Accuracy in Pharmacoeconomic Literature Review: Lessons Learned From the Navajo Code Talkers

Kathleen A. Fairman, MA

The Navajo Code Talkers, who faithfully transmitted messages in an indecipherable code to support U.S. military efforts from 1942 to 1945, are widely credited with the achievement of numerous victories in the Pacific theater during World War II (WWII), among them the capture of Iwo Jima by the Marine Corps in 1945.¹⁻³ Originally a highly classified military secret, the Code Talkers' work was completely unknown to the American public—and even to the Code Talkers' own families—until its declassification in 1968.⁴ Official recognition of the Code Talkers' accomplishments did not come until 1992, a half-century after their work began.²

The hallmark of the Code Talkers' work was a rapid but exacting translation process. Receiving messages in “a string of seemingly unrelated Navajo words,” each Code Talker first translated the words to English, then used the first letter of each English word to spell out an English message.² In addition, both for security purposes and to speed translation, the Code Talkers memorized a dictionary of an astonishing 450 Navajo words representing commonly used military terms; for example, the word “besh-lo” (iron fish) referred to a submarine, “dah-he-tih-hi” (hummingbird) was a fighter plane, and “debeh-li-zine” (black street) indicated a squad.^{2,3}

Because of the innate complexity of the Navajo language, the use of multiple Navajo words to represent a single English letter, and the detailed nature of the translation process, the code was both impossible for anyone else to decipher and painstakingly difficult for the Code Talkers themselves. “When we were in the [training] classroom we were drilled and drilled,” one Code Talker recalled in a 2005 interview. “No writing it down. It was all memorized. ... At the end of the class you had to hand in every pencil and piece of paper.”¹ Yet, despite the difficulty of the work and the pressures of performing it during combat, the Code Talkers consistently turned in error-free performances. During the first 2 days of the battle of Iwo Jima, 6 Code Talkers worked around the clock to transmit 800 messages, all with 100% accuracy.²

With some dismay, *JMCP* editors have recently noted that an increasing number of literature reviews, both in published work and in manuscripts submitted to us, bear little or no resemblance to the careful translations that characterized the heroic cryptographers of WWII. It is common for us to read in a submitted manuscript a statement that “in Disease A, Drug X is widely accepted as more efficacious than Drug Y,” only to find in our research that the source cited for the statement investigated a dif-

ferent disease state, studied only a handful of people, produced a finding that Drug X was not superior to Drug Y, or otherwise did not support the alleged claim.

A case in point is found in examination of the literature published in the years following Soumerai et al.'s 1991 often-cited study of the effect of a medication coverage limit on a sample of chronically ill elderly Medicaid enrollees in New Hampshire.⁵ A comparison of the original study report with descriptions of the study that were provided in later manuscripts provides a revealing and at times disturbing look at the uses—and abuses—of medical literature applied in the service of making a point. This editorial reviews a sample of those descriptions and suggests a direction for the future.

The Original Study: Medicaid Prescription Drug Restrictions and Use of Hospital and Nursing Home Services

Soumerai et al.'s 1991 study assessed the relationship between a prescription drug “cap,” a limit of 3 filled prescriptions per month per Medicaid recipient, and admissions to nursing homes and inpatient hospitals. The cap had been implemented in the New Hampshire Medicaid program in September 1981 and replaced 11 months later, in August 1982, with a \$1 prescription drug copayment.^{5,6} The study authors used a quasi-experimental, time series with comparison group design to assess outcomes for a subset of Medicaid enrollees ($n = 411$) who met clinical and demographic criteria indicating older age and chronic illness (Table 1). The comparison group ($n = 1,375$), which was drawn from the New Jersey Medicaid population, met the same inclusion criteria but had not been subject to any prescription drug cost-sharing or coverage limitations.

Outcomes, including medication use and admissions to inpatient hospitals and nursing homes, were measured during a 5-month pre-implementation period, the 11-month cap period, and for 11 months after the replacement of the cap with the copayment. Measured in “standardized monthly doses” (SMDs) per patient per month (PPPM), defined as “the median number of milligrams of active ingredient per month received by all the patients who filed a claim for each study drug,” medication use rates for the New Hampshire cohort declined from a pre-implementation rate of 2.8 SMDs PPPM to a cap period rate of 1.9 SMDs PPPM. Time-series analysis indicated that the change represented a 35% drop. By the end of the 11-month cap period, nursing home admission rates were 10.6% and 6.6% for the New Hampshire and New Jersey cohorts, respectively. The relative risk

(RR) of nursing home admission for the sample overall was 1.8 (95% confidence interval [CI] = 1.2-2.6).

