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Completeness of Retail Pharmacy Claims Data: Implications for Pharmacoepidemiologic Studies and Pharmacy Practice in Elderly Adults

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Abstract

Background—In the elderly (those aged ≥65 years), retail pharmacy claims are used to study drug use among the uninsured after drug policy changes, to prevent drug drug interactions and duplication of therapy, and to guide medication therapy management. Claims include only prescriptions filled at one pharmacy location or within one pharmacy chain and do not include prescriptions filled at outside pharmacies, potentially limiting research accuracy and pharmacy-based safety interventions.

Objectives—The aims of this study were to assess elderly patients' pharmacy loyalty and to identify predictors of using multiple pharmacies.

Methods—Patients enrolled in the Pharmaceutical Assistance Contract for the Elderly pharmacy benefit program with corresponding Medicare claims in the state of Pennsylvania comprised the study cohort. Among patients with pharmacy claims from all pharmacies used in 2004–2005, a *primary pharmacy* was defined as the pharmacy where >50% of a patient's prescriptions were filled. The number of pharmacies/chains used and prescriptions filled in 2005 was calculated. Predictors of using multiple pharmacies in 2005 were age, gender, race, urban residency, comorbidities, number of unique medications used, and number of prescriptions, which were all assessed in 2004.

Results—In total, pharmacy claims data from 182,235 patients (147,718 [81.1%] women; mean [SD] age 78.8 [7.1] years; 168,175 white; 76,580 residing in an urban zip code area) were included. In 2005, patients filled an average of 59.3 prescriptions, with 57.0 (96.1%) prescriptions having been filled at the primary pharmacy. Compared with patients who used <5 unique medications in 2004, patients who used 6 to 9 unique medications had 1.39 times (95% CI, 1.34–1.44), and patients who used 15 unique medications had 2.68 times (95% CI, 2.55–2.82) greater likelihood of using multiple pharmacies in 2005. Patients aged ≥85 years were 1.07 times (95% CI, 1.03–1.11) as likely to use multiple pharmacies compared with patients aged 65 to 74 years.

Conclusions—This study found that patients aged ≥65 years were loyal to their primary pharmacy, offering reassurance to researchers and pharmacists who use retail pharmacy claims to evaluate and/or to improve safe and appropriate medication use among the elderly. Care should be used in analyzing claims from or managing the drug regimens of patients using many medications or patients

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aged ≥85 years; they are more likely to use multiple pharmacies and thus are more likely to have missing prescription information.

Keywords

retail pharmacy; medication errors; drug utilization; loyalty; missing data

INTRODUCTION

With increasing frequency, researchers and pharmacists have relied on retail pharmacy claims data for information about patients' drug utilization. Researchers use retail pharmacy claims to study drug use among patients who do not have drug insurance.[1] Retail pharmacy claims have also been particularly helpful in assessing patient drug utilization before and after the implementation of Medicare Part D (Part D),[1–4] which expanded the federal government's role in providing drug coverage to elderly (aged ≥65 years) Americans.[5] Pharmacists use retail pharmacy claims to assist in the prevention of drug–drug interactions[6] and duplication of therapies,[7,8] and to identify other medication-related errors,[9] improve adherence to medication regimens,[10] and implement medication therapy management programs (MTMPs).[11] Because the Medicare Modernization Act of 2003 mandates that Part D plans have such programs in place, MTMPs have become increasingly prevalent.[12,13] The success of both safety protocols and MTMPs depends on the completeness of pharmacy claims data.

Despite the utility of retail pharmacy claims data, these claims include only prescriptions filled at one pharmacy location or within one retail pharmacy chain, but does not include prescriptions filled at nonaffiliated pharmacies.[1] Missing or incomplete prescription information may reduce the accuracy of research findings and expose patients to medication-related adverse events. The completeness of retail pharmacy prescription drug data among patients aged ≥65 years is of particular interest. Elderly patients comprise the largest population enrolled in Part D,[14] and before 2006, they were less likely to have drug insurance than were adults aged 18 to 64 years.[15–18] Many MTMPs and safety programs[6–11] for the elderly population rely on complete pharmacy data. To quantify the completenessof retail pharmacy prescription data, we undertook a validation study among the population aged ≥65 years who had complete pharmacy claims information.

