ACUMEN

Methodology for Estimating Influenza Vaccination Coverage

Monitoring the *Healthy People 2020* Objective

January 2016

Contents

1 Overview

To help the Centers for Disease Control (CDC) monitor progress toward the Healthy People 2020 influenza objective, Acumen estimated the annual seasonal influenza vaccination rates of institutionalized adults aged 18 years and older in long-term care facilities or nursing homes (NHs) certified by the Centers for Medicare & Medicaid Services (CMS). This analysis extends across the influenza seasons 2005-06 to 2014-15.

This report explains the data and methodology used for the analysis:

- *Section 2, Data Source:* This section provides background on the data source, the Minimum Data Set (MDS), and identifies the specific data elements used to calculate influenza vaccination rates.
- *Section 3, Study Population*: This section explains how the study population was constructed and how resident characteristics were categorized.
- *Section 4, Vaccination Rate Methodology:* This section defines the numerator and denominator of the influenza vaccination rate. This section also describes how the project team identified reasons for non-vaccination.
- *Section 5, Additional Investigations:* This section presents the results of supplemental investigations undertaken to support the main analysis and chosen methodology. Specifically, the section discusses inconsistent vaccination information, explores two alternative definitions of vaccination status, and looks at the vaccination rates by month of exit.

2 Data Source

The *Healthy People 2020* objective uses the MDS as its primary data source. This section begins with an overview of the MDS and then further explains the set of items that are particularly relevant to this project.

2.1 Understanding the MDS

The MDS assesses the health and care needs of all residents admitted to Medicare- or Medicaid-certified NHs and Veterans Health Administration Community Living Centers. It was originally introduced as a means of identifying resident characteristics and issues in order to develop individualized care plans. The use of the MDS assessment tool has since expanded to include purposes such as monitoring the quality of care, determining Medicare and Medicaid payment, and providing consumer access to NH information.

There are two general types of MDS assessments: Omnibus Budget Reconciliation Act (OBRA) assessments and Medicare Prospective Payment System (PPS) assessments. OBRA assessments satisfy the Act's mandate to conduct comprehensive assessments based on uniform data with the goal of ensuring quality of care. NHs are required to submit OBRA records for all residents in Medicare- or Medicaid-certified beds, regardless of the payer. PPS assessments help determine Medicare payment for Part A beneficiaries in skilled nursing facilities (SNFs), so SNFs submit these assessments only for residents covered under the Medicare Part A SNF benefit.

Assessments are conducted at time intervals relative to the date a resident entered a facility:

- Completed for all nursing home residents: The OBRA requires facilities to fill out assessments at the following points in the stay.
    - Admission (within the first two weeks)
    - Quarterly (92 days following the previous OBRA assessment of any type)
    - Annually (366 days following the last comprehensive OBRA assessment)
    - Significant change in the patient's status
    - Discharge
- Completed for Medicare SNF PPS residents: The following assessments are required for SNF PPS residents to determine Medicare payment. Assessments can occur any time during the range of dates provided in parentheses.
    - 5-day assessment (days 1-8)
    - 14-day assessment (days 13-18)

- 30-day assessment (days 27-33)
- 60-day assessment (days 57-63)
- 90-day assessment (days 87-93)
- Change in therapy treatment (start of therapy, end of therapy, change in intensity)

When OBRA and SNF PPS assessment time frames coincide, one assessment may be used to satisfy both requirements. Additional information about assessment scheduling may be found in Chapter 2 of the MDS Resident Assessment Instrument (RAI) Manual.

This project extracts information from all types of MDS assessments—OBRA, PPS, and combined OBRA/PPS. These assessment requirements result in approximately 4-5 assessments each season per unique resident[1] in the study population, as shown in ***Table 1***.

Table 1. *Average number of assessments per resident in study population*

2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
4.3	4.3	4.4	4.4	4.3	4.9	5.0	5.0	4.9	4.9

2.2 Using the MDS for analysis

To answer the *Healthy People 2020* objective, Acumen used the influenza vaccination questions from the MDS assessment. These questions changed during the study window of this project, however, which divided the time frame into two periods: MDS Version 2.0 and MDS Version 3.0. The MDS was updated from Version 2.0 to 3.0 on October 1, 2010, and the new version of the assessment introduced changes to the wording, formatting, and submission requirements of the influenza questions, as the following tables show. Accordingly the influenza seasons 2010-11 and after are not directly comparable to those prior to 2010-11; within a season, though, the data are generated from only one MDS version.