The results most frequently reported for the study are derived from a *subsample* of study patients (48% of 411 in New Hampshire and 55% of 1,375 in New Jersey) who had at least 8 claims per year for at least 3 *chronic* medication classes (including the “core” therapeutic classes used in the sampling process plus 21 therapeutic classes for treatment of cardiovascular disease, diabetes, psychiatric disorders, pain, and other conditions). For this *subsample*, nursing home admission rates were 14.4% for New Hampshire and 6.2% for New Jersey; the reported RR of nursing home admission for New Hampshire was 2.2 (95% CI = 1.2-4.1).⁵ However, among those who did *not* meet the subsample criteria, the relationship between the cap and nursing home admission was not statistically significant.⁵ Moreover, even among those who did meet the subsample criteria, rates of hospital admission for New Hampshire and New Jersey Medicaid recipients during the cap period did not significantly differ (RR=1.2, 95% CI=0.8-1.6).⁵ Attributing their findings to either “declining health” because of “loss of medications” or “financial reasons” arising from additional medication expense, Soumerai et al. concluded that their findings “raise questions about the clinical and economic wisdom” of “limits on drug reimbursement” in state Medicaid programs.⁵

Shortly after the study’s publication, a commentary by Schulz and Lewis raised several concerns about its conclusions, calling them “tentative at best.”⁷ One of the most compelling of Schulz and Lewis’s stated reasons for skepticism about the study’s findings was the lack of relationship between the cap and hospital admission. If the cap had resulted in deteriorating health status, Schulz and Lewis pointed out, one would logically expect both hospital and nursing home use to be affected. Schulz and Lewis also appropriately questioned the logic of Soumerai et al.’s alternative explanation for their findings—that community-dwelling elderly had entered nursing homes in order to avoid paying out-of-pocket for medications. Schulz and Lewis concluded with the important prediction that, although the sampling criteria used by Soumerai et al. were so restrictive that their results were “not representative of a sizeable group of the population,” the “appeal of the authors’ conclusions to some [health care] constituencies” would raise “the danger that broad generalizations will be voiced, and policy decisions may be influenced, by a study whose conclusions should be interpreted cautiously.”⁷

Descriptions of the Soumerai et al.

Study in the Research Literature: 1991-2001

Schulz and Lewis’s expectation that Soumerai et al.’s findings would have broad appeal was certainly realized in the years following the study’s publication. To date, more than 300 published papers have cited the work.⁸ Consistent with Schulz and Lewis’s concerns, examination of a convenience sample of these publications reveals numerous serious errors in describing the

TABLE 1 Sample Selection Criteria for Soumerai et al. Study of Medicaid Drug Payment Cap⁵

- Aged 60 years or older
- White race
- No nursing home admissions during the 6 pre-implementation months
- Filled a mean of 3 or more prescriptions per month (total of 36 claims) for any medications during baseline pre-implementation year
- At least 1 prescription per quarter for any medications during baseline year
- “Regular use” (at least 8 claims per year) of at least 1 “core” medication, defined as a drug in any of the following therapeutic classes—antianginal drugs, loop diuretics, antiarrhythmic agents, bronchodilators, inhaled steroids, insulin, anticoagulants, and anticonvulsants—during baseline year

study’s results (Table 2).⁹⁻²⁴ The most common and serious error was attributing inpatient hospitalizations to the cap although Soumerai et al. found no significant relationship between the cap and hospital admission rates.^{9,11-13,19,21,23}

Additional errors occurred when describing the cap itself, which was commonly represented as a formulary.^{12,16,19-21} Similarly, one description of the paper attributed negative outcomes to *copayments* despite Soumerai et al.’s finding that the risk of nursing home admission returned to its baseline (pre-cap) level when the cap was replaced by a \$1 copayment.^{5,15} Notably, some discussions of the work cited outcomes that were not even studied by Soumerai et al.; these included changes in physician practice patterns, prescribing rates, emergency room use, and even mortality.^{12,14,18,22,24}

More recently, an erroneous description of the study appeared in a 2007 publication (not shown in Table 2), which stated that the cap “was found to be associated with increased nursing home admissions 10 years after implementation.”²⁵ The statement implied that the risk of nursing home admission continued to be elevated 10 years after cap implementation; in fact, the original study report indicated that the nursing home admission rate reverted to pre-cap levels upon replacement of the 3-prescription cap with the \$1 copayment.

