Quality of Prescribing by Physicians, Nurse Practitioners, and Physician Assistants in the United States

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Objective Nurse practitioners (NPs) and physician assistants (PAs) have increasingly broad prescribing authority in the United States, yet little is known regarding how the quality of their prescribing practices compares with that of physicians. The objective of this study was to compare the quality of prescribing practices of physicians and nonphysician providers.

Methods A serial cross-sectional analysis of the 2006–2012 National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey was performed. Ambulatory care services in physician offices, hospital emergency departments, and outpatient departments were evaluated using a nationally representative sample of patient visits to physicians, NPs, and PAs. Main outcome measures were 13 validated outpatient quality indicators focused on pharmacologic management of chronic diseases and appropriate medication use.

Results A total of 701,499 sampled patient visits were included during the study period, representing ~8.33 billion visits nationwide. Physicians were the primary provider for 96.8% of all outpatient visits examined; NPs and PAs each accounted for 1.6% of these visits. The proportion of eligible visits where quality standards were met ranged from 34.1% (angiotensin-converting enzyme inhibitor use for congestive heart failure) to 89.5% (avoidance of inappropriate medications among elderly). The median overall performance across all indicators was 58.7%. On unadjusted analyses, differences in

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quality of care between nonphysicians and physicians for each indicator did not consistently favor one practitioner type over others. After adjustment for potentially confounding patient and provider characteristics, the quality of prescribing by NPs and PAs was similar to the care delivered by physicians for 10 of the 13 indicators evaluated, and no consistent directional association was found between provider type and indicator fulfillment for the remaining measures.

CONCLUSIONS Although significant shortfalls exist in the quality of ambulatory prescribing across all practitioner types, the quality of care delivered by nonphysicians and physicians was generally comparable.

KEY WORDS quality of care, prescribing patterns, physician’s practice patterns, nurse practitioner’s practice patterns, physician assistant’s practice patterns, health care quality indicators, health care quality improvement.


Long-standing shortages exist in the primary care workforce in the United States.1–3 A much larger and specialized workforce will be required by 2025 to meet a projected 14% growth in the demand for adult primary care services.4 Driven by these shortages, as well as the desire for greater autonomy on the part of professional groups such as nurse practitioners (NPs) and physician assistants (PAs), a growing number of states have expanded the prescription privileges of nonphysician providers.5, 6 For example, the District of Columbia and 21 states currently allow NPs to practice independently without physician oversight, and only a few states prohibit NPs and PAs from prescribing controlled medications.7 As of 2016, PAs had attained full prescriptive authority in 42 states and Washington, D.C.8, 9

Expansions in prescribing authority have generated questions regarding whether the quality of care provided by NPs, PAs, and other nonphysicians is comparable with that provided by physicians. The general consensus is that the quality of NP and PA care is reliable in a variety of ambulatory settings.10–13 However, most studies are not adequately powered or have limitations in study design or quality.16, 17 Patient survey data indicate that patients prefer to see an NP or PA soon instead of waiting for a physician visit, and they provide additional evidence for similar quality of care on measures of satisfaction.18, 19

Despite the insights that these investigations provide, they also leave many questions unanswered. Most prior analyses comparing the quality of care between physician and nonphysician providers focused on narrowly defined clinical conditions such as cardiovascular risk management20 or vulnerable older patients.21, 22 In addition, many have derived information about clinical appropriateness from administrative claims or patient self-report, rather than directly from clinician-reported information about patients’ conditions and treatment regimens.23, 24

Using nationally representative data from ambulatory practices in the United States between 2006 and 2012, the quality of prescribing by physician and nonphysician practitioners working within physician offices and community health centers or hospital emergency and outpatient departments was surveyed. Although many NPs and PAs practice independently in settings other than those examined, these analyses provided a unique opportunity to analyze quality of care using validated quality measures applied to large rigorously conducted national health care surveys. This study also improved on previous studies comparing physician and nonphysician providers by scrutinizing a relatively wide scope of conditions in prescribing practices across all ages.20–22

