Physician Specialization and the Quality of Care for Human Immunodeficiency Virus Infection

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Background: There is debate over the types of physicians who should treat patients with complex chronic medical conditions such as human immunodeficiency virus (HIV) infection. We sought to assess the relationship between specialty training and expertise and the quality of care delivered to patients with HIV infection.

Methods: We selected random samples of HIV-infected patients receiving care at 64 Ryan White CARE (Comprehensive AIDS Resources Emergency) Act–funded clinics throughout the country and their primary HIV physicians for an observational cohort study in which quality-of-care measures were assessed by medical record review.

Results: We studied 5247 patients linked to 177 physicians who responded to a survey. Fifty-eight percent of the physicians were general medicine physicians (“generalists”) and 42% were infectious diseases specialists. Sixty-three percent of the generalists (37% overall) considered themselves expert in HIV care. In hierarchical logistic regression models that controlled for patient characteristics, infectious diseases physicians and expert generalists had similar performance. In contrast, nonexpert generalists delivered lower quality care. More than 80% of the appropriate patients being cared for by infectious diseases physicians and expert generalists were receiving highly active antiretroviral therapy, compared with 73% of appropriate patients of nonexpert generalists (P<.001). Physicians with fewer than 20 patients with active HIV had fewer appropriate patients on highly active antiretroviral therapy (73% vs 82% of physicians with ≥20 such patients, P= .04) and saw patients less frequently.

Conclusion: These findings extend previous work by examining a range of quality-of-care measures and suggest that generalists with appropriate experience and expertise in HIV care can provide high-quality care to patients with this complex chronic illness.

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Introduction. It is important to know whether differences in quality between physicians with different training and expertise have persisted and exist across a broader range of treatment.

This study assessed the relationship between specialty training and expertise and the quality of care delivered recently to patients with HIV infection in a national sample of patients receiving care from clinics funded by the Ryan White Comprehensive AIDS Resources Emergency (CARE) Act. We compared the care provided by generalists with and without expertise in HIV care with that of ID physicians and assessed the independent impact of HIV case-load. We examined 8 different measures of quality in the areas of antiretroviral drug use, screening and prophylaxis, and delivery of routine services.

METHODS

OVERVIEW

As part of an evaluation of a quality-improvement program, we abstracted quality-of-care information from medical records and surveyed physicians caring for study patients about their background, training, and experience with treating HIV infection. The care was delivered in a nationally representative group of CARE Act–funded clinics.

PARTICIPANTS AND DATA COLLECTION

Study Site Selection

The evaluation study included 69 CARE Act–funded clinics that provided care for at least 100 patients with HIV infection during 1999. The sites included community health centers, community-based organizations, health departments, hospital outpatient clinics, and university medical centers.

Patient Sample

We identified random samples of patients at each of the clinics during 2 time periods corresponding to the beginning and end of the quality-improvement intervention. For the first sample, sites were asked to provide lists of all HIV-infected patients at least 18 years old seen at the site between January 1 and June 30, 2000, and for the second sample, sites were asked to provide a list of patients seen at the site between July 1 and December 31, 2001. We randomly selected up to 75 patients per sample for medical record reviews. For patients sampled in both periods, only data from the first period were included.

Clinician Identification and Data Collection

All clinicians providing care to HIV-infected patients at the sites were eligible for the clinician surveys, which were conducted in 2000 and 2001. A study facilitator at each of the clinics identified all relevant clinicians (including physicians, nurse practitioners, and physician assistants) with primary responsibility for caring for HIV-infected patients. We randomly sampled up to 5 clinicians to participate. Each survey was sent with a $20 incentive.

The overall response rate to the survey was 87%, and 243 distinct clinicians responded across its 2 waves. When a physician responded to both waves, we used his or her survey data from the first wave. If 2 surveys were received, the major predictors were almost always consistent. Sixty-six responses were received from nurse practitioners or physician assistants, and those clinicians were excluded from the current analysis, leaving a total of 177 physician responses. There were no differences in response rates according to region, type of clinic, or survey wave.

