Prescribing and Testing by Primary Care Providers: Adherence to the Choosing Wisely Recommendations

Research: Retrospective Cohort Study

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Abstract

Background: Unnecessary diagnostic tests, procedures and medical therapies cause patient harm at a significant cost to the health system. This study describes patterns of potential over-prescribing and over-testing identified by the Choosing Wisely (CW) Campaign.

Methods: This retrospective cohort study of Electronic Medical Record (EMR) data from 239 primary care providers assessed the records of patients with an encounter between 2014 and 2016. Patient encounter data was reviewed for the following treatments and diagnostic tests: prescribing antibiotics for viral infections, prescribing antipsychotics in patients with dementia, measuring vitamin D levels, and measuring prostate-specific antigen (PSA) levels. Descriptive statistics and multivariable models assessed associations between patient and practice characteristics, and adherence to the recommendations.

Results: Sixteen percent (N=25,629) of 164,195 patients had an encounter that represented potential unnecessary diagnostic testing and treatment. A small number of providers accounted for the majority of potentially unnecessary care evaluated in this study. The majority of potential over-prescribing was of antibiotics for clinically viral presentations (65.3%). Seventeen percent was prescription of an antipsychotic medication for dementia. PSA and vitamin D testing accounted for 28.7% and 9% respectively of potentially unnecessary care. Patient and provider characteristics associated with higher rates of unnecessary care were dependent on the test or treatment considered.

Interpretation A small number of primary care providers contribute disproportionally to unnecessary care. Thus, improvement strategies must be tailored to the potentially unnecessary intervention and could target specific providers to prevent patient harm and reduce extraneous health care system costs.

Background

Despite one of the highest expenditures on health care per capita in the OECD[1], Canada ranks 10th among 17 countries in health performance outcomes including life expectancy, self-perceived health status and mortality. [2] Unnecessary care contributes to inefficiency in the health care system.[3-5] A recent report from the Canadian Institute for Health Information estimated that as much as 30% of total healthcare spending in Canada is associated with unnecessary care. [1] Similarly, American studies suggests 20-30% of care is unnecessary.[4,5] The Choosing Wisely (CW) Canada campaign was adopted by the Canadian Medical Association in 2014 to address this issue. Originally created by the American Board of Internal Medicine (2012), the campaign aims to help patients and providers choose tests and procedures that have evidence to support their efficacy, while reducing duplicate or extraneous testing.[6]

In order to promote evidence-based prescribing, CW promotes recommendations developed by professional societies in 47 different clinical specialties in Canada.[3] Two such recommendations focus on antibiotic prescriptions for clinically viral presentations and use of antipsychotics to treat dementia. Over 95% of acute sinusitis, bronchitis and upper respiratory tract infections (URTIs) are caused by viruses, which do not respond to antibiotics. [7] Despite consensus guidelines recommending against antibiotic treatment for viral conditions, up to 86% of acute rhinosinusitis cases are prescribed antbiotics.[8-11] Unnecessary antibiotic prescriptions put patients at risk of adverse events including allergic reactions and increased bacterial resistance. [6] Similarly, there is strong evidence to suggest that use of antipsychotics for treatment of behavioural and psychological symptoms of dementia is harmful.[12-15] Antipsychotics should be used judiciously in elderly patients given the increased risk of premature death and adverse events such as cardiovascular effects.[6,12-15]

Unwarranted laboratory testing is also problematic and can expose patients to additional harms including false-positive results, undue anxiety, and costly follow-up investigations, all of which lead to direct and unnecessary costs for the health system. [16] The Canadian Preventative Services Task Force (CPSTF), strongly recommends against screening asymptomatic males younger than 55 years and males older than 70 with Prostate-Specific Antigen(PSA) serum testing. [16] Even for men between the ages of 55 to 70, there is a weak recommendation to not test for prostate cancer with the PSA.[17] There is some evidence suggesting a small reduction in prostate cancer mortality with PSA testing. [17-19] However, the benefit is modest and leads to increases in associated adverse events (e.g., urinary incontinence, bleeding and infection).[17,18] Testing serum vitamin D levels is another relatively common test that is not recommended at the population level. [6] Vitamin D supplementation is routinely recommended for people living in northern climates. [6,16,20-24] Vitamin D testing and supplementation is sometimes recommended for high risk patients such as those with metabolic bone disease, abnormal blood calcium, parathyroid disease, chronic renal disease, and malabsorption syndromes.[20-23]

