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Influenza Vaccine Uptake and Missed Opportunities Among the Medicare-Covered Population With High-Risk Conditions During the 2018 to 2019 Influenza Season:

A Retrospective Cohort Study

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Abstract

Background: Seasonal influenza causes substantial morbidity and mortality among older U.S. adults and those with comorbid health conditions.

Objective: To describe seasonal influenza vaccine uptake and identify factors associated with missed opportunities for influenza vaccination.

Design: Retrospective cohort study.

Setting: Medicare fee-for-service claims.

Participants: 31.6 million U.S. adults continuously enrolled under Medicare Parts A and B during the 2018 to 2019 influenza season.

Measurements: Influenza vaccine uptake and missed opportunities by patient demographic characteristics, high-risk status (that is, ≥1 condition increasing influenza complication risk), Medicare–Medicaid dual-eligibility status, and health care provider visits (that is, vaccination opportunities).

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Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Results: Overall, 50.5% of beneficiaries aged 19 years or older had Medicare claims for influenza vaccination: 31.6% among people aged 19 to 64 years and 54% among people aged 65 years or older. More White beneficiaries were vaccinated (52.9%) than Black (34.9%) or Hispanic (30.4%) beneficiaries. Uptake was higher (56.1%) for beneficiaries with high-risk conditions than for those without (27.6%). Among unvaccinated beneficiaries overall, 77.4% visited a provider during influenza season; among unvaccinated beneficiaries with and without high-risk conditions, 91% and 43%, respectively, had seen a provider at least once. The proportion of beneficiaries with missed opportunities for influenza vaccination was 44.2% and was higher for beneficiaries in the non–high-risk group (59.1%) than those in the high-risk group (42.2%). Uptake was lower and proportions of missed opportunities were higher among beneficiaries in younger age groups, of Black and Hispanic race/ethnicity, without high-risk conditions, or with Medicare-Medicaid dual eligibility.

Limitations: Influenza vaccinations without claims could not be captured. Data on reasons for nonvaccination were unavailable.

Conclusion: Influenza vaccination coverage for Medicare beneficiaries continues to be suboptimal, with missed opportunities despite availability of influenza vaccination with no copayment. Disparities persist in vaccination uptake by race/ethnicity.

Primary Funding Source: None.

The Advisory Committee on Immunization Practices recommends annual seasonal influenza vaccination for all persons aged 6 months or older (1). Influenza has resulted in 9.3 to 45.0 million illnesses, 140 000 to 810 000 hospitalizations, and 12 000 to 61 000 deaths annually in the United States since 2010 (2, 3). Most hospitalizations and deaths from influenza occur among adults aged 65 years or older (3), and high-risk adults, such as those with chronic medical conditions, are vulnerable to influenza-associated complications and death (4, 5). Annual influenza vaccination is especially important for these populations (1). Medicare Part B covers influenza vaccination at no cost to beneficiaries—that is, almost all adults aged 65 years or older and younger adults with permanent disabilities or end-stage renal disease. Other preventive services (for example, annual wellness visits) covered under Medicare Part B give providers opportunities to offer and administer influenza vaccination during influenza season.

The Healthy People 2020 annual influenza vaccination target for all adults aged 18 years or older is 70% (6); however, the estimated 2019 to 2020 coverage was 48.4% among adults aged 18 years or older (7). Despite the accessibility of the influenza vaccine, uptake among adults aged 65 years or older remains suboptimal, plateauing around 65% (7, 8). Identifying factors associated with remaining unvaccinated among those at elevated risk for influenza-related complications despite 1 or more health care visits during influenza season is essential for improving vaccination coverage. We describe seasonal influenza vaccine uptake during the 2018 to 2019 influenza season and factors associated with missed opportunities for vaccination among those covered under Medicare Parts A and B.

Methods

Data Sources

We used 3 data files from the Medicare Part A and B fee-for-service (FFS) administrative claims data managed by the Centers for Medicare & Medicaid Services (CMS): the outpatient file, containing institutional claims for outpatient services rendered during inpatient hospital stays or visits to hospital-based outpatient settings (for example, hospital outpatient departments or renal dialysis clinics); the carrier file, containing noninstitutional claims for outpatient and preventive care; and the Master Beneficiary Summary File, containing enrollment and demographic information about each beneficiary, including dual eligibility for Medicare and Medicaid due to low income and/or certain health conditions (9). For dually eligible beneficiaries, Medicaid is a payer of last resort; thus, their influenza vaccination claims should be found in Medicare FFS claims data (10).

Study Population

We defined the 2018 to 2019 influenza season as August 2018 to April 2019. The study population included Medicare beneficiaries aged 19 years or older living in the 50 U.S. states or Washington, DC, and continuously enrolled under Medicare Parts A and B FFS plan during the 2018 to 2019 influenza season. Continuous enrollment under Parts A and B was required to ensure all influenza vaccination claims were available through the study period. Coverage under Parts A and B was needed because Part B enrollment eligibility requires Part A enrollment (Supplement Methods 1, available at Annals.org). We excluded beneficiaries if they resided outside the United States or if demographic data were missing.

We classified beneficiaries according to high-risk status, defined as having 1 or more high-risk conditions associated with complications from influenza (1) (Appendix, available at Annals.org). Specific chronic or disabling conditions were those included in the Chronic Conditions Data Warehouse, which uses diagnosis codes, Medicare Severity Diagnosis Related Group codes, and/or procedure codes in CMS FFS claims data to identify specific conditions (11). Beneficiaries could have 1 or more diagnoses of chronic or disabling conditions, so we categorized diagnoses of similar chronic or disabling conditions within a single condition (Appendix Table 1, available at Annals.org).

Outcome Measures

Our study had 2 outcomes. The first was influenza vaccine uptake, defined as the proportion of Medicare beneficiaries with an influenza vaccination claim during influenza season. We extracted claims using Current Procedural Terminology and Healthcare Common Procedure Coding System codes for seasonal influenza vaccines and vaccine administration (12) and a quality code for “influenza immunization administered or previously received” to identify and confirm prior influenza vaccination receipt (Supplement Methods 2, available at Annals.org).

The second outcome measure was the proportion of beneficiaries with missed opportunities for influenza vaccination, defined as the proportion of beneficiaries who had documented evaluation and management (E/M) services during influenza season but no influenza

vaccination claim. To ensure beneficiaries had chances to receive influenza vaccination at or after E/M visits, we assessed E/M visit history between September 2018 and March 2019, allowing a month of grace period after the first month (that is, August) to ensure vaccine availability, and including 1 month (that is, April) past the last month of E/M visits (March) in our analysis of the influenza season. An extended set of E/M codes were used, including not only E/M office or other outpatient visits but also face-to-face assessment services at renal dialysis facilities or nursing facility E/M services or home visits (Supplement Methods 3, available at Annals.org).

Statistical Analysis

We describe influenza vaccine uptake by age; sex; race; high-risk status; census region; Medicare–Medicaid dual-eligibility status; and E/M service visits to health care providers, including "type of provider visited" and number of visits by provider type. The uptakes and risk differences with 95% CIs were estimated using PROC FREQ with the RISKDIFF option.

We calculated the number of provider visits per beneficiary during the influenza season by aggregating numbers of E/M service visits made by the beneficiary between September 2018 and March 2019 using Current Procedural Terminology and Healthcare Common Procedure Coding System codes for E/M visits (Supplement Methods 3).

Type of provider visited was the health care provider specialty associated with the E/M visit claim. We categorized health care provider specialty and type into primary care providers (PCPs), medical specialists, or others (Supplement Methods 4, available at Annals.org).

