



Optimal delivery of outpatient follow-up to reduce readmission after hospital discharge

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An analysis using time-specific propensity scores

Background

- Hospital readmissions have been of wide policy interest, as quality measure of hospital care or as marker of poor integration of the health care delivery system
- A portion of hospital readmission may be preventable, which indicates an opportunity for containing cost AND for improving the quality of patient care
- Outpatient follow-up after discharge has been promoted as a KEY INTERVENTION POINT in medical care

Methodologically rigorous large-scale studies are needed to inform the development of policies and clinical guidelines for the optimal delivery of outpatient follow-up post hospital discharge

Objectives

- 1) To estimate the effect of the precise timing of follow-up care within 30 days on readmission in the 60 days following discharge among hospitalized elderly or chronically ill patients.
- 2) To explore this effect by type of provider (primary care physician or medical specialist) and patient morbidity level

Study Design

- Population-based claims database from the Régie de l'Assurance Maladie du Québec
- Elderly ($\geq 70+$) or chronically ill patients registered by a primary care physician
- 620,656 index hospital admissions for any cause between 2002-2009
- Physician billing data is extracted on the day of the index admission and on any medical services (outpatient or inpatient) in the 60 days following discharge
- Exclusions: long-term care facilities; transfer to another facility; same day readmissions; mental health, pregnancy/child birth and pediatric admissions; admissions with a stay ≥ 30 days; admissions for Northern Quebec
- Control variables: patient covariates (demographics, health status and health utilization), enrolling primary care physician covariates (demographics and practice type), year and hospital fixed-effects and relevant two-way interactions and time-dependent effects

Measures

Outcome:	Time (in days) to a hospital readmission
Censoring:	After 60 days following hospital discharge
Competing risk:	Death
Exposure:	Outpatient physician follow-up visit
Heterogeneity:	1. Timing (w/in 30 days) of outpatient follow-up 2. Type of physician (primary care or specialist) 3. Patient morbidity level

Models

Exposure models (propensity score models):

- Flexible parametric survival model (Royston and Parmar, 2002)
- Baseline hazard function, continuous covariates and time-dependent effects modeled using restricted cubic splines

$$\text{Stabilized IPW} = \frac{\Pr(\text{Exposure actually received})}{\Pr(\text{Exposure actually received} | \text{Covariates measured at index discharge})}$$

Outcome models (MSM estimated by IPW):

- Flexible parametric survival model for competing risk (Hinchliff and Lambert, 2013)
- Models cumulative incidence function and cause-specific hazard ratio

Time-Specific Propensity Score (PS)

Failing to account for changing temporal patterns of post-discharge follow-up may introduce bias:

- Probability of receiving post-discharge follow-up changes over time
- Patients receiving early or late follow-up may differ on health status
- Patients who died or being readmitted early after discharge may differ in their propensity to have previously received follow-up

Results

Table 1. Patient characteristics at index admission

	Proportion (%)	
	Follow-up (N = 395,014)	No follow-up (N = 225,642)
N = 620,656	51.2	55.4
Female		
Age category		
18 - 34	0.6	0.7
35 - 49	3.5	2.9
50 - 64	16.1	12.5
65 - 79	49.4	44.6
≥ 80	30.4	39.3
Material deprivation (Q, quintile)		
Q1	14.0	12.3
Q2	16.6	15.5
Q3	19.9	19.1
Q4	21.5	21.4
Q5	21.7	24.0
Geographical region		
Urban/academic	34.2	32.9
Suburban	40.4	37.0
Intermediate	20.3	22.5
Rural	4.9	7.1
Length of hospital stay (days)		
0 - 2	25.0	21.4
3 - 6	33.1	31.4
7 - 13	27.3	28.3
14 - 20	9.5	11.3
21 - 30	5.1	7.6
No. of previous admissions		
0	32.8	31.0
1	24.3	23.5
2	15.3	15.1
≥ 3	27.6	30.5
Morbidity level		
Moderate	16.3	18.5
High	28.2	27.8
Very High	55.6	53.7

Reduction in the cumulative incidence of readmission attributable to outpatient follow-up after discharge (per 1,000 discharges; 95% confidence intervals/bands)

Table 2. Any physician

Days since discharge	Reduction in risk
7	67.8 (66.7 - 69.0)
14	102.5 (100.9 - 104.1)
21	110.0 (108.2 - 111.7)
30	105.2 (103.2 - 107.2)
60	87.8 (85.5 - 90.1)

*Clustered bootstrap 95% CIs.