Methods

Data Sources

The latest publicly available data from the National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS), which extended from 2006–2012, were examined in this study. These national probability sample surveys are designed by the National Center for Health Statistics (NCHS) and include information on ambulatory patient visits to physician offices and community health centers (NAMCS) and hospital emergency and outpatient departments (NHAMCS).
Both NAMCS and NHAMCS use a multistage probability-based sample design to derive a nationally representative sample of visits in ambulatory settings. Sampled providers are instructed to keep a list of all patient visits from which a systematic random sample of 30 visits are obtained during an assigned reporting week. Data for sampled visits are recorded on patient record forms and include information such as the types of providers seen during the visit, the patient’s demographics, the provider’s diagnoses, and services provided. In addition, up to eight over-the-counter and prescription medications initiated or renewed are recorded. In general, unweighted item nonresponse rates were no more than 5% over the 7 years studied, with exceptions including race (10.4–33.5%) and ethnicity (12.8–35.0%) that were imputed by NCHS. Given the relatively low prevalence of missing data, post imputation, complete case analysis for all the investigations reported in this article was used. A more detailed description of the survey scope and sample design, data collection, and processing is available on the NCHS website.

Assessment of Treatments and Quality Indicators

Both the NAMCS and NHAMCS used the Multum Lexicon Plus database to code the generic components and therapeutic classification of each product. Multum represents a comprehensive proprietary database of all prescription and nonprescription drugs approved for sale in the United States. The Multum database assigns multiple-ingredient drugs a single generic code that encompasses all of a drug’s ingredients. A Multum therapeutic classification is assigned to each drug and each ingredient of the drug, generating up to three nested classification levels; each drug may be in up to four therapeutic categories.

A set of 13 relevant outpatient quality indicators (Table 1) selected from 23 previously established process measures according to practice guidelines or expert statements in 2005 were examined. The chosen quality indicators focus on medicinal management of common chronic diseases, appropriate antibiotic use, and avoidance of inappropriate prescribing in elderly patients. All quality indicators were constructed such that visits with clinical contraindications to the recommended treatment were excluded from quality assessment. Performance on the indicators was calculated as the percentage of eligible visits that received appropriate care according to the guideline.

Statistical Analysis

A retrospective cross-sectional analysis was conducted after combining the NAMCS and NHAMCS data sets from 2006–2012. First, the performance of each quality indicator was examined after limiting the sample to nonhospitalized patients. To do so, the eligible population of visits (such as all patients 20 years or older with a diagnosis of congestive heart failure) was derived, and then the proportion of those visits where the relevant quality standard was met (such as where an angiotensin-converting enzyme inhibitor or an angiotensin receptor blocker was prescribed or refilled) was computed. Prominent contraindications to the recommended treatment, such as patients with hyperkalemia or angioedema, were excluded from the denominator. In each case, the denominator was defined based on International Classification of Diseases, Ninth Revision, codes for provider’s diagnoses, and the six-digit generic drug codes were examined to determine whether or not the quality standard was met.

Next, the unadjusted performance of each standard across visits to a physician, NP, or PA using the \( \chi^2 \) test with Bonferroni correction was compared. To do so, the analysis was limited to visits attended by a physician, NP, and/or PA, and it excluded the 3.61% of emergency department visits performed by nonattending physicians such as residents, interns, or fellows. The primary analysis was limited to visits involving a single provider type, and thus in the primary analyses, the small proportion of visits where the patient saw both a physician and an NP (1.37%), a physician and a PA (3.95%), an NP and a PA without a physician (0.02%) or a physician or an NP and a PA (0.03%) were excluded. In sensitivity analyses, visits conducted by both a physician and an NP or visits by both a physician and a PA were classified as physician visits.

