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Do parents prefer inactivated or live attenuated influenza vaccine for their children?★

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Abstract

Objectives: To determine the proportion of children whose parents prefer them to receive live, attenuated influenza vaccine (LAIV) or inactivated influenza vaccine (IIV), examine reasons for preferences, and determine what percentage of vaccinated children receive other than the preferred type of vaccine and why.

Methods: Parental-reported data for the 2014–15 and 2015–16 influenza seasons from the National Immunization Survey-Flu (NIS-Flu), a random-digit-dialed, dual frame (landline and cellular telephone) survey of households with children, were analyzed. We calculated the proportions of vaccinated children aged 2–17 years whose parents preferred LAIV, IIV, or had no preference, and the proportions that were vaccinated with other than the preferred type of vaccine.

Results: For the 2014–15 and 2015–16 seasons, 55.2% and 53.7%, respectively, of vaccinated children had parents who reported no preference for either IIV or LAIV. The percentage who preferred LAIV was 22.7% and 21.7%, and IIV was 22.1% and 24.7%. The most common reason given by parents for preferring LAIV was the child's fear of needles (70.9%) and for preferring IIV was belief that the shot is more effective (29.0%). Approximately one-third of vaccinated children whose parents preferred LAIV received IIV only.

Conclusions: The main finding of this study was that most parents do not have a vaccine type preference for their children. The lack of overwhelming preference is advantageous for the maintenance of vaccination coverage levels during times when one vaccine type is not available or not recommended such as in the 2016–17 and 2017–18 seasons when there was a temporary recommendation not to administer LAIV.

Keywords

Influenza; Human; Child; Immunization; Surveys and questionnaires; Vaccination

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1. Introduction

In the United States, children aged 6 months to 18 years are recommended to receive annual influenza vaccination [1]. Two types of influenza vaccination are available for children, the inactivated influenza vaccine (IIV) administered by an injection and the live attenuated influenza vaccine (LAIV) administered by a nasal spray [2]. LAIV was first available and approved for use in children as young as 5 years old in 2003, and then in 2007 the approved use was expanded to also include children 2–4 years [3,4]. At a meeting of the Advisory Committee on Immunization Practices (ACIP) in June 2014, the committee voted to include in their recommendation for the 2014–15 influenza season a preference for the use of LAIV for healthy children 2–8 years; this recommendation was based on studies that appeared to show higher efficacy of LAIV when compared with IIV among children [5]. Eight months later, at the February 2015 meeting of the ACIP, the committee voted to remove this preferential recommendation when other study data showed that LAIV may not have higher efficacy than IIV [6]. Then, at the June 2016 meeting of the ACIP, the committee voted in favor of an interim recommendation that LAIV not be used during the 2016–17 influenza season due to data showing poor or relatively lower than expected effectiveness of LAIV from 2013 through 2016 [7]. The interim recommendation that LAIV not be used was extended to the 2017–18 season [8]. At the February 2018 meeting, ACIP voted to recommend LAIV as an option for vaccination beginning with the 2018–19 influenza season [1]. The American Academy of Pediatrics, however, advises parents preferentially to choose IIV for the 2018–19 season [9,10]. Changes in type recommendations could potentially affect vaccination coverage levels if parents have strong preferences for a vaccine type and are unwilling to accept another type, yet little is known about parental preferences for IIV versus LAIV for their children. A study published in 2015 showed that 32.2%, 32.1%, and 33.3% of children 2–17 years in the United States received LAIV during the 2011–12, 2012–13, and 2013–14 influenza seasons, respectively [11]. The objectives of this study were to: determine what proportion of vaccinated children had parents that prefer LAIV or IIV for their children; examine whether preferences differ by socio-demographic characteristics; examine reasons for the preferences; and determine what percentage of children are vaccinated with other than their parent's preferred type of vaccine.

2. Methods

Data from the National Immunization Survey-Flu (NIS-Flu) for the 2014–15 and 2015–16 influenza seasons were analyzed. The NIS-Flu is a national, random-digit-dialed, dual frame (landline and cellular telephone) survey of households with children. It includes three components: the NIS-Child for children 19–35 months, the NIS-Teen for children 13–17 years, and the NIS Child Influenza Module (NIS-CIM) for children 6–18 months and 3–12 years identified during the screening of households for the NIS-Child and NIS-Teen [12–15]. Data were collected by parental report. The study is restricted to the subset of interviews conducted April through June, the months the questions on vaccine preference were included in the survey. The Council of American Survey and Research Organizations (CASRO) response rates ranged (over the three survey components and over the two study years) from 53.5% to 64.8% for landline and 29.9%–38.8% for cellular telephones [16–18].