Figure 1. Any physician

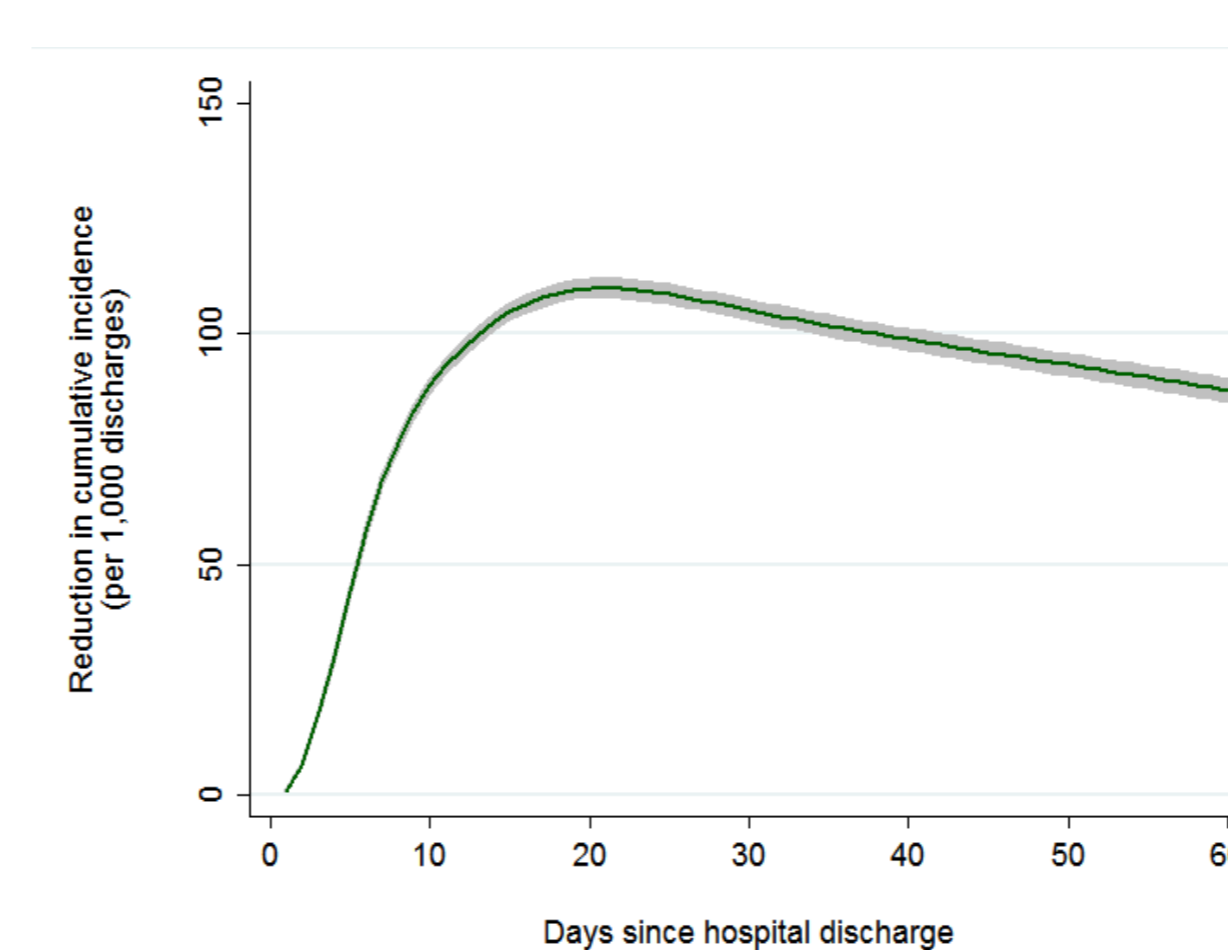