Table 2. O0250A & W2A: *The question evaluating whether or not the resident received the influenza vaccination was changed slightly in wording and formatting. In MDS 3.0 the season dates are removed in the question and RAI manual.*

MDS 3.0	MDS 2.0
Did the resident **receive the influenza vaccine in this facility** for this year's influenza season?	Did the resident receive the Influenza vaccine in this facility for this year's Influenza season (October 1 through March 31)?
0. **No** --> Skip to O0250C, If Influenza vaccine not received, state reason	0. No (If No, go to item W2b)

[1] Residents are identified in the assessment data by a unique combination of resident identifier and state code. As a result, residents who lived in multiple states were included once in each state, while residents who lived in multiple nursing homes within a state were included only once in that state.

1. **Yes** --> Continue to O0250B, Date vaccine received	1. Yes (If Yes, go to item W3)

Table 3. O0250B: *This question was added in MDS 3.0.*

MDS 3.0	MDS 2.0
Date vaccine received --> Complete date and skip to O0300A, Is the resident's Pneumococcal vaccination up to date?	-

Table 4. O0250C & W2B: *The answers to reasons for non-vaccination changed in wording and formatting. MDS 3.0 adds the last option "None of the above", which also applies to cases in which the reason for non-vaccination is unknown.*

MDS 3.0	MDS 2.0
If Influenza vaccine not received, state reason:	If Influenza vaccine not received, state reason:
1. **Resident not in facility** during this year's flu season	1. Not in facility during this year's flu season
2. **Received outside of this facility**	2. Received outside of this facility
3. **Not eligible** - medical contraindication*	3. Not eligible
4. **Offered and declined**	4. Offered and declined
5. **Not offered**	5. Not offered
6. **Inability to obtain vaccine** due to a declared shortage	6. Inability to obtain vaccine
9. **None of the above**	-

**Medical contraindications include, but are not limited to; allergic reaction to eggs or other vaccine component(s), previous adverse reaction to influenza vaccine, a physician order not to immunize, moderate to severe illness with or without fever, and/or history of Guillain-Barre Syndrome within 6 weeks of previous influenza vaccination.*

For reference, the full MDS 3.0 and 2.0 questions are displayed below.

Figure 1. *MDS 3.0 influenza vaccination questions*

O0250. Influenza Vaccine - Refer to current version of RAI manual for current influenza vaccination season and reporting period

Enter Code ☐

A. Did the **resident receive the influenza vaccine *in this facility*** for this year's influenza vaccination season?

0. **No** → Skip to O0250C, If influenza vaccine not received, state reason
1. **Yes** → Continue to O0250B, Date influenza vaccine received

B. Date influenza vaccine received → Complete date and skip to O0300A, Is the resident's Pneumococcal vaccination up to date?

☐☐ – ☐☐ – ☐☐☐☐
Month Day Year

Enter Code ☐

C. If influenza vaccine not received, state reason:

1. **Resident not in this facility** during this year's influenza vaccination season
2. **Received outside of this facility**
3. **Not eligible** - medical contraindication
4. **Offered and declined**
5. **Not offered**
6. **Inability to obtain influenza vaccine** due to a declared shortage
9. **None of the above**

Figure 2. *MDS 2.0 influenza vaccination questions*

2.	**Influenza Vaccine**	a . Did the resident receive the Influenza vaccine in this facility for this year's Influenza season (October 1 through March 31)? 0. No (If No, go to item W2b) 1. Yes (If Yes, go to item W3) b. If Influenza vaccine not received, state reason: 1. Not in facility during this year's flu season 2. Received outside of this facility 3. Not eligible 4. Offered and declined 5. Not offered 6. Inability to obtain vaccine

3 Study Population

Acumen created and classified a study population for analysis using information from the MDS assessments. This section first explains how Acumen created a base population of nursing home residents and implemented restrictions to improve the quality of the data. The section then discusses how the project team classified the characteristics of the cleaned resident population.

