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Abstract

Psychiatric hospitalizations could be reduced if mental illnesses were detected and treated earlier in the primary care setting, leading to the World Health Organization recommendation that mental health services be integrated into primary care. The mental health services provided in primary care settings may vary based on how physicians are incentivized. Little is known about the link between physician remuneration and psychiatric hospitalizations. We contribute to this literature by studying the relationship between physician remuneration and psychiatric hospitalizations in Canada's most populous province, Ontario. Specifically, we study family physicians (FPs) who switched from blended fee-for-service (FFS) to blended capitation remuneration model, relative to those who remained in the blended FFS model, on psychiatric hospitalizations. Outcomes included psychiatric hospitalizations by enrolled patients and the proportion of hospitalized patients who had a follow-up visit with the FP within 14 days of discharge. We used longitudinal health administrative data from a cohort of practicing physicians from 2006 through 2016. Because physicians practicing in these two models are likely to be different, we employed inverse probability weighting based on estimated propensity scores to ensure that switchers and non-switchers were comparable at the baseline. Using inverse probability weighted fixed-effects regressions controlling for relevant confounders, we found that switching from blended FFS to blended capitation was associated with a 5.4% decrease in the number of psychiatric hospitalizations and a 3.8% decrease in the number of patients with a psychiatric hospitalization. No significant effect of remuneration on follow-up visits within 14 days of discharge was observed. Our results suggest that the blended capitation model is associated with fewer psychiatric hospitalizations relative to blended FFS.

Keywords: physician remuneration; blended fee-for-service, blended capitation; mental health services; hospitalizations; aftercare; Ontario; Canada

JEL classification: I10; I12; I18; C23; C33

1. Introduction

Mental disorders affect millions of people worldwide (Mental Health Commission of Canada, 2013; Steel et al., 2014; World Health Organization, 2008), leading to significant disability (Whiteford et al., 2013) and premature mortality (Walker et al., 2015); they impose substantial direct costs on health care systems and indirect costs on the economy through lost productivity (Jacobs et al., 2017; Mental Health Commission of Canada, 2013). One of the most expensive forms of mental health care is inpatient care – ranging from 28 to 69% of total mental health care costs in many Organization for Economic Cooperation and Development (OECD) countries (Hewlett and Moran, 2014). In 2016/17, approximately 253,000 hospitalizations occurred for mental illness in Canada, with a cumulative length of stay of over 5.6 million days (Canadian Institute for Health Information, 2018). The number of psychiatric hospitalizations in the province of Ontario has increased slightly over the past decade (MHASEF Research Team, 2018).

The provision of mental health services in primary care settings may help reduce mental-health related hospitalizations through early detection and treatment (Chen et al., 2018; Ministry of Health and Long-Term Care, 2008). Primary care providers are best placed to advise patients on mental health promotion and treatments, and play a key role in the provision of timely referrals. Primary care is more accessible than specialty care, and the availability of mental health services on short notice, like walk-in counselling, has the potential to reduce the need for hospital admission (Horton et al., 2012). In fact, a Canadian simulation study found that increasing access to mental health services in primary care for adults with depression could reduce the lifetime prevalence of hospitalizations by about 8% (Vasiliadis et al., 2017). The integration of mental health services into primary care also allows for the co-management of mental and physical health problems (Hert et al., 2011), further reducing potentially preventable

hospitalizations (Mai et al., 2011). Mental health-related hospitalizations may be an indicator of the quantity and quality of mental health services provided in primary care.

Primary care provides the opportunity for timely follow-up care after hospital discharge. Evidence suggests that timely aftercare with a physician after discharge provides an opportunity to determine whether the patient has unresolved concerns, reducing the likelihood of readmission (Kurdyak et al., 2017; Vigod et al., 2013). Readmission within 30 days of hospital discharge is a commonly-used quality of care indicator, reflecting both the effectiveness of the treatment received during hospitalization as well as the quality and availability of primary care received after discharge (Hermann et al., 2006; Rumball-Smith and Hider, 2009). In OECD countries, readmission to the same hospital within 30 days is approximately 13% for patients with schizophrenia and 11% for patients with bipolar disorder (Hewlett and Moran, 2014). In Ontario, data from 2014/15 suggest that approximately one in ten patients who have a hospitalization for a mental health reason are readmitted to any hospital within 30 days (MHASEF Research Team, 2018). Timely aftercare may help to improve patient outcomes and reduce readmissions.

Given that early detection, improved access, and the timely treatment of mental illnesses can reduce hospital admissions, primary care is considered the best place to provide mental health services (Mental Health Commission of Canada, 2017). One method for encouraging mental health service provision in primary care settings is by incentivizing family physicians (FPs). More than a decade ago, Ontario introduced innovative blended fee-for-service and blended capitation models to enhance access to comprehensive primary care, including mental health services, as well as a pay-for-performance incentive for aftercare (Marchildon and Hutchison, 2016; Sweetman and Buckley, 2014).

Blended remuneration models combined with pay-for-performance incentives were introduced in many OECD countries to mitigate the weaknesses of the overprovision of pure fee-for-service (FFS) and underprovision of pure capitation payment systems (McGuire, 2011; OECD, 2016). The theoretical health economics literature suggests that risk-adjusted capitation payments are better suited for primary care physicians than pure FFS for the optimal provision of primary care in general (Christianson and Conrad, 2012; Eggleston, 2005; McGuire, 2011). But, Frank et al. argue that for the efficient provision of mental health services, a blended form of FFS payment provides better incentives for primary care physicians (Frank et al., 2015). On the one hand, pure FFS encourages shorter visits, which may discourage FPs from providing time-consuming services such as counselling, instead choosing faster options such as pharmacotherapy (Blomqvist and Busby, 2012). Identifying and treating mental illnesses like depression can take more time than physical illnesses, therefore FPs paid under pure FFS may not provide required mental health services in the absence of adequate compensation for treating these disorders (Frank et al., 2003). It has also been argued that many activities involved in treating mental illnesses cannot be billed in a pure FFS structure, and an alternative payment system like blended FFS is needed (Frank et al., 2015). On the other hand, while capitated FPs may not be as focused on quick services as their FFS counterparts, capitation may encourage FPs to roster more healthy patients to boost their income, and to withhold services unless capitation payments are fully risk-adjusted. In Ontario's blended capitation model, capitation rates are adjusted only for age and sex but have comprehensive pay-for-performance incentives (Sweetman and Buckley, 2014). Additionally, a proportion of blended capitation physicians are part of the interdisciplinary practice setting known as Family Health Teams ,many of which include mental health professionals (Marchildon and Hutchison, 2016; Sweetman and Buckley,

2014). To date, there is a dearth of empirical evidence regarding whether the blended FFS or blended capitation model is associated with an adequate supply of mental health services, and hence fewer psychiatric hospitalizations.

