Comparison of the Quality of Patient Referrals From Physicians, Physician Assistants, and Nurse Practitioners

Robert H. Lohr, MD; Colin P. West, MD, PhD; Margaret Beliveau, MD; Paul R. Daniels, MD; Mark A. Nyman, MD; William C. Mundell, MD; Nina M. Schwenk, MD; Jayawant N. Mandrekar, PhD; James M. Naessens, ScD; and Thomas J. Beckman, MD

Abstract

Objective: To compare the quality of referrals of patients with complex medical problems from nurse practitioners (NPs), physician assistants (PAs), and physicians to general internists.

Patients and Methods: We conducted a retrospective comparison study involving regional referrals to an academic medical center from January 1, 2009, through December 31, 2010. All 160 patients referred by NPs and PAs combined and a random sample of 160 patients referred by physicians were studied. Five experienced physicians blinded to the source of referral used a 7-item instrument to assess the quality of referrals. Internal consistency, interrater reliability, and dimensionality of item scores were determined. Differences between item scores for patients referred by physicians and those for patients referred by NPs and PAs combined were analyzed by using multivariate ordinal logistical regression adjusted for patient age, sex, distance of the referral source from Mayo Clinic, and Charlson Index.

Results: Factor analysis revealed a 1-dimensional measure of the quality of patient referrals. Interrater reliability (intraclass correlation coefficient for individual items: range, 0.77-0.93; overall, 0.92) and internal consistency for items combined (Cronbach’s α = 0.75) were excellent. Referrals from physicians were scored higher (percentage of agree/strongly agree responses) than were referrals from NPs and PAs for each of the following items: referral question clearly articulated (86.3% vs 76.0%; P = .0007), clinical information provided (72.6% vs 54.1%; P = .003), documented understanding of the patient’s pathophysiology (51.0% vs 30.3%; P < .0001), appropriate evaluation performed locally (60.3% vs 39.0%; P < .0001), appropriate management performed locally (53.5% vs 24.1%; P < .0001), and confidence returning patient to referring health care professional (67.8% vs 41.4%; P < .0001). Referrals from physicians were also less likely to be evaluated as having been unnecessary (30.1% vs 56.2%; P < .0001).

Conclusion: The quality of referrals to an academic medical center was higher for physicians than for NPs and PAs regarding the clarity of the referral question, understanding of pathophysiology, and adequate prereferral evaluation and documentation.

Primary care workforce shortages are predicted for many areas of the United States in the next decade.¹,² Nurse practitioners (NPs) and physician assistants (PAs) are increasingly being used to improve health care access. For example, new models of care delivery, such as the Patient Centered Medical Home, often include NPs and PAs along with primary care physicians.³ All states require that PAs be supervised by physicians, and many states require that NPs be supervised by physicians. However, the availability of supervision for NPs and PAs varies, and several states allow NPs to practice independently.⁴,⁵ Indeed, allowing NPs to practice independently in all states has been identified as a potential solution to the primary care workforce shortage.⁶,⁷ However, controversy exists regarding the roles of physicians and NPs within health care teams and levels of supervision.⁸

It has been suggested that NPs and PAs can perform the roles of primary care physicians.⁹,¹⁰ Although patients with multiple...
We conducted a retrospective comparison study of all 160 patients referred by NPs and PAs, as well as a computer-generated random sample of 160 patients referred by physicians, to the Division of General Internal Medicine from January 1, 2009, through December 31, 2010. Data were de-identified so that investigators reviewing the patient histories would be blinded to the referral source and patient identities. We estimated that this 2-sample comparison of 160 participants per group would provide 80% power to detect a small to moderate Cohen’s d effect size of 0.32.

During the time frame of our study, approximately 800 regional patients per year were referred to the Division of General Internal Medicine, with 10% of these referrals coming from NPs and PAs. For this study, 160 patients were referred by 90 NPs or PAs. Eight of these patients were excluded because of missing authorization to use medical records for research purposes, and 6 were excluded because of incomplete de-identification. In addition, we identified a random sample of 160 of the remaining patients who were referred by 126 individual physicians. Five of these patients were excluded because of missing authorization to use the medical records for research purposes, and 9 were excluded because of incomplete de-identification, which resulted in a total of 292 patient referrals available for analysis, with 146 referrals in each cohort. This study was approved by the Mayo Clinic Institutional Review Board.

