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Did a physician-targeted intervention that reduced potentially inappropriate prescribing to elderly patients also reduce related hospitalizations?

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INTRODUCTION

- A potentially inappropriate medication (PIM) is a drug that may be inappropriate because the risks outweigh the potential benefits.¹
- PIM use in the elderly can be especially harmful due to less effective clearance systems, frail bodies, and polypharmacy.^{2,3}
- Maio and colleagues estimated that approximately 20% of elderly Emilia-Romagna residents were prescribed a PIM in 2006.⁴
- A retrospective, longitudinal analysis of over 1.4 million elderly, Emilia-Romagna residents (2003-2013) demonstrated that individuals exposed to a PIM were 16% more likely to be hospitalized than persons unexposed to PIM.⁵
- Evidence of the clinical effectiveness of interventions aimed at reducing PIM prescribing in the elderly is limited and has yielded mixed results.⁶

OBJECTIVES

To determine whether a general practitioner focused intervention aimed at decreasing PIM prescribing in the elderly can decrease the risk of PIM-related hospitalizations.

METHODS

This study was reviewed by the Thomas Jefferson University IRB and determined not to constitute human subjects research.

Intervention

- Implemented over a 2 year time period: 2008-2009.⁷
- Serving residents of the Local Health Authority (LHA) of Parma, Emilia-Romagna region (RER), Italy, one of the 11 regional LHAs.
- Aimed to engage 303 general practitioners (GPs) on PIM awareness in the elderly population.
- The three components of the intervention included:
 - Circulation of a developed list of PIM to “always be avoided” and a list of alternatives.
 - Annual reviews of incidence of PIM use in the elderly.
 - Educational sessions on PIM use (academic, case reviews).

Comparators

- We evaluated the effectiveness of the physician-directed PIM intervention by comparing the risk of PIM-related hospitalizations for residents under the care of a general practitioner (GP) in Parma LHA during and after intervention (post-intervention, 1/1/2008-9/30/2011) to residents under the care of a GP in the rest of the RER (Non-Parma).

Study Population

- Study time period: 01/01/2005 – 09/30/2011.
- Elderly individuals (≥65 years old) who were residents of RER for at least one year were included in the cohort.
- Individuals exited the cohort at the earliest time they met one of the following criteria: death, moved out of the region, or hospitalization for more than 30 consecutive days.

Modeling

- We developed a time-dependent covariate, repeated-events, Cox Proportional Hazard Model using fully-linked longitudinal administrative claims from the RER database.
- Event of interest: PIM-related hospitalizations, defined as an unplanned, inpatient hospitalization occurring during PIM exposure.
 - Defined PIM: Drugs that should be “always be avoided”, according to the 2007 Maio Criteria.⁸
 - To estimate PIM exposure we computed the number of days supplied for each medication of interest (using Defined Daily Doses) and added 30 days to capture any residual effects of a PIM. An individual was considered exposed to PIM from the date the prescription was filled until 30 days after the prescription was expected to end based on DDD.
 - Adjustments for the outcome included: age, gender, number of non-PIM hospitalizations (in the previous four quarters), number of chronic condition drug groups (CCDGs) (in the previous four quarters).⁹

Calculations

- Demographics were summarized for Parma and Non-Parma at the start of the intervention (01/01/2008).
- Unadjusted PIM exposure and PIM related-hospitalizations were estimated for Parma vs. Non-Parma residents.
- We used Cox modeling to estimate adjusted hazard ratios (HRs) of PIM-related hospitalizations for Parma post vs. pre-intervention.
- We calculated the number of PIM-related hospitalizations avoided in Parma post-intervention vs. pre-intervention (Figure 1).

