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Time series evaluation of an intervention to increase statin tablet splitting by general practitioners

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Abstract

Background—Tablet splitting, in which a higher-dose tablet is split to get two doses, reduces patients' drug costs. Statins can be split safely. General practitioners (GPs) may not direct their patients to split statins because of safety concerns or unawareness of costs. Medical chart inserts provide cost-effective education to physicians. We evaluated whether providing GPs with statin splitting chart inserts would increase splitting rates and identified predictors of splitting.

Methods—In 2005–2006, we faxed a statin chart insert to British Columbia GPs with a request for a telephone interview. Consenting GPs were mailed 3 statin chart inserts and interviewed by phone (the intervention). In an interrupted time series, we compared monthly rates of statin splitting prescriptions among intervention and non-intervention GPs before, during, and after the intervention. In multivariate logistic regressions accounting for patient clustering, predictors of splitting included physician and patient demographics and the specific statin prescribed.

Results—Of 5,051 GPs reached, 282 (6%) agreed to the intervention. Before the intervention, GPs' splitting rate was 2.6%; after, intervention GPs' splitting rate was 7.5%, non-intervention GPs' was 4.4%. Intervention GPs were 1.68 (95% CI 1.12–2.53) times more likely to prescribe splitting after the intervention than were non-intervention GPs. Other predictors were a patient's female sex (OR=1.26, 95% CI 1.18–1.34), lower patient income (OR=1.33, 95% CI 1.18–1.34), and no drug insurance (OR=1.89, 95% CI 1.69–2.04).

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Interpretation—An inexpensive intervention was effective in producing a sustained increase in GPs' splitting rate during 22 months of observed follow-up. Expanding statin splitting education to all GPs could reduce prescription costs for many patients and payors.

Keywords

tablet splitting; primary care; physician education; chart inserts

INTRODUCTION

As prescription drug costs have risen, payors have implemented numerous strategies to contain or modify them, including formulary restrictions, generic substitution, reference pricing, and prior authorization.¹ Another method to reduce prescription drug costs is tablet splitting,² a practice which takes advantage of the fact that for many prescription drugs, the price per milligram decreases at higher strengths. Substantial cost savings have been realized by splitting a higher dose tablet to obtain two or more prescribed lower doses at a reduced price.^{2–5} Potential drawbacks include the unsuitability of extended release dosage forms, wastage and/or incorrect dosage from inaccurate splitting, and patient non-compliance.⁶ Given these considerations, statin medications have been found to be well-suited to tablet splitting.⁶ In several studies, lipid levels, health outcomes, and medication adherence were not affected by statin splitting,^{3, 7–10} and patients' acceptance of and satisfaction with tablet splitting is high.^{3, 7, 8, 11, 12}

Despite the fact that statins are well-suited to splitting, many clinicians do not prescribe splitting for their patients, whether due to concerns about efficacy and safety, a lack of awareness about cost savings, or all three. Chart inserts or chart reminders are educational messages, in paper or electronic form, placed in the patient's chart to provide information to the physician for diagnosis and treatment.¹³ Studies indicate that chart reminders are a cost-effective strategy that have greater impact than printed materials not linked to charts.^{14, 15} We designed and mailed chart inserts regarding statin splitting to general practitioners (GPs) in British Columbia. In this study, we test the hypothesis that receipt of the chart inserts would prompt GPs to increase their prescribing of statin tablet splitting. We expected that some GPs would be more likely to split statins than others, so we also assess GP, patient, and other predictors of statin tablet splitting. Understanding correlates associated with tablet splitting will allow us to improve future chart inserts and interventions to increase tablet splitting.

PATIENTS AND METHODS

Study population

All general practitioners (GPs) practicing in the province of BC during the time period October 2003 – July 2008 were eligible for the intervention. We obtained physician contact information from the College of Family Practitioners of British Columbia and cross-checked these with information in the 2003 – 2004 Medical Directory published by the College of Physicians and Surgeons of British Columbia. Physician characteristics such as sex, medical specialty and years since medical school were obtained from the British Columbia Ministry of Health Practitioner Information File.