Linking Patients to Clinicians

As part of the medical record review, reviewers who worked at the clinics were asked to identify the name and qualifications (eg, physician, nurse practitioner, or physician assistant) of the clinician “who makes most of the major (eg, changing antiretroviral regimen) decisions regarding this patient’s care.” They identified a responsible clinician for 8841 of the 9020 patients in the study (98.0%). We were able to link 6551 (72.6%) of the 9020 medical record review patients with clinicians who responded to the survey. After eliminating 1304 patients who were linked to nonphysicians, the final sample included 5247 patients being cared for in 64 of the clinics (5 clinics did not have patients linked to physicians). The other patients were cared for by clinicians who were not sampled or did not respond to the survey.

Medical Record Review Procedures

Each clinic had 1 or 2 medical records reviewers (typically nurses). We first pilot tested the medical record review instrument with reviewers at 3 sites and modified the instrument on the basis of their feedback. We then sent the instrument to each of the remaining reviewers and asked them to review 2 or 3 charts at their clinics. Each reviewer then participated in a conference call with the investigators to review the instrument, identify problem questions, and clarify instructions.

Data were collected from each sampled patient’s medical record covering a 1-year period of care. No major changes in guidelines for HIV care were released during this period. The abstracted data included sociodemographic information such as age and sex, history of AIDS-defining conditions, comorbid medical or psychiatric conditions including current substance abuse or psychiatric illness, screening and prophylaxis for HIV-related conditions, number and timing of visits, CD4 counts, viral loads, and antiretroviral medications prescribed.

ANALYTIC VARIABLES

Quality of Care Measures

The quality-of-care measures (Table 1) were developed on the basis of consensus guidelines available during the study period. All measures were dichotomous, with defined criteria for eligibility for the measure and meeting the measure. Our primary focus was on rates of HAART use and control of HIV viral load for appropriate patients because we thought that antiretroviral treatment use would be most reflective of training and experience. Patients eligible for HAART included those with CD4 counts less than 500/µL or viral loads greater than 10 000 copies/mL, and patients already receiving HAART. Because of the variability in viral load assays then available, viral load was considered controlled if it was undetectable or less than 400 copies/mL. We also assessed the use of screening and prophylaxis, as well as access to care (defined as visits to any clinician during ≥3 possible quarters), and created a summary quality score that included the sum of all of the indicated measures.

Predictor Variables

Data on Physician Specialization. For these analyses, we used selected physician characteristics that were identified as predictors of care quality in previous analyses: physician spec-
pecialy training, experience treating HIV-infected patients as measured by current caseload, self-rated HIV-related expertise, and knowledge of HIV practices. Physicians were classified as being trained in infectious diseases or as general medicine/other (generalists). Based on previous analyses, we categorized the physicians’ current HIV caseload as low (0-19 patients), medium (20-299), or high (≥300). The physicians were also asked whether they considered themselves to be “experts” in the treatment of HIV, a measure that has been previously shown to be valid in predicting quality of care for HIV. Only 9 (12%) of 75 ID physicians in the sample did not consider themselves to be HIV experts. Therefore, to examine the joint effects of training and expertise in multivariable models, we created a composite training/expertise variable with 3 categories: ID physicians, expert generalists, and nonexpert generalists. As a sensitivity analysis, we also repeated our analyses after removing these 9 physicians and found no difference.

Physician Knowledge. The clinician survey included a series of 6 questions that asked about the physicians’ knowledge of current HIV treatment practices related to viral load testing and antiretroviral therapy. We therefore included the knowledge scale in analyses related to HAART use and viral load control. The number of correct responses formed a knowledge index. “Don’t know” responses were classified as incorrect.

Patient Control Variables. In all analyses, we controlled for patient age, sex, stage of disease based on lowest recorded CD4 count during the period of care, active psychiatric or substance abuse problem, history of AIDS-defining conditions, and other comorbid medical conditions.