Logistic regression analysis with fixed effects of states was done, and adjusted rates and differences with 95% CIs were estimated to evaluate associations between beneficiaries with missed opportunities; selected patient characteristics (for example, age, sex, race/ethnicity, state, and dual-eligible status); and other variables, such as number of high-risk conditions and provider type seen at E/M visits. The regression was done using the PROC GENMOD model statement. For risk differences and CI estimation, NLMeans macro, version 1.3 (last modified 27 April 2021; SAS Institute), was used. All statistical analyses were done using SAS Enterprise Guide, version 7.15 HF8 (SAS Institute).

Role of the Funding Source

No funding was received for this study.

Results

The analysis included 31 666 731 beneficiaries after excluding 631 094 (2.0%) with missing demographic information. Most beneficiaries were aged 65 years or older (84.6%), female (55.1%), and White (84.2%). Dually eligible beneficiaries were 17.1% of the study population (Table 1). Most beneficiaries had 1 or more high-risk condition (80.4%). Among those with high-risk conditions, 74.2% had more than 1 high-risk condition; 47.7% had 3 or more conditions. Heart disease was the most common high-risk condition, followed by endocrine disorders and kidney disorders (Appendix Table 2, available at Annals.org).

Influenza vaccine uptake was 50.5% among all beneficiaries and was higher (56.1%) for beneficiaries with high-risk conditions than those with no high-risk conditions (27.6%). Vaccine uptake increased with age: 25.4% were vaccinated among those aged 19 to 49 years, 34.8% among those aged 50 to 64 years, 49.2% among those aged 65 to 74 years, and 59.8% among those aged 75 years or older. Uptake was highest among White beneficiaries (52.9%), followed by Asian beneficiaries (50.2%), and it was lower among Black (34.9%) and Hispanic (30.4%) beneficiaries. Uptake by women was 6 percentage points higher than among men (95% CI, 5.95 to 6.02 percentage points). Dually eligible beneficiaries had 14.2 percentage points lower vaccine uptake than non–dually eligible beneficiaries (CI, −14.21 to −14.12 percentage points). Uptake for beneficiaries living in the West (45.7%) and South (49.9%) was lower than for those living in the Northeast (54.9%) and Midwest (52.3%).

Among beneficiaries with high-risk conditions, 94.9% had 1 or more E/M visit and 61.6% had 1 or more E/M visit to a PCP (Table 1). Beneficiaries who had E/M visits to both PCPs and specialists had the highest uptake (66.0%), followed by those with E/M visits to specialists only (57.6%). Uptake increased with the number of provider visits: 42.0% for those with 1 visit and 57.8% for those with 2 or more visits. Among unvaccinated beneficiaries during the 2018 to 2019 season (n = 15 667 549), 77.4% visited a provider for E/M services between September 2018 and March 2019 (n = 12 131 343). Among those who had no E/M service visits during influenza season (n = 3 536 206), 72.1% had no high-risk conditions. Only 16.1% of beneficiaries who had no E/M services received influenza vaccinations: 24.2% among the high-risk group and 12.5% in the non–high-risk group.

Uptake among high-risk beneficiaries was higher than in those without such conditions. Among persons aged 19 years or older, influenza vaccine uptake was 28.5 percentage points higher for those with 1 or more risk condition compared with those with none (CI, 28.49 to 28.57 percentage points); this difference was larger among men (32.7 percentage points [CI, 32.67 to 32.79 percentage points]) than women (23.8 percentage points [CI, 23.79 to 23.91 percentage points]).

Differences in uptake by high-risk status were seen within racial and ethnic groups as well. The largest difference (36.9 percentage points [CI, 36.62 to 37.14 percentage points]) was between Asian beneficiaries with and without high-risk conditions. Black and Hispanic beneficiaries who were not at high risk had the lowest vaccine uptake (<10%). Although uptake among Black and Hispanic beneficiaries with high-risk conditions (41.1% and 38.5%, respectively) was higher than those without high-risk conditions, their uptake remained lower than overall uptake (50.5%). Dually eligible beneficiaries were less likely to be vaccinated than beneficiaries covered only by Medicare in both the high-risk and non–high-risk groups. Risk differences in uptake within category and by high-risk group in all categories are presented in Appendix Table 3 (available at Annals.org).

Influenza vaccine uptake among beneficiaries increased with the number of high-risk conditions: 51.4% for beneficiaries with 1 condition, 56.1% with 2 conditions, and 58.6% for 3 or more conditions. In the Figure, influenza vaccine uptake rates by high-risk condition are compared. For each high-risk condition, the data points in each column for a condition

indicate average uptake by number of high-risk conditions: a single underlying high-risk condition alone and that underlying high-risk condition plus 1 or more additional high-risk conditions. Heart disease was the only high-risk condition that, when present alone, resulted in a higher influenza vaccine uptake than overall uptake for this population (55.4% vs. 50.5%). However, uptakes of beneficiaries with any single high-risk condition (black triangles) were lower than the average uptake among the high-risk group (56.1%, black dotted line). For chronic lung disease, immunocompromising conditions, cancer, and heart disease, the presence of just 1 additional risk condition was sufficient to increase uptake above the average among the high-risk group (Figure).

Out of 16 million providers who had submitted influenza vaccination claims, 53.4% were individual providers (n = 8 549 272) and 46.1% were organizational providers (n = 7 377 609), whereas 72 301 providers had missing information for this variable. Among the individual providers, only 18% (n = 1 544 324) were sole proprietors. One-third of the organizational providers (n = 2 436 376) belonged to subparts of organizations, whereas most of the organizational providers (n = 4 954 384) were stand-alone organizations. Vaccinated beneficiaries most often received influenza vaccinations from PCPs (43.1%) or pharmacists (42.8%), followed by nonphysician practitioners (5.8%) and medical specialists (3.6%). Among the high-risk group, most influenza vaccinations were given by PCPs (44.8%) and pharmacists (40.7%). Pharmacists administered 60% of influenza vaccinations for non–high-risk beneficiaries (Table 2).

Among 31 666 731 beneficiaries in the study, 27 450 735 had seen providers for E/M services. Overall, the proportion of beneficiaries who missed opportunities for influenza vaccination during 1 or more E/M visit was 44.2%, 16.9 percentage points higher among beneficiaries in the non–high-risk group (59.1%) than those in the high-risk group (42.2%) (Table 3; Appendix Table 4, available at Annals.org). Proportions of beneficiaries with missed opportunities for influenza vaccination were higher among beneficiaries in younger age groups, of Black and Hispanic race/ethnicity, or covered by both Medicare and Medicaid. Among those with 3 or more high-risk conditions, 40.4% did not receive influenza vaccination during E/M visits. The proportion of beneficiaries who missed opportunities for influenza vaccination was lower among those who saw PCPs and specialists by December compared with those who saw either provider type by December. Most (60.4%) beneficiaries whose E/M visits occurred after December remained unvaccinated.

Adjusted rates of missed opportunities based on the multivariate logistic regression were consistent with the findings from the bivariate analysis results. In particular, E/M visits to both PCPs and specialists by December were more likely to reduce the chance of missing influenza vaccination than E/M visits with other professional providers among beneficiaries compared with no E/M visit. Compared with White beneficiaries, Black and Hispanic beneficiaries were more likely to miss influenza vaccination despite E/M visits during influenza season. The rates of missed opportunity for influenza vaccination among high-risk beneficiaries are lower and decreased with the number of high-risk conditions. Dual-eligible beneficiaries were 8 percentage points more likely than non–dual-eligible beneficiaries to miss an opportunity for influenza vaccination (Table 4).

