, race, education level, marital status, and income.

Table 3. Multinomial Logistic Regression for Model Selection

Models	**AIC**	**P-value (Likelihood Ratio)**
Model 1	1420.019	0.0177
Model 2	1420.019	0.0332
Model 3	1501.191	0.0041

Note: Model 1- Includes Age, Gender, Race, Education level, Marital status, and Income
Model 2- Includes Model 1 and Age*Gender interaction
Model 3- Includes Gender, Marital status, and Income

Vaccine Hesitant relative to vaccine Acceptance

The results for vaccine hesitancy were computed using vaccine acceptance as a comparison group. All results for vaccine hesitancy with the corresponding reference groups and odds ratios are presented in Table 4. After examining each predictor after adjusting for other predictors in the model, none of the variables were significant in vaccine hesitancy.

Table 4. Vaccine Hesitant using Multinomial Logistic Regression, N = 893

	Odds ratio (95% CI)	**Unadjusted odds ratio (95% CI)**	**P- Value**
Gender			
Female	Reference	-	
Male	0.89 (0.57-1.42)	0.88 (0.57-1.34)	0.644
Race			
White	Reference	-	
Other race	0.91 (0.61-1.36)	0.98 (0.67-1.44)	0.639
Age group			
Young adult (18- 30)	Reference	-	
Old adult (31-55)	1.01 (0.71-1.44)	0.95 (0.69-1.31)	0.963
Marital status			
Married	Reference	-	
Not married	1.42 (1.00-2.04)	1.30 (0.95-1.79)	0.053
Education			
No college degree	Reference	-	
College degree	1.36 (0.92-2.03)	0.99 (0.72-1.36)	0.128
Income			
Middle income	Reference	-	
Low income	0.93 (0.55-1.56)	1.04 (0.64-1.69)	0.839
High income	0.77 (0.49-1.20)	0.82 (0.57-1.19)	0.374

Vaccine Refusal relative to vaccine Acceptance

The results for vaccine refusal was computed using vaccine acceptance as a comparison group. All results for vaccine refusal with the corresponding reference groups are presented in Table 5. Gender and income were significantly associated with parents who refuse vaccines. After adjusting for other predictors in the model, males were more likely than females to refuse vaccine than accept. This was significant with (OR= 1.88, 95% CI 1.03-3.43). Parents with low income were more likely to refuse than accept vaccine compared to middle-income parents (OR= 2.40, 95% CI 1.32-4.37). However, parents with high income were less likely to refuse vaccine when compared to parents with middle income (OR= 0.59, 95% CI 0.28-1.24). Other variables i.e. age, race, marital status, and education were not significant in vaccine refusal.

Table 5. Vaccine Refusal using Multinomial Logistic Regression, N = 893

	Odds ratio (95% CI)	Unadjusted odds ratio (95% CI)	P-Value
Gender			
Female	Reference	-	
Male	1.89 (1.03-3.43)	1.36 (0.79-2.34)	**0.039**
Race			
White	Reference	-	
Other race	1.08 (0.62-1.87)	1.15 (0.68-1.95)	0.798
Age group			
Young adult (18- 30)	Reference	-	
Old adult (31-55)	0.86 (0.51-1.44)	0.71 (0.45-1.14)	0.561
Marital status			
Married	Reference	-	
Not married	0.80 (0.48-1.36)	1.24 (0.79-1.96)	0.414
Education			
No college degree	Reference	-	
College degree	0.75 (0.40-1.40)	0.61 (0.38-1.01)	0.371
Income			
Middle income	Reference	-	
Low income	2.40 (1.32-4.37)	2.33 (1.34-4.05)	**0.001**
High income	0.59 (0.28-1.24)	0.56 (0.30-1.06)	**0.015**

Bold text indicates significance at the p<0.05 level

Chapter 4

Discussion

This study assessed parent's socio-demographic factors that are associated with childhood vaccination of children from birth through seven years old. In this study, (66.6%) of parents accepted the recommended vaccines, while (23.6%) hesitated, and (9.7%) refused, depending on the age of the youngest child and the recommended vaccines.