As Schulz and Lewis predicted in 1992, a particularly common error, appearing in numerous publications not shown in the table, was failing to describe the highly selective clinical characteristics of Soumerai et al.’s subsample.²⁶⁻³⁵ Omission of the subsampling criterion of at least 8 claims per year for at least 3 chronic medication classes is an especially important mistake because among those with less regular use (i.e., either less than 3 chronic medication classes or less regular use of 3 or more chronic classes), the risk of nursing home admission was not significantly related to the cap.⁵ Thus, decision-makers relying on these publications for information would be given the erroneous impression that the increased nursing home risk applied to all Medicaid enrollees, to all elderly Medicaid enrollees, or to all elderly Medicaid enrollees with chronic disease. Such a misimpression limits the opportunity

TABLE 2 Soumerai et al. Study of Medicaid Payment Cap: Inaccurate Descriptions—1991-2001

Study (First Author and Year)	Were key details about the sample reported?			Description of Findings	Problem(s) in Description
	Low Income ^a	Elderly	Chronic Medication Use ^b		
Balkrishnan, 1998 ⁹	Yes	Yes	No	The cap “was associated with an increased risk of admission to nursing homes ... and hospitalization (RR=1.2; 95% CI, 0.8-1.6).”	• As the RR shows, the relationship between the cap and hospitalization risk was not statistically significant.
Billings, 1996 ¹⁰	Yes	No	No	“Studies of state changes in Medicaid programs that limited eligibility also have demonstrated a significant decline in access to care as well as health outcomes.”	• Soumerai et al. did not study eligibility limitations or access to care.
Blustein, 1998 ¹¹	NA	NA	NA	“Barriers to securing medications ... could have increased the likelihood of preventable hospitalization among poorer elders” (in Blustein et al.’s sample).	• Relationship between the cap and hospitalization risk was not statistically significant.
Bukstein, 1997 ¹²	No	No	No	Generic substitution and formulary use could mean that “expenditures for other resources, such as hospitalizations, emergency room visits, and inappropriate antibiotic use associated with acute asthma episodes” would increase.	• Soumerai et al. did not study generic substitution, formulary changes, antibiotics, asthma, or emergency room visits. • Relationship between the cap and hospitalization risk was not statistically significant.
Elliott, 1996 ¹³	Yes	No	No	After the cap, New Hampshire’s savings on prescription costs were “accompanied by a 20% increase in use of hospital services and a 220% increase in admissions to nursing homes.”	• Relationship between the cap and hospitalization risk was not statistically significant. • A 220% increase would have been a nursing home rate of about 20%, or a RR of about 3.2 (not 2.2).
Fraser, 1996 ¹⁴	No	No	No	In a study of an educational program intended to change physicians’ digoxin monitoring behavior, cited Soumerai et al. to support the statement: “Modification of physicians’ practices carries the risk of causing patient harm while effecting change.”	• Soumerai et al. did not study physicians’ practices.
Hennessey, 2000 ¹⁵	Yes	No	No	“Even among those covered by Medicaid, coverage limits and copayments reduce medication use and worsen clinical outcomes.”	• Soumerai et al. found that nursing home admission rates returned to pre-cap levels upon institution of a \$1 copayment to replace the cap.
Horn, 1996 ¹⁶	No	No	No	“Formularies and other pharmaceutical management programs...[could] shift costs to other service areas.”	• The New Hampshire cap was not a formulary.
Johnstone, 1993 ¹⁷	No	No	No	“Studying only medical results without including costs, or costs without medical results, can lead to erroneous, if not disastrous, decisions.”	• Soumerai et al. did not study costs versus medical results.
Lipton, 1993 ¹⁸	No	No	No	Exogenous factors, such as reimbursement policies and formularies, “influence prescribing decisions.”	• Soumerai et al. did not study prescribing decisions.
Lo, 2000 ¹⁹	No	No	No	“...formulary restrictions that reduce drug costs may be associated with increased hospitalizations and total health care costs if beneficial drugs are excluded.”	• The New Hampshire cap was not a formulary. • Relationship between the cap and hospitalization risk was not statistically significant.
Miller, 2000 ²⁰	No	No	No	“...many studies of restricted formularies in the [United States] have provided evidence that pharmaceutical consumption has a positive impact on health.”	• Despite the reference to “many” studies, only the New Hampshire cap study was cited. • The cap was not a formulary. • The cap study did not directly measure the impact of pharmaceutical consumption on health.