The purpose of this study was to describe elderly patients' loyalty to a particular pharmacy and/or pharmacy chain. A secondary aim was to identify patient demographic, health care, and pharmacy characteristics that predict the use of multiple nonaffiliated pharmacies and thus an increased likelihood of missing prescription information.

PATIENTS AND METHODS

Study Population

The study cohort was assembled using complete 2004–2005 eligibility and pharmacy claims for patients enrolled in the Pharmaceutical Assistance Contract for the Elderly (PACE) program. PACE pharmacy claims were then linked with Medicare Parts A and B health care claims. The PACE program provides drug insurance coverage for low to moderate income patients aged ≥65 years in Pennsylvania. PACE beneficiaries in 2004 and 2005 were eligible for the study. To ensure consistent PACE benefit use, the final study cohort included only those patients who filled ≥1 prescription for any medication during each calendar quarter of 2005.

The study was approved by the Brigham and Women's Hospital Institutional Review Board in Boston, Massachusetts.

Pharmacy Definitions

To evaluate patients' loyalty to a particular pharmacy location, each patient's primary pharmacy was defined. The *primary pharmacy* was the unique pharmacy identifier (ID) (ID = pharmacy name + geographic location) where at least 50% of prescriptions were filled during 2005. If no pharmacy ID met this definition, then the patient's primary pharmacy was the first pharmacy ID used in 2005. If 2 pharmacy IDs each had 50% of filled prescriptions for a patient, then the patient's primary pharmacy was the first pharmacy ID used in 2005.

We examined whether pharmacy loyalty differed between those patients who used larger pharmacies versus those who used smaller chain or single location pharmacies. If larger chain pharmacy patrons are significantly more loyal than smaller chain/single-location pharmacies patrons or vice versa, then both researchers and pharmacists would need to consider these differences in their research and clinical practice. To categorize patients as patrons of larger chain pharmacies or not, we determined the top 5 pharmacy chains in our data based on the number of unique geographic locations in Pennsylvania. Pharmacy names and locations were manually grouped. When there was a question whether 2 pharmacies were affiliated with the same chain, these pharmacies were coded as unrelated (not in the same chain). Patients whose primary pharmacy was affiliated with 1 of the top 5 pharmacy chains were referred to as *large pharmacy chain patients*.

Baseline Measures

Baseline demographics, including age, gender, and race, were assessed for each patient using PACE enrollment files and pharmacy claims (data from 2004). The number of unique medications used and prescriptions filled in 2004 was assessed, as well as the patient's 2004 Chronic Disease Score,[19] a summary score of health status based on medication use. The score has been found to be a stable predictor of chronic disease status and subsequent hospitalizations and mortality.[20] Patients' zip codes were matched to census data on population density per square mile, and an *urban zip code* was defined as 1 in which there were ≥1000 persons per square mile.[21] Using 2004 Medicare data, we calculated a baseline Charlson comorbidity index score, based on the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes.[22] This score is predictive of mortality in populations aged ≥65 years.[23] The Charlson comorbidity index includes 19 clinical important comorbidities that were found to be predictors of 1-year mortality and assigns them weights of 1, 2, 3, or 6 based on the magnitude of their individual association with 1-year mortality.[23] Because patients with medical diagnoses regularly requiring the concurrent use of multiple drugs might have different pharmacy loyalty behavior, we noted whether patients had ≥1 diagnosis of cardiovascular disease (ICD-9 codes 410.xx–414.xx; 420.xx–429.xx), diabetes (249.xx–250.xx), and/or cancer, excluding nonmelanoma skin cancer (140.xx–172.xx; 174.xx–208.xx). Patients with psychiatric diagnoses (290.xx–319.xx) might have different pharmacy loyalty behavior because of potential difficulty in managing their medications, so these patients were also identified. Comorbidity indicators for these diseases were included in predictor models (see below).