Finally, multivariable logistic regression analyses were used to assess the association between provider type and performance on the quality measures after adjusting for potentially confounding patient (age, sex, race/ethnicity, and primary payment type), provider (geographic region), and visit (setting and survey year) characteristics. In the final models, basic patient characteristics (e.g., age, sex, race/ethnicity), variables in which we had a substantial a priori
<table>
<thead>
<tr>
<th>Quality indicator</th>
<th>Applicable visits</th>
<th>Appropriate prescription</th>
<th>Exclusions</th>
<th>Evidence source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicinal management of common chronic disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antithrombotic therapy for AF</td>
<td>Adults diagnosed with AF</td>
<td>Warfarin sodium, dicumarol, anisindione, or aspirin as antithrombotic therapy</td>
<td>GI bleeding, gastritis, alcoholism, drug abuse, gait abnormality, Alzheimer disease, cerebral hemorrhage, seizure disorder, CNS tumors, renal insufficiency, or thrombocytopenia</td>
<td>ACC/AHA/ESC</td>
</tr>
<tr>
<td>ACE inhibitor use for CHF</td>
<td>Adults diagnosed with CHF</td>
<td>ACE inhibitors or angiotensin receptor blockers</td>
<td>Hyperkalemia or angioedema</td>
<td>ICSI</td>
</tr>
<tr>
<td>Aspirin use for CAD</td>
<td>Adults with CAD</td>
<td>Aspirin, warfarin sodium, dipyridamole, clopidogrel bisulfate, ticlopidine hydrochloride, or sulfinpyrazone</td>
<td>GI bleeding, gastritis, duodenitis, or cerebral hemorrhage</td>
<td>ICSI</td>
</tr>
<tr>
<td>β-Blocker use for CAD</td>
<td>Adults with CAD</td>
<td>β-Blocker</td>
<td>Heart block, asthma, or COPD</td>
<td>ICSI</td>
</tr>
<tr>
<td>Statin use</td>
<td>Adults with hyperlipidemia</td>
<td>Statin</td>
<td>Age ≥ 80 yrs or with renal disease, liver disease, alcohol abuse, or specific concomitant medication use</td>
<td>NCEP</td>
</tr>
<tr>
<td>IC use for asthma in adults</td>
<td>Adults with asthma</td>
<td>IC</td>
<td>COPD or first-time patient visits</td>
<td>NAEP</td>
</tr>
<tr>
<td>IC use for asthma in children</td>
<td>Children with asthma</td>
<td>IC</td>
<td>COPD or first-time patient visits</td>
<td>NAEP</td>
</tr>
<tr>
<td>Treatment of depression</td>
<td>Adults with depression</td>
<td>IC</td>
<td>None</td>
<td>ACP/ASIM</td>
</tr>
<tr>
<td>No benzodiazepine use for depression</td>
<td>Adults with depression</td>
<td>No benzodiazepine</td>
<td>Anxiety disorder</td>
<td>ICSI</td>
</tr>
<tr>
<td>Appropriate antibiotic use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TMP-SMX use for UTI</td>
<td>Female adults with uncomplicated UTI who received any antibiotics</td>
<td>TMP-SMX or a selected quinolone</td>
<td>Infections of bacterial origin, other infections (vaginitis/ cervicitis, skin infections, infections of the kidney, or STD), DM, cancer, pregnancy nephrolithiasis, urologic procedures, or urologic structural/functional abnormality</td>
<td>UMHS</td>
</tr>
<tr>
<td>No antibiotic use for URTI</td>
<td>Adults with uncomplicated URTI</td>
<td>No antibiotic</td>
<td>Bronchospasm, DM, HIV/AIDS, other STD, cancer, infections of bacterial origin, or potential bacterial infections of the respiratory system</td>
<td>ACP/ASIM</td>
</tr>
</tbody>
</table>
interest (e.g., provider type), and variables that were at least of borderline statistical significance on bivariable analysis (p < 0.10) were included. Although statistically significant on bivariable analysis (p < 0.10), metropolitan status was not available in 2012 emergency department data, and this variable was excluded from the analyses after observing no significant change in effect with and without it in the models. Patient visit weights were incorporated into the regression that account for the surveys’ complex sampling design and allowed the use of sampled visits to arrive at national estimates and accounted for clustering as recommended in the data user guide.25 All hypothesis testing was two-tailed, and statistical significance was set at p < 0.05. All statistical analyses were conducted using SAS v.9.4 (SAS Institute Inc, Cary, NC). This study was exempted from institutional review board review at the Johns Hopkins Bloomberg School of Public Health.

Patient Involvement

Secondary data derived from the NAMCS and the NHAMCS were analyzed. Although the information examined reflects the experience of millions of patients receiving ambulatory care in the United States, no patients were directly involved in the design, analysis, or reporting of our study.

