PHUSE US Connect 2021

Demographic and socio-economic disparities in preference to get vaccinated by Flu shot versus Flu spray in the United States National Immunization Survey (NIS) data using Statistical Analysis Software (SAS)

Swapna Ambati, Eliassen Group, Somerset, USA
Ziphora Sam, Eliassen Group, Somerset, USA

ABSTRACT

Influenza (Flu) is one of the most common causes of respiratory illness and absenteeism at work and school. Flu is a common virus whose ability to change its genetic makeup could result in a pandemic proportion of the disease. In 2009, a novel Influenza virus caused the first Influenza related pandemic in the 21st century. The major step in preventing Flu is taking a Flu vaccine every year. A Flu vaccine can be administered as a shot or a spray. In this paper, we examined children using the national survey database the National Immunization Survey (NIS) in 2019. We discussed the disparities in the demographic and the socio-economic characteristics in preferring to get vaccinated for Flu. We also discussed the availability and preference to take Flu vaccine based on the type of administration mainly Flu shot and Flu spray. Also, we examined the reasons for the low usage in administration types and their trends in the past and prospects in the future. Our purpose is to provide knowledge of past and current usage of the Flu vaccine in general and by its administration types. The demographic and socio-economic disparities studied in this paper will help us identify any gaps in Flu vaccination usage. This also helps us to identify the areas where improvements can be done to increase Flu vaccination usage by other administration type nasal spray which could be a good option for seasonal vaccines.

INTRODUCTION

Influenza (Flu) is one of the most common causes of respiratory illness and absenteeism at work and school for parents and children, respectively. Children with age younger than 18 are likely to develop Flu infections. There are three types of viruses A, B, and C that cause influenza [1]. Flu is a common virus whose ability to change its genetic makeup could result in a pandemic proportion of the disease. In 2009, a novel Influenza virus caused the first Influenza related pandemic in the 21st century [2]. The major step in preventing Flu infection and Flu-related hospitalizations is taking Flu vaccine every year. The Flu vaccine is a seasonal vaccine given once or more every year and the Flu vaccine is updated as a new version since the Flu virus can rapidly change its composition. There are at least two ways of administering this vaccine giving people a choice in the method of administration. A Flu vaccine can be administered by different methods but mainly as a shot or as a spray. A Flu shot or Flu injection is given on the arm/ leg of a child while the spray is inhaled through the nose. The shot form of the Flu vaccine has an inactivated or recombinant virus while the nasal spray form has a live virus that has been altered to replicate only in the nose but not cause any disease. A shot can be painful while the spray may not. The side effects are minor for both Flu shot and Flu spray, but comparatively side effects are slightly more severe in the current available nasal spray as it has a live attenuated virus (LAIV). Live attenuated virus might result in increased side effects when compared to an inactivated virus. Also, there is a difference in the age restriction between different types of administration in the Flu Vaccine. The Flu shot can be given to children (6 months and up) and adults. The Flu shot cannot be given to children under 6 months, people who got Guillain-Barre Syndrome when taking the Flu vaccine, life-threatening allergies. Flu spray is given to children i.e. 2 or older and adults up to 49 years old. Restrictions for the usage of Flu spray are more than

Flu shots. Restrictions for Flu spray include children aged 2 and under, adults 50 and older, pregnant women, people with other medical conditions. A Flu shot is available for younger children, safer for a larger age group comparatively. Flu spray is easy to take when compared to a Flu shot [3]. This paper will give us insight into any preference, availability, and usage in the type of Flu vaccine administration as we will examine disparities among different demographic and socio-economic characters. Some of the demographic and socio-economic characters that we examined include mother's education, mother's age, combined family income, mother's marital status, child's birth order, child's breastfed status, child's/ teen's age group, Provider Facility, Ethnicity, Insurance, Hispanic status, Region, Gender. This will also give us insight into whether the spray is a good option.

Nasal spray can be a good option for those who do not like shots, or for those who have vaccine hesitancy because it is a shot. It is also a good option for seasonal vaccines such as Flu and Covid - 19. Seasonal vaccines are meant for the virus that can change genetic makeup. Flu vaccines are updated every year if needed. This could be also the case with the Covid -19 vaccine. The nasal spray is also good because it could trigger both mucosal and systemic immune responses, while a shot might trigger only systemic responses [4].

METHODS

The cross-sectional national survey data from the National Immunization Survey (NIS) is used for the analysis. This database is funded by the Center for disease prevention (CDC) and Respiratory Diseases (NCIRD). The National Immunization Survey (NIS) family of surveys includes NIS-Child, which monitors vaccination coverage for the U.S. population of children aged 19-35 months, and NIS- Teen, which monitors vaccination coverage for the U.S. population of adolescents aged 13-17. The NIH uses two phases of sampling (dual frame) to obtain vaccination information for a large national probability sample of young children. The first phase involves Random Digit Dialing (RDD) survey designed to identify the household with eligible children. This dialing includes landline and cell phone numbers for household interviews with the parents and the guardians. If the parent or guardian provides consent or contact information, then in the second phase of the survey, a mailed questionnaire is sent to children's vaccination providers. This second phase of the survey is called Provider Record Check (PRC) Survey, which obtains provider reported histories for eligible children. The weight, cluster, and strata variables are used as recommended in the respective year of the NIS database [5]. The latest year available i.e. 2019 is used in this study. The other database years such as 2008, 2012, 2016 are used to study trends in Flu vaccination and its usage by administration type.

Statistical Analysis Software (SAS Institute, Cary, NC, USA) is used to perform the analysis. SAS i.e., is Statistical Analysis Software is a statistical tool to retrieve data, report the data and further analyze the data. SAS procedures such as PROC SURVEYMEANS, PROC SURVEYFREQ are used to perform the weighted analysis in the NIS database. Weighted totals for continuous variables are calculated using the SUM keyword in PROC SURVEYMEANS. Weighted percent estimates (weighted mean multiplied by 100) are calculated using the MEAN keyword and weighted percent confidence limits (weighted confidence limits by 100) are calculated using PROC SURVEYMEANS for categorical variables. Subset analysis was performed using the DOMAIN statement in PROC SURVEYMEANS. PROC SURVEYFREQ can also be used for categorical variables using the TABLE statement. PROC SURVEYFREQ also has options such as CHISQ to provide results testing significance [6].