A few studies assessed the link between physician remuneration and psychiatric hospitalizations, primarily in the United States, with mixed results. Some studies indicate that when physicians are paid by capitation, there is no significant difference in psychiatric hospitalizations (Stoner et al., 1997; Xiang et al., 2019) or length of hospital stay (Mcfarland et al., 2002)) when compared to physicians paid by FFS. But other studies found that capitation was associated with a smaller proportion of patients having a psychiatric hospitalization (Hudson and Chafets, 2010), fewer total hospital stays (Cole et al., 1994), and fewer patients with severe mental illness (SMI) such as schizophrenia and bipolar disorder using inpatient services (Leff et al., 2005; Warner and Huxley, 1998). One study found that switching to capitation was associated with an initial drop in hospitalizations, which subsequently attenuated to become comparable to FFS (Grieve et al., 2008). A cross-sectional study in Ontario, Canada found that blended capitation was not associated with inpatient admissions or length of stay for severe mental illness (SMI) patients, when compared to blended FFS (Steele et al., 2014).

Aside from little evidence on the link between blended remuneration and psychiatric hospitalizations in the literature, most studies to date have relied on relatively short follow-up periods after the introduction of capitation payments, leavinng longer-term effects largely unknown. Additionally, many of these studies are from the United States where most health care is funded through private insurance plans, calling into question how these findings apply to settings with publicly-funded health care systems. FPs may be reluctant to treat patients with schizophrenia or bipolar disorder, but may be more willing to treat common mental illnesses like

depression and anxiety, and be able to provide quality care that can improve patient outcomes, leading to reduced hospitalizations. Furthermore, while hospitalizations for SMI patients make up a substantial proportion of psychiatric hospitalizations, hospitalizations for other mental health reasons are also relatively common: in Ontario, substance-related hospitalizations are nearly as common as hospitalizations for schizophrenia (MHASEF Research Team, 2018). We were unable to find studies that assessed the association between physician remuneration and follow-up visit after a discharge from a mental health hospitalization. Our study aims to fill these gaps in the literature by utilizing longitudinal health administrative data spanning over a decade from Ontario, Canada, to uncover the link between physician remuneration (blended capitation), compared to blended FFS and psychiatric hospitalizations and the likelihood of follow-up visits with their enrolled FP within 14 days of discharge.

2. Institutional context

Traditionally, most of Ontario's FPs were paid by FFS (Sweetman and Buckley, 2014), where payments were based on the volume of services provided. In the early- to mid-2000s, various changes to FP remuneration occurred, characterized by the introduction of patient-enrollment within a blended FFS or blended capitation model. By March 31st 2016, approximately 63% of FPs in Ontario had switched from the traditional FFS to one of the new patient enrollment models, and about 87% of FPs in these new models were in the Family Health Organization (FHO) or the Family Health Group (FHG) (Ministry of Health and Long-Term Care, 2016). The FHO is a blended capitation model where FPs receive the vast majority of their income from age- and sex-adjusted base capitation payments for enrolled patients to whom they are required to provide a basket of comprehensive health services. To encourage physicians to

document the services they provide, they receive 15% of the FFS amount for these in-basket services to rostered patients if they submit the billing codes (known as the shadow billing premium), and 100% of the FFS amount for out-of-basket services (Sweetman and Buckley, 2014). They are also eligible for an access bonus to encourage the provision of in-basket services, which is reduced if their rostered patients use in-basket services from other primary care physicians; this is intended to incentivize FPs to provide in-basket services to their patients. To discourage over-enrollment, FPs practicing in FHOs are subject to a disincentive if they enroll more than 2,400 patients, receiving approximately one half of the capitation payment for those additional patients (Sweetman and Buckley, 2014).

In contrast, the FHG is a blended FFS model where FPs are primarily paid by FFS while also receiving incentives for patient enrollment and comprehensive care. Note that both FHG and FHO physicians are eligible for the same pay-for-performance incentives in the areas of after-hours care, enrollment of patients with SMI, aftercare following hospital discharge, preventive care, and chronic disease management. The pay-for-performance incentives reward physicians who achieve a specific threshold of service provision as detailed in the respective contracts. For example, the incentive for aftercare following a hospitalization was introduced in 2006, where FPs are eligible to claim a $25 premium if they provide outpatient care within 14 days of discharge, including care provided to non-enrolled patients (Ministry of Health and Long-Term Care, 2006). Thus, a comparison of FHG and FHO models provides insights into the differences between FFS and capitation payment schemes associated with psychiatric hospitalization and aftercare. Appendix A1 contains a table comparing the main features of these models.

To date, the association between the physician remuneration model and health care provision has been studied for a variety of outcomes, such as quantity of services (Kantarevic et al., 2011; Kralj and Kantarevic, 2013; Somé et al., 2019; Zhang and Sweetman, 2018), referrals to specialists (Liddy et al., 2014; Sarma et al., 2018), and specific pay-for-performance incentives (Chami and Sweetman, 2019; Jaakkimainen et al., 2011; Kantarevic and Kralj, 2013; Kiran et al., 2012, 2014; Li et al., 2014), but the impact of physician remuneration on the provision of mental health services and psychiatric hospitalizations is less well-understood.

3. Methods

3.1 Study Design

We used a retrospective cohort design, with an observation period of April 1st 2007 to March 31st 2016. FPs who were in blended FFS at the beginning of this period and switched to blended capitation (switchers) were compared to FPs who remained in FHG (non-switchers). Both patient-level covariates and outcomes were aggregated at the physician level. Patients were excluded if they: a) had missing or invalid identification number, (b) had a missing or invalid age, (c) were <16 or >105 years old, (d) had missing sex or (e) were a non-Ontario resident. Physicians with fewer than 200 enrolled patients in any fiscal year were excluded, as were those who switched to other models or retired prior to the end of the observation period. We also tested using cut-offs of 100 and 500 enrolled patients as sensitivity analyses.

3.2 Data sources

Administrative claims data from ICES (formerly known as the Institute for Clinical Evaluative Sciences) were linked using unique encoded identifiers. Data on physician characteristics came from the ICES Physician Database and included: age, sex, rurality, year of

graduation, and international medical graduate (IMG) status. Physicians' expected gain in income was calculated based on data from the Ontario Health Insurance Plan (OHIP) database. The expected gain in income for joining blended capitation was calculated based on the services the FP provided in the previous fiscal year (2006/07) for enrolled and non-enrolled patients. We used an algorithm employed by the Ministry of Health and Long-Term Care based on: a base capitation rate of $144.08 multiplied by an age-sex modifier per patient, 10% of FFS value for in-basket services to enrolled patient, 100% of FFS value for out-of-basket services to any patient, 100% of FFS value for in-basket services to non-enrolled patient subject to the hard cap, and other special payments (Kralj and Kantarevic, 2013; Sarma et al., 2018). The OHIP database was also used to determine the number of mental health services provided by FPs in 2007/08.

