Primary Care Mixed Payment Models, and the Hospitalization of Diabetic Patients

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ABSTRACT

**** Preliminary and not for distribution ****

We investigate the impact on diabetic patients of primary care physicians switching from an enhanced fee-for-service remuneration model to a blended capitation one. Using administrative data, we construct a panel of diabetic patients and employ a difference-indifferences approach to identify the impact of a change in physician payment models on patients' hospital admissions. Statistically and economically significant increases in hospital admission are observed on both the intensive and extensive margins for senior female patients. In contrast, the impacts on male and younger female patients were small and not statistically significant. Physician gender does not appear to be associated with the change, but the effect is smaller for young physicians. If one of the goals of the shift in remuneration methods is improved chronic disease management, these results provide a cautionary message. While our data cannot speak to any changes in patient well-being, hospital costs are clearly not reduced.

Primary Care Payment Models
and the
Hospitalization of Diabetic Patients

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McMaster University

CHEPA Centre for Health Economics and Policy Analysis

Primary Care Reform in Ontario

Research question

- What is the impact of physicians switching from FHG (comparison group) to FHO (treatment group) on the hospitalization of diabetic patients?
  - Chronic disease management is a central goal of primary care reform

FHG	*Transitions to FHO*			
2006	**2007**	**2008**	**2009**	**2010**

- Kantarevic and Kralj (2013), and Kiran et al. (2014), find evidence of improved primary care diabetes management in this context
  - Any “follow-on” for hospitalization? (Especially, emergency admissions?)

What do we find?

- All of
  - Total number of hospitalizations (intensive margin)
  - Proportion of patients with at least one hospitalization (extensive margin)
  - Length of stay in hospital
- Increased for senior (aged 65+) female patients after their GP's remuneration model changed from FHG to FHO

- No change for male and younger female patients

Data

- Longitudinal Ontario Health Administrative data
- Identify diabetes from admin data using ICES's algorithm
- All causes hospitalization
  - Very similar results if coded as diabetes
- Unit of analysis
    - patient for coefficients
    - physician for standard errors (clusters errors)
- 159,980 patients consistently enrolled with the same GP
- Initially 2,999 FHGs (about 30% of GPs in Ontario)
  - 1,645 stayed FHG (7.3% diabetic patients)
  - 1,354 switched to FHO by the end (6.7% diabetic patients)

Empirical Strategy:
Two-stage "Double Robust" Approach

Same as Kantarevic and Kralj (2013)

- **Stage 1 –** Estimation of propensity scores and weights
  - **Stage 1.1 – propensity scores**
    - Probit: $\Pr(FHOdoc) = \mathrm{F}(\beta X)$
    - $FHOdoc = \begin{cases} 1 & \text{if a GP switched from FHG to FHO at some point during our data period} \\ 0 & \text{if a GP stayed in FHG} \end{cases}$
    - X: patient and practice characteristics
  - **Stage 1.2 – weights**
    - Generated for the comparison group (FHGs) to render its characteristics, on average, similar to those of the treatment group (FHOs)
    - Local linear regression used to combine propensity scores into weights

- Stage 2 - Difference-in-Differences (Fixed Effect model)

  - FHO = Proportion to the year in a FHO model (0, 1 or % in transition year)

  - Specification 1 – Base model

$$Hosp_{it} = \lambda_i + Year_t + \beta_X X_{it} + \beta_{FHO}\, FHO_{it} + u_{it}$$