TABLE 2 Soumerai et al. Study of Medicaid Payment Cap: Inaccurate Descriptions—1991-2001
(continued from previous page)

Study (First Author and Year)	Were key details about the sample reported?			Description of Findings	Problem(s) in Description
	Low-Income ^a	Elderly	Chronic Medication Use ^b		
Morreim, 1998 ²¹	No	No	No	"Tightly constrained drug formularies may save short-term pharmacy costs, but they can raise rates of hospitalization and emergency room use because some patients experience greater side-effects and adherence problems from older, cheaper, or generic drugs that are not quite equivalent to their newer counterparts."	<ul style="list-style-type: none"> • The New Hampshire cap was not a formulary. • Relationship between the cap and hospitalization risk was not statistically significant.
Powe, 1993 ²²	No	No	No	"...there have been few empirical studies which have provided strong evidence that federal payment policies can directly influence medical practice."	<ul style="list-style-type: none"> • Soumerai et al. did not study medical practice.
Rosenberg, 1994 ²³	Yes	No	No	The cap "put Medicaid recipients at much higher risk of hospitalization (50% higher than the control group)."	<ul style="list-style-type: none"> • Relationship between the cap and hospitalization risk was not statistically significant. • The RR was 1.2, which would have indicated a 20% increase if statistically significant.
Sumner, 1993 ²⁴	Yes	Yes	Yes	The cap "was associated with an increased nursing home admission rate and an increased mortality rate..."	<ul style="list-style-type: none"> • Soumerai et al. did not measure mortality rate.

^aIncludes explanations that the sample consisted of Medicaid enrollees.

^bFull disclosure would include mention of the subsample criterion of at least 8 claims for at least 3 chronic medications. No study shown in the table mentioned that criterion. A "Yes" in the table indicates mention of chronic disease.

CI=confidence interval; RR=relative risk.

of the decision-maker to target benefit design decisions to those unlikely to be harmed by them. In that regard, it is notable that the subsample (n=approximately 197 [48% of 411] enrollees) in which the nursing home admission rate was elevated represented less than 2% of the 10,734 continuously enrolled New Hampshire Medicaid recipients affected by the cap.⁶

We Can Do Better: Literature Review That Is Both Accurate and Concise

A suggested checklist for literature review descriptions is shown in Table 3. Although not intended to be comprehensive, the checklist presents the core basic elements that should be included in a description of previously published research. As the examples demonstrate, descriptions do not have to be lengthy, and it rarely takes many more words to describe a study adequately than to describe it inadequately. The key to informative literature review is specificity.

Descriptions should be sufficiently complete to give managed care decision-makers a sense of the degree to which the study group represents the population about which decisions must be made. For example, a study sample consisting primarily of males treated at Department of Veterans Affairs (VA) clinics for congestive heart failure would appear to have limited applicability to a commercially insured population in a service industry such

as banking that employs primarily young females. Descriptions should also indicate absolute rates rather than relying solely on relative rates. For example, the phrase "a 100% increase in risk" could represent a change either from 1% to 2% or from 25% to 50%, yet these ranges clearly have very different clinical and economic implications. Readers should also be given the temporal context for a study within clinically meaningful time frames; for example, they should be told if a study of routine clinical practice was conducted before or after the promulgation of key clinical guidelines or the development of an important technique that changed medical practice patterns.

Learning From the Navajo Code Talkers

Although pharmacoeconomic literature review is unlikely ever to approach the level of importance of the work of the Code Talkers, providing accurate information to managed care decision-makers is becoming increasingly critical as debate over health care policy proposals becomes progressively more intense. Consider what the outcome of WWII might have been, had the Navajo Code Talkers approached their work with the same complacency that characterizes too much of medical research literature review today. If those of us who promulgate information about health care evidence can achieve even a fraction of the dedication, attention to detail, and accuracy that

