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Brief Report

Effect of a Proton Pump Inhibitor Deprescribing Guideline on Drug Usage and Costs in Long-Term Care

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A B S T R A C T

Objectives: To assess the effect of a proton pump inhibitor (PPI) deprescribing guideline on PPI usage and PPI drug costs in one long-term care home in Ontario, Canada.
Design: Interrupted time-series analysis to compare monthly PPI usage and average monthly PPI cost per resident 9 months before guideline implementation to 12 months after.
Setting: One long-term care home in Ottawa, Ontario, Canada.
Participants: Long-term care residents prescribed a PPI over a 21-month period (n = 335).
Intervention: PPI deprescribing guideline and decision support tool used during quarterly medication reviews.
Measurements: (1) Total number of PPI prescriptions (PPI usage) and (2) average PPI drug cost per resident. We also measured the proportion of residents whose PPI was deprescribed in the preguideline period and postguideline period.
Results: The deprescribing guideline was associated with a decrease in PPI usage but the association was not statistically significant (−8.7 prescriptions, 95% confidence interval [CI] −22.0 to 4.6). The PPI guideline led to a significant decrease in average monthly PPI drug cost per resident over time (0.16 CAD reduction per month; 95% CI −0.29 to −0.03). In the 9 months before intervention, 57 (27.8%) of 205 eligible residents had their PPI deprescribed, and in the 12 months after intervention 134 (50.0%) of 268 eligible residents had their PPI deprescribed (difference in proportions of 22.2%; 95% CI 13.4–30.4).
Discussion/conclusion: The deprescribing guideline was associated with a decline PPI usage; however, this negative association was not statistically significant. PPI usage declined in the initial 6 months after guideline implementation but began to climb back to baseline after this, which may explain the lack of a significant reduction in PPI usage. This suggests that it was difficult to maintain PPI deprescribing efforts long-term. Although implementation of a PPI deprescribing guideline may lead to an initial reduction in PPI usage, and a significant reduction in the average cost of PPI prescriptions over time, it is imperative to explore ways to sustain deprescribing guideline use.
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Proton pump inhibitors (PPIs) effectively treat several upper gastrointestinal disorders. In many patients (such as those with mild to moderate gastroesophageal reflux), the duration of therapy should be short-term (eg, 4 to 8 weeks).[1] Some patients continue PPIs beyond the recommended duration.[2–5] In long-term care (LTC), 50% of residents may be receiving an inappropriate PPI,[6] whereas older patients

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may be at higher risk of continuing PPIs unnecessarily after hospital discharge.[5] PPI use has been associated with harms such as *Clostridium difficile* infection and fractures, the risks of which are already increased in older persons.[7–10] Approximately $250 million was spent on PPIs by public drug programs in Canada in 2012, much of which may be excessive.[11] There is a need to reduce unnecessary PPI use through deprescribing (the planned, supervised tapering and/or stopping of drugs), which may reduce PPI spending and risk of adverse effects. We developed a PPI deprescribing guideline and decision support tool[12] and implemented it at 3 LTC homes as part of a larger research study evaluating development and implementation of deprescribing guidelines.[13] In this article, we describe the effect of implementing the guideline on PPI usage and drug costs in one LTC home in Ottawa, Ontario.

Methods

We conducted a retrospective, time-series analysis from November 2013 to July 2015, using pharmacy drug utilization records in one 450-bed LTC home in Ottawa, Ontario. Although we implemented the guideline in 3 homes, this home was the only one interested in conducting a drug utilization review related to the project. The time period was divided into 21 monthly intervals (9 months before guideline implemented and 12 months after). We measured 12 months of postguideline implementation since the implementation process occurred over 3 months (it may have taken some residents up to 3 months to have their PPI reviewed because medication reviews occur quarterly). Residents were eligible if they received a PPI prescription at any point during the 21-month period. As such, we allowed for new residents to enter the study (ie, new admissions or new PPI prescriptions), and existing residents may have dropped out (discharged or died) or stayed in the sample. Therefore, the denominator may change each month (ie, number of residents whose PPI could be deprescribed that month). We did not collect any demographic or resident-specific information, such as number of concomitant medications, age, comorbidities, and so forth.

The deprescribing guideline was implemented in July 2014. We presented a PowerPoint summary of the PPI deprescribing guideline and our decision support tool (http://www.open-pharmacy-research.ca/wordpress/wp-content/uploads/ppi-deprescribing-algorithm-cc.pdf)[12] to physicians, pharmacists, and nurses at an in-person meeting at the LTC home. The support tool was used during individualized quarterly medication reviews by the physicians and pharmacists. Our outcomes of interest were: (1) monthly PPI usage and (2) monthly average PPI cost per resident.