Data source

British Columbia has a single-payor, provincial government-run health insurance system. Therefore, all health and drug claims data are managed and maintained by the BC Ministry of Health and its affiliates. Statin tablet splitting prescription data for atorvastatin,

simvastatin, rosuvastatin, pravastatin and lovastatin were obtained from the PharmaNet database, which contains records for all prescriptions dispensed at community pharmacies in BC.¹⁶ Fluvastatin was not considered for this intervention because it is a capsule and thus should not be split.¹⁷ Each prescription record includes the drug name and identifier, the prescription ingredient cost, the dispensing fee and total cost, the number of tablets dispensed, and the days' supply of medication. Using the unique patient identifier, these records were linked to information in the BC Ministry of Health's databases to obtain demographic characteristics.

Definition of statin tablet splitting

We defined tablet splitting of the included statins (atorvastatin, lovastatin, pravastatin, rosuvastatin, and simvastatin) as a prescription in which the ratio of the number of tablets dispensed divided by the days supply was exactly equal to 0.5. Prescriptions with ratios equal to 1 were considered to not be for tablet splitting. Prescriptions with other ratios were excluded from our analyses in order to maximize the specificity of the outcome. This method has been applied previously to evaluate tablet splitting in prescription claims data.^{2,5}

Chart insert handouts

The authors created three chart inserts for the intervention that may be viewed online at www.drugapi.org. The first chart insert was a "Price Speedometer," intended for the GP's use. The Price Speedometer portrayed the average cost for a year's supply of each statin medication on a speedometer dial. As with a car speedometer dial, statin prices were arrayed from lowest cost on the left side of the dial to highest cost on the right side of the dial. Statin prices and a sample calculation of annual costs were placed on the reverse side of the handout.

The second GP-oriented handout, titled "Split-and-save on statins", described recommended tablet splitting prescriptions, photos of whole and split statin tablets, and the annual cost savings from tablet splitting per patient, together with sample calculations regarding cost savings for each statin at each dose. For both the Price Speedometer and the Split-and-save on statins handouts, annual average cost savings were calculated using the Pharmacare average cost/tablet for the period January 1, 2004 - June 30, 2004. Calculations assumed that patients took one pill per day. When more than one dosage was available for a drug, the cost of the most frequently prescribed tablet dosage for each drug was used. The generic cost was used to calculate annual savings when available.

The final chart insert was intended for the GP to use with and give to his/her patient. Titled "How do you split your cholesterol tablet?" it was designed to have the same look and feel as a prescription drug pad. The first side led patients through the task of using a tablet splitter, and the second side described potential annual savings as well as the safety and effectiveness of these drugs.

Intervention

The tablet splitting intervention was known as BC ChIPS, the BC Chart Insert Pilot Study. Beginning in August 2005, members of the study team telephoned GPs. If the GP was unavailable, his/her office was telephoned up to a maximum of 8 times in order to establish contact. Once a GP was reached, the study team member arranged a time to conduct a 15 minute telephone interview with the GP regarding his/her knowledge, attitudes, and beliefs regarding tablet splitting. Prior to use, the telephone interview script was pilot tested with members of the study team and modified for important content." During the telephone interview, the study team member also obtained consent to send an introductory letter and

the three chart inserts. GPs who received the chart inserts and completed the telephone interview were offered \$30 CAD for their time. The BC ChIPS intervention continued until contact attempts with all GPs had been made, ending in September 2006. The study was approved by the Brigham and Women's Hospital, Boston, MA and the University of Victoria, Victoria, British Columbia Institutional Review Boards.

Statistical analysis

Demographic differences between those who did and did not receive the intervention were assessed using t-tests and chi square tests as appropriate. To analyze the impact of the one-time mailed intervention on GPs' rates of splitting statin prescriptions, we used an interrupted time series design that compared monthly rates of splitting among GPs who received the intervention (ChIPS GPs) versus those who did not (all other GPs). Three time segments defined the time series, a 22 month baseline period from October 2003 – July 2005, the 13 month intervention period (August 2005 – September 2006), and the 22 month follow-up period (October 2006 – July 2008). The ChIPS GPs model and the other GPs models included a baseline trend, measured in months, indicator terms for the start of the ChIPS intervention period and the follow-up period, and trend terms for the months since the ChIPS intervention period began and months since the follow-up period began.