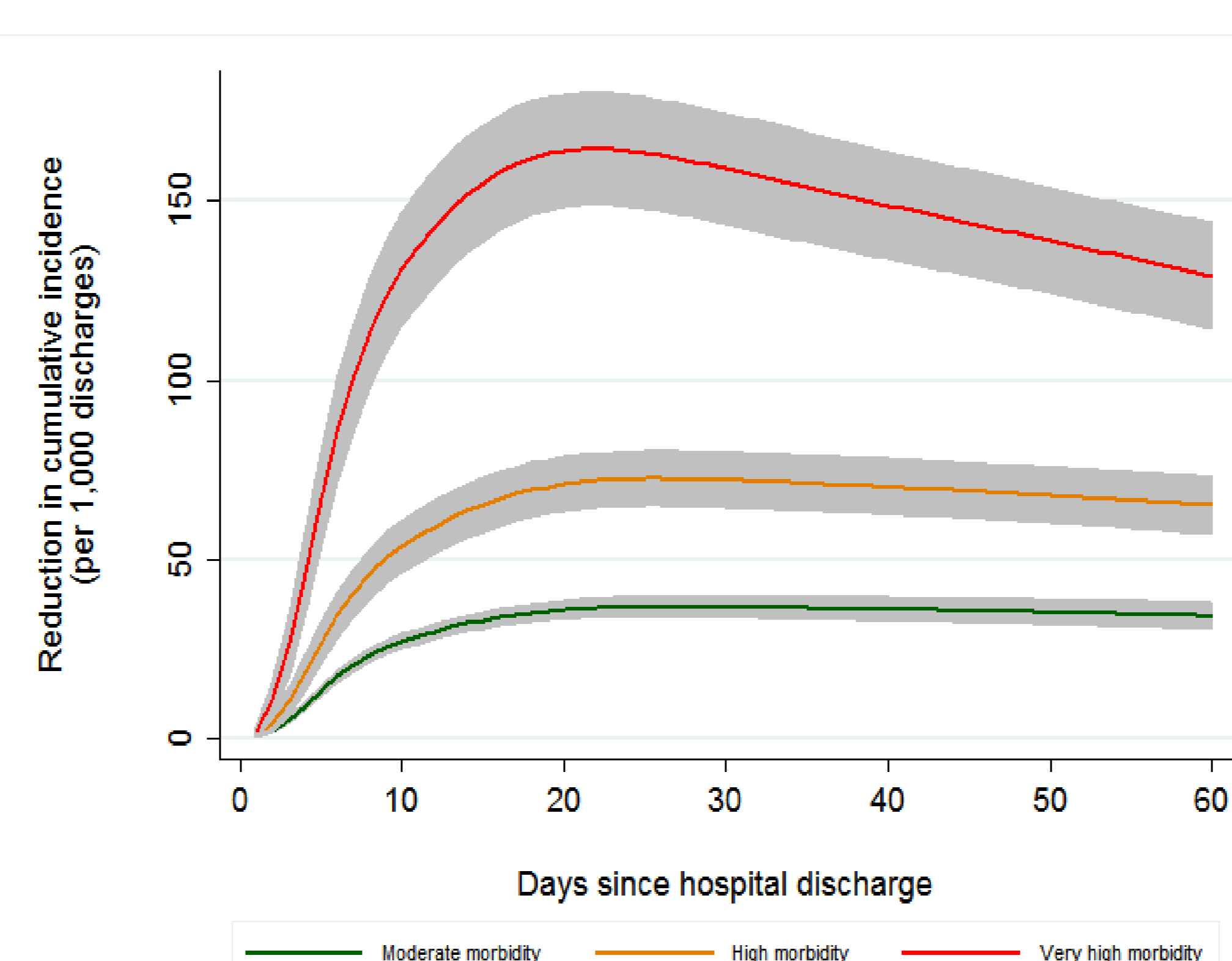
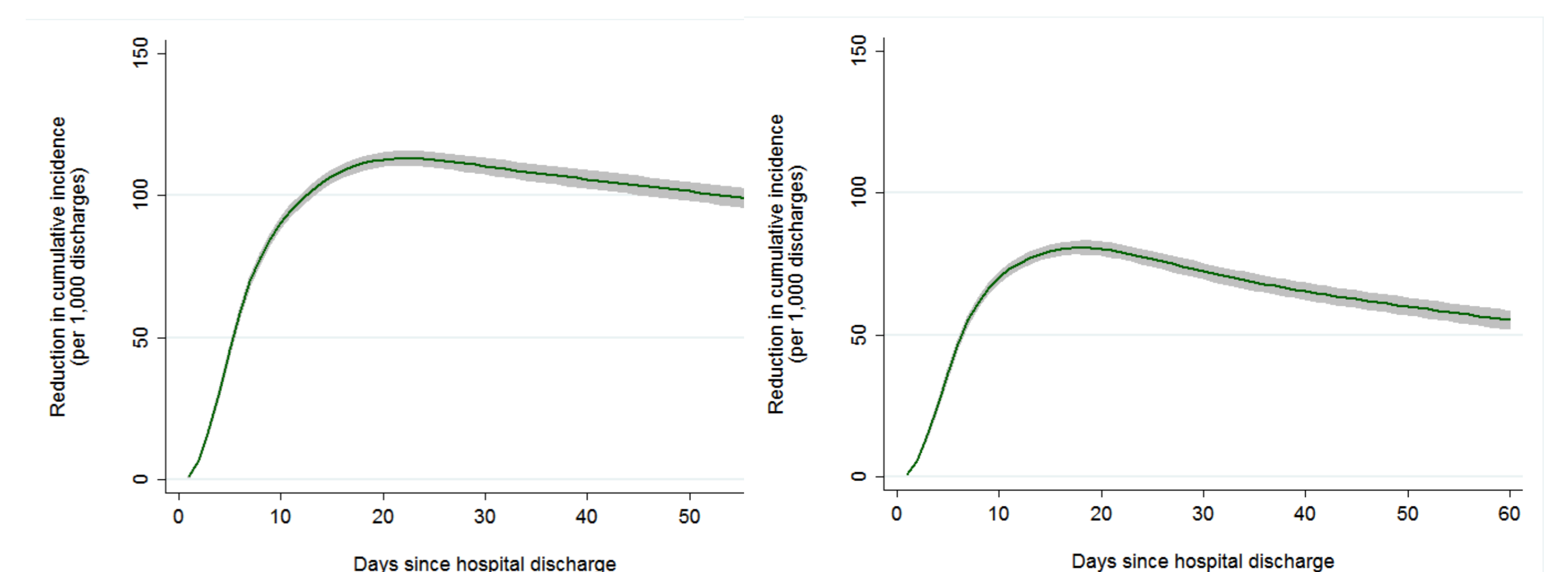