STATISTICAL ANALYSIS

We first compared characteristics of the study sites to all Title III sites in the continental United States. To examine relationships between HIV caseload, the composite training/expertise variable, and knowledge and the quality-of-care measures, we estimated a series of hierarchical logistic regression models for the quality outcomes that controlled for physician, clinical, and sociodemographic characteristics, and for the clustering of patients within individual physicians and physicians within clinics. Because these coefficients are estimated on a logarithmic odds scale, we present transformed estimates on the probability scale to make them more interpretable. We first constructed a baseline model that controlled for patient-level effects and the period of care. We then estimated separate models that examined the individual effects of the joint training/expertise variable, knowledge (for the 2 antiretroviral treatment–related measures), and current HIV caseload. The final model included the joint effects of training/expertise and current HIV caseload together. For estimating the model for the overall quality scale, we used hierarchical linear regression. In previous analyses, no differences were found in quality of care between clinics that participated in the quality improvement intervention and those that did not, so participation in the intervention was not controlled for in these analyses.

RESULTS

SITE AND PHYSICIAN CHARACTERISTICS

Study clinics were representative of all CARE Act–funded clinics nationally (Table 2). Half of the clinics were hospital-based or community health centers, and 61% characterized themselves as specialized HIV clinics. The average age of the physicians was 43 years and 61% were male (Table 3). Fifty-eight percent of the physicians identified themselves as generalists and 42% were ID specialists. Sixty-three percent of the generalists (37% overall) considered themselves expert in the care of HIV. Compared with ID physicians and generalist experts, fewer nonexpert generalists were from rural clinics. Approximately 10% of the sample was caring for fewer than 20 patients each, whereas almost 20% had a caseload of 300 patients or more. The mean knowledge score overall was 5.1 (on a 6-point scale). Nonexpert generalists had significantly lower scores (mean, 4.3) than did ID physicians (mean, 5.3; P <.001) and expert generalists (mean, 5.2; P <.001).

PATIENT CHARACTERISTICS

The average patient was 41 years old and 28% were female (Table 4). Approximately 25% had hepatitis C, 15%...
had active drug abuse documented, and 10% had CD4 counts less than 50/µL. Infectious diseases physicians primarily cared for 2176 patients (41%), expert generalists cared for 2637 patients (50%), and nonexpert generalists cared for 434 patients (8%). Disease stage, as measured by lowest ever CD4 count, was similar across the 3 physician groups.

### PHYSICIAN CHARACTERISTICS AND INDIVIDUAL MEASURES OF QUALITY OF CARE

After controlling for patient characteristics, ID physicians and expert generalists had similar performance on all of the measures examined (Table 5). In contrast, nonexpert generalists had lower quality scores. More than 80% of the patients being cared for by ID physicians and expert generalists were receiving HAART, compared with 73% of patients being cared for by nonexpert generalists (P<.001). Thirty-one percent of the patients being cared for by nonexpert generalists had their viral load controlled, compared with 39% of patients for expert generalists and 41% for ID physicians (P=.01). Nonexpert generalists also gave influenza vaccinations less frequently and their patients were seen less frequently. For every 1-point increase in the physician knowledge score, the odds of patients having their viral load controlled increased by 1.14 (data not shown). Knowledge was not significantly related to HAART use. Physicians with fewer than 20 patients with active HIV had fewer appropriate patients receiving HAART (Table 5, 73% vs 82% of higher volume physicians, P=.04) and saw patients less frequently (50% with visits in 3 quarters compared with 68% for higher volume physicians, P=.002).

Findings for the summary quality score were similar (Figure). When all 3 predictors (including specialty training, caseload, and knowledge) were examined simultaneously, the contrast of nonexpert generalists with other physicians continued to be significant (P=.02), while the relationship with caseload was no longer significant.