In PROC SURVEYMEANS, Plots are only available for continuous variables. PROC SURVEYFREQ can be used to create plots for categorical variables.

TABLES AND ANALYSIS

The patient disposition chart shown in Figure 1 shows a total number of children and teens in each of the databases followed by the subset taking the Flu vaccine and then by type of administration in the NIS child database in 2019. In NIS Child 2019, 73.5% got vaccinated for Flu while in NIS Teen 2019, 54.8% got vaccinated for Flu.

This shows, most people got vaccinated for Flu irrespective of the age group. More younger children get vaccinated when compared to teens. Among each age group, most of them took Flu vaccine by shot and very few took Flu vaccine by spray alone. Flu spray usage is very low in 2019 NIS data. When comparing different age groups, the Flu spray usage in teens is higher when compared to children i.e. 3% of the teens when compared to only 0.6% in younger children. The reason for teens having higher Flu spray usage than children could be because of the age restriction for spray vaccines in younger children. Children aged 2 and under, are not allowed to take Flu spray.

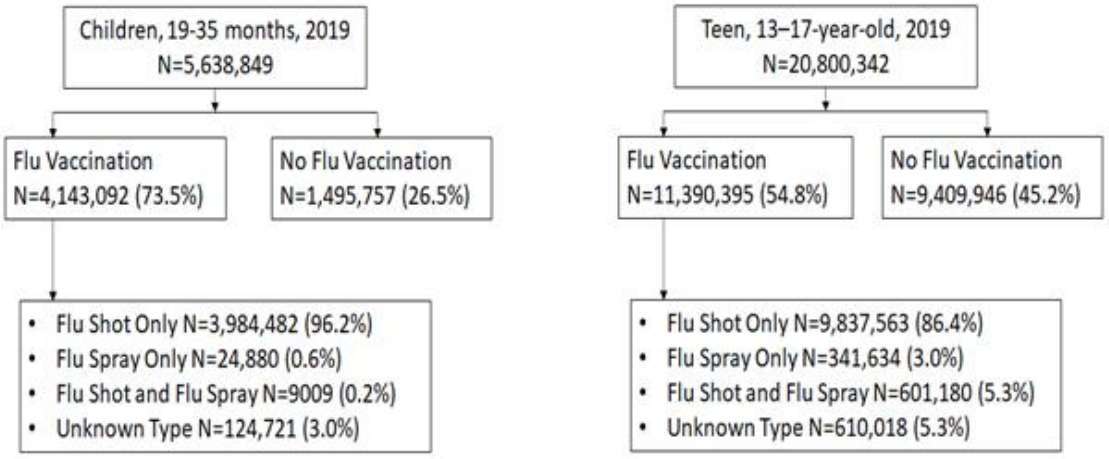

Figure 1: Vaccine coverage among children and teen by type of administration, 2019

Figures 2 to Figure 5 show the demographic and socioeconomic disparities among children and teens taking Flu vaccinations. This difference in numbers could be due to the availability, accessibility, and attainability of Flu vaccine to a certain set of populations or due to the preference to get vaccinated by a certain set of populations.

Figure 2 shows percent weighted estimates of Flu vaccination coverage. The results indicate that mothers who are college grads, older mothers, families with status above poverty, married mothers, children who are not firstborn, children who are breastfed and older-aged children comparatively had higher Flu vaccination coverage in the NIS 2019 data.