Patients' age and sex were obtained from the Ontario Registered Persons Database. Postal codes were used to identify rural place of residence (< 10,000 population (Wilkins, 2009)) and to assign two census dissemination area-level indicators from the Ontario Marginalization Index: the material deprivation score and ethnic concentration score (Matheson et al., 2018). The proportion of patients in the lowest two quintiles for each marginalization score were used as covariates. The John Hopkins Adjusted Clinical Groups version 10.0 was used to derive enrolled patients' Aggregated Diagnostic Groups (ADGs), based on patients' diagnostic codes and commonly used as an indicator of patient comorbidity in primary care (Glazier et al., 2008; The Johns Hopkins University, 2013). An ADG score indicates into how many of 32 diagnostic groups a patient falls, taking on an integer between zero and 32, with higher scores reflecting a greater number of comorbidities. Diagnosis codes from the ICES databases facilitated this calculation. The average ADG score for each FP (averaged across all enrolled patients within their practice) was used as a covariate. The OHIP database provided information on patients with

SMI, and was used to determine the proportion of such patients per FP. The number of enrolled patients with SMI was based on a combination of diagnostic and billing codes. In FHGs, any enrolled patient who made a visit that used a diagnostic code 295 (schizophrenia) or billing code Q020 (tracking code for bipolar disorder) was considered as SMI. In FHOs, any enrolled patient visit that used billing code Q020 (tracking code for bipolar disorder) or Q021 (tracking code for schizophrenia) was counted as SMI (Ministry of Health and Long-Term Care, 2014, 2007). Finally, an ICES-derived cohort, Primary Care Population, was used to determine which patients had chronic mental illness, defined as having two outpatient visits or one inpatient admission for any psychiatric reason (e.g. anxiety, depression, etc.) over the past two years (Health Quality Ontario, 2015). The proportion of patients with a chronic mental illness per FP was also used as a covariate.

The primary outcome variables were the number of psychiatric hospitalizations and the number of hospitalized patients per 1,000 enrolled patients at the physician level. Psychiatric hospitalization data came from the Discharge Abstract Database (DAD) and the Ontario Mental Health Reporting System (OMHRS) database. All hospitalizations in DAD with a psychiatric diagnostic code, as well as all hospitalizations in OMHRS, by enrolled patients of our FP cohort were included. The list of diagnosis codes used to capture psychiatric hospitalizations in DAD can be found in Appendix A.1. The number of psychiatric hospitalizations and the number of unique patients were standardized by the number of enrolled patients to account for differences in roster size across physicians. Data on aftercare following a psychiatric hospitalization were obtained from OHIP, and included any visit to the FP within 14 days following discharge. The number of follow-up visits that claimed the incentive code E080 was also obtained.

The use of data in this paper was authorized under section 45 of Ontario's Personal Health Information Protection Act, which does not require review by a Research Ethics Board.

3.3 Propensity scores

FPs voluntarily choose their remuneration models leading to a potential selection bias. To account for this, a propensity score (PS) model was used to estimate the probability of switching from FHG to FHO using a logistic regression. Physician characteristics included in the logistic regression were: age and its square; sex; rurality; IMG status; group size; and expected gain in income. Several patient characteristics were aggregated at the physician level and included: average age of enrolled patients; proportion of patients >65 years; proportion of female patients; average ADG score; proportion of rural patients; proportion of patients in the highest two quintiles of material deprivation; proportion of patients in the highest two quintiles of ethnic concentration; proportion of patients with chronic mental illness; and baseline mental health service provision, defined as the number of mental health services provided and number of patients with SMI enrolled in the 2007/2008 fiscal year.

A kernel matching procedure was used to construct weights for the non-switcher group. The non-switcher group was weighted by the inverse of their estimated propensity score corresponding to the distance between the non-switcher's and switcher's propensity scores within a bandwidth of 0.06, and the switcher group was weighted as one. The common support restriction ensures that there is sufficient overlap in the distributions of propensity scores between the two groups, and all observations met this requirement.

To check for covariate balance between groups, *t*-tests for the equality of means, standardized bias (the difference between sample means, as a percentage of the square root of the average of the sample variances), and the percentage reduction in bias before and after applying

PS-weights were used. There is no set standard for how much standardized bias is appropriate; some have suggested it should not be any higher than 10 to 25% (Austin, 2009; Stuart et al., 2013). However, even if the standardized bias for all covariates is less than 10%, the findings may still be biased. Therefore, matching was also conducted using the entropy balancing (EB) method (Hainmueller, 2012). The EB method is based on maximum entropy reweighting scheme and ensures exact balancing on moments of covariate distributions in the switcher and re-weighted non-switcher group (Hainmueller, 2012). We used the first, second, and third moments (mean, variance, and skewness) for all continuous covariates, and the first moment for binary covariates. The EB procedure is robust to propensity score misspecification (e.g. covariate imbalance and/or functional form) (Zhao and Percival, 2016). In fact, the EB procedure is doubly-robust, meaning that if either the propensity score model or the outcome model is correct then the estimated results are unbiased. Inverse probability weighted panel-data regression analyses employed the PS-weights and EB weights to assess the effect of switching from FHG to FHO on the outcomes. This two-stage approach produces an estimation of the average treatment effect on the treated, which is an estimate of the effect of switching to a blended capitation remuneration model.

3.4 Regression analyses

The estimating equation is

$$Outcome_{it} = \tau_t + c_i + \delta FHO_{it} + Z_{it}\beta + \varepsilon_{it}, \quad (1)$$

where the parameter τ_t is year fixed-effects, the parameter c_i is physician-specific time-invariant idiosyncratic factors, FHO_{it} is one if the physician i in year t was in a FHO, and zero if the physician remained in FHG, and ε_{it} is the error term. Z_{it} is a vector of physicians' observable characteristics (sex, age, age-squared, IMG, group size) and the characteristics of their patients

(average ADG score, average age of patients, proportion of female patients). Two outcome variables, the number of psychiatric hospitalizations and the number of patients who had a psychiatric hospitalization, were analyzed using three models to estimate the parameter of interest δ: a pooled ordinary least squares (OLS), a fixed-effects (FE) model, and a high-dimensional fixed-effects (HDFE) model. OLS may lead to biased estimates because of the existence of potential correlation between the FHO_{it} and the fixed-effects τ_t, and c_i. The FE model controls for the c_i while assuming same trend (τ_t) for both switchers and non-switchers (Allison, 2012; Gunasekara et al., 2014; Wooldridge, 2010). Note that if this common trend assumption is violated then FE estimates are biased. The HDFE model extends FE model by relaxing the common trend assumption and allows each physician to have his/her own trend (Balazsi et al., 2018; Correia, 2016). Allowing for physician-specific time trend, equation (1) becomes

$$Outcome_{it} = \tau_t + \sum_{t=2006/07}^{2015/16} f_i d_t + \delta FHO_{it} + Z_{it}\beta + \varepsilon_{it} \quad (2)$$

with f_i is the physician-specific linear time trend and d_t is a year binary variable. In our analysis, the HDFE models are preferred, and hence the results of these models are presented and discussed.

The percentage of psychiatric hospitalizations that had a follow-up visit within 14 days was analyzed using fractional regression models, specifically a generalized linear model (GLM) and population-averaged generalized estimating equations (GEE) with a probit link within the binomial family (Papke and Wooldridge, 2008; Wooldridge, 2010). The GLM model does not take repeated observations into account, whereas the GEE does. As the fixed-effects estimator does not exist for fractional outcomes, an alternative approach is to include physician-specific

average of covariates in the regression model, as these means do not vary within physicians but do vary between physicians, therefore including them in the regression model is analogous to a fixed-effects regression (Chamberlain, 1984; Mundlak, 1978; Papke and Wooldridge, 2008; Wooldridge, 2010).