The potential drivers of inappropriate testing and treatment are multifactorial and influenced by the provider, patient and context.[3,25] The current literature related to the CW recommendations focuses on describing the commonly used tests and treatments not supported by evidence. [3] There are very few studies describing the relationship between the frequency of potentially unnecessary testing and the characteristics of providers and patients that contribute to unnecessary care. This study assessed adherence to four CW recommendations relevant to primary care: 1) antibiotic prescription for viral infections, 2) vitamin D testing, 3) PSA testing, and 4) antipsychotic medications to treat symptoms of dementia. We sought to understand strategies for reducing unnecessary care by describing the

frequency and factors associated with these CW recommendations within primary care practices participating in the Manitoba Primary Care Research Network (MaPCReN).

Methods

We conducted a retrospective cohort study using Electronic Medical Record (EMR) data from the MaPCReN. The MaPCReN is part of the Canadian Primary Care Sentinel Surveillance Network (CPCSSN), the largest multi-system database in Canada that collects and processes de-identified EMR derived information from consenting primary care practices. Data were extracted form 239 clinicians in 46 practices. All patients with at least one encounter between 2014 and 2016 from a participating MaPCReN primary care provider were included in the study sample. Antibiotic prescriptions (Anatomical Therapeutic Chemical (ATC) Classification System code: J01***) were assessed among patients with an encounter for International Classification of Diseases (ICD-9-CM) code: 461 (acute mild-to-moderate sinusitis), 465 (URTI), 466 (bronchitis), 460 (acute rhinitis), 464 (acute laryngitis and tracheitis), 477 (nasopharyngitis) or 487/488 (influenza). [26] Among patients with a diagnosis of dementia (ICD-9-CM: 290*, 294* and 331*) prescriptions for an antipsychotic medication (ATC: N05A) were assessed. The presence of a PSA or Vitamin D test was flagged for all patients who visited a MaPCReN participating provider.

We report descriptive analytics on the use of the non-recommended diagnostic tests and treatments, and separate multivariable models for each of the CW recommendations. The generalized estimating equations assessed associations between adherence to the CW recommendations and characteristics of patients (sex, age, comorbidities, frequency of office visits), providers (type) and practice (location, size, funding model). The models also accounted for the number of encounters with each provider.

Results

Between 2014 and 2016, 164,195 patients visited a participating MaPCReN primary care provider. Patients in this study ranged from ~1 years old to ~100 years old, with a mean age of 40.8 years. There were more encounters associated with female patients (55.9%) than male patients. The median number of annual visits to a provider by a patient was 3.5 visits (IQR 4.5). Sixteen percent (N=25,629) of the MaPCReN primary care encounters between 2014 and 2016 had an outcome contrary to one of the CW recommendations evaluated; specifically, 65.3% were prescribed an antibiotic for a viral infection, 28.7% received a PSA test, and 9.0% had a Vitamin D screen. Among patients with a diagnosis of dementia, 17% had been prescribed an antipsychotic medication.

Prescribing Practices

There were 16,742 patients (15.6% of 164,195) prescribed an antibiotic in visits associated with a viral diagnosis. On average, providers prescribed antibiotics to treat a viral infection in 4.4% of the patients within their practice, equating to 11 prescriptions per year, per provider.

There were 3,372 patients 65 years of age or older with a diagnosis of dementia. Among patients diagnosed with dementia, 573 patients (17.0%) received a prescription for an antipsychotic medication. There were 214 providers with at least one patient diagnosed with, or billed for, dementia in the MaPCReN dataset. Among providers who cared for a patient diagnosed with dementia, 75% (n=160) prescribed at least one antipsychotic medication to treat symptoms of dementia. On average, 14.3% of dementia patients received an antipsychotic prescription.

A small proportion of providers contribute to the high rates of potentially unnecessary prescribing (fig1). Sixty-nine providers (29%) are responsible for the majority of potentially unnecessary prescribing of antibiotics (>10% of patients in their practice). Seven providers (3%) prescribed antibiotics to treat a viral infection in >35% of the patients in their practice (n=1,686 patients), annually. Similarly, there were 24 providers (11%) who prescribed antipsychotics to >36% of the patients diagnosed with dementia in their practice (n=109 patients). There was no correlation between the potentially unnecessary prescribing of antibiotics and antipsychotics (Figure 1).