Statistical Analysis

Baseline demographic and health care characteristics for all PACE patients and the subset of large pharmacy chain patients were analyzed and expressed as mean (SD) or frequency (percent). To measure prescription filling behavior in 2005, the mean (SD) as well as the median interquartile range for the number of prescriptions filled, number filled at the primary pharmacy, and number of unique pharmacy locations used were calculated. Because a patient might have different pharmacy loyalty behavior when filling a prescription for an acute condition than when filling a prescription for a chronic condition, we determined the total number of antibiotic prescriptions filled and the number of those that were filled in the primary pharmacy for each month and for the entire year 2005. These analyses were repeated, stratified by month, to detect seasonal variation. For large pharmacy-chain patients, we calculated the number of prescriptions filled within the primary pharmacy chain.

Univariate and multivariate logistic regression analyses were conducted to identify baseline correlates of using multiple pharmacies in filling prescriptions during 2005. Using a complete information model, which utilized pharmacy and health care claims from all pharmacies and providers in 2004, potential predictors included age (65–74, 75–84, ≥85 years), female gender, white race, residence in an urban zip code, number of unique generic medications (<5, 6–9, 10–14, ≥15), number of prescriptions filled (<25, 25–49, 50–74, ≥75), Charlson comorbidity index score (0, 1–3, ≥4), and diagnosis of cancer (excluding nonmelanoma skin cancer), cardiovascular disease, diabetes, and/or psychiatric disease.

We created a "primary pharmacy" regression model that consisted of only those data and predictors available to the primary pharmacy/pharmacy chain, which included age, female gender, white race, residence in an urban zip code, number of unique generic medications used within the primary pharmacy/pharmacy chain, and number of prescriptions filled within the primary pharmacy/pharmacy chain. In a separate analysis, we added the patients' 2004 Charlson comorbidity index score to the primary pharmacy model to determine the predictive value of diagnostic information. The complete information model and the primary pharmacy model were run for all PACE patients and for large pharmacy chain patients.

To assess the ability of the models to differentiate between those patients who used multiple pharmacies and those who did not, a C-statistic[24] comparison was calculated for each model. A Nagelkerke pseudo R^2 was also calculated. Similar to the R^2 value obtained in a linear regression, which estimates the proportion of variation in the outcome that can be attributed to the model predictors, the Nagelkerke pseudo R^2 estimates the variation attributed to the predictors in a logistic regression model.[25] Models were tested for collinearity using variance inflation factor tests.[26]

RESULTS

In total, pharmacy claims data from 182,116 patients (147,718 [81.1%] women; mean [SD] age 78.8 [7.1] years; 168,175 white; 76,580 residing in an urban zip code area) were included (Table I). Among all PACE patients, 75,413 patients' (41.4%) primary pharmacy was among the top 5 pharmacies in Pennsylvania, defining them as large pharmacy chain patients. On average, large pharmacy chain patients were more likely to reside in urban areas compared with all PACE patients ([49.5%] vs [42.1%], respectively), filled a similar number of prescriptions in 2004 (50.9 [29.9] versus 52.1 [31.0]), and had fewer comorbidities, with a Charlson comorbidity index score of 0 ([51.4%] vs [46.97%]).

Table II describes the 2005 prescription-filling behavior for PACE patients. . These patients used an average of 1.3 (0.6) unique pharmacy locations to fill prescriptions. Of the mean (SD) 59.3 (33.1) prescriptions filled by PACE patients in 2005, 57.0 (96.1%) were filled at the primary pharmacy. Patients who resided in a rural zip code area filled an average of 58.3 (98.3%) prescriptions at their primary pharmacy, whereas patients who resided in an urban area filled an average of 55.2 (93.1%) at the primary pharmacy. Large pharmacy chain patients' prescription-filling behavior was nearly identical, with 96.1% of prescriptions being filled at the primary pharmacy and 97.4% within the primary pharmacy chain. Loyalty to the primary pharmacy for antibiotic prescription fills was high, with an average of 0.4 of 0.5 antibiotic prescriptions among all PACE patients and an average of 0.4 of 0.4 antibiotic prescriptions among large pharmacy chain patients filled at the primary pharmacy. For both PACE patients and large pharmacy chain patients, analysis of prescription fills by month found minimal variation in prescription-filling behavior over the calendar year (data not shown).