As mentioned before, all regressions include physician characteristics, and a host of patient characteristics aggregated at the physician level mentioned above. For the follow-up visit outcome, roster size and its square were also included. Robust standard errors were calculated by adjusting for clustering at the physician level. Finally, subgroup analyses by physician sex, physician age (≤ 50 or > 50), and early- or late-switchers (switched in first two years or switched in last seven years) were also conducted to assess additional heterogeneity across these groups. The age and early- and late-switcher cut-off points were chosen because they led to approximately equal group sizes.

The main results presented are from PS-weighted regressions. Unweighted and EB-weighted results are reported in Appendix A. The EB-weighted results were qualitatively similar to PS-weighted results.

4 Results

4. 1 Cohort description and propensity score weighted results

A total of 4,654 FPs were practicing in a blended FFS model on April 1, 2007; after restricting to those who remained in blended FFS or switched to blended capitation, and those for whom the expected gain in income could be calculated from 2006/07, 2,774 FPs remained. Excluding FPs who had at least 200 patients in each year, yielded a total of 2,654 FPs available for analysis: 1,418 switchers and 1,236 non-switchers. Relative to non-switchers, switchers were

more likely to be younger, female, practice in an urban setting, be Canadian medical graduates, have smaller physician group sizes, and have higher expected gains in income from switching at the baseline. The patients of switchers tended to be older, have fewer comorbidities, live in rural and less deprived areas, and less likely to live in areas with higher ethnic concentration. Switchers also tended to provide fewer mental health services in primary care during the first year but have more enrolled patients with SMI. These differences were statistically significant as assessed by *t*-tests, with standardized biases ranging from 3.9% to 43.1%. Switchers and non-switchers did not differ significantly on the percentage of patients with chronic mental illness. After re-weighting using propensity scores, no significant differences between the two groups at baseline were detected, with the bias below 10% for all variables and similar distributions of the propensity scores between switchers and non-switchers (Figure 1 and Appendix Table A1.4).

4. 2 Regression results

4. 2.1 Psychiatric hospitalizations (number of hospitalizations and number of unique hospitalized patients) per 1,000 enrolled patients

A total of 137,598 psychiatric hospitalizations by enrolled patients (switchers = 68,672; non-switchers = 68,926) were observed over the study period. The standardized number of hospitalizations per year ranged from 0 to 65.0 (median = 3.4; quartile 1 = 1.8; quartile 3 = 11.0), while the standardized number of hospitalized patients per year ranged from 0 to 39.5 (median = 2.6, quartile 1 = 1.5, quartile 3 = 4.0). As switchers tended to enroll more patients than non-switchers, when standardized by the number of enrolled patients both the average number of psychiatric hospitalizations and the number of hospitalized patients per year per FP is slightly lower in the switcher group (Figure 2). Overall, switchers appear to have slightly fewer hospitalizations and hospitalized patients per year compared to non-switchers.

The PS-weighted OLS regression found a statistically significant difference between switchers and non-switchers, with a reduction of 7.3% (95% CI [-3.5%, -10.9%]) in psychiatric hospitalizations. The PS-weighted FE found a non-statistically significant decrease of 2.0% [-6.0%, 2.2%]; the HDFE regression found a significant decrease of 4.8% [-9.7%, 0.4%]. Similarly, the PSM-weighted analyses of the unique number of patients who had a psychiatric hospitalization found decreases of 5.3% [-8.4%, -2.1%], 1.5% [-4.7%, 1.8%], and 3.3% [-7.5%, 1.0%] for the OLS, FE, and HDFE regressions, with the no statistically significant differences found in the FE or HDFE models. EB-weighted regressions produced similar results (Appendix A.2). Overall, our results based on the preferred specification (HDFE regression), show that patients of physicians who switched from blended FFS to blended capitation tended to have fewer psychiatric hospitalizations.

4. 2.2 Follow-up visit within 14 days post-discharge

Approximately 28.8% (SD = 30.0%) of the psychiatric hospitalizations were followed-up within 14 days by the patient's FP (switchers = 28.2%, non-switchers = 29.4%). Figure 3 shows the PS-weighted proportion of psychiatric hospitalizations that had timely follow-up visit for switchers and non-switchers. This figure indicates there was little difference between the groups over time.

Results from the PS-weighted GLM indicated that patients of switchers were 1.0% more likely to receive follow-up care within 14 days of a psychiatric hospitalization discharge [-0.2%, 2.1%]. In the GEE analysis, this effect was no longer statistically significant, with an average increase of only 0.7% [-0.6%, 2.0%]. Thus, switching from blended FFS to blended capitation did not affect follow-up visit within 14 days after a psychiatric hospitalization.

4.3 Subgroup effects

Subgroup analyses examined the effect of switching from FHG to FHO by sex, age, and timing of switch, to investigate heterogeneous effects across different groups relative to the main results. Table 3 reports the PS-weighted HDFE results for psychiatric hospitalizations and number of hospitalized patients, as well as PS-weighted GEE results including physician-averaged covariates for follow-up; unweighted and EB-weighed results, as well as OLS, FE, and GLM results are available in Appendix A.2. Male physicians have slightly larger decreases in hospitalizations (-5.9% [-11.5, -0.02%]) compared to females (-3.9% [-12.5%, 5.6%]). In the older physicians group (> 50 years old at the baseline), switching was associated with a reduction in psychiatric hospitalizations and unique patients hospitalized (6.6 to 9.6%), but in the younger group (> 50 years old at the baseline) the effect was smaller and non-significant in the FE and HDFE models (5.3 to 7.4%). Regarding switch timing, when only early-switchers (those who switched within the first two years) were compared to non-switchers, there was no significant difference on number of hospitalizations, while a significant decrease was seen for late switchers (those who switched in the last seven years) in the OLS and HDFE models by 7.8% and 6.1% respectively, with a non-significant 1.7% decrease found in the FE model. No difference was seen for hospitalized patients between early- and late-switchers. These results suggested the presence of heterogeneity across some sub-groups of physicians in terms of psychiatric hospitalizations, but not follow-up within 14 days.

The average estimates of physician-specific time trends for switchers and non-switchers overall, as well as by sex, age, and time of switch, from the HDFE models are presented in Appendix A1. These figures suggest some differences in time trend between switchers and non-switchers, as well as in each subgroup of physicians. For both hospitalizations and hospitalized patients, smaller trend slopes are seen for female switchers compared to female non-switchers,

older switchers compared to older non-switchers, and early-switchers compared to non-switchers.