To better understand the level of physician supervision that NPs and PAs receive, we mailed a separate survey to every NP and PA for whom we had current contact information (n=88) who had referred a patient to the Division of General Internal Medicine during the study period. The survey responses of NPs and PAs were anonymous; therefore, we were unable to link the survey and comparison data. The single survey question we asked was: “How often do you discuss patients with physician colleagues before referring your patient to Mayo Clinic?” The response options to this question were as follows: never, some of the time, about half of the time, most of the time, and always.

**Study Variables**
Assessed patient characteristics included patient age, sex, and distance of the referral source from Mayo Clinic. Diseases for each...
patient at the time of referral were used to calculate Charlson Index scores. Physician attitudes regarding the quality and appropriateness of referrals were recorded for the following 7 items (on a Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree): (1) the clinical question was clearly articulated, (2) the clinical information was provided, (3) the clinical question reflected understanding of pathophysiology, (4) the patient had been appropriately evaluated locally, (5) the patient had been appropriately managed locally, (6) the clinical question could have been handled by a primary care health care professional locally, and (7) I am confident sending the patient back to the referring health care professional. The validation of the scores from these 7 items is described in the next section.

Instrument Development and Validation
An instrument was designed to measure physicians’ attitudes about the quality of patient referrals to the Division of General Internal Medicine. Instrument items addressed whether patients were appropriately referred (items 1-3 in the preceding paragraph) and whether patients were being appropriately managed by their local health care professionals (items 4-7 in the preceding paragraph). The content validity for these items was determined with input from one of the authors (T.J.B.), who has experience in scale development and validation, and a panel of 8 Mayo Clinic physicians with a minimum of 10 years of experience in the general internal medicine practice, who analyzed the items for clarity and appropriateness and suggested no revisions.

The instrument was pilot tested on 5 patient records by all physician authors. The interrater reliability across 8 physician raters for each item and overall was determined from intraclass correlation coefficients, which were interpreted as follows: less than 0.4 = poor, 0.4 to 0.75 = fair to good, and greater than 0.75 = excellent.20 Results of this interim analysis revealed an excellent interrater reliability of the intraclass correlation coefficient across all items (range, 0.77-0.93) and overall (0.92). On the basis of this analysis, it was determined that the physician raters had a consistent understanding of the rating instrument and its application to the patient records.

Five of these physicians then used the instrument to assess the quality of patient referrals to Mayo Clinic. The physician raters were blinded to the source of referral (physician or nonphysician). The factor analysis of the physician assessments was used to determine the dimensionality of the item scores. To account for the clustering of multiple ratings within rater and referral source (physician vs NP or PA) groupings, we generated an adjusted correlation matrix by using generalized estimating equations. This adjusted correlation matrix was then used to perform factor analysis. In addition, for a sensitivity analysis, we performed a factor analysis by using an unadjusted correlation matrix and within rater and referral source combinations separately. Factors were extracted by using the eigenvalue method. Internal consistency for each factor, as well as overall consistency, was calculated by using Cronbach $\alpha$, and $\alpha > 0.7$ was considered acceptable.

Statistical Analyses
Patient characteristics were reported by using standard descriptive statistics. Differences between item scores for patients referred by physicians compared with those referred by NPs and PAs were assessed by using multivariate ordinal logistical regression, adjusting for patient age, sex, distance of the referral source from Mayo Clinic, and Charlson Index. Differences between groups for Charlson Index scores were evaluated by using the analysis of variance. Two-tailed statistical significance was set at $\alpha = 0.05$. Statistical analyses were conducted by using SAS version 9.1 (SAS Institute Inc).

RESULTS
The characteristics of patients referred to the Division of General Internal Medicine are summarized in Table 1. Patients referred by physicians were older than those referred by NPs and PAs ($P = .04$). Patients referred by physicians were also more likely to be men ($P = .0003$). There were no statistically significant differences between groups in terms of the distance traveled ($P = .71$) or disease complexity (determined from the Charlson Index, $P = .1$). The reasons for referral included issues relating to all internal medicine subspecialties, as well as undifferentiated symptoms such as fatigue and weight loss. There were no substantial differences between study groups in terms of the reasons for referral.
The factor analysis revealed a 1-dimensional measure of the quality of patient referrals from physicians, PAs, and NPs. Internal consistency for all items combined was excellent (Cronbach $\alpha=0.73$). Referrals from physicians were scored significantly higher (percentage of agree/strongly agree responses) than were referrals from PAs and NPs for each of the following instrument items: referral question clearly articulated (86.3% vs 76.0%; $P<.0007$), clinical information provided (72.6% vs 54.1%; $P=.003$), documented understanding of the patient’s pathophysiology (51.0% vs 30.3%; $P<.0001$), appropriate evaluation performed locally (60.3% vs 39.0%; $P<.0001$), appropriate management performed locally (53.5% vs 24.1%; $P<.0001$), and confidence returning patient to referring health care professional (67.8% vs 41.1%; $P<.0001$). Physician referrals were also less likely to be evaluated as adding little clinical value (30.1% vs 56.2%; $P<.0001$) than referrals from PAs and NPs.