Figure 2. Any physician, by patient morbidity level



Results (cont'd)

Figure 3. Primary care physician Figure 4. Medical specialist



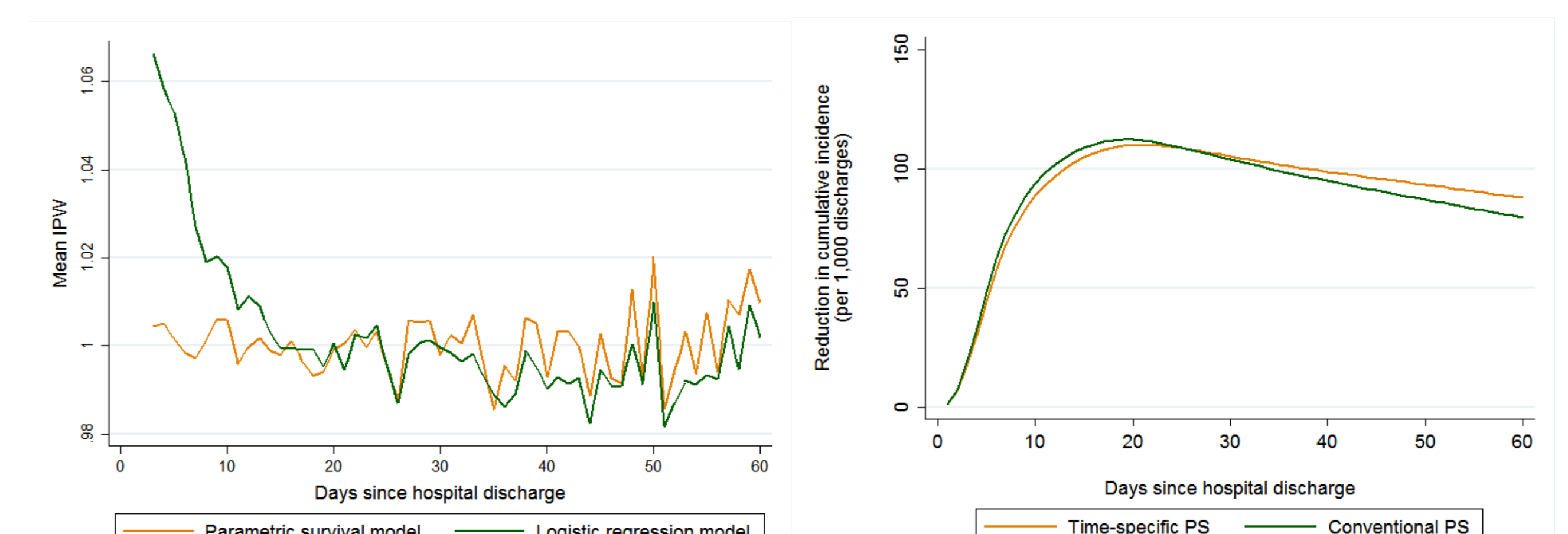
Main Findings

- 30-day risk of readmission reduced by 10.5%-point in patients who received post-discharge follow-up
- 30-day HR = 0.54 (95% cluster bootstrap CI: 0.53 - 0.56)
- Largest risk reduction achieved by follow-up within 21 days of post-discharge
- Largest risk reduction for patients with very high morbidity, timeliness especially important for them
- Post-discharge follow-up by a primary care physician contributed more towards reducing the risk of readmission than follow-up by a medical specialist

Sensitivity Analysis

Comparison of IPW diagnostics and main results obtained via time-specific PS approach or conventional approach (logistic regression)

Figure 5. Mean IPW (diagnostic) Figure 6. Comparison of main results



Conclusions

- Post-discharge outpatient follow-up yields large reductions in the risk of readmission, corresponding to approximately a 46% relative decrease in the rates of 30-day readmission
- Future policies to reduce readmission should target timely post-discharge follow-up and emphasize follow-up in the primary care setting within the first 3 weeks of discharge, and particularly for high-morbidity patients

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