Results

A total of 701,499 sample records were examined, corresponding with 261,623 visits to office-based physicians, 235,888 visits to hospital emergency departments, and 203,988 visits to hospital outpatient departments occurring between 2006 and 2012. These visits represented an estimated total of 8.33 billion ambulatory patient visits during the study period. Physicians accounted for 96.8% of ambulatory care visits, and NPs and PAs each accounted for 1.6% of visits (Table 2). Physicians were more likely than NPs and PAs to see patients younger than 15 years (12.4% vs 5.1%, respectively), and were more likely to see patients 75 years or older (12.4% vs 5.1% and 6.4%, respectively). NPs were more likely than physicians or PAs to see patients paying with private insurance (51.3% vs 37.4% and 43.0%, respectively) and were more likely to see patients paying with Medicare (51.3% vs 37.4% and 43.0%, respectively). NPs and PAs each accounted for 1.6% of visits to hospital outpatient departments, and 6.4% of visits to hospital emergency departments during 2006 and 2012. These visits represented an estimated total of 8.33 billion ambulatory patient visits during the study period. Physicians accounted for 96.8% of ambulatory care visits, and NPs and PAs each accounted for 1.6% of visits to hospital outpatient departments, and 6.4% of visits to hospital emergency departments during 2006 and 2012. These visits represented an estimated total of 8.33 billion ambulatory patient visits during the study period. Physicians accounted for 96.8% of ambulatory care visits, and NPs and PAs each accounted for 1.6% of visits to hospital outpatient departments, and 6.4% of visits to hospital emergency departments during 2006 and 2012. These visits represented an estimated total of 8.33 billion ambulatory patient visits during the study period. Physicians accounted for 96.8% of ambulatory care visits, and NPs and PAs each accounted for 1.6% of visits to hospital outpatient departments, and 6.4% of visits to hospital emergency departments during 2006 and 2012. These visits represented an estimated total of 8.33 billion ambulatory patient visits during the study period. Physicians accounted for 96.8% of ambulatory care visits, and NPs and PAs each accounted for 1.6% of visits to hospital outpatient departments, and 6.4% of visits to hospital emergency departments during 2006 and 2012. These visits represented an estimated total of 8.33 billion ambulatory patient visits during the study period.
to see patients covered by Medicaid rather than other types of coverage (32.8% vs 14.5% and 24.7%, respectively). In addition, visits to private physician or community-based offices accounted for a much higher proportion for visits performed by physicians (85.5%) than by NPs (36.0%) or PAs (45.2%). By contrast, NPs provided care more frequently in the outpatient department, and PAs provided care more frequently in emergency departments.

Unadjusted Quality of Prescribing Practices

Table 3 depicts the unadjusted quality indicators examined. For example, 3369 sampled visits, or an estimated 58.4 million visits nationwide, were eligible for inclusion to assess the use of antithrombotic therapy for atrial fibrillation. Of these, 64.2%, or approximately two-thirds, met the quality standard, ranging from 64.0% among physicians to 85.6% among NPs. Overall, the unadjusted rates of meeting quality standards ranged from a low of 34.1% (ACE inhibitor use for congestive heart failure) to a high of 89.5% (avoiding inappropriate medication use in elderly patients), with a median level of 58.7%. The unadjusted median performance including all standards was 58.8% for physicians, 55.4% for NPs, and 54.8% for PAs. Differences in the
The crude proportions of standard practices between nonphysicians and physicians for each indicator did not consistently favor one practitioner type over others.

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**Table 3. Visits Meeting Quality Standards by Provider Type, 2006–2012, NAMCS and NHAMCS**