The first question on the survey that addressed parental preference was “Earlier you mentioned that [child] received a flu vaccination. If you would have a choice, do you prefer your child receive the flu spray, the flu shot, or you have no preference?” For the 2014–15 survey only, those who selected flu spray were asked, “Why do you prefer the flu spray?” and their verbatim response was typed into the computer by the interviewer. Likewise, those who selected flu shot were asked in 2014–15, “Why do you prefer the flu shot?” For both seasons, based upon responses to previous questions, the following questions were asked: “Earlier you said that [child] received a flu shot and you prefer the flu spray. Why did your child not get the flu spray? Was it because the doctor offered only the flu shot, because of cost, or because of some other reason? ”, “Earlier you said that [child] received a flu spray and you prefer the flu shot. Why did your child not get the flu shot? Was it because the doctor offered only the spray, because of cost, or because of some other reason?” Those selecting “some other reason” were asked the follow-up question: “What was this other reason?” and their verbatim response was typed into the computer by the interviewer. Respondents reporting that they do not know to the preference question were recoded as having no preference. Verbatim responses were read by all three authors and coded into groups based upon common themes of responses. Information on socio-demographic characteristics was collected during the NIS-Flu interviews. The study population was limited to vaccinated children 2 through 17 years during each study period because children <2 years were too young to receive LAIV. Children missing vaccination status, missing number of doses of influenza vaccination, or missing vaccination type were excluded from the study (7.6% and 7.2%, respectively for the two seasons; Fig. 1).

Proportions of parents that prefer LAIV, IIV, or have no preference and the proportions that had their child vaccinated with other than the parent’s preferred type of vaccine were calculated. Tests of differences between influenza seasons were conducted with t-tests while tests of association between vaccination preference and demographic variables were conducted using Wald chi-square tests followed by pair-wise comparison t-tests. A two-sided significance level of 0.05 was adopted for all statistical tests. Reported percentages and corresponding 95% confidence intervals (95% CI) were weighted, while reported sample sizes were unweighted. All analyses were weighted to U.S. population totals and to adjust for households having multiple telephone lines, unit non-response, and non-coverage of non-telephone households. Analyses were conducted using SAS (version 9.3) and SUDAAN (version 11.0.0) statistical software to account for the complex survey design.

3. Results

In both the 2014–15 and 2015–16 seasons, more than half of vaccinated children (55.2% and 53.7%, respectively) had parents who did not have a preference as to whether their child received IIV or LAIV (Table 1). The percentage of children with parents preferring LAIV for their child was 22.7% and 21.7% for the 2014–15 and 2015–16 seasons, respectively. For IIV preference, there was a statistically significant increase from 22.1% for the 2014–15 to 24.7%, for the 2015–16 season.

The most common reasons given by parents for a preference for LAIV were: the child’s fear of needles/shot pain (70.9%), it is easier, quicker, or more convenient (13.1%), belief that the

spray is more effective (6.5%), and the parent does not like needles (4.6%; Fig. 2). The most common reasons for a preference for IIV were: belief that the shot is more effective (29.0%), the shot has been around longer (13.4%), it is not a live vaccine (9.4%), child had a bad reaction to the spray in the past (8.4%), child has asthma (7.3%), and belief that the shot is easier, quicker, or more convenient (6.5%; Fig. 2).

Socio-demographic variables associated with parental preference for LAIV are shown in Table 2. More parents of young children 2–8 and 9–12 years old preferred LAIV than parents of children 13–17 years, by a difference of between 8 and 11 percentage points. More parents of non-Hispanic white children preferred LAIV than parents of Hispanic or non-Hispanic black children, by a difference of between 5 and 8 percentage points, while slightly fewer parents in the lower income groups preferred LAIV compared to parents in the higher income group.

