Statin Medication Adherence Association with Hospitalizations or Emergency Room Visits and Total Cost of Care Over Two Years

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No external funding provided for this research

Background

- Prime's 2011 commercial book of business cholesterol drug cost trends identified the following:[1]
  - Cholesterol medication was 7.9 percent of all pharmacy benefit expenditures;
  - Generic utilization rate was 58 percent, an increase from 52.5 percent in 2010;
  - Overall 2011 ingredient costs per claim were $62.07 (brand $131.45 and generic $11.16);
  - Brand ingredient per claim annual growth rate has been 10.5 percent over the last three years increasing from $97 in 4Q2008 to $131 in 4Q2011.
- A 2005 study using 1997 to 1999 medical and pharmacy claims administrative data from a single employer found that individuals who were ≥ 80 percent adherent with their cholesterol medication were significantly less likely to be hospitalized and had lower medical costs compared to individuals with lower levels of adherence.[2]
- In 2011, a study utilizing 2005 to 2008 medical and pharmacy data examining the relationships of adherence on hospitalizations and medical costs of individuals with an average age of ≥ 65. The authors concluded that despite higher adherence to cholesterol medications resulting in higher pharmacy costs, the reductions in hospitalizations and emergency department use were associated with lower medical costs in the adherent population.[3]
- The cost analyses presented above are limited in their generalizability because data were from a single employer[2] or representative of a retiree population.[3]
- Minimal data is available quantifying outcome and cost differences for individuals adherent and non-adherent to statin medications, among those with commercial health care coverage followed for more than one year.

Objective & Purpose

To examine the association between medication adherence and all-cause hospitalization or emergency room (ER) events, and compare medical and pharmacy costs among individuals adherent and non-adherent to their statin medications.

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AMCP, October 4, 2012, Cincinnati, OH, USA

Methods

- This retrospective concurrent cohort study utilized integrated administrative medical and pharmacy claims data from a commercial Blue Cross and Blue Shield (BCBS) Plan in the Central U.S. with Prime Therapeutics pharmacy benefits covering approximately 1.2 million lives any time during 2007 through 2010.
- Members were required to be continuously enrolled from January 1, 2007 through December 31, 2010.
- Members were required to have either two separate hypercholesterolemia office visits or a hypercholesterolemia related hospitalization in 2008.
- The members' first 2008 hypercholesterolemia medical encounter was defined as the index date.
- Members were required to have a statin supply on their index date or have been identified as having a high risk condition diagnosis at any time from January 1, 2007, through their medical index date in 2008. High risk conditions were defined as diabetes mellitus (DM), coronary artery disease (CAD), embolic stroke, or peripheral vascular disease (PVD).
- All members were followed for two years post their 2008 index date.
- Adherence was assessed using the proportion of days covered (PDC) method for the two year follow up period. All statin claims were used to calculate the PDC and members were considered adherent if their PDC was ≥ 80 percent.
- All medical and pharmacy claim total allowed amounts (plan and member) were summed to determine total cost of care.
- Members were excluded if the total medical costs were $0 in the two year follow up, if there was evidence of any Medicare payments, or if demographic census data was missing.
- Members were also excluded from the analysis if they were not 18 years of age or older on the index date or if at any time in the three year study period they had a medical claim indicating a pregnancy or a nursing home stay.
- The following member characteristics were derived and used as a covariate: age, gender, Charlson Comorbidity Index score (Charlson risk score)[4], enrollment at any time in a consumer directed health plan (CDHP), education and income based on ZIP code census data, presence of a primary or secondary diagnosis field coded medical claim for depression or bipolar disorder identified in the pre-period (one year before the index date), and high risk status.
- The Kaplan-Meier method with a log-rank statistical test was used for hospitalization or emergency room (ER) event rate calculation and association with adherence. To assess the association between hospitalization or ER event rate and adherence adjusting for covariates, a Cox proportional hazard regression model was created.
- Cost analyses were performed using a generalized linear model (GLM) with gamma distribution and a log link and adjusted for the same covariates.

Results

- 144,564 members with hypercholesterolemia were continuously enrolled January 1, 2007 to December 31, 2010 and 45,869 members met inclusion and exclusion criteria. **(Figure 1)**
- During the two year follow up there were 21,693 (47.3%) members adherent to their statin medication (PDC ≥ 80 percent) and 24,176 (52.7%) members non-adherent (PDC < 80 percent).
- Significant baseline differences existed between the adherent and non-adherent groups. **(Table 1)**

Hospitalization or ER events association with statin adherence

- The unadjusted two year follow up Kaplan-Meier curve shows that the adherent group had a lower hospitalization or ER event rate at 26.5 percent compared to the non-adherent group at 29.1 percent, p < 0.001. **(Figure 2)**
- The Cox Proportional Hazards model, adjusting for baseline differences, found the adherent group had a 9 percent lower hospitalization or ER event rate (Hazard Ratio 0.91, 95% confidence interval, 0.87 to 0.94).

Total cost of care association with statin adherence **(Figure 3)**

- Overall average per person two year total costs of care were $809 higher in the adherent group ($18,034 standard deviation [SD] $10,481) compared to the non-adherent group ($17,225, SD $11,172), p < 0.001. The adherent group had four percent relative higher cost (Relative Cost [RC] 1.04, 95 percent confidence interval [CI] 1.02 to 1.06).
- Medical costs were $767 lower in the adherent group ($12,487, SD $7,490) compared to the non-adherent group ($13,254, SD $9,016), p < 0.001. The adherent group had seven percent relative lower cost (RC 0.93, 95% [CI] 0.90 to 0.95).
- Pharmacy costs were $1,606 higher in the adherent group ($5,585, SD $3,409) compared to the non-adherent group ($3,979, SD $2,595), p < 0.001. The adherent group had 45 percent relative higher cost (RC 1.45, 95% [CI] 1.42 to 1.48).