In our study, a parent's gender was associated with childhood vaccine refusal, and male parents/guardians were more likely to refuse vaccines. This finding is consistent with other studies such as by Opel et al. (2011), which reported that mothers are less likely to agree that their child should develop immunity by getting sick and that fathers are more likely to be concerned that their child might have a serious side effect from a shot.

Annual household income was another factor that was associated with vaccine refusal in this study. A study by Smith and colleague (2009), reported estimated timely vaccination rates for some vaccines such as DTaP-DTP, MMR, Hib, Hep B, varicella, and polio vaccines were significantly lower in low-income children than high income. This study is consistent with our finding that low-income parents are more likely to refuse a childhood vaccine. Another study by Opel et al. (2011), which reported that parents with a household income of >$75,000 are less likely to be unconcerned that their child might have a serious side effect from a shot than are parents with a household income of ≤$75,000 and males is consistent with our finding.

There might be few explanations of why females and parents with high-income are less likely to refuse childhood vaccines. One reason might be that the study population had more females than males. This could be because females/mothers are often strongly influential in vaccination or overall health decision of their children. Also, it could be that female's greater tendency for seeking health care (Chambers et al., 2018), or that females tend to have high influenza coverage rate (CDC, 2017), and they tend to make similar decisions (vaccination) for their child.

In this study, none of the predictors were statistically significant in vaccine hesitancy; however, marital status cannot be ignored (OR= 1.42, 95% CI 1.00 - 2.04) (Table 4), and needs further examination with additional data. This finding is reinforced by other studies that found the association between marital status and vaccine decision, such as Smith et al. (2004), that reported under-vaccinated children were more likely to have a mother who was not married (widowed, separated, or divorced). Similarly, Luman et al. (2003) found that children were less likely to be fully vaccinated if their mothers were unmarried. Even though other sociodemographic factors in our study; such as education, age, and race were not significant, few studies have shown these factors play a part in vaccine decision (Gust et al., 2005; Opel et al., 2011; Smith et al., 2004).

Though not assessed in this study, other barriers or factors such as patient-provider relationship, social norms, media, perceived vaccine safety, and efficacy play a role in childhood vaccine decision of parents. Physicians are one of the most important sources of information for parents (Gowda & Dempsey, 2013), and a study found that (68%) of parents agree with their doctor's recommendation for vaccination, and (51%) of parents agree with the recommendations of nurse practitioners (Niederhauser, Baruffi, & Heck, 2001). In addition, lack of vaccine schedule knowledge, lack of transportation access and long waiting times are other barriers faced (Lannon et al., 1995). Future researchers can use this study as a guide and take account of other factors to better understand motives for parents' refusal or delay of vaccines, and improve interventions and programs for parents of children under the age of seven.

Limitations

This study had a few limitations. This was a self- reported survey and might have included some recall or response bias. In some cases, parents who responded "not sure" for most of the vaccines could be due to the time delay between when the survey was conducted and the child's vaccination. The majority of the study population had a higher education level than most U.S. parents and are all English speakers; this may contribute to sampling bias (Frew et al. 2019). Even though the data included all U.S. states, it may not be representative of U.S. parents due to the large proportion being white married mothers with a household income ($20,000 to $80,000). Though the study included parents from all the U.S. states, the participants were a select group of people (i.e., parents from one specific setting or place). This selection method limits the generalizability of the result to that specific place from which the parents were selected. Some children that are under the age of 2-months old may not have yet reached the age to receive the recommended vaccine or had not received the vaccine by the time the survey was conducted. However, the majority of the children in the study were at the age to have begun the recommended vaccines.

Chapter 5

Conclusion

This study suggests that most of the parents accepted childhood vaccines; however appropriate intervention can still reduce the percentage of parents who hesitate, as they are more likely to change their mind with the appropriate information. To ensure this reduction of vaccine-hesitant parents and improve coverage, interventions should be tailored to a specific group of parents to identify barriers, address those barriers by implementing target specific interventions and programs and monitor them to evaluate the effectiveness of these programs.