(FIGURE 1)

Patients with three or more comorbidities had higher odds of receiving a potentially unnecessary prescription compared to patients with no comorbidities. However, patients 60 years of age or older were less likely to receive antibiotics than patients under 60 years of age (OR 0.72, CI 0.64-0.81). (Table 1). All other patient and provider factors associated with prescribing rates were dependant on the prescrption type. For example, female patients had 1.2 times higher odds (CI 1.09-1.28) of receiving an antibiotic prescription for a viral infection compared to male patients, but there was no association between patient sex and prescribing an antipsychotic medication. Patients who saw a salaried provider had 77% lower odds (CI 0.18-0.29) of receiving an antibiotic for a viral infection compared to patients who saw a fee-for-service provider. Conversely, dementia patients prescribed an antipsychotic medication had 2.1 times higher odds of having seen a salaried provider compared to a fee-for-service provider (CI 1.20-3.59) (Table 1).

(Table 1)

Laboratory Testing

There were 7,356 patients in the sample who had PSA testing and 2,307 patients had their Vitamin D tested. On average, providers ordered a PSA test for 5% of the patients in their practice and a vitamin D test for 1% of patients in their practice, annually. This equates into a median of 4 PSA tests and 1 vitamin D screen per year, per provider. A minority of providers contributed to the overall volume of testing, dependent on the test assessed. Twenty-four (9%) providers ordered between 50 and 206 PSA tests a year, testing 16.4% to 43.6% of all patients in their practice. Thirty-four providers (14%) ordered 10 or more vitamin D tests each year (Figure 2).

(FIGURE 2)

Patients who visited a primary care provider ≥10 times a year were significantly more likely to have a PSA test (OR 1.46, CI 1.30-1.62) or a Vitamin D test (OR 1.29, 95% CI 1.09-1.53) compared to patients who visited only 1-2 times a year. Practice location had an inverse association with type of test. Patients who obtained care in a rural practice had 5.6 times higher odds (CI 3.44-9.13) of receiving a PSA test compared to patients who visited an urban practice. Conversely, patients who received care at an urban practice had 3.2 times higher odds (CI 1.65-6.35) of receiving a vitamin D test compared to those seen in a rural practice (Table 2).

(TABLE 2)

Discussion

This study is the first to demonstrate that a small number of primary care providers contribute disproportionally to potential testing and treatment in direct contradiction to CW recommendations. While CW recommendations are not binary, clinical indications for the testing and treatments evaluated in this study are rare thus low baseline rates of use should be expected.[3] Providers utilizing these typically unnecessary interventions in a large proportions of their patients are more likely to cause harm than benefit. Since the burden of unnecessary testing and treatment is not equally distributed, strategies designed to reduce extraneous care could target specific provider and patient groups. Our modeling showed each of the four assessed testing and prescribing recommendations were associated with different provider and patient characteristics. For example, initiatives to reduce unnecessary antibiotic prescribing could focus on fee-for-service providers, while antipsychotic prescribing initiatives could target salaried providers. Similarly, initiatives to address unnecessary testing could consider the geographical location of the practice.

In our study, prescribing an antibiotic for a viral infection was the most common potentially unnecessary treatment. Antibiotic prescribing for a viral infection was more likely to occur among female patients and those with three or more comorbidities. Similar to other studies, we found an association between prescribing for a viral infection and patient comorbidities, which may be related to the suspicion of a secondary bacterial infection following clinical assessment.[26,27] Crucially, we found that a relatively small number of providers regularly prescribe antibiotics for a viral infection. While traditional approaches to improvement aim to improve practice patterns across the population, our findings suggest that quality improvement initiatives specifically targeted at those providers who are contributing to a large number of unnecessary prescribing may be more beneficial.

Three quarters of providers prescribed at least one antipsychotic medication for dementia. On average, antipsychotics were prescribed to 14% of patients with dementia in a practice. This is lower than a study of patients residing in Alberta long-term care facilities, which found 20% of dementia patients are prescribed an antipsychotic.[28] We found that antipsychotics were more likely to be prescribed to dementia patients who have 3 or more comorbidities. Similarly, Heckman and colleagues (2017) showed that patients diagnosed with Parkinson's disease were more likely to be prescribed an antipsychotic medication if they were medically complex. [29] If appropriately monitored for patient benefit and harms, antipsychotic prescriptions may be warranted for uncontrolled agitation and severe psychosis symptoms that are dangerous or causing significant distress to the patient. [13-15,30] Again, a relatively small number of providers are prescribing antipsychotic medication to a high proportion of dementia patients in their practice suggesting that efforts to reduce antipsychotic prescriptions to treat symptoms of dementia should focus on those practices with high prescribing rates.