Discussion

Despite Medicare coverage for influenza vaccination, universal recommendations for influenza vaccination from the Advisory Committee on Immunization Practices, and increasing accessibility to vaccination services, we found that only 50.5% of Medicare beneficiaries aged 19 years or older received an influenza vaccine during the 2018 to 2019 influenza season: 31.6% of those aged 19 to 64 years and 54% aged 65 years or older. Those with 1 or more high-risk condition were more likely to be vaccinated than those without such conditions (difference, 28.5 percentage points [CI, 28.49 to 28.57 percentage points]) and accounted for 89.3% of those vaccinated. Although the association between lower likelihood of missed opportunities for influenza vaccination and a higher number of risk conditions is somewhat reassuring—patients with multiple conditions are likely among the frailest and therefore derive greatest benefit from vaccination—that reassurance is tempered by the fact that vaccine uptake even among those with 3 or more high-risk conditions did not exceed 60%.

Racial/ethnic disparities in uptake were seen, with 52.9% of White beneficiaries vaccinated compared with 34.9% and 30.4% of Black and Hispanic beneficiaries, respectively. Although these findings are consistent with prior studies (13–17), they remain surprising given universal eligibility in the population studied for this service, suggesting that other factors prevent or disincentivize influenza vaccination. Among Black and Hispanic beneficiaries with high-risk conditions, 56.5% and 58.5%, respectively, had missed opportunities for influenza vaccination, higher than among all beneficiaries with high-risk conditions (42.2%). Our logistic regression results confirmed that identifying as Black or Hispanic was an independent risk factor for missed opportunities for influenza vaccination: The presence of a high-risk condition was not sufficient to eliminate disparities in vaccination coverage compared with Whites (58.2% for Whites with ≥1 risk conditions vs. 40.7% for Blacks and Hispanics). The observation of disparities even among those at high risk suggests that messages directed to minority populations on the importance of influenza vaccination for persons with underlying medical conditions have been insufficient to overcome other barriers to vaccination. Thus, coupled with effective communications, providers should use E/M visits as an opportunity to assess the need for and offer influenza vaccination during influenza season to increase uptake among Black and Hispanic beneficiaries (13, 16–23).

Long-standing racial and ethnic disparities in adult immunization result from multiple factors beyond socioeconomic status and health insurance coverage (19). Deep disparities in influenza vaccination between Blacks and Hispanics and their White counterparts, among a population with universal coverage without copayment for these services, illustrates this point. Addressing such disparities will require commitment to sustained, population-specific, multipronged efforts across the health care system, including providers, health system managers, public health officials, and policymakers, working in collaboration with community leaders and organizations. Development and evaluation of strategies to increase vaccination among these populations are needed to identify those that are effective and can be implemented widely. Formative research to identify messages that resonate in these communities must be completed so that tailored, culturally competent communication

campaigns may be developed. Providers must closely examine their own practice procedures and communication styles to maximize the likelihood of vaccine acceptance by all patients, including those belonging to minority populations.

Most beneficiaries (86.7%) had 1 or more preventive visit to a provider during the influenza season, yet among these beneficiaries, only 55.6% were vaccinated. Although influenza vaccination may be administered at any time during the influenza season, the greater proportion of missed opportunities for vaccination among beneficiaries whose provider visits occurred after December suggests that interest in vaccination by patients (and perhaps providers) wanes as the season ensues. The data do not allow for an understanding of the proportion of unvaccinated beneficiaries who, consistent with standards for adult immunization practice, received a vaccine recommendation from their providers or were offered the vaccine but declined (24). However, prior studies have found a close association between receipt of a strong provider recommendation and completed vaccination; it is therefore unlikely that patient refusals account for all or even most of the 12 131 343 (44.2%) beneficiaries who were seen at least once by a provider but not vaccinated (25, 26). Alarmingly, among those with 1 or more high-risk condition who saw a vaccinating provider at least once during the influenza season, 42.2% were not vaccinated, illustrating the abundance of missed opportunities for influenza vaccination—particularly among those for whom vaccination has the greatest potential to reduce risk for hospitalization and death (20, 27, 28). Thus, given that missed opportunities are directly tied to the number of encounters with providers, especially among those with high-risk conditions, providers should use visits as opportunities to work together with patients to overcome barriers to vaccination. For those who have no visits where influenza vaccination need can be assessed before December, providers may use patient reminders or recalls.

Pharmacies are rapidly becoming a preferred source for adult vaccination, including influenza vaccination (29–33). Contributing to this trend have been changes to state pharmacy practice laws and convenience for consumers, most of whom visit pharmacies more frequently than PCPs or specialist providers (34, 35). We found that after receipt of vaccination from a PCP (43.1%), the next highest proportion of beneficiaries (42.8%) received influenza vaccine from a pharmacy. It is nevertheless surprising that nearly 60% of those without underlying risk conditions received influenza vaccination from a pharmacy compared with nearly 41% of those with 1 or more such condition, given that prior studies found that 22.2% of adults aged 18 years or older received influenza vaccinations from a pharmacy, including 31.3% of adults aged 65 years or older (33). With effective outreach and messaging, pharmacies may potentially reach an even greater proportion of the 6.2 million Medicare beneficiaries without underlying risk conditions, approximately 50% of whom did not see a nonpharmacist health care provider and nearly 90% of whom were not vaccinated.

These data suggest other targeted interventions to improve influenza vaccination rates among Medicare beneficiaries. Although most E/M service visits are done by PCPs, specialists are an important source of care for persons with chronic medical conditions. Seeing either a PCP or specialist is not sufficient to ensure vaccination: Influenza vaccine uptake among high-risk beneficiaries who saw both PCPs and specialists (66.5%) was

higher than influenza vaccine uptake among high-risk beneficiaries who saw only a PCP or specialist (57.3% and 59.6%, respectively). Increasing the consistency with which both PCP and medical specialty providers advocate for influenza vaccination in the context of overall chronic disease management would likely be helpful.

Medical specialists who treat Medicare beneficiaries should understand that ensuring all patients with underlying risk conditions receive the influenza vaccine is well within the scope of their responsibilities—whether that means administering the vaccine to their patients themselves or following up to ensure the vaccine is administered by another provider. All providers should incorporate adult immunization practice standards into clinical routines and strongly recommend influenza vaccine to patients, even if they do not administer it. Practices should also implement evidence-based strategies for improving adult vaccination coverage (36, 37).