Appendix I. IRB Approval Form

UNLV

UNLV Biomedical IRB - Administrative Review
Notice of Excluded Activity

DATE:	August 13, 2019
TO:	Brian Labus, PhD
FROM:	UNLV Biomedical IRB
PROTOCOL TITLE:	[1460817-2] Evaluating age and sex differences between vaccine-hesitant and vaccine-accepting parents
SUBMISSION TYPE:	Revision
ACTION:	EXCLUDED - NOT HUMAN SUBJECTS RESEARCH
REVIEW DATE:	August 13, 2019
REVIEW TYPE:	Administrative Review

Thank you for your submission of Revision materials for this protocol. This memorandum is notification that the protocol referenced above has been reviewed as indicated in Federal regulatory statutes 45CFR46.

The UNLV Biomedical IRB has determined this protocol does not meet the definition of human subjects research under the purview of the IRB according to federal regulations. It is not in need of further review or approval by the IRB.

We will retain a copy of this correspondence with our records.

Any changes to the excluded activity may cause this protocol to require a different level of IRB review. Should any changes need to be made, please submit a Modification Form.

If you have questions, please contact the Office of Research Integrity - Human Subjects at IRB@unlv.edu or call 702-895-2794. Please include your protocol title and IRBNet ID in all correspondence.

Office of Research Integrity - Human Subjects
4505 Maryland Parkway . Box 451047 . Las Vegas, Nevada 89154-1047
(702) 895-2794 . FAX: (702) 895-0805 . IRB@unlv.edu