We next assessed the relative change in the proportion of split statin prescriptions among GPs who received the ChIPS intervention and wrote at least 5 filled statin prescriptions in each of the baseline, ChIPS intervention, and follow-up periods. For each of these GPs, we determined the number of split statin prescriptions and divided this quantity by the total number of statin prescriptions in each period. The proportion in the follow-up period was compared to the proportion in the baseline period.

To identify potential correlates of statin tablet splitting among new users of statins, we used univariate and multivariate logistic regression in which the outcome of interest was whether a unique patient's first statin prescription was split. New users of statins were defined as patients who had not received another statin prescription during the one year period preceding the first statin prescription. Thus, this model considered prescriptions written by any BC physician (GPs or specialists) from October 1, 2004 – June 30, 2008. Generalized estimating equations (GEEs) were used to adjusted standard errors for correlations between patients within a particular physician and assumed an exchangeable correlation matrix.¹⁸ We included the following variables in the analysis: patient age, sex, annual household income in Canadian dollars indexed to the year 2004 (high, $\geq$ \$28,000; moderate, \$20,000 to $<$ \$28,000; and low, $<$ \$20,000), level of public drug plan coverage (full, partial, or none), an indicator variable for whether the prescriber received the ChIPS intervention or not, prescriber specialty (GP or specialist), an indicator variable for whether the prescriber's last statin prescription involved tablet splitting, type of statin, an indicator variable for whether the smallest strength of statin was dispensed, and number of weeks' supply. In a secondary analysis, the same regression analysis was performed for all statin patients (new and continuing users) using the same variables. This analysis used GEEs assuming an exchangeable correlation matrix to adjust standard errors for correlations among patients with the same prescriber and for correlations among statin prescriptions within the same patient. The secondary analysis considered all statin prescriptions for the time period October 1, 2003 – June 30, 2008. All analyses were completed in SAS version 9.1 (Cary, North Carolina). Dr. Dormuth had full access to all data and takes responsibility for the integrity of the data and the accuracy of the data analysis.

RESULTS

Of 5,051 physicians contacted, 282 (6%) GPs agreed to the telephone interview and the mailing. A total of 97 (2%) GPs scheduled an interview appointment but subsequently did not complete the interview. The proportion of physicians who were male was about equal between the GPs who received the intervention (66%) and physicians who declined (67%), $p = 0.7366$. GPs who received the intervention had similar years of experience (mean $\pm$ standard deviation, 24 ± 10 years since medical school) as GPs who did not receive the intervention (23 ± 10 years since medical school), $p = 0.9697$.

Figure 1 displays the proportion of split statin prescriptions written by ChIPS GPs as compared to GPs who did not receive the intervention. At the beginning of the baseline period, 2.6% of all statin prescriptions were split. This proportion rose slowly to roughly 4% in both groups by the end of the 22 month baseline period. Among non-participating GPs, the splitting frequency continued its slow increase at the rate of 0.75% per year, leveling off at 4.4% beginning in month 32. In contrast, during the 13 month ChIPS intervention period, ChIPS GPs' splitting frequency suddenly changed its rate of increase to 3% per year, leveling off at 7.5% of prescriptions in month 32. Thus the absolute splitting increase was 3.1% among ChIPS GPs. Starting in November 2006 and continuing throughout the 22 month follow-up period, the differences between the two groups persisted, with splitting declining slightly among both groups. ChIPS physicians' increased splitting rate translates to an additional 5,434 split statin prescriptions during the intervention and follow-up periods.

Among 187 physicians who wrote five filled statin splitting prescriptions in each of the three observation periods, 26 (14%) increased their proportion of split statin prescriptions by 10% or more (Figure 2), and 39 (21%) by 5% or more between the baseline and follow-up periods. A total of 12 (6%) GPs decreased their proportion of split prescriptions by 1% or more; the highest decrease was 5.6%. Almost a third of prescribers had relative changes within $\pm 1\%$; 6 (3%) had no change at all.