### COMMENT

There has been a long-standing debate about the types of physicians who should treat patients with chronic medical conditions such as HIV infection.1-4,9,11 In this study, we examined the influence of both formal training and expertise (including caseload) on the treatment of a representative population of patients with HIV infection receiving care at CARE Act–funded clinics. Our group previously found that expert generalists appropriately used HAART at a rate similar to that of ID physicians.1,2 However, that study examined only a single quality measure shortly after its introduction. In addition to being more current, these findings extend previous research by examining a range of quality-of-care measures that represent different aspects of care for patients with HIV infection.1,2 Our results suggest that generalists with appropriate experience and expertise in a particular area can provide high-quality care to patients with complex chronic illness. Conversely, the approximately 10% of patients being cared for by nonexpert and/or low-volume physicians were less likely to receive the recommended treatments and testing we examined. Our results also suggest that, overall, the quality of care for these patients with HIV infection was suboptimal. These findings are consistent with national results from a wide variety of conditions.25
The pattern of findings was not consistent across all types of measures but conformed to a priori hypotheses. We expected that the largest differences would relate to antiretroviral treatment. The advent of multiple new drugs to treat HIV infection, their use in a variety of different combinations, and the multiple side effects that accompany HAART regimens make antiretroviral treatment the most challenging routine aspect of caring for HIV-infected patients. Measures related to the adequacy of antiretroviral treatment showed the strongest and most consistent differences between physicians with and without expertise. Conversely, with the exception of influenza vaccinations, rates of screening and preventive measures were similar across all types of physicians.

Our findings contrast with research done in other conditions where specialists tended to provide care deemed appropriate at higher rates than generalists did when processes of care were examined (using medical record reviews or patients’ reports) for acute myocardial infarction, unstable angina, asthma, acute arthritis, multiple sclerosis, and depression. Previous research in HIV has shown that patients of physicians with more experience in treating HIV had lower mortality (early on in the epidemic) and earlier access to antiretroviral therapy. Most of these studies, however, did not account for different levels of expertise among generalists or examine higher cutoffs for volume. A survey by Stone et al supports our findings that generalists can develop expertise in HIV infection. In a

Table 4. Characteristics of Study Patients by Type of Physician Seen

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All Patients (N = 5247)</th>
<th>Patients Seen by ID Physicians (n = 2176)</th>
<th>Patients Seen by Expert Generalists (n = 2637)</th>
<th>Patients Seen by Nonexpert Generalists (n = 434)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient age, mean (SD), y</td>
<td>40.7 (8.8)</td>
<td>40.5 (9.0)</td>
<td>40.9 (8.7)</td>
<td>40.5 (8.8)</td>
</tr>
<tr>
<td>Female, %</td>
<td>28.0</td>
<td>28.0</td>
<td>23.4</td>
<td>24.8*</td>
</tr>
<tr>
<td>AIDS-defining conditions, mean (SD), No.</td>
<td>0.2 (0.5)</td>
<td>0.20 (0.50)</td>
<td>0.15 (0.44)†</td>
<td>0.16 (0.50)</td>
</tr>
<tr>
<td>Comorbid conditions, mean (SD), No.</td>
<td>0.4 (0.7)</td>
<td>0.42 (0.70)</td>
<td>0.40 (0.69)†</td>
<td>0.37 (0.65)</td>
</tr>
<tr>
<td>Hepatitis C positive test result, %</td>
<td>24.7</td>
<td>24.9</td>
<td>23.2</td>
<td>32.7††</td>
</tr>
<tr>
<td>Psychological disorders, %</td>
<td>31.3</td>
<td>32.2</td>
<td>29.8</td>
<td>35.7††</td>
</tr>
<tr>
<td>Drug abuse documented, %</td>
<td>14.8</td>
<td>14.0</td>
<td>13.8</td>
<td>25.1††</td>
</tr>
<tr>
<td>Lowest CD4 count during the review period, cells/µL, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-49</td>
<td>10.4</td>
<td>11.1</td>
<td>9.6</td>
<td>12.0</td>
</tr>
<tr>
<td>50-199</td>
<td>20.4</td>
<td>20.5</td>
<td>20.0</td>
<td>22.4</td>
</tr>
<tr>
<td>200-499</td>
<td>42.7</td>
<td>42.1</td>
<td>43.5</td>
<td>41.2</td>
</tr>
<tr>
<td>≥500</td>
<td>26.5</td>
<td>26.3</td>
<td>26.9</td>
<td>24.4</td>
</tr>
</tbody>
</table>

Abbreviation: ID, infectious diseases.
*P < .01 for ID physicians vs expert generalists or nonexpert generalists.
†P < .01 for expert generalists vs nonexpert generalists.
‡P < .05 for ID physicians vs expert generalists or nonexpert generalists.
§P < .05 for expert generalists vs nonexpert generalists.