<table>
<thead>
<tr>
<th>Quality indicator</th>
<th>No. of sampled visits</th>
<th>No. of estimated patient visits in millions</th>
<th>Unadjusted percentage of visits meeting the quality standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antithrombotic therapy for atrial fibrillation</td>
<td>3369</td>
<td>58.4</td>
<td>64.2 64.0 85.6 66.3</td>
</tr>
<tr>
<td>ACE inhibitor use for congestive heart failure</td>
<td>10,029</td>
<td>137.7</td>
<td>34.1 34.2 34.1 27.5</td>
</tr>
<tr>
<td>Aspirin use for coronary artery disease</td>
<td>9120</td>
<td>153.8</td>
<td>58.7 58.8 60.8 53.5</td>
</tr>
<tr>
<td>β-Blocker use for coronary artery disease</td>
<td>8766</td>
<td>147.0</td>
<td>50.6 50.5 58.1 54.8</td>
</tr>
<tr>
<td>Statin use</td>
<td>46,330</td>
<td>925.6</td>
<td>43.4 43.4 39.8 46.9</td>
</tr>
<tr>
<td>Inhaled corticosteroid use for asthma in adults</td>
<td>16,364</td>
<td>241.4</td>
<td>45.5 45.5 39.8 46.2</td>
</tr>
<tr>
<td>Antithrombotic therapy for atrial fibrillation</td>
<td>42,072</td>
<td>614.2</td>
<td>55.3 55.3 55.3 55.3</td>
</tr>
<tr>
<td>ACE inhibitor use for congestive heart failure</td>
<td>35,135</td>
<td>513.0</td>
<td>83.9 83.8 88.3 82.1</td>
</tr>
<tr>
<td>Aspirin use for coronary artery disease</td>
<td>3822</td>
<td>58.7</td>
<td>58.8 58.8 58.8 58.8</td>
</tr>
<tr>
<td>β-Blocker use for coronary artery disease</td>
<td>6007</td>
<td>92.3</td>
<td>59.7 60.0 53.3 51.9</td>
</tr>
<tr>
<td>Statin use</td>
<td>16,364</td>
<td>241.4</td>
<td>45.5 45.5 44.5 46.2</td>
</tr>
<tr>
<td>Inhaled corticosteroid use for asthma in children</td>
<td>8824</td>
<td>118.1</td>
<td>61.6 61.8 49.6 68.8</td>
</tr>
<tr>
<td>Treatment of depression</td>
<td>84,762</td>
<td>1418.0</td>
<td>89.5 89.5 87.6 89.9</td>
</tr>
<tr>
<td>No benzodiazepine use for depression</td>
<td>176,144</td>
<td>2767.0</td>
<td>58.7 58.8 55.4 54.8</td>
</tr>
</tbody>
</table>

All p values < 0.001 for the differences in proportions among physicians, nurse practitioners, and physician assistants. ACE = angiotensin-converting enzyme; NAMCS = National Ambulatory Medical Care Survey; NHAMCS = National Hospital Ambulatory Medical Care Survey; TMP-SMX, trimethoprim-sulfamethoxazole.

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**Table 4. Multivariable Comparisons of Quality Standards Between Visits to Physicians (Reference Category) and Visits to Nurse Practitioners and Physician Assistants, 2006–2012, NAMCS and NHAMCS**

<table>
<thead>
<tr>
<th>Quality indicator</th>
<th>Adjusted odds ratio (95% CI)a physician as referent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antithrombotic therapy for atrial fibrillation</td>
<td>1.76 (1.16–2.67)b 2.54 (1.00–6.46) 1.23 (0.55–2.76)</td>
</tr>
<tr>
<td>ACE inhibitor use for congestive heart failure</td>
<td>1.33 (0.88–2.03) 0.86 (0.41–1.80) 0.80 (0.47–1.36)</td>
</tr>
<tr>
<td>Aspirin use for coronary artery disease</td>
<td>1.28 (0.94–1.74) 1.04 (0.50–2.14) 0.89 (0.45–1.75)</td>
</tr>
<tr>
<td>β-Blocker use for coronary artery disease</td>
<td>1.00 (0.81–1.46) 1.27 (0.63–2.55) 1.31 (0.65–2.65)</td>
</tr>
<tr>
<td>Statin use</td>
<td>0.87 (0.67–1.14) 0.84 (0.58–1.21) 1.14 (0.87–1.49)</td>
</tr>
<tr>
<td>Inhaled corticosteroid use for asthma in adults</td>
<td>0.91 (0.71–1.17) 0.89 (0.62–1.29) 0.93 (0.61–1.40)</td>
</tr>
<tr>
<td>Inhaled corticosteroid use for asthma in children</td>
<td>0.99 (0.67–1.45) 0.49 (0.30–0.79)b 1.24 (0.57–2.67)</td>
</tr>
<tr>
<td>Treatment of depression</td>
<td>0.75 (0.61–0.93)b 0.96 (0.68–1.37) 1.00 (0.71–1.40)</td>
</tr>
<tr>
<td>No benzodiazepine use for depression</td>
<td>1.01 (0.80–1.27) 1.44 (1.00–2.07) 0.88 (0.63–1.22)</td>
</tr>
<tr>
<td>TMP-SMX use for urinary tract infection</td>
<td>0.70 (0.35–1.41) 1.12 (0.46–2.71) 1.64 (0.79–3.43)</td>
</tr>
<tr>
<td>No antibiotic use for upper respiratory tract infection</td>
<td>0.75 (0.50–1.14) 0.90 (0.47–1.71) 0.61 (0.35–1.08)</td>
</tr>
<tr>
<td>Selected antibiotic use for acute otitis media</td>
<td>0.41 (0.24–0.70)b 0.61 (0.32–1.17) 0.20 (0.06–0.72)b</td>
</tr>
<tr>
<td>Avoiding inappropriate medication use in elderly patients</td>
<td>0.94 (0.79–1.11) 0.83 (0.63–1.10) 1.15 (0.85–1.56)</td>
</tr>
<tr>
<td>All visits where indicators eligible, median percentage</td>
<td>0.94 (0.78–1.12) 0.88 (0.60–1.29) 1.21 (0.87–1.68)</td>
</tr>
</tbody>
</table>