Regarding Vitamin D and PSA testing the trend was consistent that a relatively small proportion of primary care providers ordered the vast majority PSA and Vitamin D tests. A recent unpublished internal report on vitamin D testing in Manitoba noted that approximately 60% of the Vitamin D tests analyzed had no apparent medical indication.[31] We found an annual average rate of vitamin D testing of 4.83 screens, per practice, per year. This is similar to an administrative-data based Manitoba study that confirmed that a relatively small number of physicians ordered the vast majority of all Vitamin D tests.[31] This pattern is also apparent for PSA testing, where a small minority of providers account for most PSA testing above the 5% median testing rates. We found that PSA testing was 1.5 times higher among patients who visited the primary care office ≥ 10 times a year. Providers ordering PSA tests for about 5% of the patients in their practice are likely assessing for prostate cancer among symptomatic males, consistent with existing evidence.[17-19]

Limitations

While this study represents a comprehensive sample of primary care appointments in Manitoba, the MaPCReN database does not include all primary care encounters in Manitoba. Depending on patient characteristics within a practice, rates of prescribing and testing may be higher or lower than the target rates derived from this study. We did not assess provider attitude to the CW recommendations. It is possible that some providers do not agree with the CW recommendations or have different interpretations of the supporting evidence. We used structured EMR data to identify patient diagnoses, prescribing details and testing rates. Adding analysis of unstructured EMR free text notes such as encounter notes would provide clinical context of the patient encounter. In Manitoba, EMR records contain one diagnosis code (ICD-9-CM) per visit to a health care provider, for the purpose of payment to a single insurer (Manitoba Health) in both fee-for-service and salaried environments. We assumed that the diagnosis chosen for billing was correct. Since only one code is entered per visit, it is likely that the study under-captured some details regarding clinical presentation. The reliance on structured EMR data may have introduced an ascertainment bias. EMR data is known to have some gaps in terms of data completeness,[32,33] but using clinical data from EMRs has been shown to be valid for use in diagnoses of acute presentations.[34-36] Because this is a retrospective cohort study we cannot determine causality. Future study should explore if these findings are generalizable to other CW recommendations or jurisdictions.

Conclusions

A small number of primary care providers contribute disproportionally to unnecessary care. Rates of potential over-prescribing and over-testing are associated with different patient and practice factors that are dependent on the intervention. Evidence-based approaches aimed at reducing unnecessary care should target providers with known high rates of testing and prescribing to prevent patient harm and reduce extraneous health system costs.