Figure 1. Equations for Hospitalizations Avoided

$$\text{Preventable Fraction} = 1 - \text{HR}$$

HR = HR from Cox model for interaction between period (pre vs. post) and location (Parma vs. not)

$$\# \text{Expected hosp} = \frac{\# \text{Observed hosp}}{1 - \text{preventable fraction}} \quad \# \text{Avoided hosp} = \# \text{Expected hosp} - \# \text{Observed hosp}$$

RESULTS

Demographics

- When the intervention was introduced in 2008, there were 906,810 elderly residents in the Emilia-Romagna region and approximately 1/10th were under the care of a Parma GP.
- The exposure to PIM, previous hospitalizations, and comorbid status, gender, and age strata of residents in Parma and Non-Parma were similar.

Data for this study was retrieved from the Regional database of the Emilia-Romagna Region, provided through a collaborative agreement between the Health Care Authority, Regione Emilia-Romagna, Italy, and Thomas Jefferson University.

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RESULTS

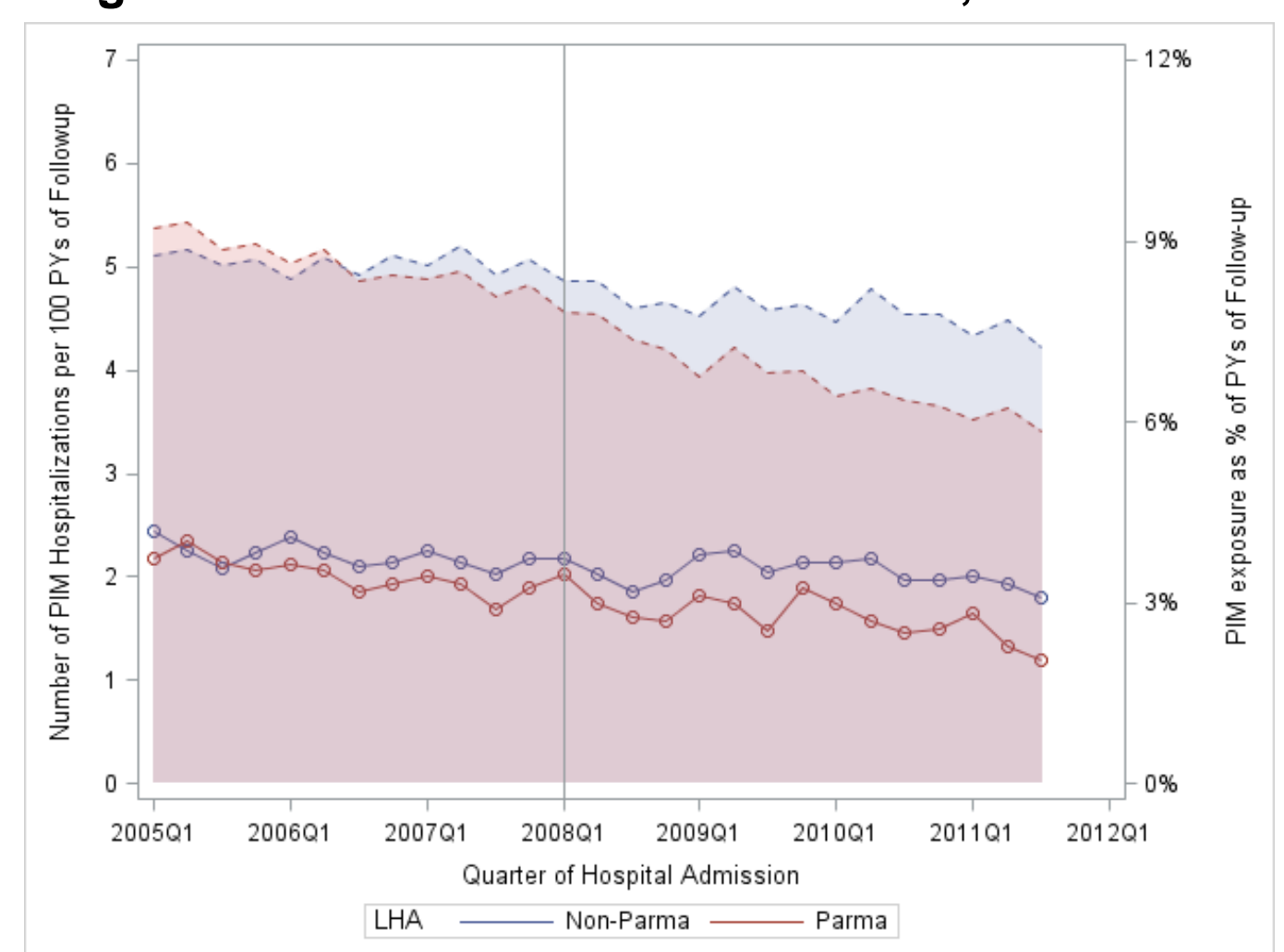
Table 1. Demographics, 2008

	All		Non-Parma, n(%)	Parma, n(%)
	N	%		
No. Patients	906,810	100%	816,325 (100%)	90,485 (100%)
Exposed to PIM (yes)	76,070	8.4%	68,798 (8.4%)	7,272 (8.0%)
Female	522,895	57.7%	470,132 (57.6%)	52,763 (58.3%)
Age				
65-74 years	459,946	50.7%	414,590 (50.8%)	45,356 (50.1%)
75-84 years	328,065	36.2%	295,318 (36.2%)	32,747 (36.2%)
>84 years	118,799	13.1%	106,417 (13.0%)	12,382 (13.7%)
Hospitalizations, 2007				
0	757,427	83.5%	681,609 (83.5%)	75,818 (83.8%)
1-2	134,989	14.9%	121,658 (14.9%)	13,331 (14.7%)
3-4	12,207	1.3%	11,043 (1.4%)	1,164 (1.3%)
5+	2,187	0.2%	2,015 (0.2%)	172 (0.2%)
CCDGs, 2007				
0	53,241	5.9%	47,367 (5.8%)	5,874 (6.5%)
1-2	378,357	41.7%	339,836 (41.6%)	38,521 (42.6%)
3-4	334,820	36.9%	302,291 (37.0%)	32,529 (35.9%)
5+	140,392	15.5%	126,831 (15.5%)	13,561 (15.0%)

PIM Exposure & Hospitalizations

- In 2005, residents of Parma and Non-Parma were exposed to approximately 8 person years (PYs) of PIM per 100 PYs follow-up time (Figure 2).
