# Retrospective Examination of Electronic Health Record Use on Office Preventive Screening Orders for Michigan Medicaid Adults

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**Abstract**

**Purpose and Scope**

The purpose of these statewide 2009-2013 analyses was to examine the relative influence of confirmed Medicaid Program *Adopt-Implement-Upgrade* (AIU) provider EHR adoption on completion of six guideline-specified preventive/screening services (i.e. screening for hyperlipidemia, diabetes, colorectal or cervical cancer, and administration of influenza & pneumococcal vaccines) in a sample of 10,149 continuously-covered Michigan Medicaid adult beneficiaries.

**Methods**

All approved Medicaid claims from the period were extracted from the Michigan Medicaid Data Warehouse for adults with at least 29 documented pre-post-attestation months of continuous and exclusive Medicaid coverage (i.e. no dually-eligible or multi-insurance beneficiaries were included in sample). Claims data were linked to State of Michigan AIU attestation data from the providers confirmed to be delivering most or all of these sample adults' office care during the same period under federal preventive/screening guidelines.

**Results**

Final within group (i.e. same patient-provider dyads during both pre and post-EHR periods) covariate-controlled models demonstrated statistically significant increases OR decreases (ranging between $p = 0.0007$ and $< 0.001$) in order likelihoods for each of the selected preventive/screening outcomes.

**Key Words**

"preventive screening" "Medicaid" "electronic health record" "electronic medical record" "primary care orders" "office-based-orders."

## Purpose and Scope

Since the passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009, [1] the federal government has offered considerable financial incentives for healthcare providers to increase use of health information technologies such as electronic health records (EHR). [2] The stated goal of related Medicaid EHR Incentive Programs in all states is to improve the quality, safety and efficiency of the healthcare provided to Medicaid-covered beneficiaries. [2,3]

The purpose of these statewide analyses was to evaluate how the adoption of a federally-certified EHR system might be associated with changes in ordering patterns of six major preventive/screening services: 1. Cervical cancer screening; 2. Colorectal cancer screening; 3. Diabetes screening, 4. Screening for Hyperlipidemia; 5. Influenza vaccine administration and 6. Pneumococcal vaccine administration. To accommodate frequent order-to-testing gaps for many of these annually-recommended services, the authors' analytic sample was comprised of all continuously and exclusively-covered Michigan Medicaid adults receiving all of their office care (i.e. could include both primary care and specialist provider orders) during a 29 or greater-month study window (i.e. at least 14 months before potential provider EHR attestation, the actual attestation month itself, and 14 month period after successful provider attestation (when the provider certified the purchase or upgrade of an EHR) between January 1, 2009 and December 31, 2013.

## Methods

### Study design

These retrospective analyses used a pre-post within group (I e. same patient-provider dyads during all pre-post EHR periods) design to compare the rates of six major preventive

screening claims in a sample of 10,149 continuously-covered Medicaid patients receiving all of their office visit care for a minimum of 29 months both before, and after, their respective 1,364 PCP had potentially AIU attested to using a certified EHR. The study was found to be exempt from IRB review by the authors' campus-based IRB because it was considered non-human subjects research due to their use of retrospective de-identified data.

**Data Sources/Collection**

The analytic sample was comprised of all adult MI Medicaid beneficiaries who had never been diagnosed with either some form of test-pertinent International Classification of Disease, ninth edition (ICD-9) coded [47] cervical cancer (e.g. no cervical cancer history), (i.e. 62210, 795.00 through 795.99), colorectal cancer (i.e. 152.00 through 154.99), diabetes mellitus (i.e. ICD-9 250.00 through 250.93) hyperlipidemia, (i.e. 272.00 through 272.89) augmented by the authors' use of claims-related diagnosis data. Sample patients had also received all of their Medicaid-covered office-based care during the minimum 29-month pre-post-EHR period between 01/01/2009 and 12/31/2013.