Appendix II. SAS Code

```
libname Qual 'E:\My data';
options fmtsearch=(qual.formats);
Proc format ;* library = Qual.Myformat;

value FMTAGE
                1='18-30 Young adult'
                2='31-55 Older Adult'    ;
value fmtrace
                1='White'
                2='Other race' ;
value fmtedu
                1='No college degree'
                2='College degree'                ;
value fmtInc
                1='Low income'
                2='Middle-Class Income'
                3='Upper middle & high income'       ;
value fmtgen
                1='Female'
                2='Male'                  ;
value fmtmar
                1='Not married'
                2='Married'               ;
value fmtvac
                1="Accept"
                2="Hesitant"
                3="Refuse";               run;

proc contents data=qual.qual_deid; run;

data qual_deid_recoded; set qual.qual_deid;
keep  Q1 Q2   Q3      Q4 Q5_1        Q5_2 Q5_3 Q5_4 Q5_5 Q5_6 Q16_1 Q17_1 Q18_1
        Q19_1 Q20_1 Q21_1 Q22_1 Q23_1 Q24_1 Q25_1 Q26_1 Q109 Q111 Q114
    childs_age ; run;

*Recoding Race ;
data qual_deid_recodedR ; set qual_deid_recoded;
race_sum= sum (Q5_1, Q5_2, Q5_3, Q5_4, Q5_5, Q5_6 );
IF Q5_2= 1 or Q5_3= 1 or Q5_4= 1 or Q5_5= 1 or Q5_6= 1 or race_sum>1 THEN Race =2;
*Other including Multirace, African-American or Black, American Indian, Asian; *Native
Hawaiian or other Pacific Islander;
ELSE IF Q5  1= 1 THEN Race =1; *White;           run;
proc freq data = qual_deid_recodedR ;
table race_sum*Q5_1*Q5_2*Q5_3*Q5_4*Q5_5*Q5_6*race race/ list missing; run;
```

```
*Recode Age ;
data qual_deid_recodedAG ; set qual_deid_recodedR;
*if Q2 = ' ' then agegroup = 'missing';
if Q2 LE 30 then agegroup = 1 ; *'young adult';
if Q2 GT 31 then agegroup = 2 ; *'older adult';run;

*Recode Education ;
data qual_deid_recodedE ; set qual_deid_recodedAG;
if Q111 in (1  2  3 4 5) then Education = 1 ;  * No college degree;
if Q111 in (6 7 8) then Education = 2;         * College degree ; run;

* Recode Income  ;
data qual_deid_recodedI ; set qual_deid_recodedE;
if Q114= 1 then Income = 1 ;                   * Low income;
if Q114 in (2 3 4) then Income = 2;            * Middle-class Income ;
if Q114 in (5 6 7 8 9 10 11) then Income= 3;    * Upper middle and high income ; run;

* Recode Marital ;
data qual_deid_recodedM ; set qual_deid_recodedI;
if Q109 in (1 2 3 5 6) then Marital_status = 1;     * Not married ;
if Q109= 4 then Marital_status = 2;                 * Married ;

* Recode Gender ;
data qual_deid_recodedG ; set qual_deid_recodedM;
*if Q3 = ' ' then Gender = 'missing';
if Q3= 1 then Gender = 1 ; * 'Female';
if Q3= 2 then Gender = 2;  * 'Male';run;

data qual_deid_recodedA;  set qual_deid_recodedG;*options yearcutoff=1900;
surveydate='01NOV2016'd;
format surveydate DATE9.;

*now calculating years of follow up and age at birth;
age_days=INTCK('day', Q1, surveydate);
child_age=age_days/365;
child_age_yrs=abs(child_age);
format child_age_yrs 3.2;

label    child_age_yrs= 'youngest childs date of birth'
         agegroup = ' Age in years at screening'
          Gender= 'Gender'
          Race= 'Race'
          Marital_status= 'Relationship'
          Education = 'Education'
         Income = 'Annual household income';
```

```
        rename
      Q16_1= DTaP
      Q17_1= Polio
      Q18_1= Hep_A
      Q19_1= Hep_B
      Q20_1= Hib
      Q21_1= RV
      Q22_1= Last_flu
      Q23_1= Current_flu
      Q24_1= MMR
            Q25_1= PCV
            Q26_1= Varicella ;

FORMAT agegroup FMTAGE.   Race  fmtrace.   Education fmtedu.   Income fmtInc.    Gender
fmtgen.  Marital_status fmtmar.  Vaccine_D fmtvac.  ;   run;

/*Data step to assign refusal, don't know as missing based on age category*/
Data qual_deid_recodedA2; set qual_deid_recodedA;
if age_days <60 then do;
array _rdmiss DTaP  Polio   Hep_A    Hib    RV   Last_flu  Current_flu    MMR   PCV
Varicella  ;
        do over _rdmiss;
        if _rdmiss in (1,2,3) then _rdmiss=0;
    end; end;

if age_days >= 60 and age_days <365  then do;
array _rdmiss1  Hep_A  Hep_B   Last_flu  Current_flu   MMR   Varicella   ;
        do over _rdmiss1;
        if _rdmiss1  in (1,2,3) then _rdmiss1=0;
        end; end;                run;

data qual_deid_recodedV; set qual_deid_recodedA2;
array _rdmiss DTaP  Polio  Hep_A    Hep_B  Hib  RV  Last_flu  Current_flu  MMR  PCV
        Varicella
;do over   rdmiss;
if _rdmiss in (2,3) then _rdmiss=0;
if _rdmiss in (1) then _rdmiss=1;
end;                 run;

data qual_deid_recodedV2; set qual_deid_recodedV;
vaccine= sum (DTaP, Polio, Hep_A, Hep_B , Hib , RV  ,Last_flu,  Current_flu,  MMR,  PCV,
Varicella);                 run;

data qual_deid_recodedVA; set qual_deid_recodedV2;
if age_days <60 and vaccine= 1 then Vaccine_D = 1 ; * accept ;
*else Vaccine_D = 3 ; *refuse ;
```

```
else if (age_days >= 60 and age_days <365) and  Vaccine >= 5 then Vaccine_D =1 ;     *accept ;
else if (age  days >= 60 and age_days <365) and  (Vaccine >2 and Vaccine <5) then Vaccine_D
= 2 ; *Hesitant;
*else if (age_days >= 60 and age_days <365) and  Vaccine <= 2 then Vaccine_D =3 ; *refuse;

else if age_days >= 365 and Vaccine >= 8 then Vaccine_D = 1 ; *accept ;
else if age_days >= 365 and (Vaccine >3 and Vaccine <8) then Vaccine_D = 2 ; *Hesitant;
*else if age  days >= 365 and Vaccine <= 3 then Vaccine_D = 3 ; *refuse;
else Vaccine_D = 3 ; *refuse;                 run;

proc freq data= qual_deid_recodedVA; table child_age_yrs*age_days / list missing; run;
proc means data = qual_deid_recodedVA
 qntldef=1
 n mean median q1 q3 max min ;
 var child_age_yrs;                 run;

proc freq data= qual_deid_recodedVA; table  agegroup   Gender   Race   Marital_status
Education   Income / list missing; run;
proc freq data= qual_deid_recodedVA; table  Vaccine_D / list missing; where  age_days >= 365
;run;

* Logistic R ;
'' ;
* all var ;
proc logistic data = qual_deid_recodedVA descending ;
class Gender(ref='Female') race(ref= 'White') agegroup (ref= '18-30 Young adult')
Marital_status (ref= 'Married') Education (ref= 'No college degree') Income (ref= 'Middle-Class
Income') ;
  model Vaccine_D = Gender race agegroup Marital_status Education Income / link = glogit  ;
run; quit;
proc logistic data = qual_deid_recodedVA descending ;
class Income (ref= 'Middle-Class Income') ;
  model Vaccine_D = Income / link = glogit  ;            run; quit;
* agegender interaction;
proc logistic data = qual_deid_recodedVA descending ;
class Gender(ref='Female') race(ref= 'White') agegroup (ref= '18-30 Young adult')
Marital_status (ref= 'Married') Education (ref= 'No college degree') Income (ref= 'Middle-Class
Income') ;
  model Vaccine_D = Gender race agegroup Marital_status Education Income
agegroup*gender/link = glogit;           run; quit;
* Pick sig ;
proc logistic data = qual_deid_recodedVA descending ;
class Gender(ref='Female') Marital_status (ref= 'Married') Income (ref= 'Middle-Class Income') ;
  model Vaccine_D = Gender   Marital_status  Income /link = glogit;          run; quit;
```