Table 1. Member characteristics

Member characteristics	Statin PDC ≥ 80% n = 21,693	Statin PDC < 80% n = 24,176	p value*
Age, n (%)			<0.001
18–44	1,944 (9.0)	3,785 (15.7)	
45–54	7,557 (34.8)	9,592 (39.7)	
55–64	11,137 (51.3)	10,064 (41.6)	
65 and up	1,055 (4.9)	735 (3.0)	
Male, n (%)	13,015 (60.0)	13,879 (57.4)	<0.001
ZIP code education, n (% with bachelor degree or above)	5,640 (26.0)	5,923 (24.5)	<0.001
ZIP code median household income ≥ $50,000, n (%)	8,819 (40.7)	8,796 (36.4)	<0.001
Enrollment in consumer directed health plan, n (%)	1,222 (5.6)	1,592 (6.6)	<0.001
High risk, n (%)	6,555 (30.2)	7,972 (33.0)	<0.001
Comorbidity (Charlson index score), (S.D.)	1.4 (1.0)	1.4 (1.0)	0.330
Depression/bipolar disorder, n (%)	1,272 (5.9)	1,672 (6.9)	<0.001

PDC = proportion of days covered; S.D. = standard deviation
High risk defined as presence of DM, CAD, embolic stroke, PVD in 1 year before index date
*Comparisons between groups were performed with the ANOVA test for continuous variables and the chi-square test for categorical variables.

Table 2. Hospitalization or emergency room event rate during 2 years of follow up: Cox proportional hazard model results

Factors	Hazard Ratio (95% CI)	p value
Adherent versus non-adherent	0.91 (0.87–0.94)	<0.001
Age (ref: 45–54 years)		
18–44	1.03 (0.97–1.09)	0.362
55–64	1.11 (1.07–1.16)	<0.001
65 and up	1.26 (1.16–1.37)	<0.001
Male	0.97 (0.94–1.01)	0.091
Education (ZIP code prevalence of bachelor degree ≥ 20%)	0.95 (0.91–0.98)	0.006
Median household income (zip code prevalence ≥ $50,000)	0.95 (0.91–0.99)	0.019
Enrollment in consumer directed health plan	0.95 (0.89–1.03)	0.215
High risk	1.37 (1.32–1.42)	<0.001
Comorbidity (Charlson index score[4])	1.19 (1.17–1.21)	<0.001
Depression/bipolar disorder	1.57 (1.48–1.67)	<0.001

CI=confidence interval; High risk defined as presence of DM, CAD, embolic stroke, PVD in 1 year before index date

Figure 1. Member flow diagram

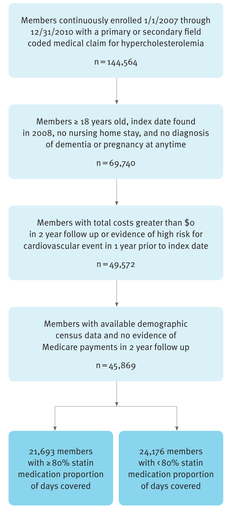


Figure 2. First hospitalization or emergency room visit event

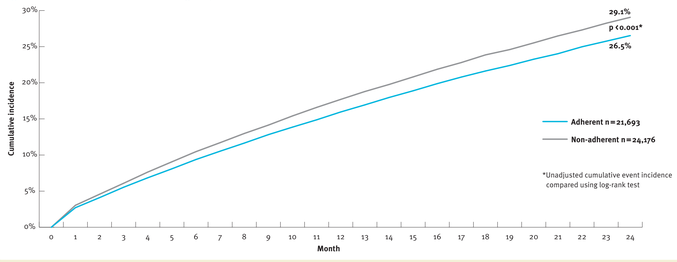
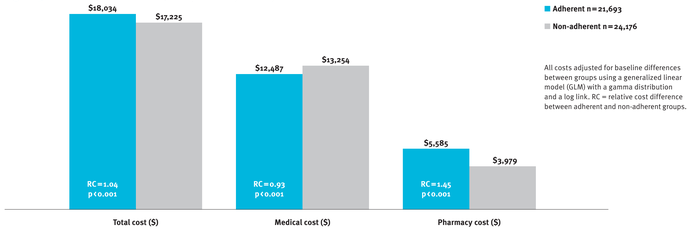


Figure 3. Total cost, medical cost, and pharmacy cost by statin adherence



Limitations

- Administrative pharmacy and medical claims have the potential for miscoding and include assumptions of member actual medication use and diagnosis.
- Data are limited to a commercial population in the Central U.S.; therefore findings may not be generalized to Medicare or Medicaid populations or other geographic regions.
- Differences found in medical events and costs between the adherent and non-adherent populations may be influenced by healthier lifestyles. Lifestyle information is unavailable in administrative claims data and therefore could not be included as a covariate in this study.
- Prime defined adherence using the PDC ≥ 80 percent which is an arbitrary cut point, however this cut point has frequently been used in previous research.[2,3]
- Adherence was determined using only statin claims and did not include other cholesterol lowering medications.

Conclusions

- In this two year total cost of care analysis, individuals adherent to statin medication had an associated unadjusted 2.6 percentage point lower hospitalization or ER event rate, which remained a significant nine percent lower after adjusting for group differences.
- In individuals with hypercholesterolemia, total annual cost of care was higher in the statin adherent group. These higher total costs were the result of higher pharmacy costs off-setting lower medical costs. Our findings differ from previous research, potentially due to population differences including younger age.
- Future research is required to determine if longer follow up will identify lower total cost of care among individuals adherent to their statin medication.

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