We acknowledge several limitations. First, because our study is based on FFS claims submitted to CMS for reimbursement, influenza vaccinations received by beneficiaries for which claims were not submitted by the provider cannot be captured (for example, if the cost of influenza vaccination was covered out of pocket or by other sources, such as employers). Future analyses using other data sources, such as electronic health records, may yield complementary, more granular information to our population-based data. Second, claims data do not capture influenza vaccination decision processes between providers and beneficiaries nor the reasons for not being vaccinated, such as vaccine refusal or contraindication (for example, history of severe allergic reaction). Although there are quality codes for influenza vaccination that was not administered, with or without documented reasons (G8483 and G8484), these codes were used so infrequently that we could not conduct further analysis. Third, the study population did not include any of the more than 30% of Medicare beneficiaries covered under Medicare Advantage plans because the data were not available (38). Medicare Advantage plans offer beneficiaries Medicare Part A and B coverage on a capitated payment basis by Medicare-approved private companies under rules set by Medicare. Beneficiaries under Medicare Advantage plans may thus show different patterns in provider encounters for preventive care (39). Although we compared factors associated with influenza vaccination among Medicare FFS recipients, inclusion of Medicare Advantage data would allow more rigorous and complete analysis of influenza vaccination predictors. Fourth, Medicare claims may underestimate influenza vaccine uptake. Others have found lower estimates of uptake using Medicare claims compared with beneficiary surveys (40). Surveys of adults self-reporting influenza vaccination consistently find a higher percentage of adults aged 65 years or older reporting vaccination (for example, 69.8% influenza vaccination coverage among adults aged 65 years or older in 2019 to 2020 [7]). Finally, chronic conditions and other disabling condition flags in CMS Medicare data are not an exact match with conditions associated with a high risk for influenza complications, so uptake estimates by high-risk conditions may not exactly correspond to high-risk conditions in Advisory Committee on Immunization Practices influenza recommendations (1). Despite these limitations, given the large proportion of beneficiaries covered by the FFS plan whose claims data we included in our analysis, the results confirmed that influenza vaccine uptakes are too low, racial disparities persist, and

too many opportunities for vaccination of this vulnerable population are missed because of modifiable factors.

Influenza vaccination is the most effective means of preventing complications from influenza, including hospitalization and death (1). Despite availability of influenza vaccination with no copayment to Medicare beneficiaries under FFS, only half were vaccinated. There were many opportunities during which beneficiaries, including those at highest risk, could have been vaccinated but were missed by both primary care and specialty providers. Uptake was even lower among beneficiaries who are members of racial and ethnic minority groups. A comprehensive strategy centered on evidence-based interventions that leverages all medical and pharmacy visits as opportunities for vaccination will be required to increase vaccination coverage and maximize the benefit of this preventive health tool in the Medicare population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix: High-Risk Indicators

The Medicare Master Beneficiary Summary files include the chronic conditions segment and the other chronic or potentially disabling conditions segment. These segments include selected variables of 66 conditions flags, including 27 common chronic conditions and 39 other chronic or potentially disabling conditions from condition categories in the Chronic Conditions Data Warehouse (www2.ccwdata.org/web/guest/condition-categories). The condition variables are developed from algorithms that search the CMS administrative FFS claims data for specific diagnosis codes, Medicare Severity Diagnosis Related Group codes, or procedure codes. However, the conditions flagged in Medicare data do not necessarily match the conditions suggested in the recommendations shown in Appendix Table 1.

Appendix Table 1.

Conditions That Increase the Risk for Influenza Complications [*]

Conditions Associated With Elevated Riskfor Influenza Complications (High-Risk Conditions)[†]	Diagnosis of Chronic Conditions and Other Disabling Conditions[‡]
Blood disorders	Anemia Sickle cell disease
Immunosuppressed conditions	HIV/AIDS Leukemia and lymphoma

Conditions Associated With Elevated Riskfor Influenza Complications (High-Risk Conditions)[†]	Diagnosis of Chronic Conditions and Other Disabling Conditions[‡]
Cancer	Breast cancer Colorectal cancer Endometrial cancer Lung cancer Prostate cancer
Chronic lung disease	Asthma Chronic obstructive pulmonary disease Cystic fibrosis and other metabolic developmental disorders
Endocrine disorders	Acquired hypothyroidism Diabetes
Heart disease	Acute myocardial infarction Atrial fibrillation Heart failure Hyperlipidemia Hypertension Ischemic heart disease Peripheral vascular disease Stroke or transient ischemic attack
Kidney disorders	Chronic kidney disease
Liver disorders	Liver disease, cirrhosis, and other liver conditions (excluding hepatitis) Viral hepatitis (general)
Neurologic and neurodevelopmental conditions	Alzheimer disease Alzheimer disease and related disorders or senile dementia Cerebral palsy Epilepsy Intellectual disabilities and related conditions Learning disabilities Multiple sclerosis and transverse myelitis Muscular dystrophy Other developmental delays Spina bifida and other congenital anomalies of the nervous system Spinal cord injury Traumatic brain injury and nonpsychotic mental disorders due to brain damage
Persons with extreme obesity (body mass index ≥40 kg/m^2)	Obesity

[*] A person could be diagnosed with >1 high-risk disease or symptom within a single high-risk condition (e.g., a person diagnosed with hyperlipidemia, hypertension, and ischemic heart disease would be listed only under the heart disease condition).

[†] From reference 1.

[‡] From reference 11.

Appendix Table 2.

Number of Beneficiaries With High-Risk Conditions,[*] by the Number of High-Risk Conditions, 2018 to 2019 Influenza Season

High-Risk Conditions[†]	Number of High-Risk Conditions = 1, *n* (%)	Number of High-Risk Conditions = 2, *n* (%)	Number of High-Risk Conditions = ≥3, *n* (%)	Any High-Risk Conditions, *n* (%)
Heart disease	4 589 830 (69.8)	5 970 852 (88.6)	11 819 948 (97.2)	22 380 630 (87.9)
Endocrine disorders	507 713 (7.7)	2 505 997 (37.2)	8 679 627 (71.4)	11 693 337 (45.9)
Kidney disorders	90 837 (1.4)	680 711 (10.1)	6 586 487 (54.2)	7 358 035 (28.9)
Blood disorders	213 131 (3.2)	842 424 (12.5)	5 540 393 (45.6)	6 595 948 (25.9)
Obesity	291 688 (4.4)	1 147 834 (17.0)	4 901 325 (40.3)	6 340 847 (24.9)

High-Risk Conditions†	Number of High-Risk Conditions = 1, *n* (%)	Number of High-Risk Conditions = 2, *n* (%)	Number of High-Risk Conditions = ≥3, *n* (%)	Any High-Risk Conditions, *n* (%)
Chronic lung disease	202 206 (3.1)	777 225 (11.5)	3 766 588 (31.0)	4 746 019 (18.6)
Neurologic/ neurodevelopmental conditions	362 529 (5.5)	721 919 (10.7)	3 110 451 (25.6)	4 194 899 (16.5)
Cancer	190 397 (2.9)	522 363 (7.8)	1 924 483 (15.8)	2 637 243 (10.4)
Liver disorders	75 482 (1.1)	203 018 (3.0)	1 354 087 (11.1)	1 632 587 (6.4)
Immunocompromising conditions	48 891 (0.7)	106 065 (1.6)	455 846 (3.7)	610 802 (2.4)
Total	6 572 704 (25.8)	6 739 204 (26.5)	12 156 478 (47.7)	25 468 386 (100)

*A person could have been diagnosed with >1 high-risk disease or symptom within a single high-risk condition (e.g., a person diagnosed with hyperlipidemia, hypertension, and ischemic heart disease would be listed only under the heart disease condition with 1 high-risk condition [and in this table in the high-risk condition = 1 column and heart disease row], whereas a person diagnosed with hyperlipidemia, breast cancer, and diabetes mellitus would be included in the heart disease, cancer, and endocrine disorder conditions [and in this table in the high-risk conditions = ≥3 column for each of those rows]). High-risk conditions are thus not mutually exclusive, and a person with multiple high-risk conditions could be included in >1 row. The rows are thus to be read discretely, e.g., among all persons with heart disease disorders, how many only had heart disease disorders (high-risk condition = 1), how many had heart disease plus ≥1 diagnoses within another condition (high-risk condition = 2), and how many had heart disease plus ≥1 diagnoses within >1 other condition (high-risk condition = 3).

†For high-risk conditions, see Appendix Table 1.

Appendix Table 3.