**Interventions:** NOT APPLICABLE

**Measures**

The following six outcome measures were each United States Preventive Services Task Force (USPSTF) [49] preventive/screening services that were "strongly recommended" or "recommended" for all adults meeting age, clinical and other eligibility indication criteria. NOTE: The authors do acknowledge that the USPSTF frequency and eligibility recommendations for some of these services changed somewhat during the full analytic period and were very likely subject to varied clinical patient characteristics. In response, the binary completion of the following six billed preventive/screening services were measured as

comprehensively was possible using the Current Procedural Technology (CPT) codes [50] according to overall federal USPSTF [49] age, clinical characteristic & frequency parameters:

a. **(Annual) Screening for Lipid Disorders** (all patients' Total Cholesterol, LDL, HDL, etc.)

b. **(Annual) Serum/Blood Type 2 Diabetes Mellitus Screening** (for all patients without current diagnosis);

c. **(At Least Baseline) Colorectal Cancer Screening** (all patients without colorectal cancer at least one baseline screening procedures at age 50 years of age);

d. **(At least Bi-yearly) Cervical Cancer Screening** (i e. Pap Smear);

f. (**Annual) Influenza Vaccine** administration (all patients with one or more chronic health condition); and

g. **Pneumococcal immunization** (at least once during adulthood).

See Table 1 for the total of 61 CPT codes used for the authors to capture virtually all orders for these six preventive screening services.

All available socio-demographic patient data from the full analytic period were also extracted through the MMDW.[48] Data for this sample also included monthly Medicaid patient eligibility data for the entire analytic period so that the authors could confirm that each beneficiary had maintained continuous eligibility during their respective pre-post-EHR claims period. All provider-level data were obtained and cross-validated from state office processing provider EHR attestation applications, state of MI licensure date, and federal National Provider Identifier (NPI) numbers. [51]

**Patient-level Factors**

Over **90**% complete data concerning each of the four following socio-demographic patient characteristics were included in each of the analytic models when possible:

a) Age (in complete years);

b) Sex;

c) Reported Racial/Ethnic affiliation; and

d) Composite Comorbidity (based on total number of all documented claims-related ICD-9 [41] diagnoses).

NOTE: Marital Status was not included into models due to a large proportion of missing claims data).

**Care Delivery Factors**

Available data concerning the two following factors was also included in the authors' analytic models:

a) The total number of other office-based providers that the patient may have received care from during their respective pre-post-EHR claims period (other than their designated PCP); and

b) The amount of time prior to their PCP provider's EHR attestation (I e. time after first possible 01/31/2011 application date).

All project analyses were conducted using Statistical Analysis Software (SAS) 9.3 software. [52] Descriptive statistics (Table 2) and a series of cross-tabulation charts were first generated to summarize the distribution of the sample characteristics of the total patient and provider samples. A series of covariate-controlled within group (i.e. same patients linked to their ongoing PCP providers) generalized estimation equation (GEE) repeated measures models [53]

were then conducted for the entire 60-month analytic period. In Table 3, we present the odds ratios (OR) estimates for the effect of EHR implementation on each selected preventive/screening outcome.

**Results**

**1. Cervical Cancer Screening**

Of the 168 female patients from the sample who were eligible for cervical cancer screening, 63 (37.5%) were white, 95 (56.6%) and had providers who had achieved AIU attestation, each had received service from only one office-based provider, and each had one or more chronic conditions. These women's' mean age was 42.0 years (SD 10.7), and 23 (13.7%) and 22 (13.1%) received cervical cancer screening screened before and after their provider's attestation month or the median attestation month, respectively.

In the GEE model for this outcome, the interaction between provider attestation status and time prior to EHR attestation (i.e. time after first possible 01/31/2011 application date) was not statistically significant and therefore excluded from the model. Compared with those patients whose providers had not achieved AIU status, those with AIU-attested providers were significantly **less** likely to receive any form of cervical cancer screening during their post-EHR claims period (OR estimate = 0.2956, 95% CI 0.1462-0.5978, p = 0.0007).

Patients who were age 40 or older were also less likely to get screened (OR = 0.4536, 95% CI 0.2442-0.8424, p = 0.0123), than younger patients. Patients with ≥ seven diagnosed chronic conditions were also less likely to get screened (OR = 0.3362, 95% CI 0.1736-0.6512, p = 0.0012) than those with fewer that seven documented chronic conditions.

**2. Colorectal Screening**

Of the 10,149 sample patients eligible for this service, 4,698 (46.3%) were white, 6,463 (63.7%) were female, 6,587 (64.9%) with providers who had achieved AIU attestation, 9,391 (92.5%) received office care from only one provider, although only 8 (0.1%) patients had zero diagnosed chronic conditions. These patients' mean age was 48.9 years (SD 10.1). A total of 3,212 (31.7%) and 2,783 (27.4%) received a colorectal screening service before, and after, the attestation month of their PCPs or the median attestation month, respectively.