5. Discussion

We found that family physicians switching from blended FFS to blended capitation was associated with a small decrease in the number of psychiatric hospitalizations for their enrolled patients, relative to FPs who remained in blended FFS. The capitation incentives are possibly leading to better continuity of care and accessibility, resulting in rostered patients being less likely to present in crisis requiring a psychiatric hospital admission. Another potential mechanism stems from the fact that a proportion of blended capitation physicians are also part of the Family Health Teams that include mental health professionals (Marchildon and Hutchison, 2016). Better provision of mental health services in these interdisciplinary teams may be the driving force behind fewer psychiatric hospitalizations in blended capitation models. Our findings differ from some previous studies which found no difference in hospitalizations arising from capitation payments to physicians in the US (Stoner et al., 1997; Xiang et al., 2019) and for Ontario patients with SMI (Steele et al., 2014). This difference may be due to our use of longitudinal data and PS-weighted high-dimensional fixed-effects regression analyses and/or blended remuneration models.

No significant differences arose between switchers and non-switchers for follow-up visit within 14 days of a psychiatric hospitalization discharge. Follow-up visits within this two-week period were low at just 28.8%, despite the availability of the financial incentive. Relatively low levels of timely follow-up may be influenced by factors such as physician accessibility on short notice or their knowledge of patients' hospital admissions; similarly, patients may not understand

the importance of aftercare and choose to not see their FP after discharge. We found slightly lower levels of follow-up visits compared to a previous study that assessed aftercare within two weeks for patients who were discharged from the hospital, excluding hospitalizations for childbirth or newborns, psychiatric hospitalizations, and palliative admissions (Lapointe-Shaw et al., 2017). This study found 34.2% of discharged patients saw their assigned FP within 14 days. A previous report has shown follow-up rates after a psychiatric hospitalization was lower compared to hospitalizations for other diseases (Health Quality Ontario, 2017). Patients may be less likely to follow-up with their physician after a psychiatric hospitalization due to fears about stigma or concerns about the FP's ability to treat their mental illness. However, we found that follow-up visits increased over time by about 1.9% per year (Table 2), which may reflect physicians and/or patients becoming more aware of the importance of timely aftercare.

As a robustness check, we also ran fractional regressions: follow-up within 14 days, psychiatric hospitalizations and hospitalized patients were divided by the number of rostered patients to produce fractional outcomes. Logit and probit models using the same covariates described previously were run, as well as models including interaction terms between covariates and their physician-averaged covariates (the results on follow-up within 14 days are presented in Appendix B and the results on hospitaizations are available upon request). With interaction terms included, switching was associated with statistically significant decreases in psychiatric hospitalizations by 2.0 to 10.3% in both the PS- and EB-weighted models. For hospitalized patients and follow-up within 14 days, the PS-weighted models suggested slight declines with switching, but the EB-weighted models were not statistically significant. Thus, the results were largely comparable to our original analyses: switching was associated with a small decrease in the number of psychiatric hospitalizations, but not follow-up within 14 days.

We assessed use of the aftercare incentive, and found that it was billed on just 20.4% of eligible follow-up visits, with no difference between switchers and non-switchers (Appendix C). It is not known why usage was low. The lack of difference between switchers and non-switchers is in contrast to a previous study of the diabetes incentive, which found that Ontario physicians paid by blended capitation used the incentive more than physicians paid by blended FFS, despite both being eligible (Kantarevic and Kralj, 2013). One possible explanation for this difference could be that the diabetes incentive is much higher at $75, compared to $25 for aftercare for psychiatric hospitalizations. Another possible explanation is that providing follow-up care after a psychiatric hospitalization may be much more time-consuming and challenging than completing the tasks needed to obtain the diabetes incentive.

We assumed that FPs with at least 200 patients were considered to be practicing full-time. To assess the sensitivity of this assumption, analyses were also conducted using cut-offs of 100 or 500 patients. When a minimum of 100 patients was used, follow-up visit was found to be slightly higher among switchers than non-switchers (1.2%), while at 200 and 500 patients there was no difference between the models. No other differences were found.

Finally, the subgroup analysis by physician age found that among older physicians, switching was associated with a decrease in hospitalizations, but not among younger physicians. We wondered if older switchers were selectively enrolling healthier patients, but the fact that mean ADG scores indicate that younger switchers are also selectively rostering healthier patients, does not support this explanation. Another possibility is that older switchers may be more motivated to support SMI patients perhaps by continuing training or gaining experience for treating mental illness, and thus provide more mental health services compared to older non-switchers, whereas younger switchers may not differ as much from younger non-switchers in this

regard. Male switchers had greater decreases in hospitalizations compared to female switchers; a similar pattern was seen for FPs who switched to blended capitation earlier compared to FPs who switched later on. This difference may be due to male physicians and later switchers having initially higher numbers of hospitalizations compared to female physicians and early-switchers, allowing them to experience a larger relative decrease.

5.1 Strengths, limitations, and future directions

To our knowledge, this is the first Canadian study to compare blended FFS and blended capitation models on psychiatric hospitalizations and aftercare visits within 14 days of a psychiatric hospital discharge. It is also the first Canadian study assessing these outcomes using a propensity score weighted panel-data regression approach. Our use of weighted regressions at least partially controls for selection bias, adding to the robustness of our findings. Previous studies either used cross-sectional designs or a short follow-up period after physicians switched to capitation models. We used nine years of data, which provides time for switchers to adjust to the new model and incentives, and to ascertain whether any observed changes were sustained.

There are also some limitations of our study. Though we have controlled for several baseline factors using the PSM technique, unobservable factors may still influence outcomes. Previous research has indicated that FPs in capitation do tend to selectively roster fewer patients with mental illness compared to FPs in FFS (Steele et al., 2013). Although we included the average ADG score and proportion of patients with chronic mental illness to adjust for the selection of patients with mental illness, this may not be sufficient. These findings also assume that the propensity score model is correctly specified, which may not be the case. We have also analyzed the data with the entropy balancing method, but the potential for residual confounding remains. We have not assessed whether patients who receive follow-up care differ from those

who do not on outcomes such as readmissions or ED visits, which is an area for future research. Our focus on enrolled patients in specific remuneration models means our results may not be generalizable to non-enrolled patients or patients in other models. We found fewer hospitalizations than a previous report, which documented 5.5 to 6 hospitalizations per 1,000 people between 2006 and 2014 in Ontario (MHASEF Research Team, 2018). This can be explained by the fact that our study focused soley on enrolled patients in blended FFS and blended capitation models. It would be interesting to see if the same pattern emerged for non-enrolled patients treated by these physicians. Finally, as we have focused on patients enrolled to FPs and follow-up visit with their assigned FP, follow-up rates do not include follow-up care from other FPs or other sources of care such as psychologists, psychiatrists, or community health services. Further research on the impact of remuneration models on the use of these other health providers is needed. One area of interest would be the effect of working in interdisciplinary teams, such as Family Health Teams on outcomes. It is possible that these teams are contributing to a higher quality of mental health care in some FHOs, leading to reduced psychiatric hospitalizations.

We do not know the mechanisms by which patients enrolled with physician in a blended capitation model have fewer psychiatric hospitalizations. Possibly, FPs under blended capitation selectively enroll healthier patients. Alternatively, patients under blended capitation may be receiving higher quality care, especially those in Family Health Teams with mental health professionals – further research is required to confirm this. Physicians remunerated by blended capitation do not differ from those under blended FFS on aftercare following a psychiatric hospitalization. Although follow-up care appears to be increasing over time, aftercare remains

low. Further research on the factors affecting follow-up care would determine how to improve its timely provision.