3.1 Constructing the study population

The *Healthy People 2020* population objective applies to all institutionalized adults aged 18 years and older in NHs certified by CMS. For each influenza season, Acumen identified all residents who had at least one assessment conducted with a target date between October 1 and March 31.[2] Due to the limitations of the resident identification number, Acumen included residents who lived in multiple states once in each state, while residents who lived in multiple nursing homes within a state were included only once in that state. Acumen then restricted the population to residents aged 18 years and older to arrive at the base population of institutionalized adults in NHs certified by CMS. After applying the restrictions described in the subsections below, this population formed the denominator of the vaccination rate.

3.1.1 Assessments missing vaccination information

Assessments with missing vaccination information were excluded (see ***Table 5***). While the influenza vaccination fields must be completed for most MDS assessment types, a small number of non-routine assessments are excluded. Assessments from swing bed facilities[3] were also excluded from this project because the influenza vaccination questions do not appear on MDS 2.0 swing bed assessments. Lastly, "not assessed/no information" is a valid entry value on all assessments, even if the influenza questions are part of the required set for that assessment.

Table 5. *Percentage of assessments with missing vaccination information*

2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
32.2%	20.3%	20.8%	21.9%	22.4%	31.3%	27.5%	28.1%	28.0%	28.5%

[2] While residents must have at least one assessment between October and March to be included in the population for a given season, all assessments from October 1 through June 30 were used to determine their vaccination status.
[3] Swing beds are beds in acute care hospitals that can be used for patients receiving SNF care. They are more commonly found in rural areas. The MDS assessments for swing bed residents are different from the assessments required for residents in NHs.

Though an individual assessment may be missing vaccination information, a resident's vaccination status can still be determined if he or she received other assessments with non-missing information in the influenza season. However, if all assessments for a resident in a single influenza season are missing vaccination information, then the resident was excluded from the population for that season (see ***Table 6***).

Table 6. *Percentage of residents excluded due to missing information*

2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
1.7%	2.0%	2.0%	2.0%	2.1%	3.8%	4.7%	4.7%	5.0%	5.4%

3.1.2 Residents not in the facility during the influenza season

Some residents were excluded from the study population because of a data limitation caused by the reasons for non-vaccination. An assessment may describe a resident's reason for non-vaccination as "not present in the facility during influenza season". Some assessments have this option selected even when the assessment date falls between the start and end dates of the influenza season in October and March. When all the assessments in the season for a non-vaccinated resident list this reason for non-vaccination, it cannot be determined whether the resident was actually vaccinated, so the resident was removed from the population (see ***Table 7*****)**. Non-vaccinated residents with a different reason for non-vaccination in at least one assessment were kept in the population.

Table 7. *Percentage of residents excluded due to having all assessments with "Resident not in facility during influenza season" as the reason for non-vaccination*

2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
0.0%	0.1%	0.1%	0.0%	0.0%	0.8%	1.6%	1.6%	1.8%	1.9%

3.2 Classifying the study population

The project team characterized the study population on several dimensions to better understand the vaccination rates. Acumen used these variables to decompose the national rate into state-specific estimates and to stratify the rate by five demographic factors: educational attainment, age, sex, race/ethnicity, and marital status. The descriptions below describe the MDS 2.0 and 3.0 variables that identify each resident demographic characteristic, as well as the variable included in Acumen's SAS program `calculate_influenza_rates.sas`. When applicable, the description also includes the mapping used to account for changes between the two MDS versions.

A value of "Inconsistent information" was assigned when two assessments in the same influenza season had conflicting values for a demographic variable. The age variable was an exception to this categorization, as an increase in a resident's age may plausibly be captured across assessments during a given season. To address this possibility, the age from the resident's first assessment of the season was

used. A value of “Missing” was assigned only when all the assessments in the season had missing information for the demographic variable.

3.2.1 State

MDS 2.0	MDS 3.0	SAS Program
STATE_ID	STATE_CD	STATE_CODE

State-specific vaccination rates and reasons for non-vaccination were calculated for all 50 states and the District of Columbia. This category can take on the following values:

- Alaska (AK)
- Alabama (AL)
- Arkansas (AR)
- Arizona (AZ)
- California (CA)
- Colorado (CO)
- Connecticut (CT)
- District of Columbia (DC)
- Delaware (DE)
- Florida (FL)
- Georgia (GA)
- Hawaii (HI)
- Iowa (IA)
- Idaho (ID)
- Illinois (IL)
- Indiana (IN)
- Kansas (KS)
- Kentucky (KY)
- Louisiana (LA)
- Massachusetts (MA)
- Maryland (MD)
- Maine (ME)
- Michigan (MI)
- Minnesota (MN)
- Missouri (MO)
- Mississippi (MS)
- Montana (MT)
- North Carolina (NC)
- North Dakota (ND)
- Nebraska (NE)
- New Hampshire (NH)
- New Jersey (NJ)
- New Mexico (NM)
- Nevada (NV)
- New York (NY)
- Ohio (OH)
- Oklahoma (OK)
- Oregon (OR)
- Pennsylvania (PA)
- Rhode Island (RI)
- South Carolina (SC)
- South Dakota (SD)
- Tennessee (TN)
- Texas (TX)
- Utah (UT)
- Virginia (VA)
- Vermont (VT)
- Washington (WA)
- Wisconsin (WI)
- West Virginia (WV)
- Wyoming (WY)

3.2.2 Educational attainment

MDS 2.0	MDS 3.0	SAS Program
AB7_EDUCATION	-	EDUCATION_BIN

A resident's educational attainment is only available on MDS 2.0 assessments. The values for this category are therefore unavailable starting October 2010, when the MDS 3.0 was implemented. The desired

bins for educational attainment differ from the options listed in MDS 2.0. ***Table 8*** describes how Acumen mapped the specific MDS 2.0 values into more general groups. This category can take on the following values:

- < High school
- High school
- Technical or trade school
- Some college
- 4-year college
- Advanced degree
- Inconsistent information (constructed value)
- Missing (constructed value)

Table 8. *Educational attainment value mapping*

MDS 2.0	Category Assignment
▪ No schooling	▪ < High school
▪ 8th grade/less	▪ < High school
▪ 9-11 grades	▪ < High school
▪ High school	▪ High school
▪ Technical or trade school	▪ Technical or trade school
▪ Some college	▪ Some college
▪ Bachelor's degree	▪ 4-year college
▪ Graduate degree	▪ Advanced degree

3.2.3 Age

MDS 2.0	MDS 3.0	SAS Program
`AA3_BIRTH_DT` (Birth Date), `TRGT_DT` (Target Date)	`A0900_BIRTH_DT` (Birth Date), `TRGT_DT` (Target Date)	`AGE_BIN` (Birth Date), `TARGET_DATE` (Target Date)

The resident's age was constructed using two variables from the MDS, the resident's birth date and the assessment target date. This category can take on the following values:

- 18-24 years
- 25-44 years
- 45-54 years
- 55-64 years
- 65-74 years
- 75-84 years

- 85+ years

3.2.4 Sex

MDS 2.0	MDS 3.0	SAS Program
AA2_GENDER	A0800_GNDR_CD	SEX_BIN

The question of gender/sex is consistent across MDS versions. This category can take on the following values:

- Female
- Male
- Inconsistent information (constructed value)
- Missing (constructed value)

3.2.5 Race/ethnicity

MDS 2.0	MDS 3.0	SAS Program
AA4_RACE_ETH	A1000A_AMRCN_INDN_AK_NTV_CD, A1000B_ASN_CD, A1000C_AFRCN_AMRCN_CD, A1000D_HSPNC_CD, A1000E_NTV_HI_PCFC_ISLNDR_CD, A1000F_WHT_CD	RACE_ETHNICITY_BIN

The question of race/ethnicity is inconsistent across MDS versions. ***Table 9*** includes the mapping used between versions. MDS 2.0 combines Asian and Pacific Islander into the same category and does not offer the option of selecting multiple races/ethnicities. MDS 3.0 features slight alterations in wording.

Table 9. *Race/ethnicity value mapping*

MDS 2.0	MDS 3.0*
▪ American Indian/ Alaskan Native	▪ American Indian or Alaska Native
▪ Asian/Pacific Islander	-
-	▪ Asian
-	▪ Native Hawaiian or Other Pacific Islander
▪ Black, not of Hispanic origin	▪ Black or African American
▪ Hispanic	▪ Hispanic or Latino
▪ White, not of Hispanic origin	▪ White
-	▪ Multiple races

**In MDS 3.0, more than one race category can be selected. For this study, any resident with "Hispanic or Latino" selected was placed in the "Hispanic or Latino" category regardless of the other races selected. For example, an individual with "Black" and "Hispanic or Latino" was categorized as "Hispanic or Latino." If multiple races not including "Hispanic or Latino" were selected, then the resident was classified as "Multiple races".*