The GEE model for this outcome showed that there was non-significant interaction between provider attestation status and length of time since 01/31/2011 before they successfully attested. During the pre-EHR period or the median attestation month, those patients whose providers had achieved AIU status were significantly **more** likely to receive some form of colorectal screening (OR = 1.4736, 95% CI 1.3490-1.6098, p <.0001) than those with unattested providers.

White patients were marginally more likely to get screened (OR = 1.0531, p = 0.0664) than those from other races. Patients who received office-based care from more than one provider were significantly less likely to get screened for colorectal cancer (OR = 2.1483, CI 0.8946-1.0317, p < .0001). No significant associations were found for other terms included in the model.

**3. Diabetes Screening**

Of the 3,294 sample patients eligible for this screening, 1,140 (34.6%) were white, 2,395 (72.7%) were female, 1,802 (54.7%) received care from providers who had achieved AIU attestation, and 3,061 (92.9%) received care from only one provider. Remarkably, only 10 (0.3%) patients lacked any diagnosed chronic conditions. Patients' mean age was 41.5 (SD

11.6), and 883 (26.8%) and 832 (25.3%) received diabetes screening tests screened before and after the attestation month of their provider or the median attestation month, respectively.

The GEE model for this outcome showed that before attestation month of their providers or the median attestation month, those patients whose providers who had achieved AIU attestation were significantly **more** likely to get screened (OR = 1.4534, 95% CI 1.2357-1.7095, p <.0001) than those with unattested providers.

Compared to patients of other races, whites were significantly more likely to get screened for diabetes (OR=1.1208, 95% CI 1.1060-1.3920, p = 0.0002). Patients who were 60 years or older were less likely to get screened (OR = 0.7384, 95% CI 0.5766-0.9454, p = 0.0162. Similar to other study outcomes, those patients receiving office care from one provider were again more likely to get diabetes screening (OR = 2.5583, 95% CI 2.0998-3.1168, p < .0001). Those with nine or more chronic conditions were less likely to get screened for diabetes, compared with those of less than five conditions (OR = 0.7427, 95% CI 0.6232-0.8852, p = 0.0009) or between six and eight conditions (OR = 0.8077, 95% CI 0.6868-0.9498, p = 0.0098).

**4. Influenza Vaccine**

Of the 10,085 eligible sample patients, 6,109 (60.6%) were white, 3,301 (32.7%) were female, 4399 (43.6%) received care from providers who had achieved AIU attestation, 9,404 (93.3%) received care from only one provider, and only 26 (0.3%) possessed no chronic conditions. These patients' mean age was 43.9 years (SD 12.6). A total of 3171 (31.4%) and 3,171 (31.4%) and 1647 (16.3%) received an influenza vaccine before and after the attestation month of their provider or the median attestation month, respectively.

The GEE model for this outcome was conducted without an attestation status-time before attestation interaction term because it resulted in failure in calculation even after trying several

different options. Those patients whose providers had achieved AIU attestation were significantly **more** likely to receive an influenza vaccine (OR = 2.2633, 95% CI 2.1357-2.3986, p <.0001) than those with unattested providers.

Compared with non-white patients, whites were less likely to receive an influenza vaccine by a slight difference (OR=0.9413, 95% CI 0.8861-0.9999, p = 0.0495). Patients of 60 years or older were more likely to receive such a vaccine (OR=1.3112, 95% CI 1.1877-1.4477, p < 0.0001). Those who received office care from more than one provider during the claims period were also more likely to get screened (OR = 2.0387, 95% CI 1.8393-2.2597, p < .0001), but no significant associations were found for total number of diagnosed chronic conditions.

5. **Lipids Screening**

Of the 2,455 eligible sample patients, 1,099 (44.8%) were white, 1,619 (66.0%) were female, 1,522 (62.0%) received care from attested providers, 2,244 (91.4%) received office care from only one provider, and only 8 (0.1%) patients had no documented chronic conditions. These patients' mean age was 42.6 years (SD 11.9), and 776 (31.6%) and 360 (14.7%) of patients had received one or more lipids screening tests before and after the attestation month of their physicians or the median attestation month, respectively.

The GEE model employed for hyperlipidemia screening showed that before provider attestation months or the median attestation month, patients with providers who had achieved AIU attestation were significantly **more** likely to receive such screening (OR = 2.8734, 95% CI 2.3552-3.5056, p <.0001) than those with unattested physicians.