The number of pharmacy locations used in 2005 by all PACE patients is shown in **Figure 1A**. In 2005, a majority of patients (142,544 [78.3%]) used 1 pharmacy, whereas 31,161 (17.1%) used 2 pharmacies. **Figure 1B** shows that again, 78.3% of PACE patients filled all of their prescriptions in 2005 at the primary pharmacy. An additional 20,022 patients (11.0%) filled ≥90% of their prescriptions at the primary pharmacy in the same year. On average, 96.1% of prescriptions were filled at the primary pharmacy.

Based on the complete information multivariate regression model (Table III), PACE patients aged 75 to 84 years were less likely to use multiple pharmacies in 2005 (odds ratio [OR] = 0.96; 95% CI, 0.94–0.99) compared with PACE patients aged 65 to 74 years. In contrast,, PACE patients aged ≥85 years were more likely to use multiple pharmacies (OR = 1.07; 95% CI, 1.04–1.11). Compared with PACE patients who used ≤ 5 unique medications in 2004, patients who used 6 to 9 unique medications in 2004 were 1.38 times (95% CI, 1.34–1.43) more likely to use multiple pharmacies in 2005; patients who filled ≥15 prescriptions unique medications in 2004 were 2.66 times (95% CI, 2.53–2.80) more likely to use multiple pharmacies in 2005. After controlling for the number of unique medications used and other covariates, the greater the number of prescriptions filled, the lesser the likelihood that a PACE patient used multiple pharmacies. PACE patients who filled 25 to 49 prescriptions in 2004 had a reduced likelihood of using multiple pharmacies compared with patients who filled <25 prescriptions in 2004 (OR = 0.87; 95% CI, 0.84–0.90). While PACE patients with a Charlson comorbidity index score of 1 to 3 or those with a score ≥4 were more likely to use multiple pharmacies than were PACE patients with a Charlson score of 0 (OR = 1.07; 95% CI, 1.04–1.11; and OR = 1.20; 95% CI, 1.14–1.27, respectively), the specific diagnoses of cancer, cardiovascular disease, diabetes, and psychiatric disease were not significant predictors. Large pharmacy chain patients' model findings were similar in magnitude and direction, and CIs largely overlapped those in a model that included nonlarge pharmacy chain patients (data not shown), suggesting no effect-measure modification by pharmacy type (large chain vs small chain or single business).

In the primary pharmacy model (Table IV), the same predictors of using multiple pharmacies were observed. PACE patients aged ≥85 years were 1.09 times (95% CI, 1.06–1.13) more likely to use multiple pharmacies in 2005 than were patients aged 65 to 74 years. Among all PACE patients, patients who used ≥15 unique medications in 2004 were 1.92 times (95% CI, 1.82–2.03) more likely to use multiple pharmacies in 2005 compared with patients who used ≤5 unique medications in 2004. After controlling for the number of unique medications used in 2004 and all other covariates, patients who filled 25 to 49 prescriptions in 2004 were half as likely (OR = 0.51; 95% CI, 0.49–0.53) to use multiple pharmacies compared with patients who filled <25 prescriptions, and the likelihood of using multiple pharmacies further decreased as the number of prescriptions filled increased. In comparison with the complete information models in Table III, the C statistic and pseudo R^2 were not meaningfully reduced when only the primary pharmacy's data were used in the model for all PACE patients (C = 0.595; pseudo R^2 = 0.0291). Large pharmacy chain patient model findings were similar to those among all PACE patients and to those among nonlarge pharmacy chain patients (data not shown), and CIs overlapped, indicating no effect-measure modification by pharmacy type. Adding the Charlson comorbidity index score to the primary pharmacy model did not meaningfully change other predictor effect estimates, and minimally improved the C statistic and pseudo R^2 in the model with all PACE patients (C = 0.601; pseudo R^2 = 0.0329).