This category can take on the following values (the union of the two columns in ***Table 9***):

- American Indian or Alaska Native
- Asian or Pacific Islander
- Asian
- Native Hawaiian or Other Pacific Islander
- Black or African American
- Hispanic or Latino
- White
- Multiple races
- Inconsistent information (constructed value)
- Missing (constructed value)

3.2.6 Marital status

MDS 2.0	MDS 3.0	SAS Program
A5_MARITAL_STATUS	A1200_MRTL_STUS_CD	MARITAL_STATUS_BIN

The question of marital status is consistent across MDS versions. This category can take on the following values:

- Never married
- Married
- Widowed
- Separated
- Divorced
- Inconsistent information (constructed value)
- Missing (constructed values)

4 Vaccination Rate Methodology

The goal of this analysis is to estimate the influenza vaccination rate and the composition of reasons for non-vaccination. This section describes the methodology used to build these estimates from the population described in *Section 3*. The first subsection presents how the project team defined the vaccination rate. The second subsection defines the reasons for residents failing to receive the influenza vaccination.

4.1 Defining the vaccination rate

The influenza vaccination numerator includes all those from the denominator population described in *Section 3* who were reported to have received an influenza vaccination in any assessment between October 1 and June 30. The vaccination status was based on information from the O0250A/O0250C (MDS 3.0) and W2a/W2b (MDS 2.0) questions. Residents with a "yes" on an assessment were counted as vaccinated for that influenza season.

Numerator: All those who were reported to have received an influenza vaccination in any assessment between October 1 and June 30.

Denominator: All institutionalized adults aged 18 years and older in long-term care facilities or NHs certified by CMS who had resident assessments conducted with a target date between October 1 and March 31.

Table 10 shows that the "yes" response can take two different forms: (1) A value of 1 in the first vaccination question, indicating that the resident received the vaccine *in the facility*, or (2) a value of 0 in the first question with reason 2 for non-vaccination, which indicates that the resident did not receive the vaccine in the facility, but did receive the vaccine *outside of the facility*. The question wording can be found in *Section 2.2.* Both answer forms were considered equivalent when identifying a resident as vaccinated.

Table 10. *Vaccination status on the MDS*

"Yes" on MDS 3.0	"Yes" on MDS 2.0
O0250A = 1 or O0250A = 0 and O0250C = 2	W2a = 1 or W2a = 0 and W2b = 2

Section 5.2 explores two other methods of defining the vaccination rate, applying different levels of stringency to inconsistent answers. The national and state-specific vaccination rates were stratified by all five resident characteristics.

4.2 Defining non-vaccination reasons

The analysis of non-vaccination reasons was conducted at the national and state levels. The analysis also looked at non-vaccination reasons by race/ethnicity at the national level. Acumen used two methodologies to determine a resident's reason for non-vaccination. The first methodology classified a resident into one of seven reasons for non-vaccination, based on all assessments performed in a given influenza season:

- Not eligible – medical contraindication
- Offered & declined
- Not offered
- Inability to obtain vaccine (definition limited in MDS Version 3.0*)
- None of the above
- Multiple reasons
- Missing

** MDS 3.0 phrasing: "Inability to obtain vaccine due to declared shortage"*

The first six reasons are derived directly from the MDS questions explained in *Section 2.2*. If the assessments across the season indicated different reasons for non-vaccination, the resident qualified for the "Multiple reasons" category. If all assessments in the season for an unvaccinated resident were missing an answer for the non-vaccination question, then the resident fell under the "Missing" category.

The second methodology classified a resident into one of six reasons for non-vaccination, based only on the last assessment with non-missing vaccination information performed in a season:

- Not eligible – medical contraindication
- Offered & declined
- Not offered
- Inability to obtain vaccine (definition limited in MDS Version 3.0*)
- None of the above
- Missing

Because only one assessment was used for this methodology, a resident could not have inconsistent reasons for non-vaccination and therefore could not be classified into the "Multiple reasons" category. If all assessments in the season for an unvaccinated resident were missing an answer for the non-vaccination question, then the resident fell under the "Missing" category.

The motivation for using this methodology was that a modification in the reported reason for non-vaccination could reflect an actual change, rather than a data inconsistency. For example, a resident may

not have been offered the vaccine at the time of their first assessment, but could have been offered and declined it by the time of their last assessment. Using the last assessment with non-missing information may provide the ultimate reason why a resident was not vaccinated in the season.