6. Conclusions

Our findings suggest that switching from a blended FFS model to a blended capitation model reduces psychiatric hospitalization for enrolled patients, but has no benefit in terms of post-discharge follow-up care. Timely follow-up does appear to be increasing over time, but no difference was observed between blended FFS and blended capitation models. These findings indicate that FHO-type blended capitation may help to reduce psychiatric hospitalizations relative to FHG-type blended FFS.

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Figures and Tables

Figure 1. Distribution of propensity scores before and after weighting.

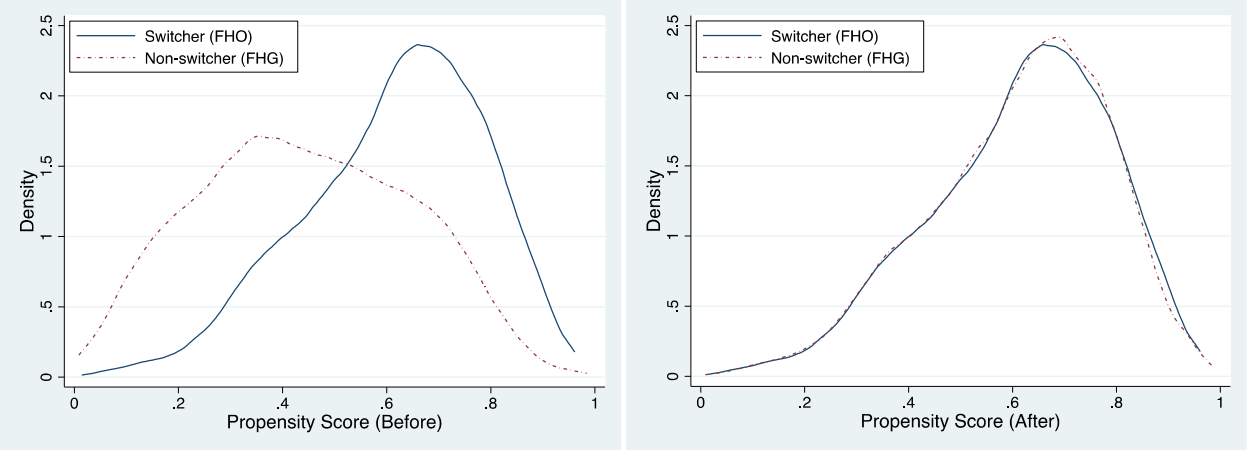
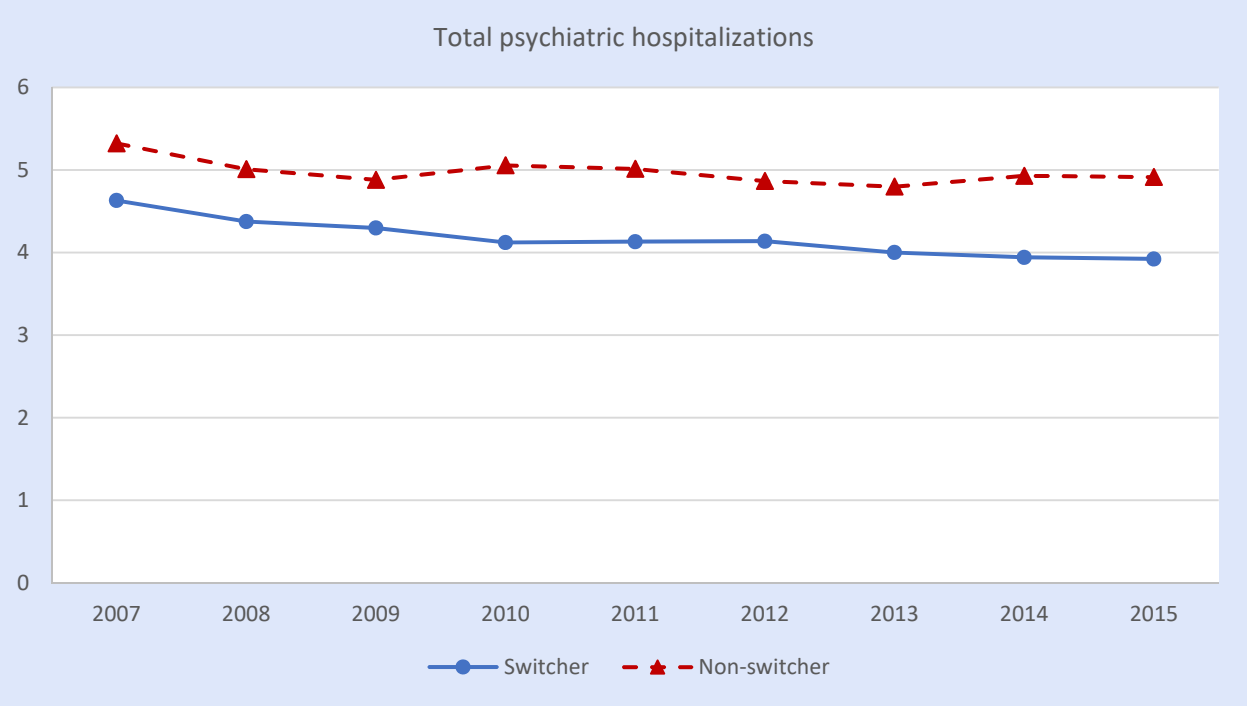


Figure 2. Psychiatric hospitalizations and number of unique patients who had a psychiatric hospitalization (both per 1000 enrolled patients and PS-weighted).