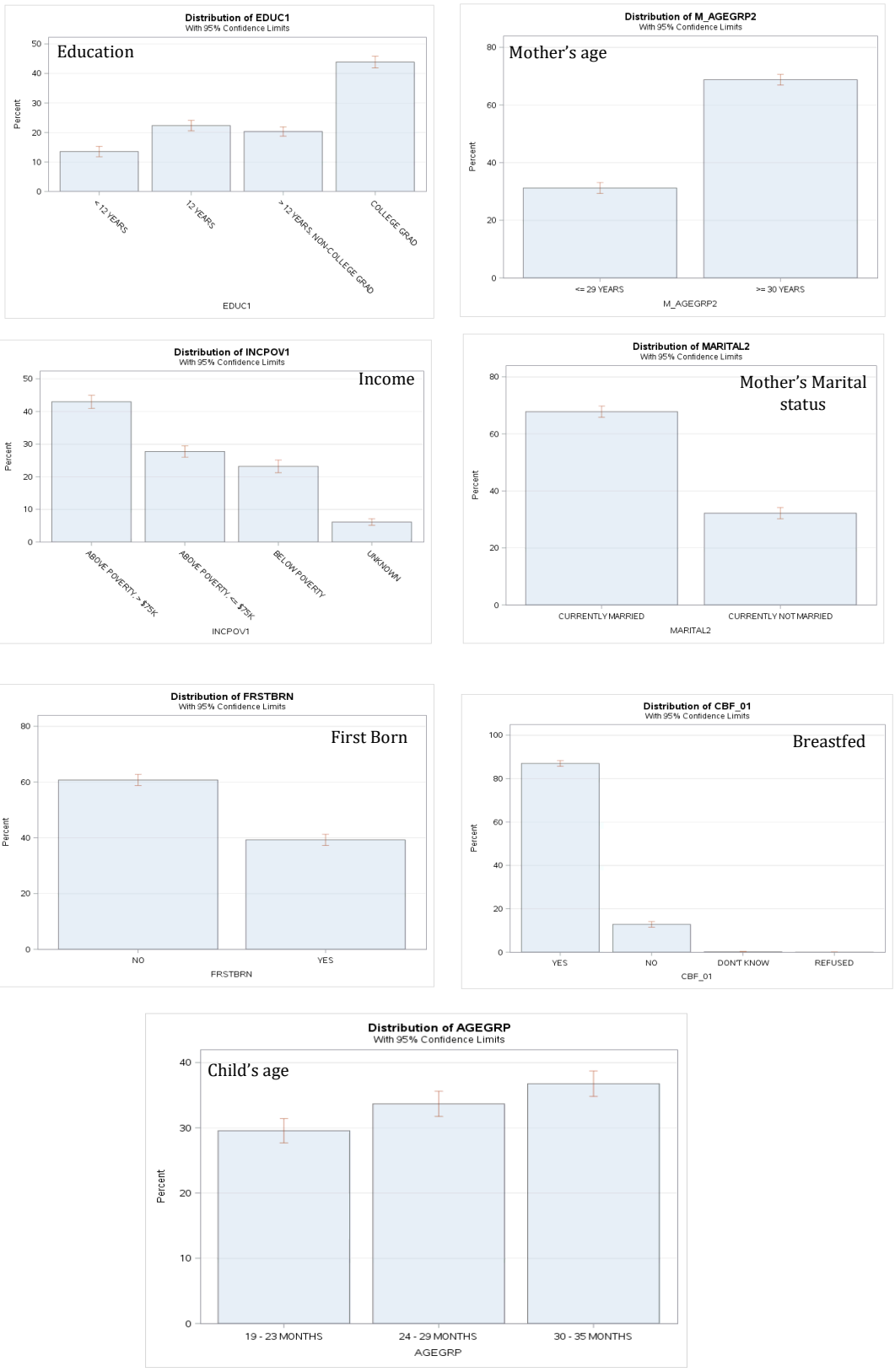

Figure 2: Vaccine coverage among children 2019 data by mother's education, mother's age, combined family income, mother's marital status, child's birth order, child's breastfed status, child's age group.

The NIS Children 2019 data is further analyzed in Figure 3 below. This shows that private facilities, non-Hispanic white race, family's with private insurance, non-Hispanic ethnicity, people in South region, and males comparatively have a higher percentage of Flu vaccination coverage.

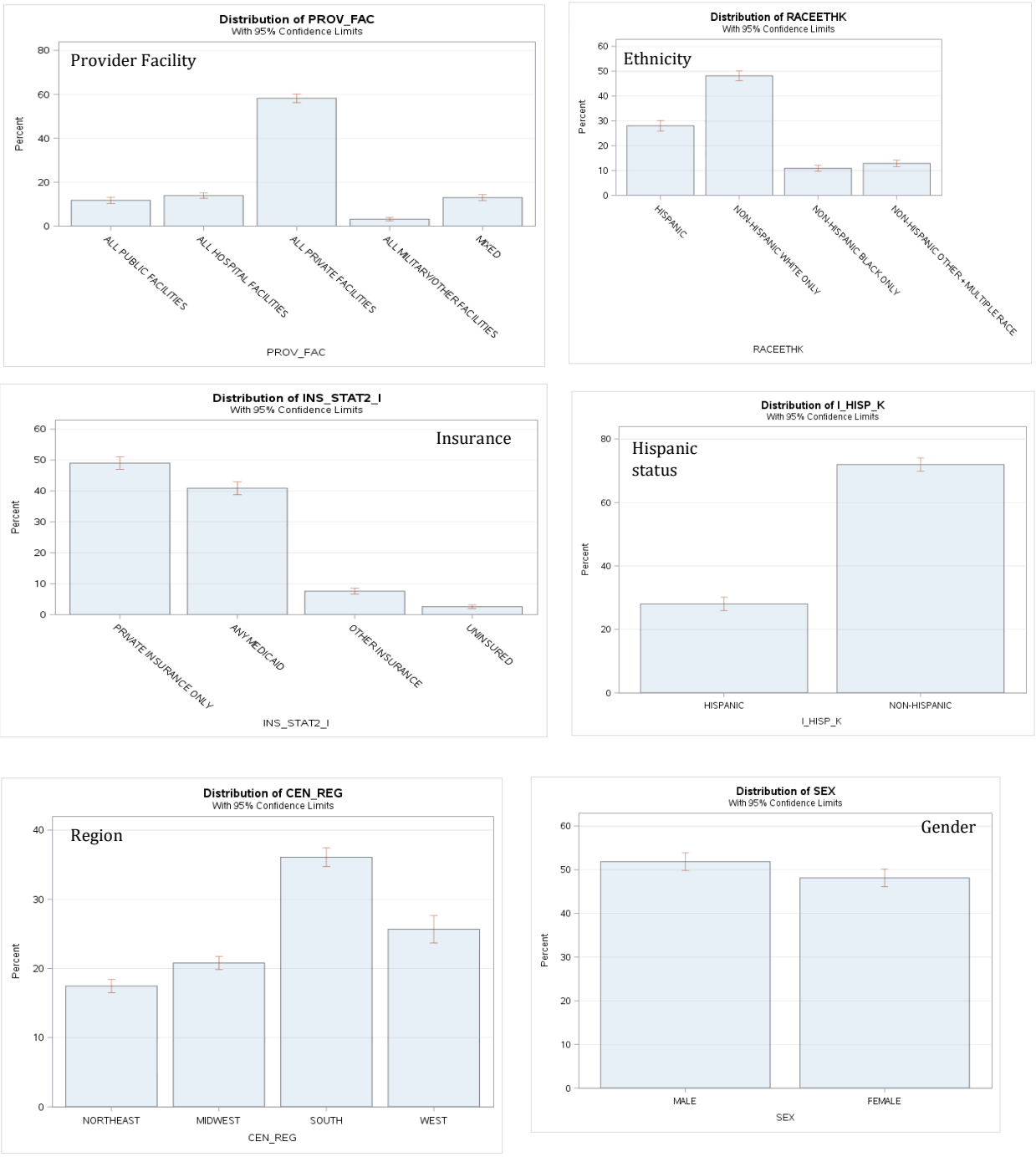

Figure 3: Vaccine coverage among children 2019 data by Provider Facility, Ethnicity, Insurance, Hispanic status, Region, Gender.

Similar results are observed in teens using NIS 2019 data as shown in Figures 4 and 5. Mothers who are college grads, older mothers, people with above poverty status, people who are privately insured, married mothers, people in the south region, private facilities, non-Hispanic white race, non-Hispanic ethnicity, male and older teens comparatively had higher Flu vaccination coverage.