DISCUSSION

To assess the completeness of prescription information in retail pharmacy claims data, this study examined loyalty to a particular pharmacy or pharmacy chain in a population aged ≥65 years. Of all prescriptions filled, 96.1% of prescriptions were filled at a single pharmacy location. This high degree of pharmacy loyalty was replicated among patients who patronize large pharmacy chains, suggesting no differences in prescription-filling behavior between patients who use major pharmacy chains and those who do not.

The present study also assessed patient factors that were predictive of using multiple unrelated pharmacies. In all multivariate models, the number of unique medications used in 2004 was a strong predictor of using multiple pharmacies in 2005. From this perspective, patients who used ≥15 unique medications in 2004 were twice as likely to use multiple pharmacies compared with those who used ≤5 unique medications. There appeared to be a greater potential for drug exposure misclassification (missing prescriptions) when using retail pharmacy data to evaluate drug use in patients who used a greater number of unique medications. In contrast, after controlling for the number of unique medications used, the more prescriptions a patient filled, the less likely it was that the patient used multiple pharmacies. These conclusions might suggest that patients who were more adherent to their medications were less likely to use multiple pharmacies, but more dedicated research is needed to confirm this finding. Among all PACE patients, those aged ≥85 years had a 7% increased odds of using multiple pharmacies compared with patients aged 65 to 74 years. Mobility restrictions may play a contributory factor in the increased likelihood of using multiple pharmacies, as patients might have to rely on adult children or caregivers to fill prescriptions.

The complete information regression models and the primary pharmacy models both identified the same predictors of using multiple pharmacies, with nearly identical C statistic and pseudo R^2 values. Researchers and pharmacists who use retail claims data exclusively, without complementary access to health services claims, can be reassured that among the population aged ≥65 years, the number of missing prescriptions is minimal, and that prescription data completeness can be predicted with similar accuracy with or without diagnostic information.

The findings from the present study also suggest that while patients are, for the most part, loyal to a particular pharmacy and even more so to a particular pharmacy chain, patients with more complicated drug regimens and those aged ≥85 years merit additional attention from researchers and pharmacists. At minimum, researchers should consider what effect missing prescriptions will have on the findings of their studies. For the practicing pharmacist, a first step toward minimizing safety concerns related to missing prescriptions is to ask the oldest patients and/or patients who use many unique medications about their use of other pharmacies. Questions such as, “What other medications are you taking that you do not fill here at our pharmacy?”; and “Does someone else fill prescriptions for you at a different pharmacy?” are currently being asked at some pharmacies on a routine basis. Other pharmacies might benefit from adopting these or similar safety questions. The oldest patients and those using numerous medications may therefore gain the most from MTMPs, because a more thorough evaluation of medication use is employed. In fact, a patient’s use of multiple medications is a criterion for MTMP intervention under Part D.[12,27]

Limitations

Our study described pharmacy loyalty among a population of elderly patients (aged ≥65 years). This population is largely retired, suggesting that they might have had more time and flexibility to patronize a single pharmacy location. It is unclear whether the high level of pharmacy loyalty found in this study is generalizable to a younger, working-age population who might fill some prescriptions at a pharmacy near their workplace, some prescriptions at an unrelated pharmacy near their home, and/or use mail-order prescription services. The patients in the present study all had drug insurance coverage. It is unknown whether patients with no drug insurance coverage have different loyalty behaviors, but such information would only be available from survey data, which, to our knowledge, has not been published. Since the time period 2004–2005 under study, some pharmacies have introduced drug discount programs (e.g., $4 generics, free antibiotics), but our data do not allow us to comment on these programs' impact. Finally, while our regression models found predictors of using multiple pharmacies, their predictive ability was low. Other factors must be enumerated to better clarify why elderly patientsuse multiple pharmacies.

Nevertheless, the findings of the present study provide reassurance to researchers who use retail pharmacy claims data to evaluate drug use by the elderly and to pharmacists who use these data to improve safe and appropriate medication use in this population. This study also highlights predictive variables that can be used to address the implications of missing prescription data in research and clinical applications.