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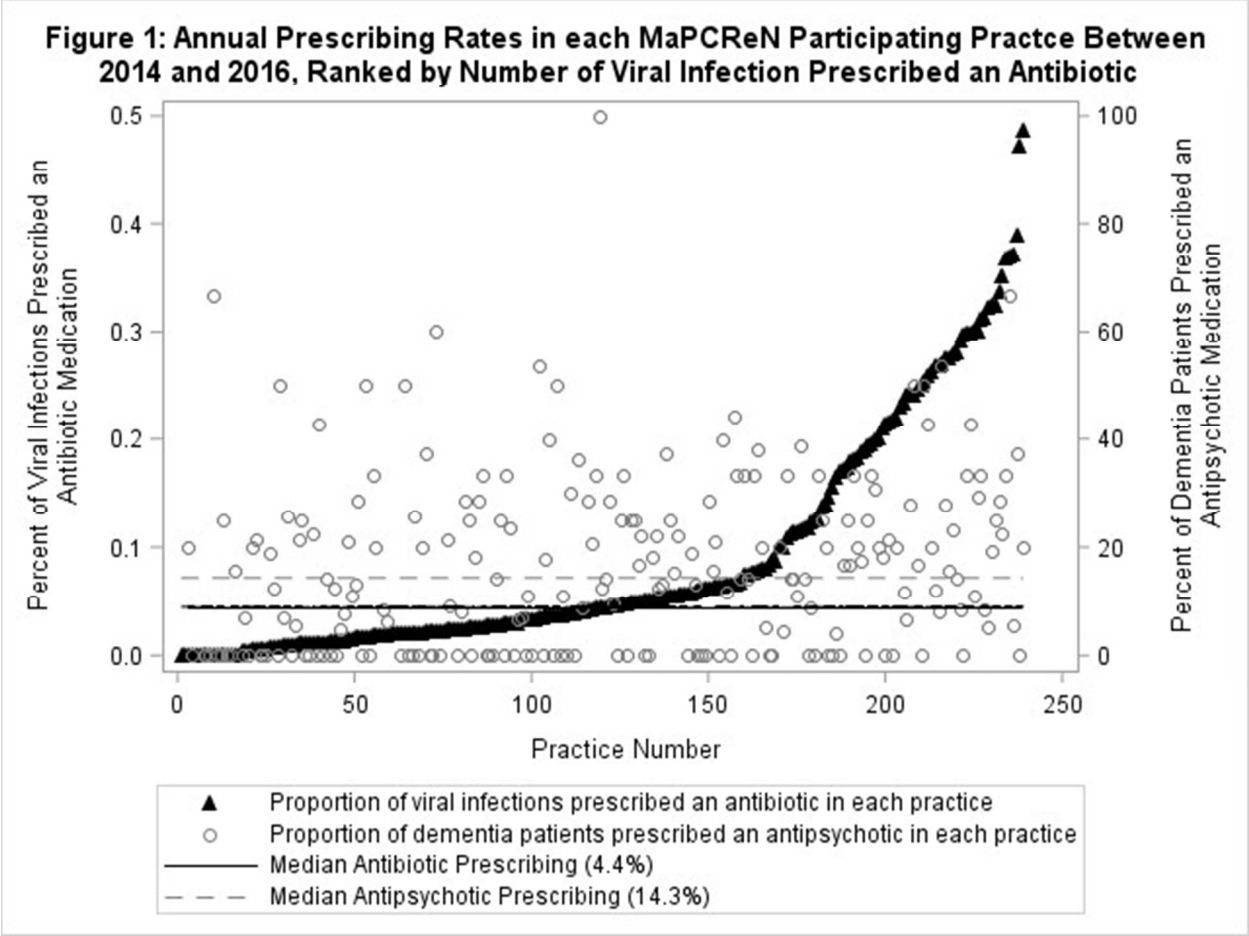
Figure 1: Annual Prescribing Rates in each MaPCReN Participating Practce Between 2014 and 2016, Ranked by Number of Viral Infection Prescribed an Antibiotic
Percent of Viral Infections Prescribed an Antibiotic Medication
Percent of Dementia Patients Prescribed an Antipsychotic Medication
0.5
0.4
0.3
0.2
0.1
0.0
100
80
60
40
20
0
0
50
100
150
200
250
Practice Number
Proportion of viral infections prescribed an antibiotic in each practice
Proportion of dementia patients prescribed an antipsychotic in each practice
Median Antibiotic Prescribing (4.4%)
Median Antipsychotic Prescribing (14.3%)

Table 1: Generalize Estimating Equation Results for Factors Associated with not Adhering to Prescribing Recommendations

Variable	Antibiotic prescription for Viral Infection		Antipsychotic Prescription for Treatment of Symptoms of Dementia	
	Odds Ratio	P-Value	Odds Ratio	P-Value
Patient sex (Female vs Male)	1.18 (1.09-1.28)	**<.0001**	0.88 (0.6-1.28)	0.5
Patient age (≥60 vs. <60 years of age)	0.72 (0.64-0.81)	**<.0001**	-	-
Increased comorbidities (3 or more vs. 0)	1.61 (1.45-1.79)	**<.0001**	9.58* (5.98-15.37)	**<.0001**
Increased frequency of office visits (10 or more visits vs. 1-2 visits a year)	1.01 (0.92-1.11)	0.80	1.29 (0.82-2.03)	0.28
Funding type (Salaried vs. Fee-for-service)	0.23 (0.18-0.29)	**<.0001**	2.08 (1.2-3.59)	**0.009**
Practice location (Urban vs Rural)	1.57 (0.71-3.47)	0.27	1.58 (0.52-4.78)	0.42
Practice Size (<1055 patients vs =>1055 patients)	1.23 (0.89-1.69)	0.2	1.06 (0.58-1.92)	0.85
*comorbidities excludes a diagnosis of dementia				

Figure 2: Annual Number of Screening Tests Ordered by each MaPCReN Participating Provider Between 2014 and 2016, Ranked by Number of PSA Tests Ordered