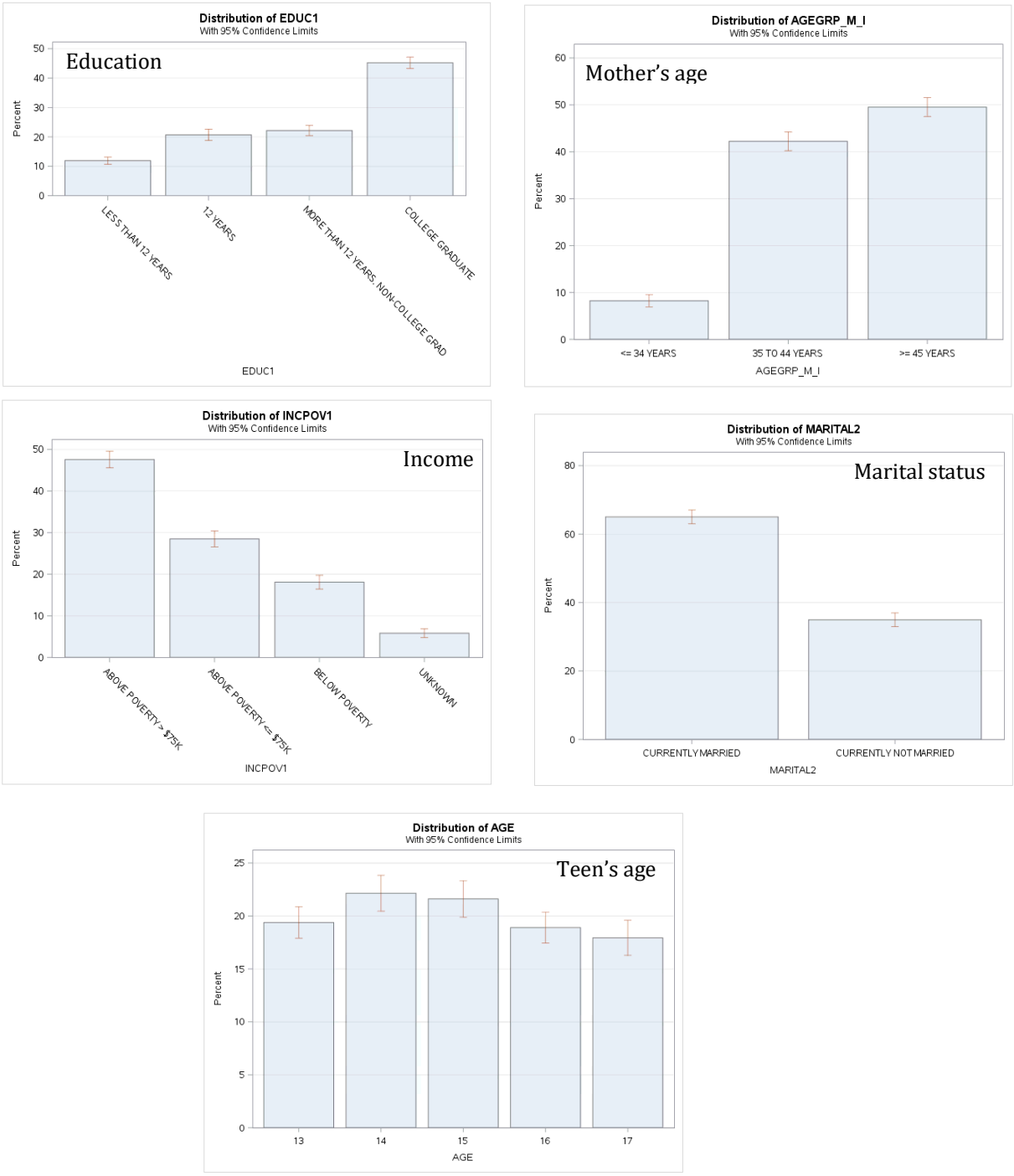

Figure 4: Vaccine coverage among teen 2019 data by mother's education, mother's age, combined family income, mother's marital status, teen's age group.