For the 2014–15 influenza season among vaccinated children of parents who preferred LAIV, 71.2% received LAIV (e.g. they received LAIV only [70.4%] or LAIV and IIV [0.8%]; Table 3). Among vaccinated children of parents who preferred IIV, 93.4% received IIV (91.8% IIV only, 1.6% IIV and LAIV; Table 3). Likewise, for the 2015–16 influenza season among vaccinated children of parents who preferred LAIV, 67.3% received LAIV (65.7% + 1.6%); and among vaccinated children of parents who preferred IIV, 95.3% (93.9% + 1.4%) received IIV. The percentage of vaccinated children who received LAIV decreased from the 2014–15 season to the 2015–16 season for both children whose parents preferred LAIV for their child (70.4–65.7%, respectively) and children whose parents preferred IIV (6.6–4.7%, respectively, Table 3).

More than one-fourth of vaccinated children whose parents preferred LAIV received IIV only (2014–15: 28.0%, 2015–16: 32.7%), while far fewer children whose parents preferred IIV received LAIV only (2014–15: 6.6%, 2015–16: 4.7%; Table 3). The most common reasons why a child received IIV when the parent preferred LAIV were: the doctor offered only the shot (55.6% and 54.2% for 2014–15 and 2015–16, respectively), LAIV was not available/ran out (10.5%, 14.2%), child had asthma (5.6%, 4.7%), and cost (3.1%, 5.3%; Fig. 3). The most common reasons why a child received LAIV when the parent preferred IIV were: the doctor offered only the spray (33.8% and 31.4% for 2014–15 and 2015–16, respectively), fear of needles/shot pain (15.0%, 21.6%), and child's choice (14.1%, 17.1%, Fig. 3). Other less frequently mentioned reasons are also shown in Fig. 3.

4. Discussion

During the 2014–15 and 2015–16 influenza seasons over half of vaccinated children aged 2–17 years in the United States had parents who did not have a preference about the type of influenza vaccination their child received, and among those with a preference, they were almost evenly split between those who prefer IIV or LAIV. A lack of preference for spray over shot was found in a study conducted in Japan to evaluate parents' preference for type of influenza vaccine if alternatives were available (only IIV was available at the time of the study in 2013) [19]. The Japan study found that rather than type of vaccine, parents preferred influenza vaccines with higher vaccine effectiveness, lower risk of adverse events,

fewer required doses, and lower cost [19]. Another study, conducted during 2009 in the United States of 500 parents, found no statistically significant difference in parental preference for LAIV versus IIV (55% versus 45%, $P = 0.32$) [20]. Likewise that study found that the most important aspects parents considered when choosing an influenza vaccine were effectiveness, risk of side effects, and doctor recommendation [20]. In our study, the most commonly given reason for preferring IIV was the belief that the shot is more effective while the most common reason stated for preferring LAIV was not related to effectiveness or safety, but rather to the child's fear of needles/shot pain. Similar to our study, another study found that parents who would choose the nasal spray also cited discomfort of injection and the child's dislike of shots as reasons for their preference [20]. If a parent believes both IIV and LAIV to be of equal effectiveness and safety, they may opt for LAIV if their child has fear of needles. We did not assess parents' beliefs in the effectiveness and safety of each type of vaccine so we could not determine if those who preferred LAIV due to child's fear of needles believed the vaccine to be equally effective as IIV. Parents could have the reasonable expectation and understanding that if they were given the choice of two vaccine modes by the provider that they would have equal efficacy and safety profiles.

We found that slightly more young children (2–8 years and 9–12 years) had parents that preferred LAIV than parents of children 13–17 years. This could be due to parents being more concerned about crying and shot pain for younger children who routinely receive a number of other recommended injection vaccines. This finding is consistent with the finding in a study of three influenza seasons between 2011 through 2014, that more children 2–8 years and 9–12 years receive LAIV than children 13–17 years [11].

We found that more than one-fourth of vaccinated children whose parents preferred LAIV did not receive LAIV. The two most common reasons parents gave were that the doctor offered only the shot and LAIV was not available/ran out. LAIV availability is not as widespread as IIV. There is only one vaccine manufacturer for LAIV while there are several for IIV. During the 2014–15 season 147.8 million doses of influenza vaccine were distributed in the United States, and during the 2015–16 season 146.4 million doses were distributed [21]. Prior to the 2015–16 season between 14 and 15 million doses of LAIV were distributed in a season thus LAIV represented approximately 8–10% of the doses distributed [22]. Furthermore, during the 2015–16 season the sole manufacturer of LAIV experienced production problems that delayed deliveries of the vaccine resulting in a substantial portion of LAIV being delayed during this season [22,23]. The third most common reason given by parents who preferred LAIV for why their child did not receive LAIV was in 2014–15 that their child has asthma and in 2015–16 cost reasons. While a parent may prefer LAIV for their child, it is recommended that children with asthma not receive LAIV, thus it is expected that these children would receive IIV rather than LAIV [6]. Cost may have been a perceived barrier for some for LAIV as it had a higher price than IIV [24]. We found that between 5 and 7% of vaccinated children whose parents preferred IIV did not receive IIV. The most common reasons why a child received LAIV when the parent preferred IIV were: the doctor offered only the spray, fear of needles/shot pain, and child's choice. As to why some practices may have offered only LAIV rather than IIV is unclear.