Compared with non-whites, whites were more likely to get screened (OR=1.2068, 95% CI 1.0593-1.3747, p =0.0047). Those who received office-based care from more than one provider were more likely to get more orders lipid disorder screening (OR = 2.4028, 95% CI

1.9715-2.9285, p < .0001). Compared with patients with less than five chronic conditions, those patients who had between six and eight chronic conditions were less likely to get screened (OR=0.8632, 95% CI 0.7492-0.9945, p = 0.0417). Notably, possessing nine or more chronic conditions was not significant in this model.

**6. Pneumococcal Vaccine**

Of the 4,406 eligible sample patients, 2,551 (57.9%) were white, 1,524 (34.6%) were female, 1,996 (45.3%) received care from providers who achieved AIU attestation, 4,345 (98.6%) received orders from only one provider, and only 8 (0.2%) lacked any documented chronic condition. These beneficiaries' mean age was 46.3 years (SD 11.5). A total of 1,392 (31.6%) and 1,024 (23.2%) received a pneumococcal vaccination before and after the attestation month of their provider or the median attestation month, respectively.

The GEE model employed for this outcome demonstrated that patients with AIU-attested providers were **less** likely to get screened by providers during the post-EHR period than the pre-EHR period or the median attestation month (OR = 0.5782, 95% CI 0.4981-0.6712, p < 0.0001. Those patients who received office visit care from more than one provider, however, were more likely to receive a pneumococcal vaccination when indicated (OR = 1.9479, 95% CI 1.3436-2.8240, p = 0.0004).

**Conclusions, Significance, Implications**

These statewide sample results provide one of the first indications that receiving office-based care under Medicaid from a provider after their adoption of a federally-certified EHR is associated with mixed (i.e. sometimes more frequent, sometimes less) order rate changes for a set of major preventive/screening services.

Although we are unable to precisely discern the full nature of these variable changes from administrative claims data, we would like to suggest that these results suggest that typical EHR modules ordering prompts (serving to increase order rates) and improved access to historical documentation data (serving to decrease redundant, not-yet due, or less clinically-indicated orders) simultaneously enabled many AIU-attested providers to more efficiently order these preventive/screening tests. Although our results are similar to the mixed results found from some smaller samples (i.e. some studies showing overall increases, a few with overall decreases, [4,6-8,10,11,18-21] this appears to be the first study using such a large multi-site statewide sample showing such bi-directional findings.

Of course, these results are subject to some inherent data-related limitations. We could not feasibly discern from these claims data what proportion of tests may have actually been ordered and never completed due to variability among patients (e.g. refusing to complete placed orders, lacking transportation to receive services, functional limitations, etc.). The extent to which these lower-income adults' own clinical impairments, home/resource contexts or other factors may have primarily driven the completion of initially ordered preventive services simply can't be realistically gauged from administrative claims data.

More focused future analyses comparing the likely mixed preventive/screening impact from different ambulatory EHR product prompts and decision support modules will be required. Longitudinal projects examining how long it might typically take providers to make the optimal use of their EHR products for preventive screening adherence may also prove very insightful.

Additional subgroup designs with more Medicaid beneficiaries and other types of insured/uninsured patients who may experience different impacts from the many available office EHRs and other health information technologies are needed since so many preventive/screening

services are now ordered in such settings. Ideally, these initial findings will serve to provide Medicaid and other healthcare program officials with evidence concerning the future potential preventive/screening changes likely measured after EHR implementation for our nation's especially vulnerable lower-income primary healthcare consumers.

**Key Words**

"preventive screening" "Medicaid" "electronic health record" "electronic medical record" "primary care orders" "office-based-orders."

**List of Publications and Products to Date**

1. Corser WD, You Z, Hazewinkel J. Retrospective examination of electronic health record use on office preventive screening orders for Michigan Medicaid adults. (under review, BMC-Health Serv Res).
2. Corser W, You Z, Hazewinkel J. "Effects of EHR Use on Preventive Screening Service Rates for Comorbid Michigan Medicaid Adults." (research poster). 2015 AcademyHealth Annual Research Meeting. 06/14/2015. Minneapolis, MN.
3. Corser W, You Z, Hazewinkel J. "Effects of EHR Use on Preventive Screening Service Rates for Comorbid Michigan Medicaid Adults." (research poster). 2015 Statewide Campus System Research Poster Day. 05/20/2015. East Lansing, MI.