CONCLUSIONS

In the present study, patients aged ≥65 years displayed a high level of loyalty to their primary pharmacy, with 96.1% of prescriptions filled at a single pharmacy location. Missing prescriptions are most common among the oldest patients and those using more unique medications; both are more likely to use multiple pharmacies.

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Table I

Patient demographic and clinical characteristics in a study assessing pharmacy loyalty and predictors of using multiple pharmacies among patients enrolled in the Pharmaceutical Assistance Contract for the Elderly (PACE) pharmacy benefit program and those whose primary pharmacy was among the top 5 pharmacies in Pennsylvania. Values are expressed as no. (%) or mean (standard deviation) unless otherwise specified.

	All PACE Patients (N =182,116)	Patients with Primary Pharmacy in the Top 5 (N =75,413)
Age as of January 1, 2005, y	78.8 (7.1)	78.7 (6.9)
Female	147,718 (81.1%)	61,802 (82.0%)
White race	168,175 (92.3%)	67,571 (89.6%)
Urban residence	76,580 (42.1%)	37,300 (49.5%)
Population density (persons/sq mile)	2903.0 (4940.1)	3475.6 (5314.6)
<500	76,210 (41.8%)	25,786 (34.2%)
500–999.99	29,326 (16.1%)	12,327 (16.3%)
1000–1499.99	8699 (4.8%)	3902 (5.2%)
≥1500	67,881 (37.3%)	33,398 (44.3%)
Chronic disease score for 2004	3.9 (2.7)	3.9 (2.7)
0	20,952 (11.5%)	8714 (11.6%)
1–3	66,420 (36.5%)	27,272 (36.2%)
≥4	94,744 (52.0%)	39,427 (52.3%)
Unique medications used in 2004	9.1 (5.1)	8.9 (5.0)
≤5 Medications	48,570 (26.7%)	20,656 (27.4%)
6–9 Medications	61,494 (33.8%)	25,894 (34.3%)
10–14 Medications	46,661 (25.6%)	19,097 (25.3%)
≥15 Medications	25,391 (13.9%)	9766 (13.0%)
Prescriptions filled in 2004	52.1 (31.0)	50.9 (29.9)
<25 Prescriptions	34,294 (18.8%)	14,912 (19.8%)
25–49 Prescriptions	63,720 (34.7%)	26,563 (35.2%)
49–74 Prescriptions	45,718 (25.1%)	18,881 (25.0%)
≥75 Prescriptions	38,384 (21.1%)	15,057 (20.0%)
Charlson comorbidity index score* in 2004	1.4 (1.8)	1.2 (1.8)
0	85,499 (46.9%)	38,788 (51.4%)
1–3	74,024 (40.7%)	28,285 (37.5%)
≥4	22,593 (12.4%)	8340 (11.1%)
Diagnosis of cardiovascular disease in 2004	70,697 (38.8%)	26,912 (35.7%)
Diagnosis of psychiatric disease in 2004	30,284 (16.6%)	10,744 (14.3%)
Diagnosis of diabetes in 2004	42,208 (23.2%)	15,973 (21.2%)
Diagnosis of cancer in 2004	15,953 (8.8%)	6174 (8.2%)

* The scale can be used to predict 1-year mortality.

Table II

Prescription-filling behavior during calendar year 2005 in a study assessing pharmacy loyalty and predictors of using multiple pharmacies among patients enrolled in the Pharmaceutical Assistance Contract for the Elderly (PACE) pharmacy benefit program and those whose primary pharmacy was among the top 5 pharmacies in Pennsylvania.