Changes in type recommendations could potentially affect vaccination coverage levels if parents have strong preferences for a vaccine type and are unwilling to accept another type. During the 2016–17 season, the first season of the interim recommendation that LAIV not be used, influenza vaccination coverage did not change compared to the 2015–16 season for children 6 months–17 years [25]. Our study showed that most parents did not have any type preference prior to the interim recommendation and thus implying they were open to having their child vaccinated with IIV when LAIV was not a choice. Changes in recommendations and the corresponding publicity likely have effects on parental preferences. The small but statistically significant increase in preference for IIV for the 2015–16 seasons compared to the 2014–15 season may be due to providers or parents learning of the removal of the preferential recommendation for LAIV because study data showed that LAIV may not have higher efficacy than IIV [6].

This study is subject to several limitations. First, vaccination status was based on parental report and was not confirmed by medical records; studies show that parents tend to over-report influenza vaccination [26,27]. Second, the type of vaccine was also parentally reported and may be subject to recall error although one study showed that parent and provider report of LAIV versus IIV are close [11]. Third, children whose parents did not know their vaccination status, or number of doses, or type of vaccine were excluded from the study; while the percentage excluded was small, there is the potential for bias if the missing status is related to the outcome of interest. Fourth, the coding of verbatim responses involved some degree of subjective judgment. To reduce rater effects, all three authors participated in the coding of the responses, with the first author coding all of the verbatim responses first, followed by a review of the initial coding by the other two authors, and then a discussion and consensus among all authors when there was disagreement. Fifth, we only asked reasons for preference in the 2014–15 season (not the 2015–16 season) due to a change in the questionnaire for the 2015–16 season. Sixth, this study could not determine the percentage who remained unvaccinated because the parent preferred vaccine was not available. Seventh, and lastly, the NIS-Flu is a telephone survey with a moderate to low response rate, thus bias is possible and may remain even after weighting adjustments designed to reduce this bias.

5. Conclusions

For the upcoming 2018–19 influenza season, with the interim recommendation not to administer LAIV lifted by the ACIP but a preferential recommendation for IIV in place by the AAP, this study is helpful by showing that most parents do not have a vaccine type preference for their children [1,9,10]. The lack of overwhelming preference is advantageous for the maintenance of vaccination coverage levels during times when one vaccine type is not available or not recommended.

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Abbreviations:

IIV	inactivated influenza vaccine
LAIV	live, attenuated influenza vaccine
NIS-Flu	National Immunization Survey-Flu
CI	confidence interval