Risk Difference of Influenza Vaccination Uptakes by Category and High-Risk,* Status, 2018 to 2019 Influenza Season†

Characteristic	Comparison Within Category, Risk Difference (95% Confidence Limit)			Comparison by High-Risk Status (High Risk Minus Non-High Risk), Risk Difference (95% Confidence Limit)
	High Risk	Non-High Risk	Total	
Total	-	-	-	28.5 (28.5 to 28.6)
Age group				
19–49 y	−22.1 (−22.2 to −22.0)	−19.4 (−19.5 to −19.3)	−23.8 (−23.9 to −23.7)	22.7 (22.5 to 22.8)
50–64 y	−15.2 (−15.3 to −15.1)	−16.5 (−16.6 to −16.4)	−14.4 (−14.5 to −14.3)	26.7 (26.6 to 26.8)
65–74 y	Referent	Referent	Referent	25.3 (25.3 to 25.4)
≥75 y	7.3 (7.3 to 7.3)	5.0 (4.9 to 5.1)	10.6 (10.5 to 10.6)	27.6 (27.6 to 27.7)
Sex				
Male	Referent	Referent	Referent	32.7 (32.7 to 32.8)
Female	3.0 (3.0 to 3.0)	11.9 (11.8 to 12.0)	6.0 (6.0 to 6.0)	23.8 (23.8 to 23.9)
Race/ethnicity				
White	Referent	Referent	Referent	27.5 (27.5 to 27.6)
Black	−17.1 (−17.1 to −17.0)	−21.2 (−21.2 to −21.1)	− 17.9 (−18.0 to −17.9)	31.6 (31.5 to 31.7)
Hispanic	−19.7 (−19.8 to −19.6)	−21.9 (−22.1 to −21.8)	−22.5 (−22.6 to −22.3)	29.8 (29.6 to 30.0)

Characteristic	Comparison Within Category, Risk Difference (95% Confidence Limit)			Comparison by High-Risk Status (High Risk Minus Non-High Risk), Risk Difference (95% Confidence Limit)
	High Risk	Non-High Risk	Total	
Asian	−0.1 (−0.3 to 0.0)	−9.5 (−9.7 to −9.2)	−2.7 (−2.8 to −2.5)	36.9 (36.6 to 37.1)
Other	−4.2 (−4.4 to −4.1)	−8.7 (−8.9 to −8.5)	−6.0 (−6.1 to −5.9)	32.0 (31.8 to 32.2)
Region				
Midwest	5.5 (5.4 to 5.6)	4.9 (4.8 to 5.0)	6.6 (6.6 to 6.7)	26.6 (26.6 to 26.7)
Northeast	8.3 (8.3 to 8.4)	2.6 (2.5 to 2.7)	9.2 (9.1 to 9.2)	31.8 (31.7 to 31.9)
South	3.0 (2.9 to 3.0)	−0.2 (−0.3 to −0.1)	4.3 (4.2 to 4.3)	29.2 (29.1 to 29.2)
West	Referent	Referent	Referent	26.1 (26.0 to 26.1)
Dual eligibility for Medicare and Medicaid				
Dual eligible	−15.3 (−15.3 to −15.2)	−15.2 (−15.3 to −15.1)	−14.2 (−14.2 to −14.1)	29.0 (29.0 to 29.1)
Not dual eligible	Referent	Referent	Referent	29.0 (29.0 to 29.1)
Type of provider visited for E/M				
None	Referent	Referent	Referent	11.7 (11.6 to 11.7)
PCP	33.1 (33.1 to 33.2)	30.8 (30.7 to 30.9)	39.8 (39.7 to 39.8)	14.0 (13.9 to 14.1)
PCP and specialist	42.3 (42.2 to 42.4)	44.4 (44.2 to 44.6)	49.9 (49.8 to 49.9)	9.5 (9.4 to 9.7)
Specialist	35.4 (35.3 to 35.5)	33.3 (33.1 to 33.4)	41.5 (41.4 to 41.5)	13.8 (13.7 to 14.0)
Others[≠]	24.6 (24.5 to 24.8)	20.8 (20.7 to 20.9)	29.6 (29.6 to 29.7)	15.5 (15.4 to 15.6)
Number of E/M visits				
0	Referent	Referent	Referent	11.7 (11.6 to 11.7)
1	21.3 (21.2 to 21.4)	21.5 (21.4 to 21.6)	25.9 (25.8 to 25.9)	11.4 (11.3 to 11.6)
≥2	35.0 (34.9 to 35.1)	31.7 (31.7 to 31.8)	41.7 (41.7 to 41.7)	14.9 (14.9 to 15.0)
Number of E/M visits to PCP				
0	Referent	Referent	Referent	26.9 (26.9 to 27.0)
1	7.5 (7.4 to 7.5)	22.2 (22.1 to 22.3)	14.4 (14.4 to 14.5)	12.2 (12.1 to 12.3)
≥2	13.3 (13.2 to 13.3)	26.7 (26.5 to 26.8)	21.3 (21.3 to 21.4)	13.6 (13.4 to 13.7)
Number of E/M visits to specialist				
0	Referent	Referent	Referent	27.9 (27.9 to 27.9)
1	10.5 (10.4 to 10.6)	24.8 (24.7 to 25.0)	15.6 (15.6 to 15.7)	13.6 (13.4 to 13.7)
≥2	13.2 (13.2 to 13.3)	27.4 (27.2 to 27.6)	19.1 (19.1 to 19.2)	13.7 (13.5 to 13.9)

E/M = evaluation and management; PCP = primary care provider.

[*] Indicates diagnosis with a condition associated with elevated risk for influenza complications.

[†] The risk differences are estimated based on the uptakes reported in Table 1.

[‡] Includes clinics or group practices; nonphysician providers (including nurse practitioners, physician assistants, and clinical nurse specialists); ambulatory outpatient facilities, such as end-stage renal disease facilities; and institutional providers, such as hospitals, skilled-nursing facilities, and home health agencies.

Appendix Table 4.

Difference of Rates of Missed Opportunities for Influenza Vaccination by Category and High-Risk[*] Status, 2018 to 2019 Influenza Season[†]