In Table 1, results of the multivariable analysis among prescriptions to new statin patients and prescriptions to all statin patients are presented. In the new user analysis, after adjusting for baseline differences in splitting frequency between groups, ChIPS GPs increased their splitting frequency by 68% in the 3 years following the intervention compared to all other prescribers. Physicians were less likely to split prescriptions for patients aged 80 or older as compared to patients aged 55 – 59. Splitting was 26% more likely for female patients than for male patients, and 33% more likely for patients with income $< \$20,000$ compared to those with income $> \$28,000$. Physicians were 65% less likely to split a prescription for a patient with full prescription drug coverage than for one with no prescription drug coverage. GPs were more than twice as likely to split statin prescriptions as compared to specialists, and all physicians were 3.4 times as likely to split statins if their last statin prescription had been for splitting. Compared to a prescription for fluvastatin, which cannot be split and so provides a reference group for GPs who choose not to split statins, physicians were 45 times as likely to write a split prescription for lovastatin, and between 7 – 20 times more likely to split all other statins.

The secondary analysis among all statin patients produced largely the same results, although weakened the magnitude of effect. For example, after adjusting for baseline differences in splitting frequency between groups, ChIPS GPs increased their splitting frequency by 32% in the intervention period and by 61% in the follow-up period.

DISCUSSION

A one-time intervention combining a mailing and telephone interview was effective in producing a sustained increase in the frequency of statin tablet splitting among BC GPs who agreed to participate. GPs who received the ChIPS chart inserts increased their absolute statin tablet splitting rate by 3.1%, and this increase persisted over a 22-month follow-up period. From the start of the intervention through the end of the follow-up period, ChIPS GPs wrote an additional 5,434 split statin prescriptions more than they would have had they not received the intervention, producing substantial cost savings.

Physicians, in consultation with their patients at the point of prescribing, appeared to take a patient's ability to pay into account when prescribing a split statin: patients with lower incomes and patients with no drug coverage were more likely to receive a split statin prescription. GPs were more likely than specialists to split statins, possibly because they are more familiar with their patients' ability to pay. Female sex, associated with greater cost sensitivity than male sex,^{2, 19} was also a predictor of tablet splitting. A patient's age was associated with the likelihood of statin tablet splitting, but not monotonically. In BC, older age is correlated with having better drug insurance under the provincial insurance system,² and so this correlation explains at least a portion of the lower relative likelihood of tablet splitting among older patients. Also, physicians may be less likely to prescribe splitting for older patients who are frail or cognitively impaired. The relative likelihood of splitting a particular statin was also related to cost: the most expensive statin in British Columbia, atorvastatin (\$2.23/20mg pill), had the greatest likelihood of being split, followed by rosuvastatin (\$1.82/20mg pill), simvastatin (\$1.48/20mg pill) and pravastatin (\$1.20/20mg pill). The only exception to this pattern was lovastatin (\$1.17/20mg pill), which comes as a pre-scored tablet and thereby facilitates splitting.¹⁷ These results imply that physicians who split statin prescriptions were knowledgeable about statin drug costs and used this information as a motivation for tablet splitting.

Based on our results, having information about drug costs and potential cost savings seems critical to increasing tablet splitting among GPs. Surveys of physicians in BC²⁰ and elsewhere²¹ have shown that many are unaware of drug costs. Our chart inserts provided explicit information about drug costs and savings and recommended tablet splitting as an option to save money without compromising efficacy and safety, critical decision support information¹³ that made the intervention relevant to physicians considering tablet splitting. Calculating and providing information on drug costs was relatively easy in BC because it has a single payor system. In other settings, drug prices vary substantially depending on the insurance plan and may not be publicly available. However, individual insurance providers such as the Veteran's Affairs Administration,^{3, 10, 22} Medicaid⁴ and commercial insurers⁷ have successfully increased tablet splitting in their particular jurisdictions.

A strength of our assessment of the intervention's effects is the use of a 22-month baseline period in the time series design. During this period, we observed no significant differences in tablet splitting rates between ChIPS physicians and all other GPs, suggesting that any changes in tablet splitting rates after the intervention began were due to the intervention itself. Although only a small percentage of GPs self-selected into the intervention, and these GPs may be more cost conscious or have more favorable attitudes towards tablet splitting than GPs who did not participate in the intervention, the sudden change in the slope coinciding with the intervention suggests a causal relation. The fact that the slope among non-participating GPs was identical to that of the participants before and continued unchanged during the intervention, suggests that the non-participants are good representatives of the counterfactual splitting experience had the ChIPS GPs not participated. Further, the variability of the change in splitting (one fifth of ChIPS GPs

showed increases of more than 5%, one third showed little or no change and 6% showed reductions) could reflect not only variability in GPs' attitudes to splitting but also variability in patients' and pharmacists' responses to GPs' suggestions.