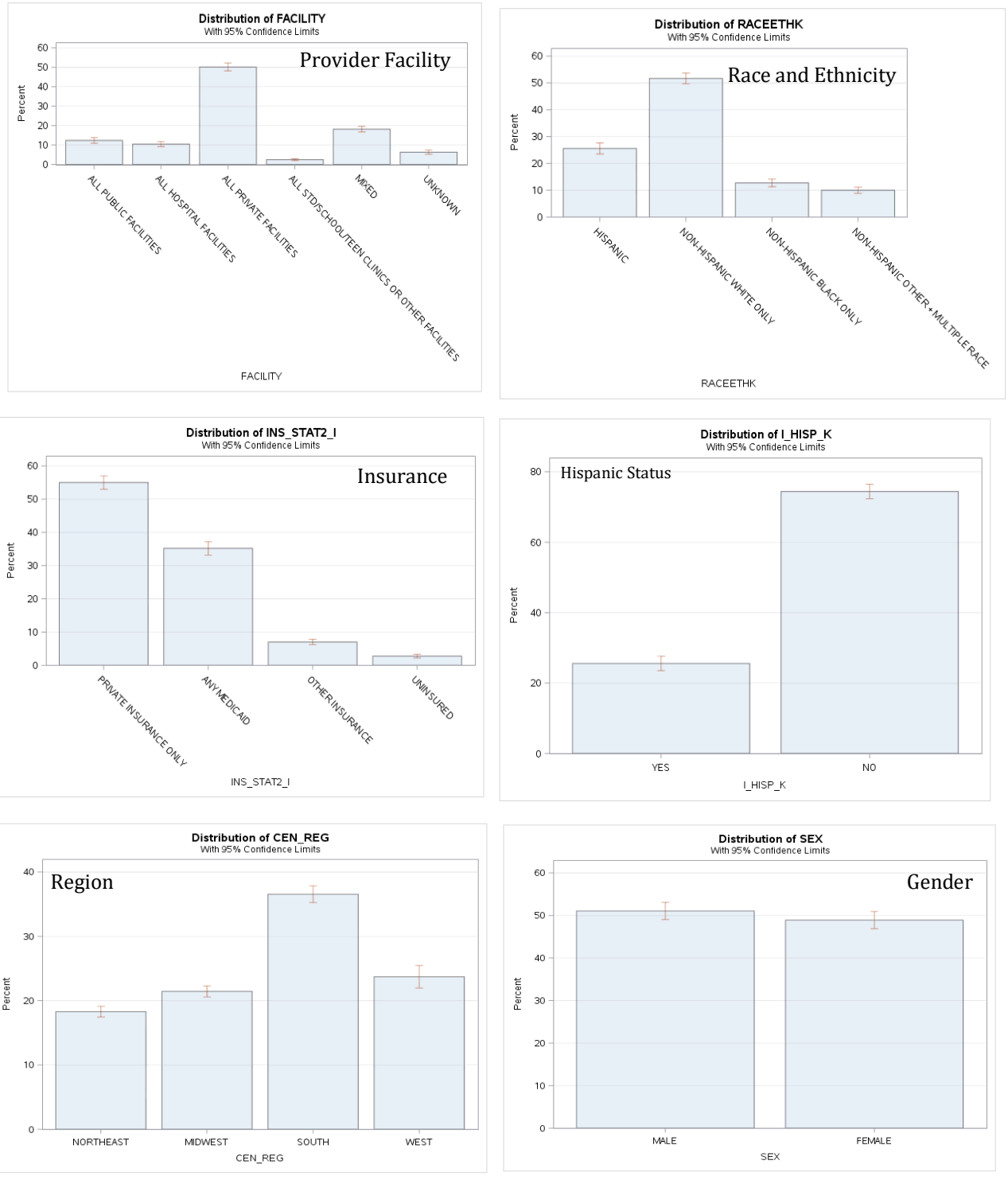

Figure 5: Vaccine coverage among teen's 2019 data by Provider Facility, Ethnicity, Insurance, Hispanic status, Region, Gender.

Demographic and Socioeconomic characteristics	Administration Type			
	Flu Shot only	Flu Spray only	Flu Shot and Flu Spray	Unknown
Child's Age				
19-23 months	96 (94.2-97.9)	0.6 (0.1-1)	0.1 (0-0.1)	3.4 (1.5-5.2)
24-29 months	95.2 (93.8-96.7)	0.8 (0.4-1.2)	0.2 (0-0.3)	3.8 (2.4-5.2)
30-35 months	97.2 (96.4-97.9)	0.5 (0.1-0.9)	0.4 (0.1-0.7)	2 (1.4-2.6)
Child's Race				
Hispanic	95.5 (93.4-97.6)	0.6 (0.1-1)	0.3 (0.1-0.5)	3.7 (1.6-5.7)
Non-Hispanic White only	97 (96.1-97.9)	0.6 (0.3-1)	0.2 (0-0.4)	2.1 (1.4-2.9)
Non-Hispanic Black only	94.4 (91.9-96.8)	0.1 (0-0.2)	0 (0-0.1)	5.5 (3.1-8)
Non-Hispanic Other + Multiple Race	96 (94.5-97.6)	1 (0.1-1.8)	0.3 (0-0.6)	2.7 (1.5-4)
Child's Ethnicity				
Hispanic	95.5 (93.4-97.6)	0.6 (0.1-1)	0.3 (0.1-0.5)	3.7 (1.6-5.7)
Non Hispanic	96.4 (95.7-97.2)	0.6 (0.3-0.9)	0.2 (0-0.4)	2.8 (2.1-3.4)
Child's Gender				
Male	96.6 (95.8-97.4)	0.5 (0.2-0.7)	0.2 (0.1-0.3)	2.7 (2-3.5)
Female	95.7 (94.3-97.1)	0.7 (0.3-1.2)	0.3 (0-0.5)	3.3 (2-4.6)
Child First Born				
Yes	95.8 (94.7-96.9)	0.8 (0.4-1.1)	0.2 (0.1-0.3)	3.3 (2.2-4.3)
No	96.7 (95.7-97.8)		0.3 (0-0.6)	2.6 (1.6-3.6)
Mother's Education				
Less than 12 Years	95.6 (91.9-99.2)	0 (00)	0.1 (0-0.2)	4.4 (0.7-8)
12 Years	94.5 (92.7-96.2)	1.2 (0.3-2.1)	0.4 (0-0.9)	3.9 (2.5-5.4)
More than 12 years, not a collge graduate	96.3 (94.7-97.8)	0.5 (0.1-0.9)	0.1 (0-0.2)	3.1 (1.6-4.6)
College Graduate	97.2 (96.3-98)	0.5 (0.3-0.8)	0.2 (0.1-0.3)	2.1 (1.3-2.9)
Mother's Age Group				
<= 29 Years	95.6 (94.3-96.9)	0.6 (0.2-1)	0.4 (0-0.8)	3.4 (2.2-4.7)
>= 30 Years	96.4 (95.4-97.4)	0.6 (0.3-0.9)	0.1 (0.1-0.2)	2.8 (1.9-3.8)
Marital Status				
Currently Married	97 (96.3-97.7)	0.6 (0.3-0.9)	0.1 (0.1-0.2)	2.3 (1.6-2.9)
Not Currently Married	94.5 (92.5-96.4)	0.6 (0.2-1)	0.4 (0-0.7)	4.5 (2.7-6.4)
Breastfed				
Yes	96.7 (96-97.3)	0.5 (0.3-0.8)	0.2 (0.1-0.3)	2.6 (2-3.2)
No	92.8 (88.7-97)	1 (0.1-1.9)	0.6 (0-1.4)	5.6 (1.6-9.6)
Poverty				
Above Poverty > $75k	97.5 (96.5-98.4)	0.5 (0.2-0.8)	0.1 (0-0.2)	1.9 (1-2.8)
Above Poverty <= $75k	96.1 (94.9-97.2)	1 (0.3-1.7)	0.2 (0.1-0.3)	2.8 (1.8-3.7)
Below Poverty	93.9 (91.4-96.4)	0.4 (0.1-0.7)	0.5 (0-1)	5.2 (2.8-7.6)
Unknown	96 (93.2-98.8)	0.3 (0-0.9)	0 (00)	3.7 (1-6.4)
Census Region				
Northeast	96.3 (94.8-97.9)	0.9 (0.2-1.6)	0.4 (0-1)	2.4 (1.1-3.7)
Midwest	95.4 (94.1-96.7)	0.3 (0-0.6)	0.1 (0-0.3)	4.2 (2.9-5.5)
South	96.8 (96-97.7)	0.6 (0.3-1)	0.2 (0.1-0.4)	2.3 (1.5-3)
West	95.8 (93.4-98.2)	0.6 (0-1.2)	0.1 (0-0.3)	3.5 (1.1-5.8)
Provider Facility				
All Public Facilities	94.7 (92.6-96.7)	0.3 (0-0.7)	0 (0-0.1)	5 (3-7)
All Hospital Facilities	93 (89.3-96.7)	0.3 (0-0.6)	0.5 (0-1.3)	6.2 (2.5-9.9)
All Private Facilities	96.9 (96-97.7)	0.8 (0.4-1.2)	0.2 (0.1-0.3)	2.2 (1.4-2.9)
All Military/ Other Facilities	96.2 (93.7-98.6)	0.4 (0-0.9)	0.6 (0-1.8)	2.9 (0.8-4.9)
Mixed	97.8 (96.6-99.1)	0.3 (0-0.7)	0.2 (0-0.4)	1.6 (0.4-2.8)
Insurance				
Private insurance only	97.3 (96.5-98.1)	0.4 (0.2-0.7)	0.3 (0-0.5)	2 (1.3-2.8)
Any medicaid	95 (93.4-96.6)	0.4 (0.2-0.6)	0.2 (0-0.3)	4.4 (2.9-6)
Other insurance (chip, ihs, military, or other, alone or in comb. with private insurance)	95.9 (93.2-98.6)	2.9 (0.3-5.5)	0.1 (0-0.3)	1.1 (0.4-1.9)
Uninsured	94.4 (89.8-98.9)	0.5 (0-1)	0.4 (0-1.3)	4.7 (0.3-9.2)