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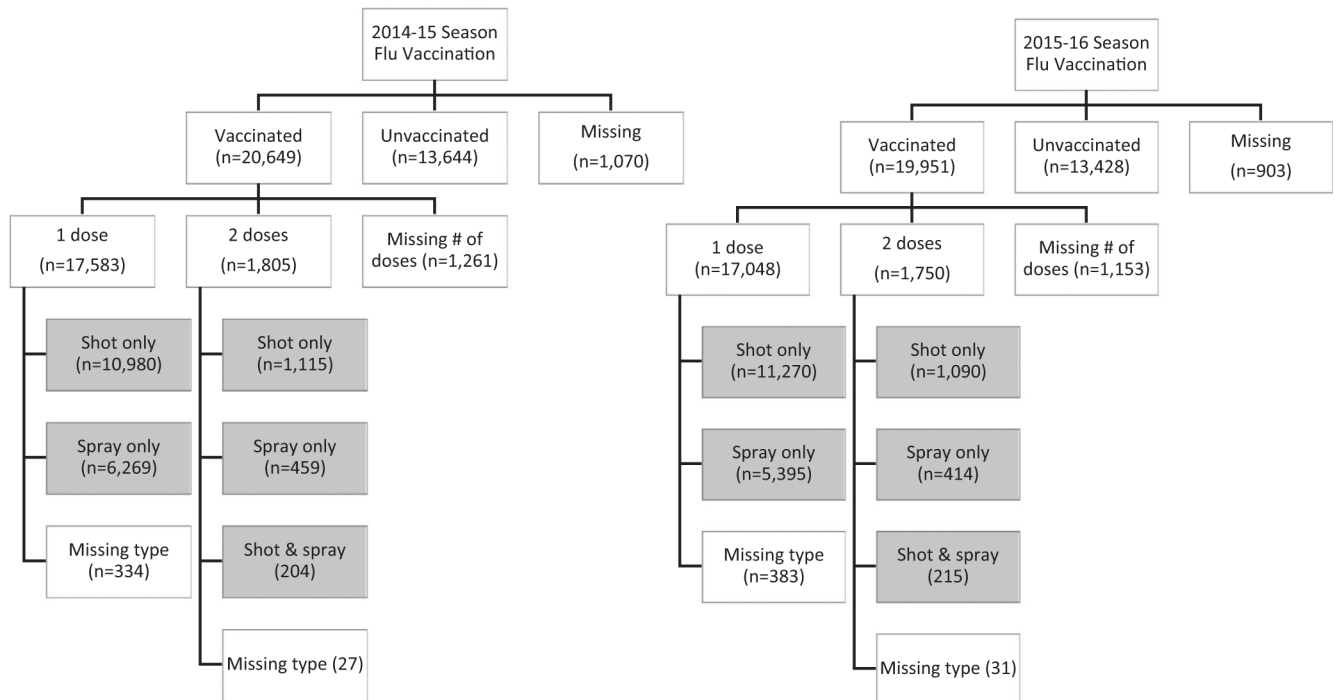


Fig. 1. Study Population of Children 2–17 years, National Immunization Survey-Flu (NIS-Flu), April-June Interviews, United States, 2014–15 and 2015–16 Influenza Seasons. For the 2014–15 season, there were 12,095 children receiving IIV only, 6728 children receiving LAIV only, and 204 receiving both IIV and LAIV, for a total study population of $n = 19,027$ (highlighted in grey). For the 2015–16 season, there were 12,360 children receiving IIV only, 5809 children receiving LAIV only, and 215 receiving both IIV and LAIV, for a total study population of $n = 18,384$ (highlighted in grey).