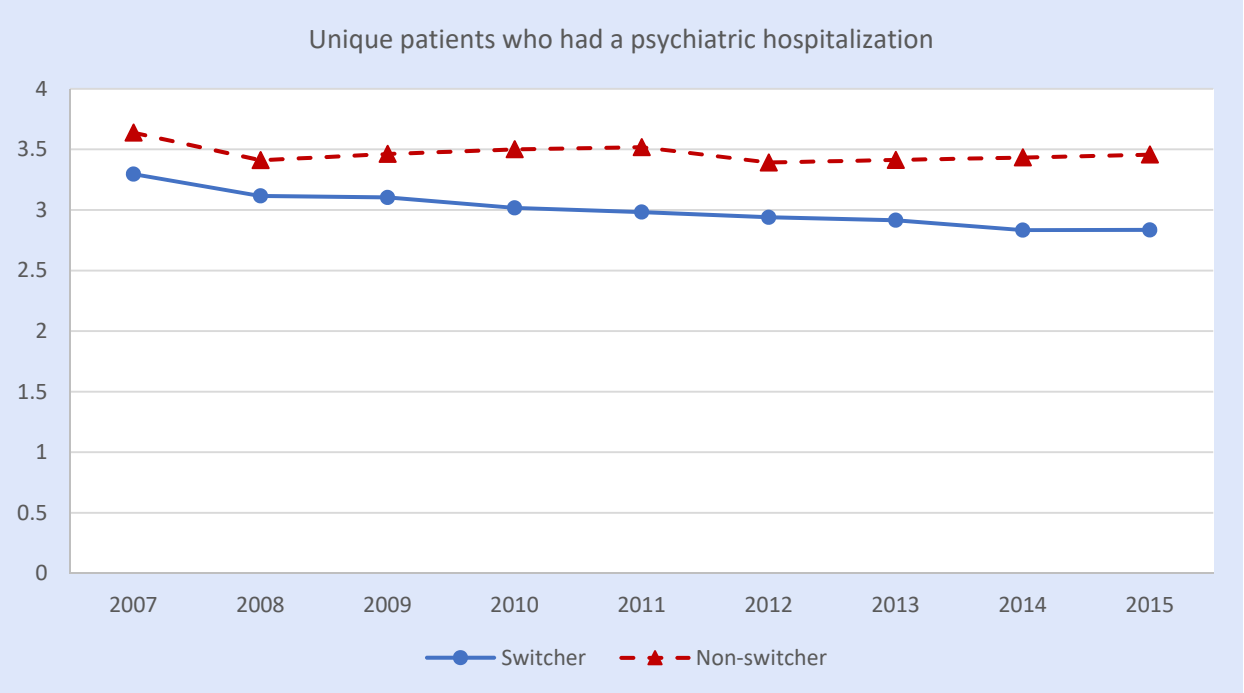


Table 1: Coefficient of FHO on hospitalizations for psychiatric reasons: total visits and number of unique patients, per 1,000 enrolled patients (PS-weighted)

	OLS	**FE**	**HDFE**
Total visits	-0.076*** [-0.116,-0.036]	-0.020 [-0.062,0.022]	-0.049^ [-0.102,0.004]
Unique patients	-0.054** [-0.088,-0.021]	-0.015 [-0.048,0.018]	-0.034 [-0.078,0.011]
Physicians	2,654	2,654	2,654
Observations	23,886	23,886	23,886

*** p < 0.001; ** p < 0.01; * p < 0.05; ^ p < 0.10

Estimated coefficients and 95% confidence intervals (standard errors were clustered at the physician level).

All regressions include full set of control variables defined in Methods section.

Figure 3. Proportion of psychiatric hospitalizations where the patient followed up with their assigned FP within 14 days (PS-weighted)

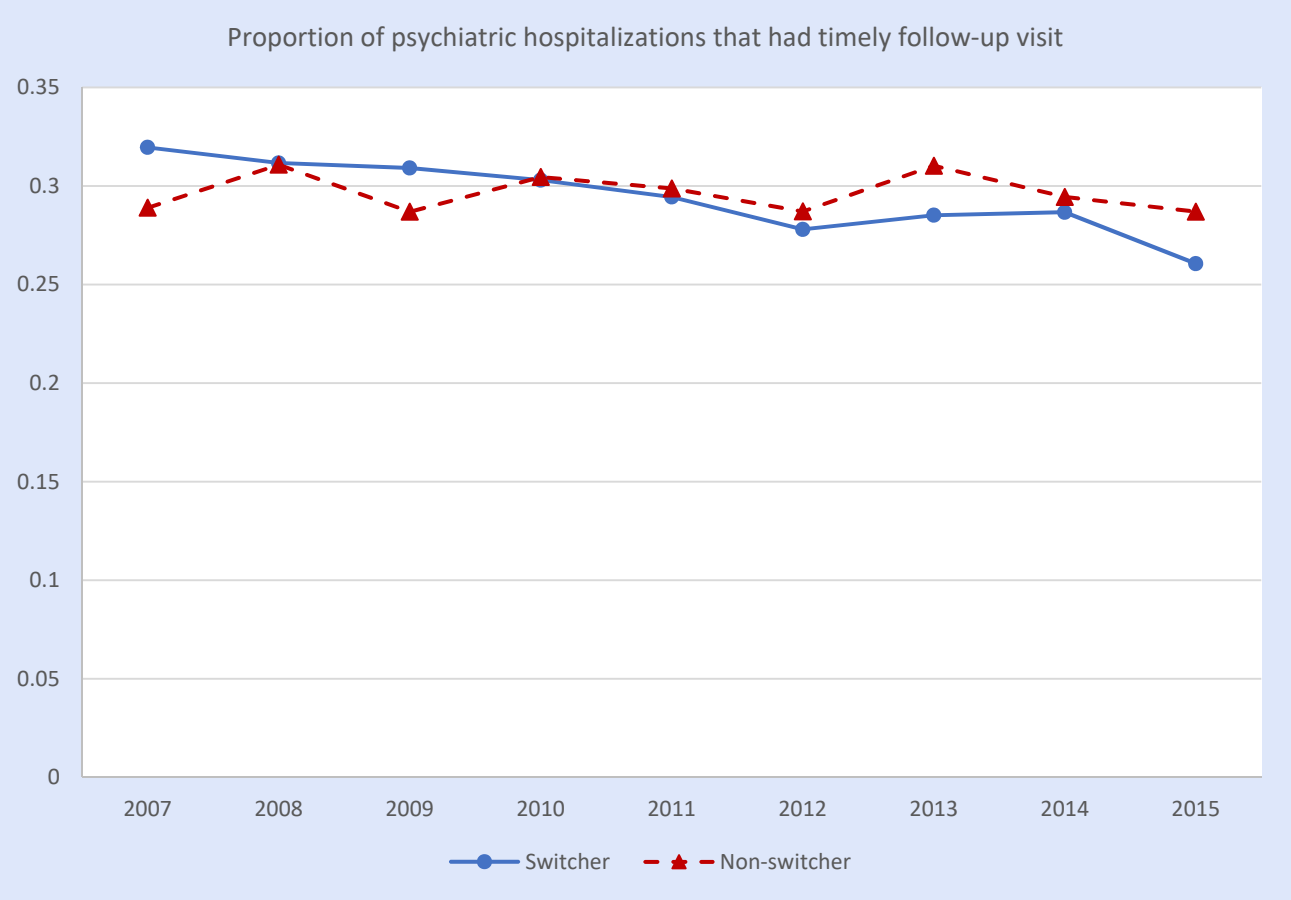


Table 2: Marginal effect of FHO and year on follow-up visit within 14 days after a psychiatric hospitalization (PS-weighted)

	Without physician-specific means		**With physician-specific means**	
	GLM	**GEE**	**GLM**	**GEE**
FHO	0.010^ (-0.002, 0.021)	0.007 (-0.006, 0.020)	0.010^ (-0.002, 0.021)	0.007 (-0.006, 0.020)
Year	-0.003* (-0.005, -0.0005)	-0.002* (-0.005, -0.0003)	0.019* (0.004, 0.034)	0.019** (0.005, 0.033)
Physicians	2,652	2,652	2,652	2,652
Observations	22,045	22,045	22,045	22,045

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Marginal effects and 95% confidence intervals (standard errors were clustered at the physician level).

All regressions include full set of control variables defined in Methods section.