Characteristic	Comparison Within Category, Risk Difference (95% Confidence Limit)			Comparison by High-Risk Status (High Risk Minus Non-High Risk), Risk Difference (95% Confidence Limit)
	High Risk	Non-High Risk	Total	
Total	-	-	-	−16.9 (−17.0 to −16.8)
Age group				
19–49 y	21.4 (21.3 to 21.5)	26.8 (26.6 to 26.9)	23.7 (23.7 to 23.8)	−18.5 (−18.6 to −18.3)
50–64 y	15.0 (14.9 to 15.0)	21.9 (21.7 to 22.0)	15.3 (15.3 to 15.4)	−20.0 (−20.1 to −19.8)
65–74 y	Referent	Referent	Referent	−13.1 (−13.2 to −13.0)
≥75 y	−7.0 (−7.0 to −7.0)	−7.3 (−7.5 to −7.2)	−8.2 (−8.3 to −8.2)	−12.7 (−12.9 to −12.6)
Sex				
Male	Referent	Referent	Referent	−20.5 (−20.6 to −20.4)
Female	−2.0 (−2.1 to −2.0)	−8.2 (−8.3 to −8.1)	−2.7 (−2.8 to −2.7)	−14.3 (−14.3 to −14.2)
Race/ethnicity				
White	Referent	Referent	Referent	−16.7 (−16.8 to −16.7)
Black	16.2 (16.1 to 16.3)	23.1 (22.8 to 23.4)	16.1 (16.0 to 16.2)	−23.7 (−23.9 to −23.5)
Hispanic	18.5 (18.4 to 18.7)	23.0 (22.7 to 23.3)	18.9 (18.8 to 19.0)	−21.2 (−21.6 to −20.8)
Asian	−1.1 (−1.2 to −0.9)	3.6 (3.2 to 4.0)	−1.0 (−1.1 to −0.9)	−21.4 (−21.9 to −21.0)
Other	3.4 (3.3 to 3.6)	6.0 (5.6 to 6.3)	3.6 (3.5 to 3.7)	−19.3 (−19.6 to −18.9)
Region				
Midwest	−5.0 (−5.1 to −5.0)	−3.7 (−3.9 to −3.6)	−5.2 (−5.3 to −5.2)	−15.9 (−16.0 to −15.8)
Northeast	−7.9 (−8.0 to −7.9)	−3.3 (−3.4 to −3.1)	−8.1 (−8.1 to −8.0)	−19.2 (−19.4 to −19.1)
South	−2.5 (−2.6 to −2.5)	0.4 (0.3 to 0.6)	−2.9 (−3.0 to −2.9)	−17.5 (−17.6 to −17.4)
West	Referent	Referent	Referent	−14.6 (−14.7 to −14.4)
Dual eligibility for Medicare and Medicaid				
Dual eligible	15.2 (15.2 to 15.3)	21.0 (20.9 to 21.2)	15.3 (15.2 to 15.3)	−22.5 (−22.6 to −22.4)
Not dual eligible	Referent	Referent	Referent	−16.7 (−16.8 to −16.6)
Number of high-risk conditions				

Characteristic	Comparison Within Category, Risk Difference (95% Confidence Limit)			Comparison by High-Risk Status (High Risk Minus Non-High Risk), Risk Difference (95% Confidence Limit)
	High Risk	Non-High Risk	Total	
1	Referent	-	Referent	-
2	−3.5 (−3.6 to −3.4)	-	−3.5 (−3.6 to −3.4)	-
≥3	−5.3 (−5.4 to −5.3)	-	−5.3 (−5.4 to −5.3)	-
Type of provider visited for E/M by December				
None	Referent	Referent	Referent	−9.9 (−10.1 to −9.8)
PCP and specialist	−24.9 (−25.0 to −24.8)	−27.2 (−27.5 to −26.9)	−28.1 (−28.2 to −28.0)	−7.6 (−7.9 to −7.4)
PCP	−16.6 (−16.7 to −16.5)	−14.8 (−14.9 to −14.6)	−19.2 (−19.2 to −19.1)	−11.7 (−11.9 to −11.6)
Specialist	−18.2 (−18.3 to −18.1)	−15.9 (−16.1 to −15.7)	−20.2 (−20.3 to −20.1)	−12.3 (−12.4 to −12.1)
Others[‡]	−8.1 (−8.2 to −8.0)	−3.8 (−3.9 to −3.7)	−9.3 (−9.4 to −9.2)	−14.2 (−14.3 to −14.1)

E/M = evaluation and management; PCP = primary care provider.

[*] Indicates diagnosis with a condition associated with elevated risk for influenza complications.

[†] Missed opportunity for influenza vaccination is defined as number and proportion of beneficiaries who did not receive influenza vaccination while visiting providers for E/M visits. The risk differences are estimated based on the uptakes reported in Table 3.

[‡] Includes clinics or group practices; nonphysician providers (including nurse practitioners, physician assistants, and clinical nurse specialists); ambulatory outpatient facilities, such as end-stage renal disease facilities; and institutional providers, such as hospitals, skilled-nursing facilities, and home health agencies.

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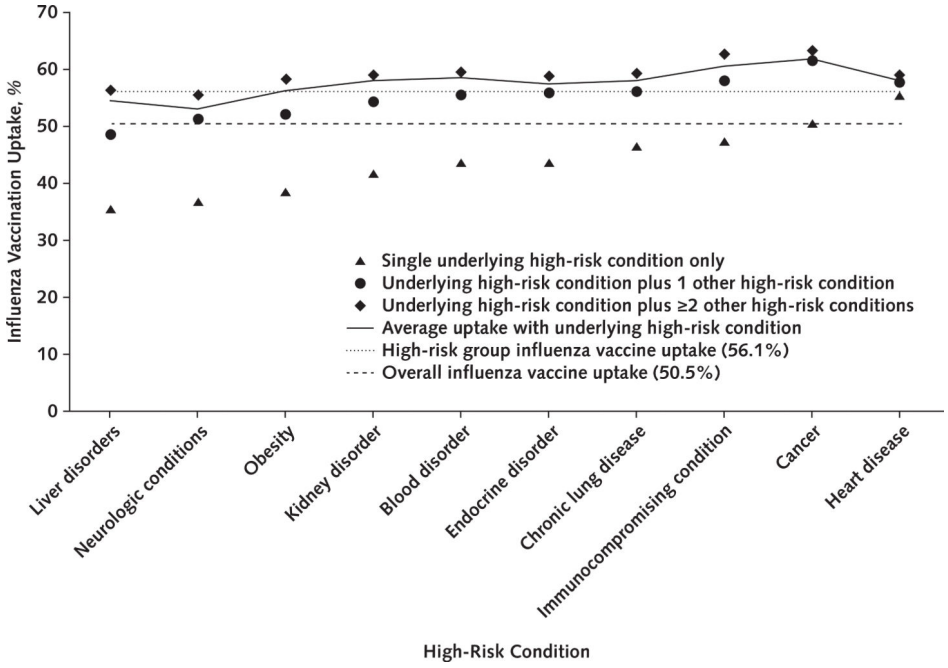

Figure. Comparison of influenza vaccination uptake among Medicare beneficiaries, by number and type of high-risk conditions during the 2018 to 2019 influenza season.

Each data point represents influenza vaccine uptake among the beneficiaries with the underlying high-risk condition by the number of high-risk conditions: a single underlying high-risk condition only, an underlying condition along with 1 other high-risk condition, or ≥2 other high-risk conditions. For example, among all persons with heart disease disorders, how many only had heart disease disorders (high-risk condition = 1), how many had heart disease plus ≥1 diagnoses within another condition (high-risk condition = 2), and how many had heart disease plus ≥1 diagnoses within >1 other condition (high-risk condition = 3). For more information, see Appendix Table 2.

Table 1.

Characteristics of Medicare Beneficiaries in the Study Population and Influenza Vaccination Uptake, 2018 to 2019 Influenza Season