ACE = angiotensin-converting enzyme; NAMCS = National Ambulatory Medical Care Survey; NHAMCS = National Hospital Ambulatory Medical Care Survey; TMP-SMX, trimethoprim-sulfamethoxazole.

Adjusted Quality of Prescribing Practices

After adjustment for potentially confounding patient, provider, and visit characteristics, no
statistically significant differences were found in the quality of prescribing practices between physicians and nonphysicians (NPs and PAs) for 10 of the 13 quality standards evaluated (Table 4). For the remaining three indicators, there was no consistent directional association. Nonphysicians met the quality standard of antithrombotic therapy for atrial fibrillation more often than physicians (odds ratio [OR] 1.76, 95% confidence interval [CI] 1.16–2.67), and they met the quality standards for depression treatment (OR 0.75, CI 0.61–0.93) and selected antibiotic use for acute otitis media (OR 0.41, CI 0.24–0.70) less frequently than physicians.

The results of the analyses were generally similar when examining NPs and PAs separately. No statistically significant differences were found in the quality of prescribing practices between physicians and NPs or between physicians and PAs for all but one of the 13 measures examined for each comparison (Table 4).

### Sensitivity Analysis

In analyses where visits performed by a physician and an NP or PA were attributed to the physician, the quality of prescribing practices provided by NPs and PAs was comparable with physicians for all but one of the 13 indicators for each comparison. NPs met the quality standards of prescribing inhaled corticosteroid for asthma in children less frequently than physicians (OR 0.49, CI 0.30–0.80), and PAs met the quality standard of prescribing selected antibiotics for acute otitis media less frequently than physicians (OR 0.21, CI 0.06–0.75).

### Discussion

Data from large nationally representative surveys of ambulatory care were used to examine the quality of prescribing by physicians, NPs, and PAs in the United States between 2006 and 2012. Based on 13 quality indicators spanning the management of common chronic diseases, appropriate antibiotic use, and avoiding contraindicated medications among the elderly, the quality of care delivered by physicians, NPs, and PAs working in physician offices, hospital outpatient departments, and emergency departments was generally comparable across the quality standards examined. However, large gaps in quality were found, as well as wide variations across different measures, ranging from slightly more than a third of patients with congestive heart failure receiving ACE inhibitors to nearly 9 of 10 individuals 65 years or older appropriately avoiding treatments that are not recommended for the elderly.

This study adds to several prior investigations that compared practice patterns of NPs and PAs with physicians. Although most studies have suggested similar quality of care, including prescribing practices, many of these studies have had low statistical power or have had other methodological limitations. In addition, in contrast to prior studies of electronic medical records or administrative claims, this study examined practice patterns using large and nationally representative ambulatory care surveys where data were derived from clinician reports and included both new and renewed prescription and over-the-counter medications. The development of the quality measures that were used was previously described and was based on Institute of Medicine criteria including clinical importance, scientific soundness, and feasibility of use.

NPs and PAs were historically seen as solutions to shortages and uneven distributions of primary care physicians, a pressing issue that has grown since the passing of the Affordable Care Act (ACA). With millions of Americans gaining health care coverage, efforts to expand the primary care workforce, including prescription privileges, have generated concerns regarding whether nonphysicians can provide care comparable with that provided by physicians. In step with studies supporting their similar quality of care, professional societies of NPs and PAs have been advocating for greater autonomy and prescriptive authority of these providers as facile responders to evolving health care needs. This role is especially important in smaller, more rural states, given the greater likelihood of NPs and PAs practicing in rural areas and providing care to vulnerable populations.