TABLE 3 Literature Review Brief Checklist for Writing About Previous Work

Principle to Disclose	Description Should Include	Example of Sufficient Descriptive Phrase ^a	Example of Insufficient Descriptive Phrase ^a
Who	1. Demographic and clinical characteristics 2. Key sample selection criteria	<ul style="list-style-type: none"> Male veterans receiving treatment at VA Clinics for congestive heart failure Used 2 or more medications to treat cardiac disease during a 6-month pre-intervention period 	<ul style="list-style-type: none"> Veterans with serious cardiac disease Patients using chronic medications
What	3. Specific outcomes measured 4. Time period for measurement 5. Absolute findings, not just relative ratios 6. Number of cases	<ul style="list-style-type: none"> Hospitalization rate was 5.2% in the comparison group and 2.2% in the intervention group (OR 2.44; 95% CI=1.24-3.64) in 6 months of follow-up 	<ul style="list-style-type: none"> Intervention group patients were 58% less likely to be hospitalized. The intervention significantly reduced hospitalization risk.
When and Where	7. Time period for conduct of study, especially if standards of care have changed over time 8. Type of setting 9. Diagnoses and ICD-9-CM codes, especially for claims database studies if comparing to a different claims database study	<ul style="list-style-type: none"> Patients receiving at least 1 office visit for hypercholesterolemia during 2003, 1 year prior to the publication of ATP-III guidelines in April 2004 Patients receiving care for schizophrenia at a clinic that serves primarily Medicaid and working poor patients Patients with a primary diagnosis of unspecified chest pain (ICD-9-CM code of 786.50 or 786.59) for an emergency room visit (revenue codes 450-459) during 2005 	<ul style="list-style-type: none"> Patients diagnosed with hypercholesterolemia Patients who are low-income and mentally ill Patients receiving care from an emergency room

^a Examples are hypothetical.

ATP-III=Adult Treatment Panel III; CI=confidence interval; ICD-9-CM=International Classification of Diseases, Ninth Revision, Clinical Modification; OR=odds ratio; RR=relative risk; VA=Department of Veterans Affairs.

characterized the work of the Code Talkers, we will be much closer to informed decision-making that will deliver high-quality and cost-effective care.

Author

KATHLEEN A. FAIRMAN, MA, is Associate Editor and Senior Methodology Reviewer of the *Journal of Managed Care Pharmacy*.

AUTHOR CORRESPONDENCE: Kathleen A. Fairman, MA, Kathleen Fairman LTD, P.O. Box 31278, Phoenix, AZ 85046. Tel.: 602.867.1343; E-mail: kfairman@amcp.org

DISCLOSURES

The author reports no conflicts of interest related to the subjects or products discussed in this article.

REFERENCES

1. The Navajo language: a blessing in disguise—Interview with Keith Morrison Little on January 23, 2005. Available at: www.bpcmp.com/history/interview_transcripts.html. Accessed October 25, 2008.
2. Navajo Code Talkers: World War II Fact Sheet. Department of the Navy. Available at www.history.navy.mil/faqs/faq61-2.htm. Accessed October 25, 2008.
3. Six Navajo Code Talkers take part in dedication of new Marine Corps network operations, Security Command. The Navajo Nation. May 22, 2007. Available at: www.navajo.org/images/pdf%20releases/George%20Hardeen/may07/Six%20Navajo%20Code%20Talkers%20take%20part%20in%20dedication%20of%20new%20Marine%20Corps%20Network%20Operations,%20Security%20Command_May22.pdf. Accessed October 25, 2008.
4. Honoring the Navajo Code Talkers Act. Congressional Record: April 12, 2000 (Senate). Available at: www.fas.org/irp/congress/2000_cr/s041200.html. Accessed October 25, 2008.
5. Soumerai SB, Ross-Degnan D, Avorn J, McLaughlin TJ, Choodnovskiy I. Effects of Medicaid drug-payment limits on admission to hospitals and nursing homes. *N Engl J Med*. 1991;325(15):1072-77.
6. Soumerai SB, Avorn J, Ross-Degnan D, Gortmaker S. Payment restrictions for prescription drugs under Medicaid: Effects on therapy, cost and equity. *N Engl J Med*. 1987;317:550-56.
7. Schulz RM, Lewis NJW. Payment restrictions for prescription drugs under Medicaid. *Pharmacoeconomics*. 1992;1(3):217-19.
8. Google Scholar. Available at: http://scholar.google.com/scholar?hl=en&lr=&cites=14479705701467177870&um=1&ie=UTF-8&sa=X&oi=science_links&resnum=5&ct=sl-citedby. Accessed October 25, 2008.
9. Balkrishnan R. Predictors of medication adherence in the elderly. *Clin Ther*. 1998;20(4):764-70.
10. Billings J, Kretz SE, Rose R, et al. National Asthma Education and Prevention Program working group report on the financing of asthma care [suppl]. *Am J Respir Crit Care Med*. 1996;154:S119-S130.
11. Blustein J, Hanson K, Shea S. Preventable hospitalizations and socioeconomic status. *Health Aff (Millwood)*. 1998;17(2):177-89.