Table 1: Flu vaccination coverage by route among different demographic and socio-economic groups of children in 2019 data.

Above Table 1 shows that Flu shot was the main method of administration irrespective of different demographic and socioeconomic groups in NIS children 2019 data.

Demographic and Socioeconomic characteristics	Administration Type			
	Flu Shot only	Flu Spray only	Flu Shot and Flu Spray	Unknown
Teen's Age				
13	84 (80.6-87.4)	2.3 (1.4-3.2)	6 (4.3-7.7)	7.6 (4.6-10.7)
14	87.6 (85.3-90)	3.1 (1.9-4.2)	5.5 (3.9-7)	3.8 (2.5-5.2)
15	87.9 (85.4-90.5)	2.3 (1.2-3.4)	5.5 (3.7-7.3)	4.3 (2.7-5.9)
16	85.2 (82.2-88.1)	4.5 (2.6-6.4)	5.3 (3.9-6.7)	5.1 (3.1-7.1)
17	86.7 (82.7-90.7)	3 (1.7-4.2)	4 (2.7-5.3)	6.3 (2.5-10.2)
Teen's Race				
Hispanic	87 (83.4-90.6)	2.4 (1.4-3.4)	3.8 (2.5-5.1)	6.8 (3.4-10.1)
Non-Hispanic White only	85.9 (84.3-87.4)	3.4 (2.6-4.3)	6.4 (5.4-7.3)	4.3 (3.4-5.3)
Non-Hispanic Black only	84.5 (80.4-88.6)	3.5 (1.7-5.3)	5.6 (2.9-8.3)	6.3 (3.5-9.1)
Non-Hispanic Other + Multiple Race	89.7 (86.4-93)	1.5 (0.7-2.3)	2.9 (1.7-4.2)	5.8 (2.8-8.8)
Teens's Ethnicity				
Hispanic	87 (83.4-90.6)	2.4 (1.4-3.4)	3.8 (2.5-5.1)	6.8 (3.4-10.1)
Non Hispanic	86.2 (84.8-87.5)	3.2 (2.5-3.9)	5.8 (4.9-6.6)	4.9 (4-5.8)
Teens's Gender				
Male	85.5 (83.5-87.6)	3.5 (2.6-4.5)	5.2 (4.2-6.3)	5.7 (4-7.4)
Female	87.2 (85.5-88.9)	2.4 (1.9-3)	5.3 (4.4-6.3)	5 (3.6-6.4)
Mother's Education				
Less than 12 Years	87.6 (84.3-90.9)	2.9 (1-4.7)	4.2 (2.5-5.9)	5.3 (3-7.7)
12 Years	85.5 (82-89)	3.9 (2.3-5.6)	4.5 (3.1-5.9)	6.1 (3.2-8.9)
More than 12 years, not a collge graduate	86 (82.5-89.4)	2.4 (1.6-3.3)	5.1 (3.3-6.8)	6.5 (3.4-9.7)
College Graduate	86.6 (85-88.3)	2.9 (2.1-3.7)	6 (5-7.1)	4.5 (3.3-5.6)
Mother's Age Group				
<= 34 YEARS	84.2 (79.4-89)	2.7 (0.9-4.4)	5.3 (2.6-8.1)	7.8 (4.2-11.4)
35 TO 44 YEARS	84.4 (81.9-86.9)	3.8 (2.7-4.8)	5.3 (4.2-6.4)	6.5 (4.4-8.7)
>= 45 YEARS	88.4 (86.9-89.9)	2.4 (1.7-3.1)	5.3 (4.3-6.2)	3.9 (2.9-5)
Marital Status				
Currently Married	85.9 (84.1-87.6)	3.1 (2.4-3.9)	5.6 (4.7-6.4)	5.4 (3.9-6.9)
Not Currently Married	87.3 (85.3-89.3)	2.8 (1.8-3.7)	4.7 (3.5-6)	5.2 (3.9-6.5)
Poverty				
Above Poverty > $75k	87.2 (85.6-88.8)	2.9 (2.2-3.7)	5.7 (4.7-6.8)	4.1 (3.1-5.2)
Above Poverty <= $75k	85.4 (82.3-88.4)	3.3 (2.1-4.5)	5.3 (3.9-6.8)	6 (3.4-8.6)
Below Poverty	84.2 (80.5-88)	3.1 (1.7-4.5)	4.4 (3-5.8)	8.3 (5-11.6)
Unknown	91 (86.8-95.2)	1.6 (0-3.6)	4.1 (1.4-6.7)	3.3 (0.7-5.9)
Census Region				
Northeast	88.7 (86.5-90.9)	1.5 (0.8-2.3)	5.3 (3.8-6.7)	4.5 (2.8-6.2)
Midwest	87.5 (85.4-89.6)	2.4 (1.5-3.2)	5 (3.6-6.4)	5.1 (3.7-6.6)
South	84.3 (82.2-86.3)	4.7 (3.4-5.9)	6.4 (5.1-7.6)	4.7 (3.5-5.9)
West	86.8 (82.7-90.8)	2.2 (1.2-3.2)	3.8 (2.4-5.3)	7.2 (3.5-11)
Provider Facility				
All Public Facilities	87.8 (84.3-91.2)	2.5 (1-3.9)	4.6 (2.2-7)	5.1 (3-7.2)
All Hospital Facilities	89.9 (86.8-92.9)	2.1 (0.9-3.3)	3.1 (1.6-4.5)	4.9 (2.5-7.3)
All Private Facilities	86.6 (84.7-88.4)	3.2 (2.4-4)	5.8 (4.8-6.8)	4.5 (3.1-5.9)
All Military/ Other Facilities	88.9 (82.9-95)	2.2 (0-5.2)	1.9 (0-3.7)	7 (1.8-12.1)
Mixed	85 (82.2-87.8)	4.2 (2.4-6)	6.6 (5-8.3)	4.2 (2.6-5.8)
Unknown	79.1 (69.2-89)	1.1 (0-2.1)	3.5 (0.4-6.7)	16.3 (6.4-26.3)
Insurance				
Private insurance only	86.8 (85.2-88.3)	2.8 (2.1-3.5)	5.5 (4.6-6.5)	4.9 (3.8-5.9)
Any medicaid	85.2 (82.2-88.1)	2.8 (1.7-3.8)	5.6 (4.2-7)	6.5 (3.9-9)
Other insurance (chip, ihs, military, or other, alone or in comb. with private insurance)	89.6 (86.9-92.2)	3.6 (2-5.2)	3.2 (1.8-4.7)	3.6 (2-5.2)
Uninsured	85.7 (78.6-92.9)	7.6 (1.1-14)	1.1 (0.2-2)	5.6 (2-9.2)