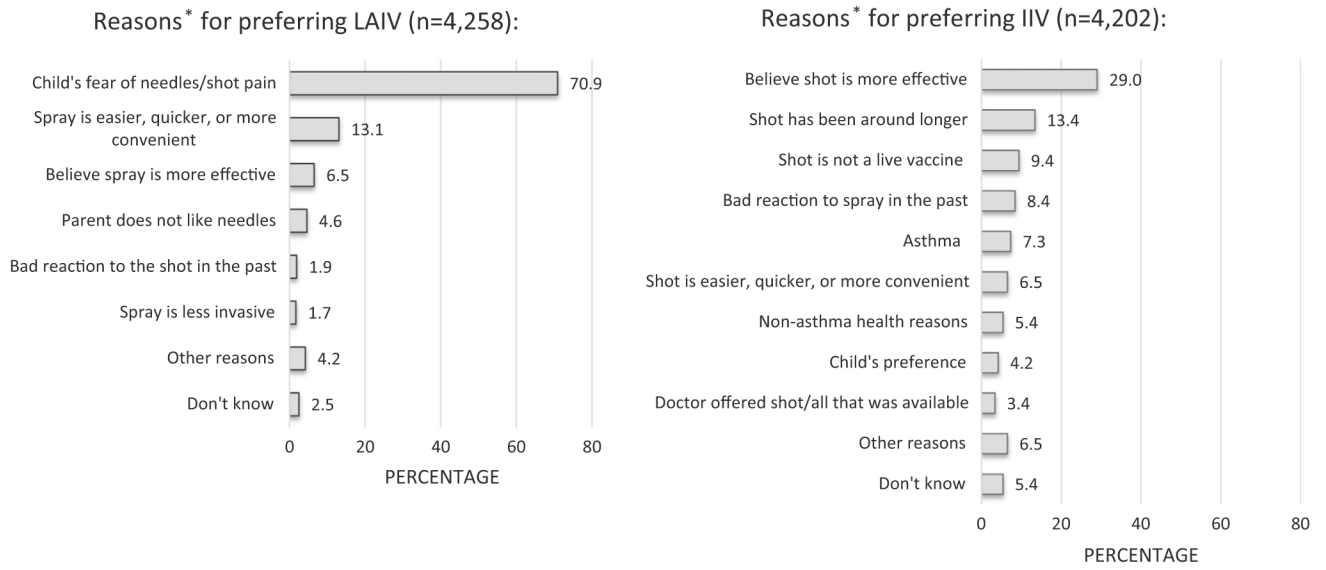


Fig. 2. Reasons for Preference for IIV or LAIV among Parents of Vaccinated Children 2–17 years, National Immunization Survey-Flu (NIS-Flu), United States, 2014–15 Influenza Season. *Up to two reason categories were coded for each respondent.

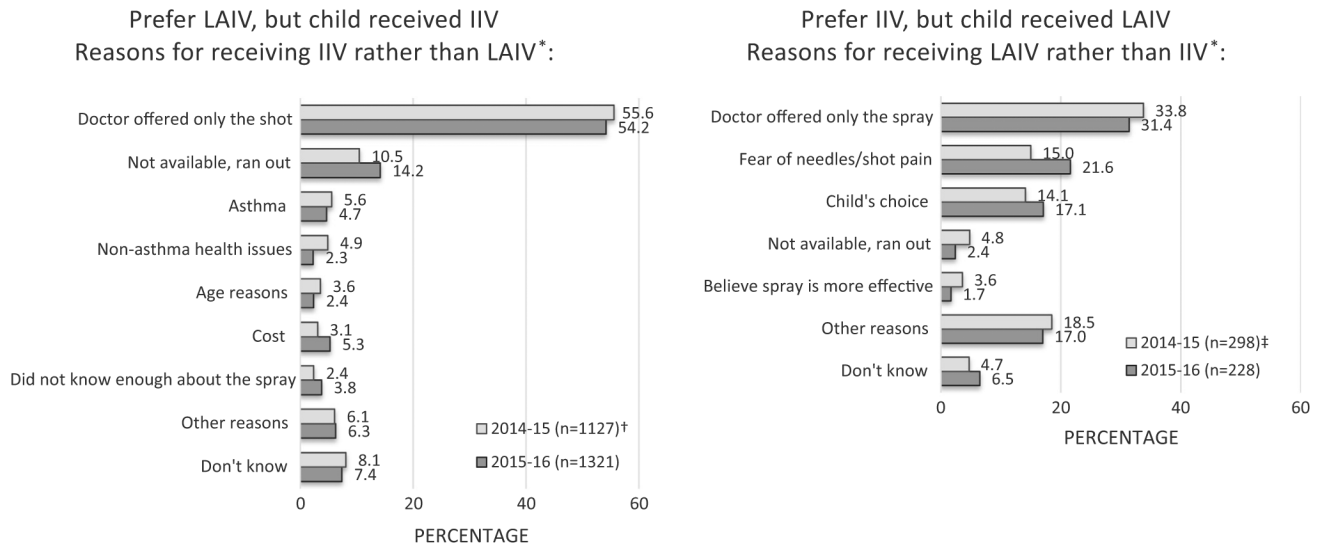


Fig. 3. Reasons for a Child Receiving Other than the Parent-Preferred Influenza Vaccination Type among Vaccinated Children 2–17 years, National Immunization Survey-Flu (NIS-Flu), United States, 2014–15 and 2015–16 Influenza Seasons *Only one reason category was coded per respondent. [†] 1127 of the 1134 respondents eligible for this question completed the question in the 2014–15 season and 1321 of the 1329 completed this question in the 2015–16 season. [‡]298 of the 299 completed this question in the 2014–15 season and 228 of the 231 completed this question in the 2015–16 season.

Parental preference for either IIV or LAIV for their child among vaccinated children 2–17 years, National Immunization Survey-Flu (NIS-Flu), United States, 2014–15 and 2015–16 influenza seasons.

Table 1

	2014–15 Influenza season		2015–16 Influenza season	
	n	%	n	%
Overall	19,027	100.0	18,384	100.0
Prefer LAIV	4258	22.7 (21.4, 24.0)	3,961	21.7 (20.5, 22.9)
Prefer IIV	4202	22.1 (20.9, 23.5)	4142	24.7 (23.3, 26.1)
No preference	10,567	55.2 (53.6, 56.8)	10,281	53.7 (52.1, 55.2)

Bolded estimates indicate a statistically significant difference between the 2014–15 and 2015–16 season by *t*-test, $p < 0.05$.