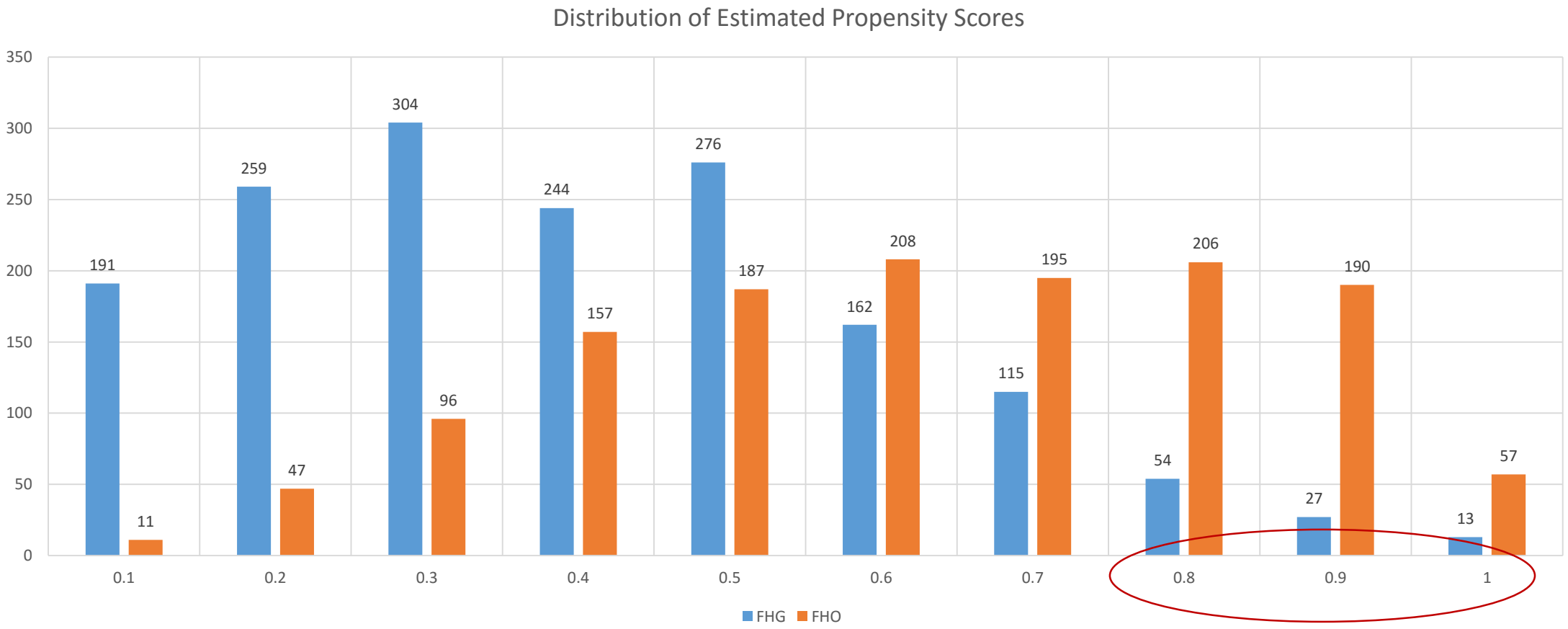
  - Specification 2 – Interactions (e.g., Age; or geography or sex)

$$Hosp_{it} = \lambda_i + Year_t + \beta_X X_{it} + \beta_{FHO}\, AgeGroup * FHO_{it} + u_{it}$$

Summary Statistics, by Treatment Status, Fiscal Year 2006/07

	Treatment (FHO)	Comparison (FHG)	
		Unweighted Sample	Weighted Sample
Expected Income gain ($1,000)	23.6	-25.5***	25.5
Average Age	48.5	50.9***	48.9
Male Percentage	0.634	0.664	0.642
Canadian University Graduate	0.850	0.723***	0.835
Rurality Index	8.73	4.17***	9.57
Percent in Toronto	0.134	0.107*	0.119
Services per day	39.2	45.3***	40.3
Visits per day	28.7	31.7***	29.4
Annual workdays	249	251	252
Roster size	1388	1310**	1428
Referrals made	6133	6270	6243
N	1354	1645	1645

Estimated propensity score distribution



Sensitivity tests: Trim observations with extreme propensity scores; cap weights; various bandwidths
No important changes to the findings

Getting the standard errors right

- “Normal” (analytical) fixed-effect standard errors are not appropriate
  - In part because weights are estimates

- Bootstrap (999 replications)
  - Cluster-bootstrap at level of physician
  - Each bootstrap sample encompasses both estimation stages
  - Studentize the bootstrap coefficients
    - Bootstrap t-statistics, not coefficients
    - Re-center the t-statistics
  - Generate p-values from bootstrapped t-distribution

Base Model

	Hospitalization Intensive Margin			Hospitalization Extensive Margin			Length of Stay in Hospital
	All	Ambulance	Emergency	All	Ambulance	Emergency	
β_{FHO}	0.0065*	0.0038**	0.0052*	0.0041**	0.0021*	0.0029	0.0563**
Std Err	(0.0027)	(0.0019)	(0.0031)	(0.002)	(0.0012)	(0.0019)	(0.0287)
P-value	[0.073]	[0.053]	[0.095]	[0.047]	[0.093]	[0.130]	[0.046]
N	799990	799990	799990	799990	799990	799990	799990

Note: Analytical standard errors in parentheses; * p<0.10, ** p<0.05, *** p<0.01.
P-values from bootstrapped t-statistics in brackets.

- The switch to a FHO from a FHG is associated with a small increase in hospitalizations for this set of consistently rostered diabetic patients.