12. Bukstein DA. Incorporating quality of life data into managed care formulary decisions: A case study with salmeterol. *Am J Manag Care*. 1997;3:1701-06.
13. Elliott WJ. The costs of treating hypertension: What are the long-term realities of cost containment and pharmacoeconomics? *Postgrad Med*. 1996;99(4):241-52.
14. Fraser GL, Wennberg DE, Dickens JD, Lambrew CT. Changing physician behavior in ordering digoxin assays. *Ann Pharmacother*. 1996;30:449-54.
15. Hennessey S. Potentially remediable features of the medication-use environment in the United States. *Am J Health Syst Pharm*. 2000;57:543-48.
16. Horn SD. Unintended consequences of drug formularies. *Am J Health Syst Pharm*. 1996;53:2204-06.
17. Johnstone RE, Martinec CL. Costs of anesthesia. *Anesth Analg*. 1993;76:840-48.
18. Lipton HL, Bird JA. Drug utilization review in ambulatory settings: State of the science and directions for outcomes research. *Med Care*. 1993;31(12):1069-82.
19. Lo B, Alpers A. Uses and abuses of prescription drug information in pharmacy benefits management programs. *JAMA*. 2000;283(6):801-06.
20. Miller RD, Frech HE. Is there a link between pharmaceutical consumption and improved health in OECD countries? *Pharmacoeconomics*. 2000;18(Suppl 1):33-45.
21. Morreim EH. Revenue streams and clinical decisions. *J Am Geriatr Soc*. 1998;46:311-37.
22. Powe NR, Griffiths RI, Anderson GF. Medicare payment policy and recombinant erythropoietin prescribing for dialysis patients. *Am J Kidney Dis*. 1993;22(4):557-67.
23. Rosenberg GB. Opportunities for alliances between industry and pharmacy. *Am J Hosp Pharm*. 1994;51:3061-65.
24. Sumner B, Lurie N. Financial payment systems and asthma care [suppl]. *Med Care*. 1993;31(3):MS74-MS81.
25. Wharam JF, Daniels N. Toward evidence-based policy making and standardized assessment of health policy reform. *JAMA*. 2007;298(6):676-77.
26. Beers MH, Baran RW, Frenia K. Drugs and the elderly, part 1: The problems facing managed care. *Am J Manag Care*. 2000;6(12):1313-20.
27. Benjamin KL, Perfetto EM, Greene RJ. Public policy and the application of outcomes assessments: Paradigms versus politics [suppl]. *Med Care*. 1995;33(4):AS299-AS306.
28. Cromwell DM, Bass EB, Steinberg EP, et al. Can restrictions on reimbursement for anti-ulcer drugs decrease Medicaid pharmacy costs without increasing hospitalizations? *Health Serv Res*. 1999;33(6):1593-1610.
29. Dombrower H, Izukawa TA, Veinich SL. Factors affecting access to drug therapy in the elderly. *Drugs Aging*. 1998;13(4):303-09.
30. Freemantle N, Bloor K. Lessons from international experience in controlling pharmaceutical expenditure. I: influencing patients. *BMJ*. 1996;312:1469-71.
31. Greco PJ, Eisenberg JM. Changing physicians' practices. *N Engl J Med*. 1993;329(17):1271-74.
32. Hershey CO, Lanham RJ, Colligan NR, et al. Medicaid caps: Implications for ambulatory services in academic medical centers. *Med Care*. 1995;33(1):119-25.
33. Lillard LA, Rogowski J, Kington R. Insurance coverage for prescription drugs: Effects on use and expenditures in the Medicare population. *Med Care*. 1999;37(9):926-36.
34. Ray WA. Policy and program analysis using administrative databases. *Ann Intern Med*. 1997;127:712-18.
35. Hsu J, Price M, Huang J, et al. Unintended consequences of caps on Medicare drug benefits. *N Engl J Med*. 2006;354:2349-59.