5 Additional Investigations

This project encountered two main data quality concerns: missing vaccination information and inconsistent answers to the vaccination question. Acumen addressed the first concern with a population restriction, as *Section 3.1* describes. This section explains the second concern—inconsistent vaccination information—and then presents an investigation that explored how inconsistent information affects the national vaccination rates.

5.1 Interpreting inconsistent vaccination information

Inconsistent information for a given resident is defined as a "yes" for vaccinated on an assessment and a "no" on a later assessment in that season. This definition is set because the influenza vaccine is only administered to a person once per season; once a resident appears as vaccinated in one assessment, the resident should be counted as vaccinated in all later assessments for that season. Approximately 4-5% of the cleaned study population has inconsistent vaccination information. The vaccination rate calculation considers these residents vaccinated, placing higher confidence on earlier, positive responses.

Table 11. *Percentage of residents with inconsistent information*

2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
4.9%	4.9%	4.8%	4.6%	4.5%	4.7%	5.1%	4.4%	4.3%	4.2%

5.2 Investigating alternative definitions of vaccination rate

Before CDC selected the *Section 4.1* definition, the project team presented two additional methods of calculating the vaccination rate. Each method varies in the level of stringency of accounting for residents with inconsistent answers for the vaccination status. ***Table 12*** summarizes the three methods. The upper bound is the method selected by CDC and defined previously in *Section 4.1*.

Table 12. *Methods for defining vaccination rate*

Upper Bound	Lower Bound	Alternative Sample
Motivation		
This definition does not account for data entry errors. This definition places greater confidence in positive or earlier answers.	This definition places greater confidence on negative or later answers. This definition yields the low bound for the influenza vaccination rate.	This definition accounts for possible data entry errors by restricting the population to residents with consistent vaccination information.
Definition of Vaccinated Status		

Residents with a "yes" on any assessment within the season are counted as vaccinated for that season regardless of any "no" assessments.	Residents with inconsistent answers on assessments within a season are counted as not vaccinated for that season.	Residents with inconsistent answers on assessments within a season are dropped for that season.
Population		
Full population *Includes:* Residents with inconsistent info. (***Table 11***). *Excludes:* Residents with missing info. (***Table 6*** and ***Table 7***).	Full population *Includes:* Residents with inconsistent info. (***Table 11***). *Excludes:* Residents with missing info. (***Table 6*** and ***Table 7***).	Alternative population *Excludes:* - Residents with inconsistent information (***Table 11***). - Residents with missing info. (***Table 6*** and ***Table 7***).

The treatment of inconsistent information affects the estimated rate of vaccination. ***Table 13*** shows the vaccination rates using each of the three methods.

Table 13. *Vaccination rates under the three methods*

Method	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Upper Bound	71.4%	74.3%	76.5%	77.5%	78.4%	75.4%	76.8%	76.7%	76.5%	75.7%
Lower Bound	66.3%	69.3%	71.7%	72.9%	73.9%	70.4%	71.5%	72.1%	71.9%	71.2%
Alternative Sample	69.9%	72.9%	75.3%	76.4%	77.4%	74.1%	75.5%	75.6%	75.4%	74.5%

5.3 Stratifying the vaccination rate by month of exit

There are no assessments to indicate if a resident was vaccinated after leaving a facility. Residents leave the facility at different points in the influenza season, which limits the information available to determine whether they were vaccinated. To investigate the impact of this limitation, vaccination rates were stratified by the month of exit. The month of exit is defined as the month of the resident's last assessment in the influenza season. For all influenza seasons, the vaccination rate increased from the beginning to the end of the season. ***Table 14.*** shows the vaccination rates for influenza season 2014-15.

Table 14. *Influenza vaccination rate for 2014-15 season by month of exit*

Month of Last Assessment in Season	Vaccination Rate	# Vaccinated	# Not Vaccinated
October	54.3%	84,643	71,140
November	66.4%	117,587	59,500
December	69.7%	140,774	61,078
January	71.7%	155,785	61,511

February	72.1%	151,073	58,594
March	71.9%	166,897	65,154
April *	80.2%	356,846	88,301
May *	82.5%	370,926	78,435
June *	82.1%	453,436	98,539

** The study population is restricted to residents with at least one assessment between October and March. However, assessment through June are included.*