Appendix III. National Parent Vaccine Confidence Survey

National Parent Vaccine Confidence Typology Survey – Frew et al., 2019

Instructions: Please complete the following questions to reflect your opinions as accurately as possible and to answer questions to the best of your knowledge. Your information will be kept strictly confidential.

Q1 What is your youngest child's date of birth? (yyyy/mm/dd)

If What is your youngest child... Is Less Than 2010/10/20, Then Skip To End of Block

Q2 How old are you (years)?

If How old are you (years)? Is Less Than 18, Then Skip To End of Block

Q3 What is your gender?

- ❍ Female (1)
- ❍ Male (2)

Q5 Please choose one or more of the following to describe your race (select all that apply):

- ❑ White (1)
- ❑ Black or African-American (2)
- ❑ American Indian (3)
- ❑ Asian (4)
- ❑ Native Hawaiian or other Pacific Islander (5)
- ❑ Other (6)

Instructions Please select the answer choice that best describes your knowledge of the vaccines your youngest child has received.

Q14

	Yes, s/he has received this vaccine (1)	No, s/he has not received this vaccine (2)	Not sure if s/he has received this vaccine (3)
Whooping Cough (Diphtheria, Tetanus, and acellular Pertussis (DTaP)) (1)	❍	❍	❍

Q15

	Yes, s/he has received this vaccine (1)	No, s/he has not received this vaccine (2)	Not sure if s/he has received this vaccine (3)
Polio (1)	❍	❍	❍

Q16

	Yes, s/he has received this vaccine (1)	No, s/he has not received this vaccine (2)	Not sure if s/he has received this vaccine (3)
Hepatitis A (HAV) (1)	❍	❍	❍

Q17

	Yes, s/he has received this vaccine (1)	No, s/he has not received this vaccine (2)	Not sure if s/he has received this vaccine (3)
Hepatitis B (HBV) (1)	❍	❍	❍

Q18

	Yes, s/he has received this vaccine (1)	No, s/he has not received this vaccine (2)	Not sure if s/he has received this vaccine (3)
Hib (Haemophilus Influenzae type b) (1)	❍	❍	❍

Q19

	Yes, s/he has received this vaccine (1)	No, s/he has not received this vaccine (2)	Not sure if s/he has received this vaccine (3)
Rotavirus (RV) (1)	❍	❍	❍

Q20

	Yes, s/he has received this vaccine (1)	No, s/he has not received this vaccine (2)	Not sure if s/he has received this vaccine (3)
Flu (Influenza) – Last Season (2015/2016) (1)	❍	❍	❍