Table 5. Association Between Rates of Achieving Individual Quality Measures and Physician Characteristics

<table>
<thead>
<tr>
<th>Physician Predictor†</th>
<th>HIV Care</th>
<th>Screening</th>
<th>Routine Care</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HAART</td>
<td>VL</td>
<td>PCP Prophylaxis</td>
</tr>
<tr>
<td>Specialty</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID physician</td>
<td>0.83</td>
<td>0.41</td>
<td>0.64</td>
</tr>
<tr>
<td>Expert generalist</td>
<td>0.82</td>
<td>0.39</td>
<td>0.72</td>
</tr>
<tr>
<td>Nonexpert generalist</td>
<td>0.73‡‡</td>
<td>0.31§§</td>
<td>0.69</td>
</tr>
<tr>
<td>HIV caseload, No.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-19</td>
<td>0.73‡‡</td>
<td>0.30</td>
<td>0.69</td>
</tr>
<tr>
<td>20-299</td>
<td>0.82</td>
<td>0.39</td>
<td>0.73</td>
</tr>
<tr>
<td>≥300</td>
<td>0.80</td>
<td>0.37</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Abbreviations: HAART, highly active antiretroviral therapy; HIV, human immunodeficiency virus; ID, infectious diseases; OP, outpatient; PCP, Pneumocystis jirovecii pneumonia; PPD, purified protein derivative; VL, viral load.
*All results are presented as percentage rates after adjustment for patient characteristics including age, sex, stage of disease based on lowest recorded CD4 count over the period of care, active psychiatric or substance abuse problem, history of HIV-related diagnoses, and other comorbid medical conditions. The adjusted rates represent the estimated probability of receiving the indicator for a hypothetical person with average characteristics.
†Infectious diseases physician is the omitted category for specialty; caseload of 20 to 299 is the omitted category for HIV caseload.
‡P < .05.
§P < .01.
‖P = .002.
national survey using vignettes, they found that generalists who reported providing care for HIV-infected patients were equally likely to appropriately prescribe antiretroviral therapy.

Our findings also suggest that acquiring expertise in HIV care differs from the “practice makes perfect” model observed in surgical specialties. Previous work by our group demonstrates that a physician can acquire expertise by virtue of interest in a particular condition and through multiple means, including attending continuing medical education courses and conferences and keeping up with the literature, without being a high-volume HIV provider. Thus, while we found that lower volume physicians provided care of lower quality, there did not seem to be a relationship to volume over a threshold.

Our study has several limitations. First, we studied clinicians being funded by Title III of the CARE Act Program. In 2001, such programs served more than 150,000 patients. Almost two thirds of these low-income patients were from racial/ethnic minority groups. The clinics in our study were representative of clinics receiving CARE Act funding. An advantage of studying this population is that their health care is supported by the CARE Act and the patient population is more homogeneous. However, the results may not be generalizable to other outpatient settings. Second, we did not have data on the treating clinician for all of the patients in our sample. This was due to how physicians were selected as well as nonresponse. Third, we were not able to contact patients for this study and therefore could not analyze other important outcomes, including patient satisfaction and experiences with care. In addition, other important aspects of care, including accessibility, counseling, coordination, continuity, and comprehensiveness of services, are difficult to measure from medical records.

In summary, in this national study of more than 5000 patients, we found that generalists with expertise in HIV infection provided a quality of care equal to that of specialists trained in infectious diseases on multiple important components of outpatient care for HIV infection. Guidelines and strategies to improve care for HIV should therefore promote the use of expert generalists as well as ID physicians. Developing strategies to obtain appropriate expert input for patients who receive care from non-expert generalists might also lead to improved outcomes.

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