Regarding the survey of all referring NPs and PAs over the study time frame, 44 NPs/PAs responded to 88 mailed letters (response rate 50%). Twenty-six of 44 respondents reported that either they “never” discussed referral plans with their supervising physicians or they did so “some of the time,” and only 3 of 44 respondents reported that they “always” discussed referral plans with their supervising physicians.

**DISCUSSION**

To our knowledge, this is the first study to report that the quality of patient referrals from primary care health care professionals to general internists at an academic medical center, as determined by a panel of experienced internal medicine faculty members blinded to source of referral, is substantially higher for physicians than for PAs and NPs with respect to several characteristics including clarity of the referral question, understanding of pathophysiology, and adequate prereferral evaluation and documentation. These preliminary findings suggest that there is an opportunity to improve the quality of all patient referrals from primary care practices, but especially those that use NPs and PAs, by involving integrated health care teams that combine the skills of physicians, NPs, and PAs.

The reasons why the quality of referrals differs between physicians and nonphysicians are likely multifactorial and might best be viewed in the context of team-based care and the broader health care system. Specifically, these differences could be considered with respect to interacting patient, health care professional, and system-related factors. Patients who require referral to a tertiary medical center are typically more complex and undifferentiated in terms of a diagnosis. Although there is evidence that NPs and PAs can deliver effective primary care,10-12 there is little research on their abilities to independently manage patients with undifferentiated and complex problems. However, there are many examples of multidisciplinary teams including NPs, PAs, and physicians that provide excellent care to patients with complex medical problems. Such models have been found in the intensive care unit,13-15 trauma unit,21 emergency department,22 and hospital ward.23 Notably, in all these settings, NPs and PAs had immediate access to physician support, whereas this level of support is not necessarily available in all outpatient practice settings.11 Indeed, our survey of referring NPs and PAs indicated that they usually did not consult with a physician colleague before referring a patient. Potential reasons for limited supervision in outpatient practices would include high patient volumes, abbreviated appointment times, and geographic separation between physicians, NPs, and PAs.

All states require a supervisory relationship between physicians and PAs5,10; however, this

### TABLE 1. Characteristics of Regional Patients Referred by Physicians and Nonphysicians to the Division of General Internal Medicine at Mayo Clinic

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Physicians (n=146 patients)</th>
<th>Nonphysicians (n=146 patients)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-34</td>
<td>15 (10.3)</td>
<td>21 (14.4)</td>
<td>.04</td>
</tr>
<tr>
<td>35-49</td>
<td>25 (17.1)</td>
<td>39 (26.7)</td>
<td></td>
</tr>
<tr>
<td>50-64</td>
<td>41 (28.1)</td>
<td>45 (30.8)</td>
<td></td>
</tr>
<tr>
<td>65-79</td>
<td>45 (30.8)</td>
<td>26 (17.8)</td>
<td></td>
</tr>
<tr>
<td>≥80</td>
<td>20 (13.7)</td>
<td>15 (10.3)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td>.0003</td>
</tr>
<tr>
<td>Male</td>
<td>62 (42.5)</td>
<td>32 (21.9)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>84 (57.5)</td>
<td>114 (78.1)</td>
<td></td>
</tr>
<tr>
<td>Distance (mi)</td>
<td></td>
<td></td>
<td>.71</td>
</tr>
<tr>
<td>&lt;120</td>
<td>128 (87.7)</td>
<td>131 (89.7)</td>
<td></td>
</tr>
<tr>
<td>≥120</td>
<td>18 (12.3)</td>
<td>15 (10.3)</td>
<td></td>
</tr>
<tr>
<td>Charlson Index score$^b$</td>
<td>0.97±1.50</td>
<td>0.62±1.09</td>
<td>.10</td>
</tr>
</tbody>
</table>