CONCLUSIONS

The statin splitting intervention was sufficiently effective that it is worth extending and expanding. Based on GPs' interest in cost containment revealed by ChIPS, the government of British Columbia has funded a province-wide program, in collaboration with the BC Medical Association, in which all active GPs receive prescribing portraits (feedback for self-audit), price speedometers and related interventions. The program is called Evidence for Quality Improvement for Patient Care (EQIP, www.eqip.ca). It is known that GPs are often reluctant to discuss costs and ability to pay for drugs,²³ which probably was a factor in the modifying effects of age, sex and income in our results. Therefore, a future enhancement to the intervention might be materials and education to assist physicians to talk with their patients about costs and ability to pay. Such an enhancement could accompany the mailings or be provided directly through programs such as academic detailing.²⁴

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Figure 1.
Proportion of Prescriptions for Statins in BC that were Split Before and After Chart Insert Pilot Study (CHIPS) in British Columbia (October 2003 to July 2008)

Figure 2.
Distribution of Splitting Increases Across 187 Physicians in the Chart Insert Pilot Study (ChIPS), Post-ChIPS Relative to Baseline

Table 1

Multivariable analysis of statin splitting in the Chart Insert Pilot Study (ChIPS) in British Columbia (October 2003 to July 2008)

Parameter	Prescriptions to New Statin Patients*		Prescriptions to All Statin Patients [†]	
	Univariate	Adjusted	Univariate	Adjusted
Number of prescriptions				
Number of split prescriptions		170,776		5,816,779
Number of whole prescriptions		10,242		224,721
Number of whole prescriptions		160,534		5,592,058
ChIPS Prescribers vs. Other Prescribers				
Before (October 2003 – July 2005)	1.14	1.00	1.05	1.00
During (August 2005 – September 2006)	1.88	1.68	1.43	1.32
After (October 2006 – July 2008)	1.97	1.68	1.80	1.61
Patient characteristics				
Age (in years)				
35–54	1.02	0.92	1.24	0.93
55–59	1.05	1.00	1.27	1.00
60–64	1.14	1.02	1.49	1.06
65–69	1.08	1.05	1.31	1.06
70–74	0.94	0.97	0.88	0.83
75–79	0.83	0.93	0.66	0.73
80–84	0.70	0.82	0.50	0.64
≥85	0.63	0.80	0.35	0.55
Female sex	1.15	1.26	0.93	1.24
Income > \$28K	0.98	1.00	1.65	1.00
\$20K ≤ Income < \$28K	1.15	1.33	0.98	1.34
Income < \$20K	1.02	1.33	0.60	1.32
Public drug coverage				
No PharmaCare Coverage	1.26	1.00	2.37	1.00
Partial PharmaCare Coverage	0.96	0.80	0.97	0.65
Full PharmaCare Coverage	0.64	0.53	0.29	0.29
Physician characteristics				

	Prescriptions to New Statin Patients*		Prescriptions to All Statin Patients†	
GP/FP	2.47	2.12	1.59	1.42
Physician's last statin script split	3.60	3.41	2.85	2.70
<i>Statin type</i>				
Fluvastatin dispensed	0.08	1.00	0.13	1.00
Atorvastatin dispensed	0.90	19.89	1.56	12.92
Rosuvastatin dispensed	1.62	19.17	1.62	10.55
Lovastatin dispensed	1.92	45.10	0.85	12.70
Simvastatin dispensed	0.49	7.31	0.43	4.29
Pravastatin dispensed	0.73	9.80	0.31	2.80
<i>Strength and Supply</i>				
Smallest strength tablet dispensed	0.49	0.36	0.69	0.47
No. of weeks supply dispensed	1.08	1.07	1.10	1.08

* Newly treated patients between October 1, 2004 to June 30, 2008;

† Statin prescriptions to new and existing patients between October 1, 2003 (2004 for new patients) and June 30, 2008, excluding prescriptions with tablet-to-days-supply ratios other than 0.5 or 1.0;

‡ Estimates from univariate logistic regression model;

§ Estimates from multivariable GEEs that adjusted for all other covariates in the table, and for prescriber-level clustering;

// Estimated from multivariable GEEs that adjusted for all other covariates in the table, and for patient-level clustering and prescriber-level clustering.