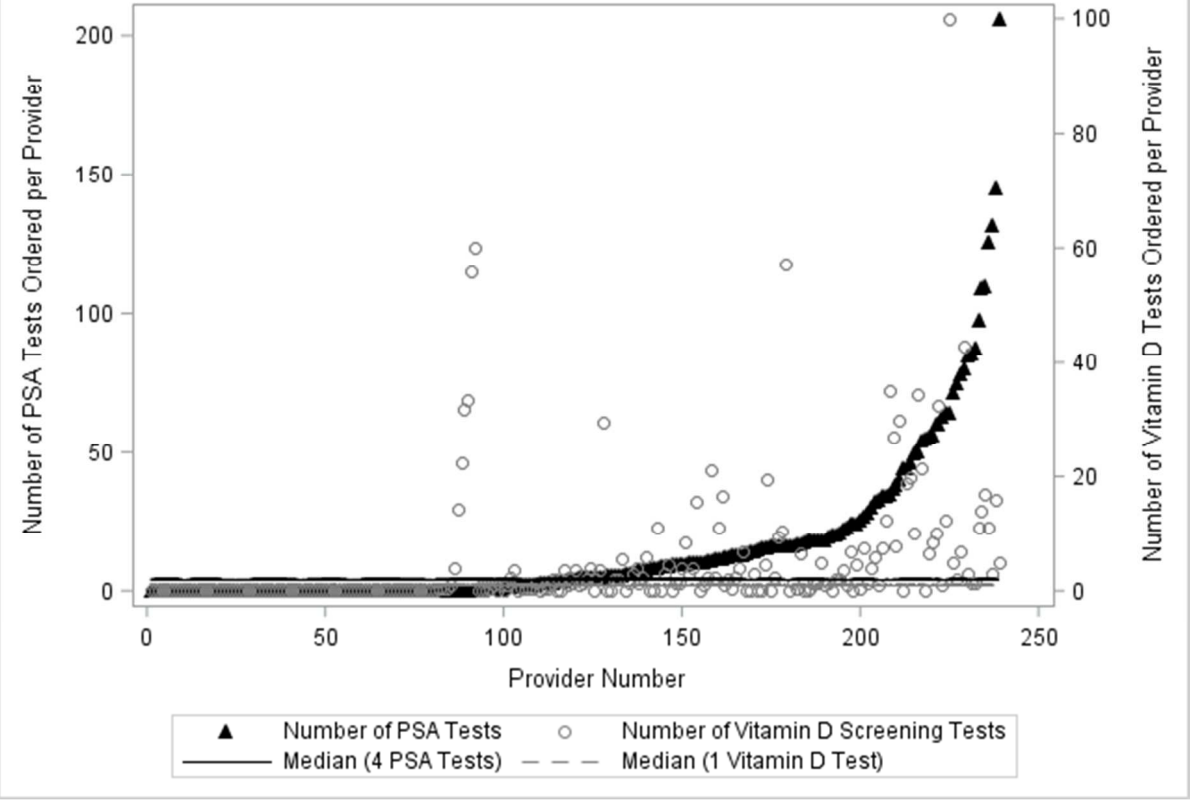

Table 2: Generalize Estimating Equation Results for Factors Associated with not Adhering to testing Recommendations

Variable	Vitamin D Test		PSA Test	
	Odds Ratio	P-Value	Odds Ratio	P-Value
Patient sex (Female vs Male)	1.55 (1.27 -1.89)	**<.0001**	-	-
Patient age (60 or older vs. 18 or under)	1.06 (0.88-1.27)	0.55	3.56*[1] (3.24-2.92)	**<.0001**
Increased comorbidities (3 or more vs. 0)	1.02 (0.78-1.32)	0.89	0.78 (0.68 -0.90)	**0.0005**
Increased frequency of office visits (10 or more visits vs. 1-2 visits a year)	1.29 (1.09-1.53)	**0.002**	1.46 (1.30-1.62)	**<.0001**
Funding type (Salaried vs. Fee-for-service)	2.36 (0.91-6.12)	0.08	0.85 (0.56-1.21)	0.4392
Practice location (Urban vs Rural)	3.24 (1.65-6.35)	**0.001**	5.61*[2] (3.44-9.13)	**<.0001**
Practice Size (<1055 patients vs =>1055 patients)	0.76 (0.29-1.99)	0.58	0.55 (0.05-1.24)	0.0706

*[1] Patients under 55 or over 70 vs. patients 55-70

*[2] Rural vs urban practice location