Characteristic	Beneficiaries, *n (Column %)*			Influenza Vaccinated, *n (Uptake %)*		
	High Risk*	Non-High Risk	Total	High Risk*	Non-High Risk	Total
Total	25 468 386	6 198 345	31 666 731	14 289 697 (56.1)	1 709 485 (27.6)	15 999 182 (50.5)
Age group						
19–49 y	1 088 886 (4.3)	595 836 (9.6)	1 684 722 (5.3)	363 848 (33.4)	64 088 (10.8)	427 936 (25.4)
50–64 y	2 545 890 (10.0)	658 492 (10.6)	3 204 382 (10.1)	1 025 762 (40.3)	89 754 (13.6)	1 115 516 (34.8)
65–74 y	11 048 944 (43.4)	3 631 183 (58.6)	14 680 127 (46.4)	6 130 181 (55.5)	1 094 442 (30.1)	7 224 623 (49.2)
≥75 y	10 784 666 (42.3)	1 312 834 (21.2)	12 097 500 (38.2)	6 769 906 (62.8)	461 201 (35.1)	7 231 107 (59.8)
Sex						
Male	11 105 456 (43.6)	3 124 884 (50.4)	14 230 340 (44.9)	6 043 218 (54.4)	677 786 (21.7)	6 721 004 (47.2)
Female	14 362 930 (56.4)	3 073 461 (49.6)	17 436 391 (55.1)	8 246 479 (57.4)	1 031 699 (33.6)	9 278 178 (53.2)
Race/ethnicity						
White	21 521 756 (84.5)	5 140 242 (82.9)	26 661 998 (84.2)	12 523 523 (58.2)	1 575 050 (30.6)	14 098 573 (52.9)
Black	2 391 797 (9.4)	580 521 (9.4)	2 972 318 (9.4)	983 666 (41.1)	55 059 (9.5)	1 038 725 (34.9)
Hispanic	496 875 (2.0)	184 734 (3.0)	681 609 (2.2)	191 280 (38.5)	16 103 (8.7)	207 383 (30.4)
Asian	496 147 (1.9)	134 142 (2.2)	630 289 (2.0)	288 084 (58.1)	28 414 (21.2)	316 498 (50.2)
Other†	561 811 (2.2)	158 706 (2.6)	720 517 (2.3)	303 144 (54.0)	34 859 (22.0)	338 003 (46.9)
Region						
Midwest	5 717 047 (22.5)	1 428 733 (23.1)	7 145 780 (22.6)	3 295 344 (57.6)	442 961 (31.0)	3 738 305 (52.3)
Northeast	4 688 725 (18.4)	1 003 239 (16.2)	5 691 964 (18.0)	2 834 781 (60.5)	287 851 (28.7)	3 122 632 (54.9)
South	10 360 209 (40.7)	2 220 708 (35.8)	12 580 917 (39.7)	5 707 836 (55.1)	575 603 (25.9)	6 283 439 (49.9)
West	4 702 405 (18.5)	1 545 665 (24.9)	6 248 070 (19.7)	2 451 736 (52.1)	403 070 (26.1)	2 854 806 (45.7)
Dual eligibility for Medicare and Medicaid						
Dual eligible	4 509 555 (17.7)	889 880 (14.4)	5 399 435 (17.1)	1 963 915 (43.6)	129 502 (14.6)	2 093 417 (38.8)
Not dual eligible	20 958 831 (82.3)	5 308 465 (85.6)	26 267 296 (82.9)	12 325 782 (58.8)	1 579 983 (29.8)	13 905 765 (52.9)
Type of provider visited for E/M						
None	1 302 194 (5.1)	2 913 802 (47.0)	4 215 996 (13.3)	314 909 (24.2)	364 881 (12.5)	679 790 (16.1)
PCP	10 067 410 (39.5)	1 123 284 (18.1)	11 190 694 (35.3)	5 770 363 (57.3)	486 137 (43.3)	6 256 500 (55.9)
PCP and specialist	5 606 451 (22.0)	309 027 (5.0)	5 915 478 (18.7)	3 727 368 (66.5)	175 965 (56.9)	3 903 333 (66.0)

Characteristic	Beneficiaries, *n (Column %)*			Influenza Vaccinated, *n (Uptake %)*		
	High Risk*	**Non-High Risk**	**Total**	**High Risk***	**Non-High Risk**	**Total**
Specialist	3 075 976 (12.1)	523 993 (8.5)	3 599 969 (11.4)	1 833 352 (59.6)	239 978 (45.8)	2 073 330 (57.6)
Others‡	5 416 355 (21.3)	1 328 239 (21.4)	6 744 594 (21.3)	2 643 705 (48.8)	442 524 (33.3)	3 086 229 (45.8)
Number of E/M visits						
0	1 302 194 (5.1)	2 913 802 (47.0)	4 215 996 (13.3)	314 909 (24.2)	364 881 (12.5)	679 790 (16.1)
1	2 425 502 (9.5)	1 070 872 (17.3)	3 496 374 (11.0)	1 103 579 (45.5)	364 739 (34.1)	1 468 318 (42.0)
≥2	21 740 690 (85.4)	2 213 671 (35.7)	23 954 361 (75.6)	12 871 209 (59.2)	979 865 (44.3)	13 851 074 (57.8)
Number of E/M visits to PCP						
0	9 794 525 (38.5)	4 766 034 (76.9)	14 560 559 (46.0)	4 791 966 (48.9)	1 047 383 (22.0)	5 839 349 (40.1)
1	4 325 274 (17.0)	774 740 (12.5)	5 100 014 (16.1)	2 439 880 (56.4)	342 374 (44.2)	2 782 254 (54.6)
≥2	11 348 587 (44.6)	657 571 (10.6)	12 006 158 (37.9)	7 057 851 (62.2)	319 728 (48.6)	7 377 579 (61.4)
Number of E/M visits to specialist						
0	16 785 959 (65.9)	5 365 325 (86.6)	22 151 284 (70.0)	8 728 977 (52.0)	1 293 542 (24.1)	10 022 519 (45.2)
1	3 708 932 (14.6)	509 017 (8.2)	4 217 949 (13.3)	2 317 994 (62.5)	249 125 (48.9)	2 567 119 (60.9)
≥2	4 973 495 (19.5)	324 003 (5.2)	5 297 498 (16.7)	3 242 726 (65.2)	166 818 (51.5)	3 409 544 (64.4)

E/M = evaluation and management; PCP = primary care provider.

*Indicates diagnosis with a condition associated with elevated risk for influenza complications.

†Includes beneficiaries whose race was Native American and other.

‡Includes clinics or group practices; nonphysician providers (including nurse practitioners, physician assistants, and clinical nurse specialists); ambulatory outpatient facilities, such as end-stage renal disease facilities; and institutional providers, such as hospitals, skilled-nursing facilities, and home health agencies.

Table 2.

Number of Vaccinated Medicare Beneficiaries by Vaccination Provider Type and High-Risk* Status, 2018 to 2019 Influenza Season

Provider Type	Beneficiaries With High-Risk Conditions, *n* (%)	Beneficiaries Without High-Risk Conditions, *n* (%)	Total, *n* (%)
Total	14 289 697 (100)	1 709 485 (100)	15 999 182 (100)
Primary care†	6 401 196 (44.8)	497 753 (29.1)	6 898 949 (43.1)
Pharmacy	5 809 837 (40.7)	1 031 093 (60.3)	6 840 930 (42.8)
Nonphysician practitioners‡	832 240 (5.8)	91 675 (5.4)	923 915 (5.8)
Medical specialist†	556 194 (3.9)	17 772 (1.0)	573 966 (3.6)
Others§	690 230 (4.8)	71 192 (4.2)	761 422 (4.8)

*Indicates diagnosis with a condition associated with elevated risk of influenza complications.

†Appendix C: Definition of included provider types and broad specialty categories in MD-PPAS User Documentation (version 24, last update on June 2021).

‡Includes nurse practitioners, physician assistants, and clinical nurse specialists.

§All other types of Medicare providers, such as surgical specialists, other nonphysician practitioners, public health clinics, and clinics or hospitals.

Table 3.