PPI usage was defined as the total number of PPI prescriptions each month. PPI deprescribing was classified as complete cessation, using a lower dose, or switching to as-needed or “on-demand” therapy. To capture deprescribing interventions whereby a PPI was not ceased completely, we subtracted prescriptions where the PPI dose had been lowered (eg, changed from high-dose PPI to low-dose PPI, changed from twice-daily dose to once-daily dose) or switched to “on-demand” use from the total (the total already took into account cases in which the PPI was stopped completely). PPI cost included drug cost only (professional fee and markup not included). Unit drug costs were obtained from Ontario’s drug formulary for publicly funded drugs.[14] For drugs not covered by the public formulary, we used the pharmacy provider’s drug cost (drugs provided by pharmacy wholesaler). Data on the number of residents overall at the LTC home was provided by the pharmacy provider. Drug cost was calculated as the average PPI cost per resident. There were no changes in physician reimbursement, prescribing limitations, drug coverage, or legislation that may have affected physician prescribing of PPIs in LTC over the time period of the study.

We used segmented interrupted time-series (ITS) regression analysis with adjustment of autocorrelation[15] to assess the impact of PPI guideline implementation on PPI usage and associated cost. The analysis provides an estimation of changes in level and trend in pre- and postintervention periods. The level is defined as the value at the beginning of a given period (intercept), whereas the trend represents the rate of change during a study period (slope). We compared the level and trend of the segment after the intervention with those of the segment before the intervention. Our model evaluated the effect of the intervention, the effect of time, and the intervention*time interaction (effect of the intervention over time). We assessed for autocorrelation using the Durbin-Watson statistic. We performed analysis using the PROC AUTOREG command in SAS 9.4 (SAS Institute, Cary, NC).

We also compared the proportion of eligible residents whose PPI was deprescribed in the entire 12 months after the guideline was implemented to the proportion of eligible residents whose PPI was deprescribed in the 9 months leading up to guideline implementation (difference in proportions test assuming independent samples, 95% confidence interval [CI]). The project was approved by the LTC home’s internal research ethics board as an evaluation of a quality improvement initiative.

Results

PPI usage from November 2013 to July 2015 is displayed in Figure 1. A total of 335 residents received a PPI prescription over the 21-month period. At baseline, there were 147 residents on PPIs. The sample at guideline implementation was 180 residents, and in the last month of the study the sample was 206 residents. The mean number of new residents entering the sample each month was 8.7 residents (SD 3.1). Following guideline implementation, PPI usage dropped by 8.7 prescriptions (95% CI −22.0 to 4.6, $P = .19$). Guideline implementation did not result in a significant change in slope (reduction in PPI usage) in the 12 months after implementation (1.42 fewer prescriptions per month, 95% CI −4.40 to 1.56, $P = .34$). Before implementation of the deprescribing guideline, there was an upward increase in average monthly PPI cost per resident (0.14 CAD [Canadian dollars]; 95% CI 0.03–0.25, $P = .016$). Following guideline implementation, the average monthly PPI cost dropped by 0.56 CAD per resident (95% CI −1.12 to 0.01, $P = .059$). PPI deprescribing guideline implementation resulted in a significant change in slope, suggesting that average monthly PPI costs per resident decreased over time (0.16 CAD per month reduction; 95 % CI −0.29 to −0.03, $P = .019$). In the entire 9 months before intervention, 57 (27.8%) of 205 eligible residents had their PPI deprescribed, and in the entire 12 months after intervention, 134 (50.0%) of 268 eligible residents had their PPI deprescribed. This represents a difference in proportions of 22.2% (95% CI 13.4–30.4, $P < .00001$).

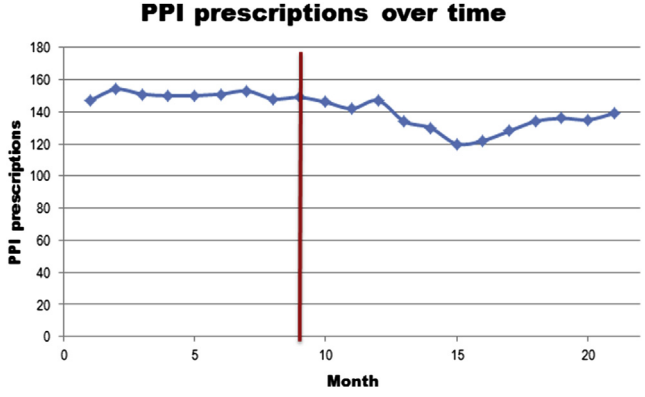

Fig. 1. PPI usage across 21 months.

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