- Post-intervention, we observed a decrease in exposure to PIM, appearing a more drastic decline in Parma than Non-Parma.
- Post-intervention there appears to be a decline in PIM-related hospitalizations in Parma consistent with the decline in PIM-exposure (post-intervention).

Figure 2. Parma vs. Non-Parma Trends, 2005-2011



Hazard Ratios

- Compared with others in the RER during the same periods, Parma residents post-intervention were 7% less likely to have a PIM-related hospitalization than pre-intervention (Table 2).
- We estimated that approximately 411 PIM-related hospitalizations were avoided due to the intervention.

Table 2. Cox Model Results

	HR (95% CI)	P value
Post- vs. Pre- Intervention	0.93 (0.89, 0.97)	0.002
Female	0.90 (0.89, 0.91)	<0.001
Age	1.08 (1.08, 1.08)	<0.001
1+ CCDG	1.50 (1.50, 1.51)	<0.001
1+ hospitalization	1.23 (1.23, 1.24)	<0.001

LIMITATIONS

- The RER database does not include inpatient medications (potential underestimation of PIM exposure).
- Although adjusted for available confounders, causality of hospitalizations is unknown.

CONCLUSIONS

- Approximately 411 PIM-related hospitalizations were avoided in Parma LHA and elderly residents during post-intervention were at significantly lower risks of PIM-related hospitalizations than pre-intervention.
- We believe that the observed decline in PIM-hospitalizations within Parma LHA was attributable to the decreased exposure to PIMs.
- To our knowledge this is the first study to evaluate the effectiveness of a multi-year, PIM awareness program with respect to incident hospitalizations.
- We believe that the observed decreased risk of PIM-related hospitalizations in Parma LHA post-intervention was due to changes in physician behavior.
- We urge researchers to continue to evaluate the effectiveness of interventions targeted at increasing awareness of the potential harms of PIM in the elderly.

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