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**Table 1: CPT [50] Codes for Selected Preventive/Screening Tests and Procedures**

| Test/Procedure | CPT Codes | Notes |
|---|---|---|
| **Cervical Cancer Screening** | 88164, 88141, P3000, P3001 | All forms Papanicolaou test (Pap Smears) |
| **Colorectal Cancer Screening** | G0105, G0121, Go122, G0104, G0106, G0120, G0328, 82270, 82274, 45330, 45331, 45333, 45338, 45339, 45378, 45380, 45383, 45384, 45385, 44388, 44389, 44392, 44392, 44394, 74263, S0601, | Includes all endoscopic, CT colonoscopy, sigmoid, occult blood, testing etc. per 2013 American Gastroenterology Association guidelines |
| **Diabetes Screening** | 82947, 82948, 82950, 82951, V77.1 | Includes GTT, Post-glucose dose, and random quantitative blood per 2013 Medicare parameters. |
| **Lipid Panel** | 80061 82465 83700 83701 83704 83715 83718, 83719, 83721, 84478, V77.91 | Includes variants of LDL, HDL, Total Cholesterol, etc. |
| **Influenza Vaccination** | 90653, 90654, 90656, 90660, 90661, 90662, 90672, 90673, 90686, 90688, Q2033, Q2034, Q2035, Q2036, Q2037, Q2038, Q2039 | Includes all intramuscular and intranasal forms administered to adults per 2013 American Hospital Association guidelines. |
| **Pneumococcal Vaccination** | 90669, 90670, 90732 | 2013 American Hospital Association coding guidelines. |

**Table 2. Characteristics of Total Sample of Beneficiaries & Providers**

| | | **Adult Beneficiaries** (N = 10,149) | | | **Providers** (N = 6,587) | |
|---|---|---|---|---|---|---|
| **Age** | | Mean 48.9 years (SD 10.1, Range 21-94) | | | Mean 50.20 years (SD 12.52, range 24-93) | |
| | | | | | **Attested during analytic period?** | |
| | | | | | YES 1364 (20.7%) | |
| | | | | | NO 5223 (79.3%) | |
| | | **Number** | **%** | | **Number** | **%** |
| **Sex** | Male | 3,686 | 36.3 | Male | 3,438 | 52.2 |
| | Female | 6,463 | 63.7 | Female | 3,149 | 47.8 |
| **Race** | White | 4,698 | 46.3 | **Provider Type** | MD/DO 4,723 | 71.7 |
| | Black | 4,493 | 44.3 | | Physician's Assistant 520 | 7.9 |
| | Other or Missing | 958 | 9.4 | | Advanced Practice Nurse 1,337 | 20.3 |
| | | | | **Primary Care Provider** | YES 3,735 | **5**6.7 |
| | | | | **Urban County Practice Home?** | YES 5,092 | 77.3 |

**Table 3: GEE Model Results for Selected Study Outcomes**

| **Cervical Cancer Screening (N = 168 females)** | | | | |
|---|---|---|---|---|
| | **Odds Ratio (OR) Estimate** | **Lower Confidence Interval** | **Upper Confidence Interval** | **P Value** |
| **Did Provider AIU Attest?** | 0.2956 | 0.1462 | 0.5978 | **0.0007** |
| **Time to Attestation** | -0.0577 | -0.8008 | 0.6854 | 0.8791 |
| **White Race** | 0.2658 | -0.3252 | 0.8569 | 0.3780 |
| **Age ≥ 40 years** | 0.4536 | 0.2442 | 0.8424 | **0.0123** |
| **Greater than or Equal to, SEVEN Chronic Conditions** | 0.3362 | 0.1736 | 0.6512 | **0.0012** |

| Colorectal Cancer Screening (N = 10,149 adults) | | | | |
|---|---|---|---|---|
| | **OR Estimate** | **Lower Confidence Interval** | **Upper Confidence Interval** | **P Value** |
| **Did Provider AIU Attest?** | 1.4736 | 1.3490 | 1.6098 | **<.00001** |
| **Time to Attestation** | 0.9523 | 0.8671 | 1.0457 | 0.3059 |
| **Did Provider Attest * Time to Attestation** | 0.9560 | 0.8771 | 1.0420 | 0.3062 |
| **White Race** | 1.0531 | 0.9965 | 1.1130 | 0.0664 |
| **Male Sex** | -0.0124 | -0.0687 | 0.0438 | 0.6652 |
| **Age ≥ 60 years** | 0.0498 | -0.0551 | 0.1546 | 0.3524 |
| **More than ONE Office Provider** | 2.1483 | 0.8946 | 1.0317 | **< 0.0001** |
| **Greater than or Equal to, SIX Chronic Conditions** | -0.0401 | -0.1113 | 0.0312 | 0.2701 |