To support the expanding role of nonphysician practitioners in the workforce, the ACA made substantial investments, including over $60 million in 2010 to fund NP and PA training programs in an effort to increase the supply by 2015, and 10% of Medicare bonus payments for services provided by primary care practitioners including NPs and PAs.

Despite these gains, resistance remains about expanding of nonphysician prescription authority on the part of some, including physician professional societies that have iterated that...
Nonphysician practitioners receive training for roles complementary to that of physicians. Some have opposed nonphysician practitioners practicing independently, believing that nonphysician practitioners are not replacements for physicians; others have noted that many NPs, PAs, and graduates from osteopathic schools are not practicing in primary care and cannot provide a solution to the problem of provider shortages.

Interestingly, although we did not find consistent differences in quality of care based on provider type, NPs appeared to be less likely to prescribe inhaled corticosteroids for asthma in children, and PAs appeared to provide lower quality of care with respect to selected antibiotic use for acute otitis media. Several potential reasons can be postulated for such findings including unmeasured patient, provider, or practice-level differences that confound the associations of interest, as well as true differences that represent practice-level variation in quality across the various providers.

It is noteworthy that the overall quality of prescribing practices was low across all of the provider types we examined. Such findings are consistent with prior studies that have documented suboptimal prescribing practices in many clinical areas. For example, using a different set of quality indicators and a different data source and study design, one study also reported significant deficits in the quality of pharmacologic care with an overall performance of 61.9%. Although these results are not directly comparable, they nevertheless highlight persistent shortcomings and the need for expanded multimodal efforts to improve the quality of prescription drug use in the United States.

Our study has several limitations. First, although 13 quality indicators were considered, these reflect only a portion of the spectrum of pharmacologic care delivered in ambulatory settings. For example, education/documentation and medication monitoring were not assessed, yet these are important components of quality of care. Second, although the indicators were carefully developed for use in data such as the NAMCS, they were designed more than a decade ago and may not reflect the updates in the standards for appropriate prescribing. It is likely that performance on these metrics has improved since 2012 as pay-for-performance and other value-based payment models have been developed over the years. However, any significant improvement would be speculative that could be tested as data from more recent years become available. Third, the visit-based sample overrepresents frequent users of care, the small number of sampled visits to NPs and PAs in some quality indicators led to wide CIs, and the analyses were not stratified by the type of visit, such as whether it was for acute or chronic care. However, providers were instructed to prioritize the recoding of new medications and those associated with the listed diagnoses across the different visit types. Although it is possible that the focus of visits differed for physicians, NPs, and PAs, in this sense our analysis is a real-world one, where the actual practice patterns of these differing groups of health care providers were examined. Fourth, although we adjusted for a variety of patient, provider, and visit characteristics that were available, visits may have differed in unobserved and unobservable ways including practice characteristics, area-level provider shortages, or participation in a disease management program. As a result, the findings of this study are subject to omitted variable bias. Notably, we were unable to adjust for severity of the medical conditions being treated and patient comorbidities that may influence the choice of provider and the quality of care provided. Fifth, the providers are only permitted to record eight medications per visit, which increased to 10 in 2012. Although the assessment of appropriate prescribing could be inaccurate for the small portion of visits that might have exceeded eight medications, it should be noted that in those cases, providers were instructed to prioritize prescriptions associated with the listed diagnoses and new medications as they record.

Finally, the NAMCS and NHAMCS only capture a select subset of NPs and PAs practice, and thus our conclusions may not be generalizable to entire professions. The NAMCS data are especially susceptible to this limitation because this is a physician-based sample, and thus it only represents NPs and PAs working within physician office practices. The quality of care provided by these nonphysicians may be different from that of their counterparts practicing in other independent settings. In addition, these data are not informative on the expansion in the scope of practice for NPs and PAs over time and its effect on quality of care provided. For future directions, it would be interesting to investigate over time the rate of improvement on adherence to medication-related guidelines, comparing the responsiveness of physicians and nonphysician providers with incentives to enhance prescribing behaviors.
Conclusions
Despite the concerted actions of many stakeholders, large gaps remain in the quality of prescribing in the United States. Among the visits examined in this study, these deficiencies were similarly present among physician and nonphysician providers alike. These findings also support efforts to expand the primary care workforce through enhanced prescriptive authority of nonphysician prescribers, at least those who are practicing in physician offices, hospital emergency departments, and outpatient departments.

References