Parental preference for LAIV influenza vaccination for their child among vaccinated children 2–17 years, by socio-demographic characteristics, National Immunization Survey-Flu (NIS-Flu), United States, 2014–15 and 2015–16 influenza seasons.

Table 2

	Prefer LAIV		2015–16 Influenza Season	
	2014–15 Influenza Season	2015–16 Influenza Season	%	95% CI
Overall	22.7	(21.4, 24.0)	21.7	(20.5, 22.9)
<i>Age group</i>				
2–8 years	23.1	(20.4, 26.1)	24.7	(22.2, 27.3)
9–12 years	26.4	(24.6, 28.2)	24.5	(22.8, 26.3)
13–17 years (REF)	15.3	(12.9, 18.1)	14.4	(12.6, 16.4)
<i>Child's race/ethnicity*</i>				
Hispanic	17.0	(14.4, 20.0)	18.3	(15.8, 21.1)
Black only, non-Hispanic	20.3	(16.9, 24.2)	17.5	(14.8, 20.7)
White only, non-Hispanic (REF)	25.2	(23.4, 27.1)	24.7	(23.0, 26.4)
Other or multiple races, non-Hispanic	25.6	(21.8, 29.7)	20.0	(16.9, 23.4)
<i>Income/poverty level[†]</i>				
Above poverty, >\$75 K/year (REF)	28.0	(25.9, 30.3)	25.8	(23.7, 28.0)
Above poverty, \$75 K/year	20.6	(18.5, 22.8)	21.4	(19.3, 23.7)
Below poverty	16.8	(13.9, 20.1)	15.9	(13.7, 18.3)
Not reported	20.2	(16.4, 24.7)	17.8	(15.0, 20.9)
<i>Mother's education</i>				
<High school (REF)	12.7	(10.0, 16.0)	14.9	(12.0, 18.4)
High school or equivalent	18.4	(15.2, 22.0)	18.3	(15.7, 21.3)
Some college	22.5	(19.8, 25.5)	21.6	(19.3, 24.1)
College degree	27.9	(25.8, 30.0)	25.4	(23.5, 27.4)

Bolded estimates indicate a statistically significant difference between the estimate compared to the estimate for the referent group (indicated by REF), $p < 0.05$.

* Race of child was reported by parent/guardian respondent. Children of Hispanic ethnicity may be of any race. Children identified as multiple races had more than one race category selected.

[†] Income/Poverty level was defined based on total family income in the past calendar year, and the U.S. Census poverty thresholds for that year specified for the applicable family size and number of children <18 years. Poverty thresholds are available at <http://www.census.gov/hhes/www/poverty/data/threshld/index.html>.

Child Receipt of IIV or LAIV by parental preference for either IIV or LAIV, vaccinated children 2–17 years, National Immunization Survey-Flu (NIS-Flu), United States, 2014–15 and 2015–16 influenza seasons.

Table 3

	2014–15 Influenza Season			2015–16 Influenza Season		
	n	%	95% CI	n	%	95% CI
Prefer LAIV	4258	100.0		3961	100.0	
Received IIV only	1134	28.8	(25.6, 32.2)	1329	32.7	(29.8, 35.6)
Received LAIV only	3081	70.4	(67.0, 73.6)	2576	65.7	(62.7, 68.6)
Received IIV & LAIV	43	0.8	(0.5, 1.3)	56	1.6	(1.0, 2.6)
Prefer IIV	4202	100.0		4142	100.0	
Received IIV only	3868	91.8	(89.9, 93.4)	3871	93.9	(92.3, 95.2)
Received LAIV only	299	6.6	(5.5, 8.0)	231	4.7	(3.6, 6.1)
Received IIV & LAIV	35	1.6	(0.7, 3.5)	40	1.4	(0.9, 2.4)
No preference	10,567	100.0		10,281	100.0	
Received IIV only	7093	67.4	(65.3, 69.4)	7160	68.3	(66.3, 70.2)
Received LAIV only	3348	31.0	(29.1, 33.1)	3002	29.8	(27.9, 31.7)
Received IIV & LAIV	126	1.6	(1.0, 2.4)	119	1.9	(1.4, 2.7)

Bolded estimates indicate a statistically significant difference between the 2014–15 and 2015–16 season by χ^2 -test, $p < 0.05$.