Table 2: Flu vaccination coverage by route among different demographic and socio-economic groups among teen in 2019 data.

Like children's 2019 data, Table 2 shows that Flu shot was the main method of administration in all the demographic and socioeconomic groups in NIS teen 2019 data.

DISCUSSION:

In this study using the 2019 NIS database, Flu vaccination coverage was mostly done by Flu shot as the administration type. This raises several questions on Flu spray as an option for vaccination. Figure 6 shows some of the possible reasons and suggestions to understand the usage of Flu vaccination as a spray option.

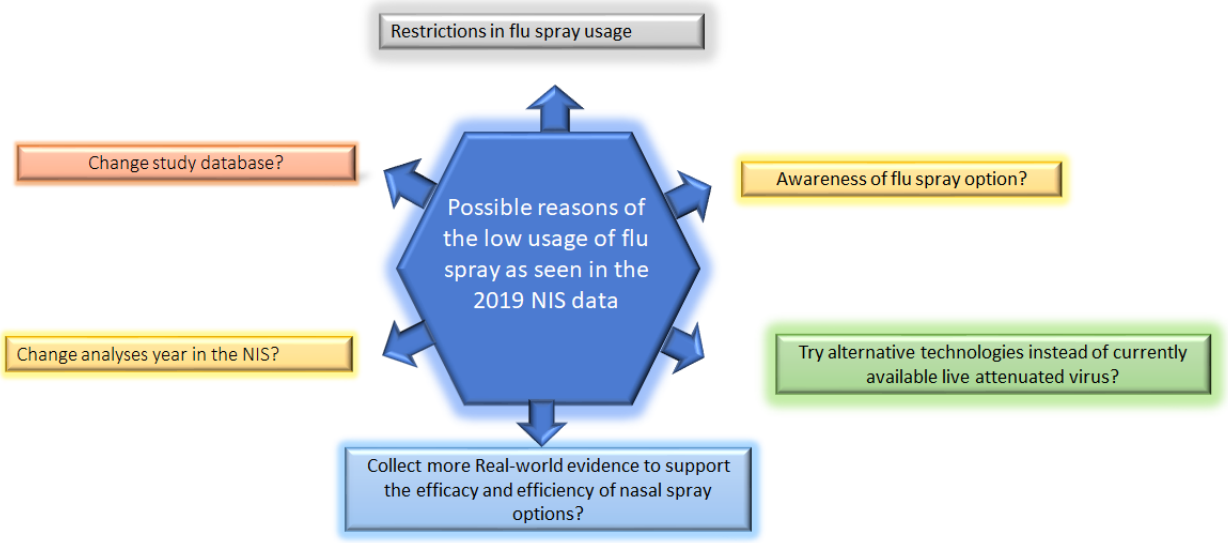

Figure 6: Possible reasons of low usage of spray as a Flu vaccination option

In this study, we used the survey database, this analysis could also be conducted using other big data options such as claims and electronic health records. This might provide us with a better understanding of spray option usage.