Q21

	Yes, s/he has received this vaccine (1)	No, s/he has not received this vaccine (2)	Not sure if s/he has received this vaccine (3)
Flu (Influenza) – Current Season (2016/2017) (1)	❍	❍	❍

Q22

	Yes, s/he has received this vaccine (1)	No, s/he has not received this vaccine (2)	Not sure if s/he has received this vaccine (3)
Measles, mumps, and rubella (MMR) (1)	❍	❍	❍

Q23

	Yes, s/he has received this vaccine (1)	No, s/he has not received this vaccine (2)	Not sure if s/he has received this vaccine (3)
Pneumonia (Pneumococcal (PCV)) (1)	❍	❍	❍

Q24

	Yes, s/he has received this vaccine (1)	No, s/he has not received this vaccine (2)	Not sure if s/he has received this vaccine (3)
Chickenpox (Varicella) (1)	❍	❍	❍

Q110 Please select your current relationship status:
- ❍ Single/Not Married (1)
- ❍ Divorced (2)
- ❍ Widowed (3)
- ❍ Married (4)
- ❍ Domestic Partner (5)
- ❍ Separated (6)

Q112 What is the highest level of education you have completed?
- ❍ K - 8th grade (1)
- ❍ 9th -11th grade (2)
- ❍ High school graduate/GED (3)
- ❍ Some college credit but no degree (4)
- ❍ Technical/Vocational or Associates degree (5)
- ❍ Bachelor’s degree (6)
- ❍ Master’s degree (7)
- ❍ Doctorate (e.g. MD, JD, PhD) (8)

Q115 What is your annual household income (i.e., combined income of all members of your family)?
- ❍ Less than $20,000 (1)
- ❍ $20,001-$40,000 (2)
- ❍ $40,001-$60,000 (3)
- ❍ $60,001-$80,000 (4)
- ❍ $80,001-$100,000 (5)
- ❍ $100,001-$120,000 (6)
- ❍ $120,001-$140,000 (7)
- ❍ $140,001-$160,000 (8)
- ❍ $160,001-$180,000 (9)
- ❍ $180,001-$200,000 (10)
- ❍ $200,001 or more (11)

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Curriculum Vitae

Mehret Girmay

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EDUCATION

University of Nevada, Las Vegas (UNLV) August 2019
Masters of Public Health, Epidemiology and Biostatistics

St. Cloud State University (SCSU), St. Cloud, MN May 2013
Bachelor of Science in Community Health, *Cum Laude*

- Minor in Biology

St. Cloud Technical College, St. Cloud, MN April 2012
Certified Nursing Assistant (CNA**)**

RESEARCH PRESENTATION

Presenter, St. Cloud State University, Kinesiology Department, 2012

- Presented poster at a Student Research Colloquium on new public health epidemic which mainly focused on the elderly population.
- The research informed and acknowledged the statistics in the change of the numbers of the elderly that are infected with STDs. It also contained the types of STDs that are seen in this population, the cause, symptoms and prevention of STDs among the older population

Thesis, University of Nevada, Las Vegas, School of Public Health, 2019

- Presented prospectus and thesis for faculty and students on ‘evaluating factors that affect vaccine decision of parents whose child is under the age of seven.
- The research aim was to address characteristic differences among vaccine refusers, delayers, and acceptors, by comparing parents based on age, gender, race, education level and income. The results from the study can help to identify and reach primary targets for intervention and surveillance efforts and to increase childhood vaccination coverage.

EMPLOYEMENT

Graduate Assistant

University of Nevada, Las Vegas, NV Aug 2017- Present

- Reviewed manuscripts to be published
- Collected data for research purposes on health behaviors among opioid users
- Worked on posters for presentation that was presented on a conference
- Analyzed data related to childhood vaccine and parent’s vaccine decision

Laboratory duties

- Conducted reagent preparation, DNA extraction, and general laboratory maintenance
- Updated stock culture inventory spreadsheet
- Organized and prepared drums to collect pollen samples

- Collected field (pollen) samples and prepared the samples for analysis
- Ordered, obtained and organized invoices from multiple vendors for laboratory orders