	All PACE patients (N = 182,116)		PACE enrollees whose primary pharmacy was in the top 5 pharmacies in Pennsylvania(N = 75,413)	
	Mean (SD)	**Median (IQR)**	**Mean (SD)**	**Median (IQR)**
Unique pharmacy locations where prescriptions were filled, no.	1.3 (0.6)	1 (1–1)	1.3 (0.6)	1 (1–1)
Unique medications used, no.	9.8 (5.5)	9 (6–13)	9.5 (5.3)	9 (6–12)
Prescriptions filled, no.	59.3 (33.1)	54 (35–78)	57.4 (31.6)	52 (34–76)
Prescriptions filled at the primary pharmacy, no.	57.0 (32.4) (96.1%)	52 (33–76)	55.3 (31.2) (96.3%)	50 (32–74)
Residing in an urban zip code, no.	55.2 (31.7) (93.1%)	50 (31–73)	53.4 (30.3) (93.0%)	48 (30–71)
Residing in a rural zip code, no.	58.3 (32.8) (98.3%)	53 (34–77)	57.1 (31.9) (99.5%)	52 (33–76)
Prescriptions filled at a nonprimary pharmacy, no.	2.3 (7.8)	0 (0–0)	2.2 (7.3)	0 (0–0)
Prescriptions filled within the same pharmacy chain, no.	–	–	55.9 (31.3) (97.4%)	51 (32–74)
Antibiotic prescriptions filled, no.	0.5 (1.1)	0 (0–1)	0.4 (1.1)	0 (0–1)
Antibiotic prescriptions filled at the primary pharmacy, no.	0.4 (1.1)	0 (0–0)	0.4 (1.1)	0 (0–0)

IQR = interquartile range.

Table III

Baseline predictors of using multiple pharmacies to fill prescriptions during calendar year 2005 in a study assessing prescription-filling behavior among patients enrolled in the Pharmaceutical Assistance Contract for the Elderly (PACE) pharmacy benefit program and those whose primary pharmacy was among the top 5 pharmacies in Pennsylvania, using a complete information model.

	All PACE patients (N = 182,116).		**Patients whose primary pharmacy was among the top 5 pharmacies in Pennsylvania (N =75,413).**	
	Univariate	**Multivariate**	**Univariate**	**Multivariate**
		C statistic = 0.597 **Pseudo R^2 = 0.0304**		**C statistic = 0.599** **Pseudo R^2 = 0.0323**
	Odds ratio (95% CI)			
Baseline covariates assessed in 2004				
Age, y, as of January 1, 2005				
65–74	Reference	Reference	Reference	Reference
75–84	0.96 (0.94–0.99)	0.96 (0.94–0.99)	0.92 (0.88–0.96)	0.93 (0.89–0.97)
≥85	1.05 (1.02–1.09)	1.07 (1.04–1.11)	0.90 (0.86–0.95)	0.93 (0.88–0.98)
Female gender	1.06 (1.03–1.09)	1.00 (1.00–1.00)	1.05 (1.00–1.09)	1.00 (1.00–1.00)
White race	0.64 (0.61–0.66)	1.00 (1.00–1.00)	0.64 (0.61–0.67)	1.00 (1.00–1.00)
Residence in an urban zip code	1.27 (1.24–1.30)	1.00 (1.00–1.00)	1.34 (1.30–1.39)	1.00 (1.00–1.00)
Number of unique medications in 2004				
5 or less	Reference	Reference	Reference	Reference
6–9 Medications	1.29 (1.25–1.33)	1.38 (1.34–1.43)	1.27 (1.21–1.33)	1.37 (1.30–1.45)
10–14 Medications	1.64 (1.59–1.69)	1.83 (1.75–1.90)	1.60 (1.52–1.68)	1.81 (1.70–1.93)
≥15 Medications	2.35 (2.27–2.44)	2.66 (2.53–2.80)	2.38 (2.25–2.52)	2.78 (2.57–3.01)
Number of prescriptions filled in 2004				
<25 Prescriptions	Reference	Reference	Reference	Reference
25–49 Prescriptions	1.07 (1.04–1.11)	0.87 (0.84–0.90)	1.06 (1.01–1.12)	0.86 (0.82–0.91)
49–74 Prescriptions	1.26 (1.22–1.31)	0.82 (0.78–0.86)	1.23 (1.16–1.30)	0.81 (0.76–0.87)
≥75 Prescriptions	1.52 (1.47–1.57)	0.77 (0.74–0.81)	1.45 (1.37–1.53)	0.74 (0.69–0.80)
Charlson comorbidity index score* in 2004				
0	Reference	Reference	Reference	Reference
1–3	1.08 (1.06–1.11)	1.07 (1.04–1.11)	1.04 (1.00–1.08)	1.05 (1.00–1.11)
≥4	1.45 (1.41–1.50)	1.20 (1.14–1.27)	1.43 (1.35–1.51)	1.18 (1.08–1.29)
Diagnosis of cardiovascular disease in 2004	1.14 (1.12–1.17)	1.00 (1.00–1.00)	1.13 (1.09–1.17)	1.00 (1.00–1.00)
Diagnosis of diabetes in 2004	1.12 (1.09–1.15)	1.00 (1.00–1.00)	1.13 (1.09–1.18)	1.00 (1.00–1.00)
Diagnosis of psychiatric disease in 2004	1.34 (1.30–1.38)	1.00 (1.00–1.00)	1.26 (1.21–1.33)	1.00 (1.00–1.00)
Diagnosis of cancer (excluding nonmelanoma skin cancer) in 2004	1.11 (1.07–1.15)	1.00 (1.00–1.00)	1.12 (1.06–1.19)	1.00 (1.00–1.00)