In this study, the 2019 year was selected as it was the latest year of NIS database available but selecting a different year for analyses could show higher usage of Flu spray as an option. The reason being that the CDC website mentions that before the 2009 Flu pandemic, the nasal spray vaccine was found to be effective against different Flu viruses. After the 2009 pandemic, several U.S. studies among 2 through 17-year-olds found that the nasal spray vaccine was as effective against influenza B viruses and influenza A(H3N2) viruses as inactivated influenza vaccines but was less effective than inactivated Flu vaccines against the 2009 pandemic H1N1 viruses. These data led Advisory Committee on Immunization Practices (ACIP) and CDC to recommend against the use of nasal spray vaccine for the 2016-17 and 2017-18 seasons. Since the 2017-2018 season, the manufacturer of nasal spray vaccine has used new influenza A(H1N1) vaccine virus ingredients in production. Due to this reason, we could be seeing low usage of Flu vaccination as a spray option in the immediate year 2019. As the manufacturer of Flu spray now rectified the spray vaccine, maybe the data collected from the NIS database in further years will show better usage of spray option.

To examine if the NIS data before the 2009 pandemic shows a different amount of usage of Flu vaccinations by the administration, the data from prior years were analyzed as shown in Figure 7.

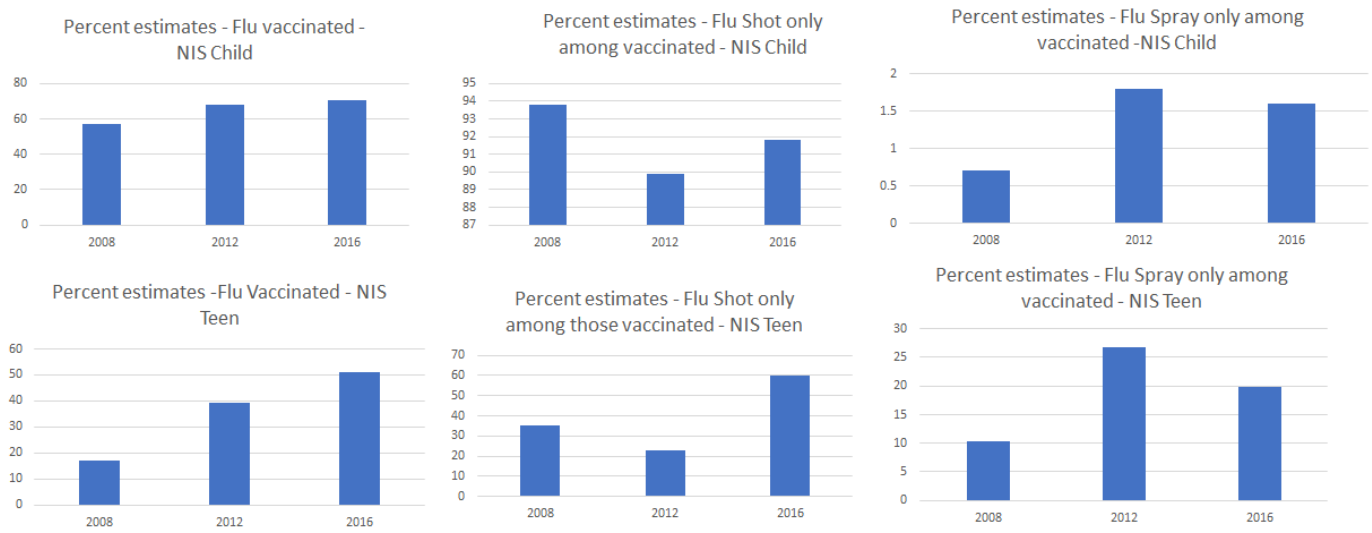

Figure 7: Trends in Flu vaccination usage.

The 2008 data before the 2009 H1N1 pandemic shows higher usage of spray options especially in the teen group compared to the data in the year 2019. Flu spray usage was much higher in the prior years than in 2019 especially in the NIS Teen group for the year 2012. It was more than 25% in 2012. So maybe if we perform the analysis in later years as data becomes available, the usage of current updated nasal spray might increase again. Also, these trends show that the total Flu vaccinated population increased from 2008 to 2016.

Flu spray has more restrictions than Flu shot in terms of who can use it. The low usage could be due to the restrictions on its usage such as not being available for younger children, pregnant women, and adults 50 and older, etc. These restrictions could be possible since the current Flu nasal spray option is based on the live attenuated virus. Although Live attenuated could trigger a stronger immune response. It might have more side effects and hence more restrictions in its usage. Some of the common types of vaccines include inactivated, live attenuated, recombinant, toxoid, mRNA, and viral vector vaccines. Recently nanoparticle-based technology [7] is also used to develop vaccines. These alternative technologies could also be adapted in the spray form of a vaccine in addition to shot form.

Also, not everyone might be aware of the spray option, so increasing awareness & marketing to the public could improve its usage. CDC website mentions that data from other countries have demonstrated protection from LAIV to be like that of standard-dose, egg-based inactivated Flu vaccine in children. So the collection of more post-market data and conducting further studies on the Flu spray effectiveness especially in the US may provide us with more proof to support the usage of spray option. The spray option as a vaccine form could also be implemented to develop vaccines against other viruses such as COVID 19.

These results provide us with an understanding of the current usage of flu vaccinations and their main administration options and give us insight into areas that can be improved to provide better flu vaccination coverage and to identify the areas that can be improved in nasal administration options.

REFERENCES:

1. Virendar kumar, Influenza in Children
2. Seth J Sullivan, Robert M Jacobson, Walter R Dowdle, Gregory A Poland, 2009 H1N1 influenza
3. https://www.cdc.gov/Flu/index.htm
4. Markus A Rose, Stefan Zielen, Ulrich Baumann, Mucosal immunity, and nasal influenza vaccination
5. https://www.cdc.gov/vaccines/imz-managers/nis/index.html
6. SAS survey analysis Support
   https://support.sas.com/rnd/app/stat/procedures/SurveyAnalysis.html
7. B Bernocchi, R Carpentier, D Betbeder, Nasal nanovaccines

CONTACT INFORMATION:

Swapna Ambati
Eliassen Group
400 Atrium Drive, 4th Floor South
Somerset, NJ-08873
sambati@eliassen.com

TRADEMARK