Teaching assistance

- Conducted scientific literature reviews to update supplemental course reading materials for EOH 740, Fundamentals of Environmental Health
- Obtained webpage links to newspaper articles related to current events for EOH 740
- Contacted internship preceptors for poster donation to the Nevada Gear Up Program, and prepared gift bags for preceptors

Accreditation tasks

- Revised spreadsheets/Google Sheets to incorporate new competencies
- Conducted data entry related to exit surveys and faculty evaluation of students
- Routinely updated Google sheet for tracking the exit surveys and faculty evaluation of students
- Transcribed hand changes for degree worksheets into electronic documents
- Transcribed hand changes for the SCHS faculty booklet into the electronic document
- Researched, compiled, organized and updated a bulletin board for accreditation by the Council on Education for Public Health (CEPH)

Teacher

Childcare Development Center, St. Cloud, MN Aug. 2016 - Aug. 2017

- Taught different subjects to preschool children (3-5 yrs. old) by following a curriculum
- Prepared lesson plans and small projects weekly
- Met with parents/guardians to discuss students' progress

Teacher

Moonlight day care, St. Cloud, MN May 2014- Jul 2016

- Taught Math and English to preschool and school age children
- Prepared lesson plans and projects daily
- Met with parents weekly to discuss students' progress

Community Health Intern

Women's center, St. Cloud, MN Jan 2013- May 2013

- Coordinated programs for health promotion and community outreach
- Attended meetings as a representative of the Women's Center
- Involved in women health promotion and community outreach
- Created a registration form for a workshop and take notes at a weekly staff meeting to update the agenda on share drive
- Planned and organized a liberation or Bust event which was organized to educated college students about body image.
- Contacted with different departments and small business for sponsor and donations
- Assisted with a program called "operation Beautiful" which entails leaving behind anonymous thoughtful messages throughout the campus.
- Represented the women's center by getting involved with the planning and coordinating committee for National Eating Disorders awareness (NEDA/ANAD) week
- Worked in the front desk at times and assisted with information

Tutor

Technical High School, Pre- College Program, SCSU, MN Sep 2009- May2013

- Tutored and mentored high school students from grade 9 to 12
- Assisted advisors with school field trips by supervising the students
- Entered and filed students' data and other paper work
- Assisted teachers in classroom with lab experiments and math solving
- Helped students who had hard time following the teacher in class room with translation, and slow explanation

Volunteer

St. Benedict's Senior Community, St. Cloud, MN Feb 2009- 2012

- Worked with the event coordinator in planning and organizing events
- Interacted one-on-one with residents and participated in activities
- Assisted manager with resident's morning physical exercise routine
- Organized daily activities and participated in the activities to encourage residents

UNIVERSITY HONORS AND SCHOLARSHIPS

- Graduate assistantship, 2017-2019
- Dean list St. Cloud University, 2013
- Cultural sharing scholarship, 2008-2013

ACTIVITIES AND INVOLVMENTS

- **Representative**, Active minds, SCSU, Jan.2013- Dec.2013
- **Representative,** for Power in Diversity Leadership Conference, Jan. 2012
- **Event coordinator**, Ethiopian Student Association (ESA), Jan. 2011-May 2013
- **Volunteer**, Alzheimer's Association, SCSU, Sept. 2012
- **Volunteer**, University Program Board (UPB), Aug. 2010- Dec. 2010
- **Volunteer**, St. Benedict's Senior Community, St. Cloud, MN, 2009- 2012
- **Active member,** African Student Association(ASA), 2008- 2010
- **Active member,** Organization for People with AIDS in Africa (OPPA), 2008-2009
- **Conference speaker**, the Model United Nations, A.A, Ethiopia, 2006- 2007

ADDITIONAL SKILLS

- Statistical Software, SPSS and SAS
- Collect, manage and organize data
- Fluent in English, Amharic, and Tigrigna
- Lab Techniques and Procedures
- Microsoft Office Word, Power Point, and Excel
- Educated in the evaluation and interpretation of epidemiological literature
- Statistical skills to calculate and interpret epidemiologic measures
- Well-informed on strengths and limitations of different study designs
- Knowledgeable about chronic and infectious disease surveillance
- Knowledge about data analysis using Regression Models