Missed Opportunities for Influenza Vaccination* by Beneficiary Characteristics, 2018 to 2019 Influenza Season

Characteristic	Beneficiaries Seen by Providers at Least Once, *n*			Beneficiaries With ≥1 Missed Opportunities for Influenza Vaccination, *n (Proportion %)*		
	High Risk†	Non-High Risk	Total	High Risk†	Non-High Risk	Total
Total	24 166 192	3 284 543	27 450 735	10 191 404 (42.2)	1 939 939 (59.1)	12 131 343 (44.2)
Age group						
19–49 y	991 393	310 329	1 301 722	636 510 (64.2)	256 580 (82.7)	893 090 (68.6)
50–64 y	2 385 372	331 660	2 717 032	1 378 005 (57.8)	257 876 (77.8)	1 635 881 (60.2)
65–74 y	10 441 319	1 941 395	12 382 714	4 470 644 (42.8)	1 085 069 (55.9)	5 555 713 (44.9)
≥75 y	10 348 108	701 159	11 049 267	3 706 245 (35.8)	340 414 (48.6)	4 046 659 (36.6)
Sex						
Male	10 412 682	1 398 625	11 811 307	4 510 526 (43.3)	892 206 (63.8)	5 402 732 (45.7)
Female	13 753 510	1 885 918	15 639 428	5 680 878 (41.3)	1 047 733 (55.6)	6 728 611 (43.0)
Race/ethnicity						
White	20 510 244	2 898 979	23 409 223	8 262 552 (40.3)	1 652 799 (57.0)	9 915 351 (42.4)
Black	2 219 321	206 679	2 426 000	1 253 032 (56.5)	165 658 (80.2)	1 418 690 (58.5)
Hispanic	453 035	58 847	511 882	266 495 (58.8)	47 089 (80.0)	313 584 (61.3)
Asian	460 316	51 174	511 490	180 516 (39.2)	31 019 (60.6)	211 535 (41.4)
Other‡	523 276	68 864	592 140	228 809 (43.7)	43 374 (63.0)	272 183 (46.0)
Region						
Midwest	5 413 434	794 458	6 207 892	2 206 389 (40.8)	449 826 (56.6)	2 656 215 (42.8)
Northeast	4 478 725	540 824	5 019 549	1 696 585 (37.9)	308 804 (57.1)	2 005 389 (40.0)
South	9 891 165	1 157 567	11 048 732	4 281 036 (43.3)	703 491 (60.8)	4 984 527 (45.1)
West	4 382 868	791 694	5 174 562	2 007 394 (45.8)	477 818 (60.4)	2 485 212 (48.0)
Dual eligibility for Medicare and Medicaid						
Dual eligible	4 254 860	449 824	4 704 684	2 327 763 (54.7)	347 287 (77.2)	2 675 050 (56.9)
Not dual eligible	19 911 332	2 834 719	22 746 051	7 863 641 (39.5)	1 592 652 (56.2)	9 456 293 (41.6)
Number of high-risk conditions						
0	-	3 284 543	3 284 543	-	1 939 939 (59.1)	1 939 939 (59.1)
1	5 920 415	-	5 920 415	2 706 718 (45.7)	-	2 706 718 (45.7)
2	6 394 343	-	6 394 343	2 699 961 (42.2)	-	2 699 961 (42.2)

Characteristic	Beneficiaries Seen by Providers at Least Once, *n*			Beneficiaries With ≥1 Missed Opportunities for Influenza Vaccination, *n (Proportion %)*		
	High Risk†	Non-High Risk	Total	High Risk†	Non-High Risk	Total
≥3	11 851 434	-	11 851 434	4 784 725 (40.4)	-	4 784 725 (40.4)
Type of provider visited for E/M by December						
None	1 563 203	833 019	2 396 222	890 688 (57.0)	557 483 (66.9)	1 448 171 (60.4)
PCP and specialist	3 701 422	136 342	3 837 764	1 187 249 (32.1)	54 149 (39.7)	1 241 398 (32.3)
PCP	9 640 536	755 502	10 396 038	3 895 761 (40.4)	394 012 (52.2)	4 289 773 (41.3)
Specialist	3 080 632	415 220	3 495 852	1 194 389 (38.8)	211 957 (51.1)	1 406 346 (40.2)
Others§	6 180 399	1 144 460	7 324 859	3 023 317 (48.9)	722 338 (63.1)	3 745 655 (51.1)

E/M = evaluation and management; PCP = primary care provider.

*Missed opportunity for influenza vaccination is defined as number and proportion of beneficiaries who failed to received influenza vaccination while visiting providers for evaluation and management visits.

†Indicates diagnosis with a condition associated with elevated risk for influenza complications.

‡Includes beneficiaries whose race was Native American and other.

§Includes clinics or group practices; nonphysician providers (including nurse practitioners, physician assistants, and clinical nurse specialists); ambulatory outpatient facilities, such as end-stage renal disease facilities; and institutional providers, such as hospitals, skilled-nursing facilities, and home health agencies.

Table 4.

Adjusted Rates of Missed Opportunities for Influenza Vaccination, 2018 to 2019 Influenza Season: Multivariate Logistic Regression With Fixed Effects of States [*]

Characteristic	Adjusted Rate (95% CI)	Risk Difference (95% CI)
Age group		
19–49 y	61.1 (61.0 to 61.2)	16.7 (16.6 to 16.8)
50–64 y	56.5 (56.5 to 56.6)	12.1 (12.0 to 12.2)
65–74 y	44.4 (44.4 to 44.5)	Referent
≥75 y	38.6 (38.5 to 38.6)	−5.9 (−5.9 to −5.8)
Sex		
Male	43.0 (43.0 to 43.1)	−2.3 (−2.3 to −2.2)
Female	45.3 (45.3 to 45.3)	Referent
Race/ethnicity		
White	42.8 (42.8 to 42.8)	Referent
Black	55.5 (55.4 to 55.6)	12.7 (12.6 to 12.8)
Hispanic	52.3 (52.1 to 52.4)	9.4 (9.3 to 9.6)
Asian	37.6 (37.5 to 37.8)	−5.2 (−5.3 to −5.0)
Other [†]	42.9 (42.8 to 43.1)	0.1 (−0.0 to 0.3)
Dual eligibility for Medicare and Medicaid		
Dual eligible	50.5 (50.4 to 50.5)	7.8 (7.8 to 7.9)
Not dual eligible	42.7 (42.7 to 42.7)	Referent
Number of high-risk conditions		
0	54.7 (54.6 to 54.7)	Referent
1	45.2 (45.2 to 45.2)	−9.5 (−9.5 to −9.4)
2	42.8 (42.7 to 42.8)	−11.9 (−12.0 to −11.8)
≥3	41.2 (41.2 to 41.2)	−13.5 (−13.5 to −13.4)
Type of provider visited for E/M by December		
None	57.4 (57.4 to 57.5)	Referent
PCP and specialist	34.2 (34.2 to 34.3)	−23.2 (−23.3 to −23.1)
PCP	41.9 (41.9 to 42.0)	−15.5 (−15.6 to −15.4)
Specialist	40.5 (40.5 to 40.6)	−16.9 (−17.0 to −16.9)

Characteristic	Adjusted Rate (95% CI)	Risk Difference (95% CI)
Others[‡]	49.7 (49.6 to 49.7)	−7.8 (−7.9 to −7.7)

E/M = evaluation and management; PCP = primary care provider.

[*] The dependent variable in the model was 1 if no receipt of influenza vaccination; otherwise, it was 0 among beneficiaries with a history of ≥1 E/M visit.

[†] Includes beneficiaries whose race was Native American and other.

[‡] Includes clinics or group practices; nonphysician providers (including nurse practitioners, physician assistants, and clinical nurse specialists); ambulatory outpatient facilities, such as end-stage renal disease facilities; and institutional providers, such as hospitals, skilled-nursing facilities, and home health agencies.