$^a$Data are presented as No. (percentage) of patients or mean ± SD.
$^b$Charlson Index is a comorbidity score giving larger weights to conditions related to lower 1-year survival.
is not true for NPs, who are allowed to practice independently in many states.⁵,⁶ Therefore, the actual level of supervision is not known. The degree of NP and PA supervision is more clearly articulated in health maintenance organizations and multispecialty clinics,¹¹ as well as in academic medical centers, in which NPs and PAs are increasingly used to offset resident duty hour limitations.²³ It appears that guidelines regarding NP and PA supervision are generally determined locally. We could find little literature that addresses the situation of NP and PA supervision,¹¹ suggesting the potential need for more universal guidelines regarding best practices for collaboration between NPs, PAs, and physicians. Therefore, future research should determine whether physician supervision of NPs and PAs has an effect on the quality of patient evaluation and referral to academic medical centers.

Our assessment of the quality of referrals to an academic general internal medicine practice revealed that the overall quality of referrals was suboptimal. Consequently, methods to improve this process should be studied, with shared input from both the referring health care professionals and the referral practices, such as those typically found at academic medical centers. Although some may argue that using NPs and PAs reduces health care costs, our study findings suggest that inappropriate referrals to tertiary referral centers by NPs/PAs could offset any potential savings. Finally, we postulate that optimizing the quality of referrals from both nonphysicians and physicians will be necessary to achieve an integrated, functional, national health care system that uses resources effectively.

Our study has several limitations. When conducting the assessments and statistical analyses, we pooled referral data for both NPs and PAs while recognizing that they have training unique to their respective degrees and, potentially, different skills. However, we would highlight that NPs and PAs are often considered to be similar groups in the contexts of practice settings, health care professional recruitment, and the literature.¹¹ Similarly, we were unable to determine what specialties comprised the referring physicians in our study cohort, although the internal Mayo Clinic referral data indicate that most of these physicians are primary care internists and family physicians. Many attributes of the referrals in this study are unknown, including the experience level of the referring health care professional, the level of supervision provided to NPs and PAs, patient panel sizes of the local practices, patient volumes seen on a typical day, and the extent to which patients may have requested their own referrals to Mayo Clinic. Nonetheless, our study results were based on a multivariate analysis that adjusted for patient age, sex, distance of the referral source from Mayo Clinic, and Charlson Index.

**CONCLUSION**

We found that the quality of previsit care and patient referrals to general internists at a tertiary...
medical center, on the basis of a validated assess-
ment by academic faculty members, was higher for
physicians than for NPs and PAs. Although pre-
vious research has examined the value of care
provided by NPs and PAs in supervised
settings, we are unaware of previous research
comparing referrals and care provided by physi-
cians, NPs, and PAs. Our findings indicate the
need for future studies to compare patient refer-
ral patterns between physicians, NPs, and PAs
with respect to higher-level outcomes such as pa-
sient satisfaction and quality of care metrics, as
well as research into optimal interdisciplinary
models for teams involving physicians, NPs, and PAs.

Abbreviations and Acronyms: NP = nurse prac-
titioner; PA = physician assistant

Grant Support: This work was financially supported by the Depart-
mament of Internal Medicine, Mayo Clinic, Rochester, MN.

Correspondence: Address to Robert H. Lohr, MD, Division
of General Internal Medicine, Mayo Clinic, 200 First St SW,
Rochester, MN 55905 (rlohr@mayo.edu).

REFERENCES

3. American Academy of Family Practice, American Academy of Pediatrics, American College of Physicians, American Osteo-
9. Blumenthal D, Abrams MK. Putting aside preconceptions—
11. Jacobson PD, Parker LE, Coulter ID. Nurse practitioners and physician assistants as primary care providers in institutional set-
13. Gershengorn HB, Johnson MP, Factor P. The use of nonphysi-
15. Kleinpell RM, Ely EW, Grabenkort R. Nurse practitioners and physician assistants in the intensive care unit: an evidence-
16. Fried TR, Tinetti ME, Iannone L. Primary care clinicians’ experi-
17. Subramanian U, Kerr EA, Klemmer ML, Zikmund-Fisher BJ, Hillerman RG, Hofer TP. Treatment decisions for complex pa-
tients: differences between primary care physicians and midlevel
21. Gillard JH, Szeke A, Hoff WS, Wannwright GA, Stehly CD, Toetler LJ. Utilization of PAs and NPs at a level I trauma cen-
ter: effects on outcomes. JAAPA. 2011;24(7):40-43.