| Diabetes Screening (N = 3,294 adults) | | | | |
|---|---|---|---|---|
| | **OR Estimate** | **Lower Confidence Interval** | **Upper Confidence Interval** | **P Value** |
| **Did Provider AIU Attest?** | 1.4534 | 1.2357 | 1.7095 | **<.00001** |
| **Time to Attestation** | 1.1737 | 0.9985 | 1.3796 | 0.0521 |
| **Did Provider Attest * Time to Attestation** | 1.0446 | 0.8719 | 1.2514 | 0.6362 |
| **White Race** | 1.1208 | 1.1060 | 1.3920 | **0.0002** |
| **Male Sex** | -0.0109 | -0.133 | 0.1113 | 0.8618 |
| **Age≥ 60 years** | 0.7384 | 0.5766 | 0.9454 | **0.0162** |
| **More than ONE Office Provider** | 2.5583 | 2.0998 | 3.1168 | **<.00001** |
| **Greater than or Equal to, NINE Chronic Conditions** | 0.7427 | 0.6232 | 0.8852 | **0.0009** |
| **Between SIX-EIGHT Chronic Conditions** | 0.8077 | 0.6868 | 0.9498 | **0.0098** |

| Influenza Vaccine (N = 10,085 adults) | | | | |
|---|---|---|---|---|
| | **OR Estimate** | **Lower Confidence Interval** | **Upper Confidence Interval** | **P Value** |
| **Did Provider AIU Attest?** | 2.2633 | 2.1357 | 2.3986 | **<.00001** |
| **Time to Attestation** | 0.4102 | 0.3803 | -0.8157 | **<.00001** |
| **White race** | 0.9413 | 0.8861 | 0.9999 | **0.0495** |
| **Male Sex** | 0.0414 | 0.8861 | 0.9999 | 0.2030 |
| **Age ≥ 60 years** | 1.3112 | 1.1877 | 1.4477 | **<.00001** |
| **More than ONE Office Provider** | 2.0387 | 1.8393 | 2.2597 | **<.00001** |
| **Greater than or Equal to, NINE Chronic Conditions** | 0.0298 | -0.0514 | 0.1109 | 0.4719 |

**Lipids Screening (N = 2,455 adults)**

| | OR Estimate | Lower Confidence Interval | Upper Confidence Interval | P Value |
|---|---|---|---|---|
| **Did Provider AIU Attest?** | 2.8734 | 2.3552 | 3.5056 | **<.00001** |
| **Time to Attestation** | 0.6116 | 0.4844 | 0.7721 | **<.00001** |
| **Did Provider Attest * Time to Attestation** | 0.2113 | 0.1727 | 0.2586 | **<.00001** |
| **White Race** | 1.2068 | 1.0593 | 1.3747 | **0.0047** |
| **Male Sex** | 0.0409 | -0.095 | 0.1768 | 0.5556 |
| **Age ≥ 60 years** | 1.0417 | 0.9093 | 1.1934 | 0.5556 |
| **More than ONE Office Providers** | 2.4028 | 1.9715 | 2.9285 | **<.0001** |
| **Between SIX & EIGHT Chronic Conditions** | 0.8632 | 0.7492 | 0.9945 | **0.0417** |
| **Greater than or Equal to, NINE Chronic Conditions** | 0.0275 | 0.8472 | 1.2470 | 0.7805 |

**Pneumococcal Vaccine (N = 4,406 adults)**

| | OR Estimate | Lower Confidence Interval | Upper Confidence Interval | P Value |
|---|---|---|---|---|
| **Did Provider AIU Attest?** | 0.5782 | 0.4981 | 0.6712 | **<0.0001** |
| **Time to Attestation** | 1.1225 | 0.9751 | 1.2921 | 0.1076 |
| **Did Provider Attest * Time to Attestation** | 0.5782 | 0.4981 | 0.6712 | **<0.0001** |
| **White Race** | 0.021 | -0.0568 | 0.0988 | 0.5965 |
| **Male Sex** | 1.0212 | 0.9448 | 1.1038 | 0.5965 |
| **Age > 60 years** | 0.0861 | -0.0524 | 0.2247 | 0.223 |
| **More than ONE Office Provider** | 1.9479 | 1.3436 | 2.8240 | **0.0004** |
| **Greater than or Equal to, NINE Chronic Conditions** | 0.9569 | 0.8672 | 1.0559 | 0.3805 |