By patient age (Results driven by older patients)

	Hospitalization Intensive Margin			Hospitalization Extensive Margin			Length of Stay in Hospital
	All	Ambulance	Emergency	All	Ambulance	Emergency	
β_{FHO_y}	0.0051	0.0040	0.0016	0.0006	0.0028	-0.0053	0.0324
	(0.0191)	(0.0068)	(0.0159)	(0.0109)	(0.0046)	(0.0095)	(0.0931)
	[0.795]	[0.561]	[0.921]	[0.956]	[0.548]	[1.000]	[0.720]
β_{FHO_m}	-0.0014	-0.0013	-0.0003	-0.0001	-0.0013	0.0004	-0.0018
	(0.0038)	(0.0020)	(0.0033)	(0.0023)	(0.0013)	(0.0020)	(0.0322)
	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[0.852]	[1.000]
β_{FHO_s}	0.0170***	0.0103***	0.0127**	0.0098***	0.0064***	0.0070**	0.1336***
	(0.0063)	(0.0035)	(0.0050)	(0.0035)	(0.0023)	(0.0031)	(0.0503)
	[0.009]	[0.007]	[0.009]	[0.007]	[0.008]	[0.027]	[0.006]
N	799990	799990	799990	799990	799990	799990	799990

Note: Analytical standard errors in parentheses; * p<0.10, ** p<0.05, *** p<0.01.
P-values from bootstrapped t-statistics in brackets.

By rurality (Result both rural and urban)

	Hospitalization Intensive Margin			Hospitalization Extensive Margin			Length of Stay in Hospital
	All	Ambulance	Emergency	All	Ambulance	Emergency	
Non-Rural ($RIO \leq 20$)							
β_{FHO_s}	0.0122**	0.0062*	0.0088*	0.0057	0.0040	0.0038	0.0776
	(0.0060)	(0.0033)	(0.0047)	(0.0037)	(0.0024)	(0.0030)	(0.0497)
	[0.0450]	[0.056]	[0.072]	[0.124]	[0.102]	[0.190]	[0.122]
N	686035	686035	686035	686035	686035	686035	686035
Rural ($RIO > 20$)							
β_{FHO_s}	0.0349*	0.0262***	0.0275*	0.0254***	0.0162***	0.0191**	0.3434**
	(0.0180)	(0.0096)	(0.0143)	(0.0085)	(0.0052)	(0.0086)	(0.1378)
	[0.067]	[0.015]	[0.076]	[0.006]	[0.003]	[0.045]	[0.021]
N	113955	113955	113955	113955	113955	113955	113955

Isolated rural = 0 group and almost identical results as rural<=20.

Combining split by sex and lag specification test (Results driven by senior female patients; no lag effect)

	Hospitalization Intensive Margin			Hospitalization Extensive Margin			Length of Stay in Hospital
	All	Ambulance	Emergency	All	Ambulance	Emergency	
<u>All</u>							
	0.0047	0.0038**	0.0046	0.0032	0.0024*	0.0025	0.0492*
	(0.0034)	(0.0019)	(0.0029)	(0.0020)	(0.0013)	(0.0018)	(0.0276)
β_{FHO_1}	0.0013	-0.0014	0.0004	0.0011	-0.0011	0.0003	-0.0015
	(0.0034)	(0.0018)	(0.0028)	(0.0020)	(0.0012)	(0.0017)	(0.0270)
<u>Senior female patients</u>							
β_{FHO_0}	0.0171***	0.0106***	0.0138***	0.0095***	0.0074***	0.0073**	0.1302***
	(0.0060)	(0.0035)	(0.0050)	(0.0035)	(0.0023)	(0.0030)	(0.0501)
β_{FHO_1}	-0.0032	-0.0035	-0.0038	-0.0004	-0.0028	-0.0007	-0.0169
	(0.0058)	(0.0034)	(0.0048)	(0.0034)	(0.0023)	(0.0030)	(0.0497)

Other sensitivity tests

- Interactions with physicians' age and sex
  - Result observed for both sexes, and all but youngest physician age group
    - But small sample size & not statistically significant for youngest
- Falsification test with various switch dates among FHG only
  - No evidence of misspecification

Conclusion

- Hospital admissions for senior female diabetic patients statistically significantly increase after their GP's remuneration model changed from FHG to FHO
  - All admissions and emergency admissions
- Sensitivity tests do not undermine the finding

- Seen for all ages and both sexes of physicians
- Seen for rural and urban patients (maybe stronger in rural areas)

- Given baseline rates, for these senior females, represents an increase of
  - 12.9% (all admissions)
  - 18.2% (ambulance)
  - 10.1% (emergency)
  - 19.1% increase in acute care hospital length of stay

How do we interpret this?

- Especially, is it causal?
  - Does the switch from FHG to FHO “cause” the increased hospitalization?
  - Or, is there some other factor driving this result?
- If what statisticians call the “unconfoundedness” assumption, and what economists call the Conditional Independence Assumption, is met then this is a causal impact of the treatment
- In practice, this asks if we have “enough” and “the right” Xs so that there is no important confounding variable that is omitted
  - We are hesitant to make this claim, but ….
  - It may be (partly) causal
  - Or, we may not be measuring some relevant factor that changes for the FHOs (but not the FHGs) at the same time as the switch from FHG to FHO holding the patient-physician relationship and other Xs constant