*The index can be used to predict 1-year mortality.

Table IV

Baseline predictors of using multiple pharmacies to fill prescriptions during calendar year 2005 among patients enrolled in the Pharmaceutical Assistance Contract for the Elderly (PACE) pharmacy benefit program and those whose primary pharmacy was among the top 5 pharmacies in Pennsylvania, using a primary pharmacy model*.

	All PACE patients (N = 182,116).		**Patients whose primary pharmacy was among the top 5 pharmacies in Pennsylvania (N =75,413).**	
	Univariate	**Multivariate**	**Univariate**	**Multivariate**
		C statistic = 0.595 **Pseudo R^2 = 0.0291**		**C statistic = 0.597** **Pseudo R^2 = 0.0304**
	Odds ratio (95% CI)			
Baseline covariates assessed in 2004				
Age on January 1, 2005, y				
65–74	Reference	Reference	Reference	Reference
75–84	0.96 (0.94–0.99)	0.99 (0.96–1.01)	0.92 (0.88–0.96)	0.95 (0.92–0.99)
≥85	1.05 (1.02–1.09)	1.09 (1.06–1.13)	0.90 (0.86–0.95)	0.95 (0.91–1.00)
Female	1.06 (1.03–1.09)	1.00 (1.00–1.00)	1.05 (1.00–1.09)	1.00 (1.00–1.00)
White race	0.64 (0.61–0.66)	1.00 (1.00–1.00)	0.64 (0.61–0.67)	1.00 (1.00–1.00)
Residing in an urban zip code	1.27 (1.24–1.30)	1.00 (1.00–1.00)	1.34 (1.30–1.39)	1.00 (1.00–1.00)
Unique medications in 2004				
≤5	Reference	Reference	Reference	Reference
6–9	0.70 (0.68–0.71)	1.01 (0.98–1.05)	0.75 (0.72–0.79)	1.03 (0.98–1.08)
10–14	0.83 (0.80–0.85)	1.36 (1.30–1.42)	0.90 (0.86–0.95)	1.39 (1.31–1.48)
≥15 Medications	1.10 (1.06–1.14)	1.92 (1.82–2.03)	1.25 (1.19–1.33)	2.07 (1.91–2.24)
Prescriptions filled in 2004				
<25	Reference	Reference	Reference	Reference
25–49	0.55 (0.54–0.57)	0.51 (0.49–0.53)	0.57 (0.54–0.59)	0.52 (0.50–0.55)
49–74	0.62 (0.60–0.64)	0.50 (0.48–0.52)	0.64 (0.61–0.67)	0.52 (0.49–0.55)
≥75	0.71 (0.69–0.74)	0.47 (0.45–0.49)	0.73 (0.69–0.77)	0.48 (0.44–0.51)

* Includes only data available to the primary pharmacy.