Table 3: Subgroup effects of switching to FHO (PS-weighted)

	Outcome variables				
	Psychiatric hospitalizations (HDFE, coefficient)			Follow-up within 14 days of discharge (GEE, marginal effect)	
Variables	Observations [Physicians]	Log(number of psychiatric hospitalizations)	Log(number of hospitalized patients)	Observations [Physicians]	Proportion of hospitalizations that had a follow-up visit
Gender					
Male	14,391 [1,599]	-0.060^ (-0.121, -0.0003)	-0.039 (-0.090, 0.012)	13,688 [1,599]	-0.002 (-0.018, 0.013)
Female	9,495 [1,055]	-0.038 (-0.133, 0.056)	0.031 (-0.110, 0.048)	8,357 [1,053]	0.014 (-0.008, 0.036)
Age					
Younger	12,294 [1,366]	-0.025 (-0.097, 0.048)	-0.013 (-0.074, 0.047)	11,225 [1,364]	0.008 (-0.011, 0.027)
Older	11,592 [1,288]	-0.086* (-0.162, -0.009)	-0.064^ (-0.128, 0.0003)	10,820 [1,288]	0.006 (-0.012, 0.025)
Time of switch					
Switched before April 1, 2009	17,082 [1,898]	-0.029 (-0.103, 0.046)	-0.027 (-0.089, 0.034)	15,777 [1,896]	0.014 (-0.004, 0.031)
Switched on or after April 1st, 2009	17,928 [1,992]	-0.062^ (-0.129, -0.005)	-0.045 (-0.101, 0.010)	16,595 [1,991]	-0.0004 (-0.016, 0.016)

Younger physicians were $\leq$ 50 years old at start of study, while older physicians were > 50 years old at start of study.
Early-switchers (switched in first two years; N = 662), or late-switchers (switched in last seven years; N = 756), were compared to the entire non-switcher group (N=1,236).
Coefficients/marginal effects and associated 95% confidence intervals are presented (standard errors clustered at the physician level).
*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$
All regressions include full set of control variables defined in Methods section, with GEE analyses including physician-specific means of covariates.

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Online Appendices

Appendix A.1: Tables and Figures

Table A1.1: Main Features of Family Health Groups and Family Health Organizations

	Family Health Group	**Family Health Organization**
Year introduced	2003	2006
Physician remuneration	Blended fee-for-service	Blended capitation
Formal patient enrolment	Yes	Yes
Minimum group size	3 physicians	3 physicians
Governance	Physician-led	Physician-led
Interprofessional team members	Yes, limited	Yes, limited unless part of the Family Health Team
After-hours care requirements	Yes	Yes
Preventative care codes (pap smear, mammogram, influenza vaccination, immunization, colorectal cancer screening or fecal occult blood testing)	Yes	Yes
Chronic disease management (diabetes management incentive, smoking cessation counselling fee, heart failure management incentive)	Yes	Yes
Premiums for providing services to rostered patients diagnosed with serious mental illness (bipolar disorder or schizophrenia)	Yes	Yes

Source: Hutchison and Glazier (2013); Sweetman and Buckley (2014).

Table A1.2: Billing and diagnosis codes for mental health services in primary care

Services provided by FPs are considered mental health services if they fall into either of the following categories:

- Any of the listed A feecodes in combination with any of the listed diagnostic codes, OR
- Any of the listed K feecodes, regardless of diagnosis code.

The fees are from the schedule of benefits released by the Ministry of Health and Long Term Care, and came into effect December 21, 2015.

Fee codes	Description	Fee
A001	Minor Assess. -F.P./G.P.	21.70
A003	Gen. Assess. -F.P./G.P.	77.20
A004	Gen.Re-Assess-F.P./G.P.	38.35
A007	Intermed.Assess/Well Baby Care-F.P./G.P./Paed.	33.70
A008	Mini Assessment-F.P./G.P.	13.05
A888	Partial Assessment Em.Dept Equivalent	33.70
A901	Individual Care per 1/2 hr	45.15
A005	Consultation -F.P./G.P.	77.20
A006	Re-consultation-F.P./G.P.	45.90
A905	General/family practice-limited consultation	65.90
A957	Focused practice assessment - addiction medicine	33.70
K005	Individual care per 1/2 hr	62.75
K007	Ind.Psychotherapy per half hour - GP	62.75
K623	Cert.mental.ill.appl.psych.assess.history exam.form 1	104.80

Diagnostic code	Description
295	Schizophrenia
296	Manic depressive psychosis, involutional melancholia
297	Paranoid states
298	Other psychoses
300	Anxiety neurosis, hysteria, neurasthenia, obsessive compulsive neurosis, reactive depression
301	Personality disorders (e.g., paranoid personality, schizoid personality, obsessive compulsive personality)
302	Sexual deviations
306	Psychosomatic disturbances
309	Adjustment reaction
311	Depressive or other non-psychotic disorders, not elsewhere classified

303	Alcoholism
304	Drug dependence, drug addiction
897	Economic problems
898	Marital difficulties
899	Parent-child problems (e.g., child-abuse, battered child, child neglect)
900	Problems with aged parents or in-laws
901	Family disruption, divorce
902	Educational problems
904	Social maladjustment
905	Occupational problems, unemployment, difficulty at work
906	Legal problems, litigation, imprisonment
909	Other problems of social adjustment

Table A1.3: Diagnostic codes used to identify hospitalizations for mental health reasons.

Hospitalizations were identified using the Discharge Abstract Database (DAD) and Ontario Mental Health Reporting System (OMHRS). Hospitalizations from DAD were included if they had any of the listed diagnostic codes below. All hospitalizations from OMHRS were included.

DAD DX10CODE1	
Codes	**Description**
F04	Organic amnesic syndrome, not induced by alcohol and other psychoactive substances
F05	Delirium
F06	Other mental disorders
F07	Organic personality and behavioural disorders
F09	Unspecified organic or symptomatic mental disorder
F1	Mental and behavioural disorders due to use of alcohol, opioids, etc.
F2	Schizophrenia, schizoaffectve, etc.
F3	Mania, bipolar, mood, etc.
F4	Phobias, panic disorders, etc.
F5	Eating disorders, sleeping disorders, etc.
F6	Personality disorders
F7	Mental retardations
F8	Developmental disorders
F9	Hyperkinetic, conduct, etc.

DAD DX10CODE2 to DX10CODE10	
Codes	**Description**
X6	Intentional self-poisoning
X7	Intentional self-harm
X80	Intentional self-harm by jumping from a high place
X81	Intentional self-harm by jumping or lying before moving object
X82	Intentional self-harm by crashing of motor vehicle
X83	Intentional self-harm by other specified means
X84	Intentional self-harm by unspecified means
Y1	Poisoning
Y28	Contact with sharp object, undetermined intent
F5	Eating disorders, sleeping disorders, etc.
F6	Personality disorders, etc.
F7	Mental retardation

F8	Developmental disorders
F9	Hyperkinetic disorders

Table A1.4: t-test and standardized bias before and after propensity score (PS) weighting

	Before PS weighting				After PS weighting				
	Switcher (FHO)	Non-switcher (FHG)	p value of t-test before PSM	% bias	Switcher (FHO)	Non-switcher (FHG)	p value of t-test after PSM	% bias	% reduction in |bias| after PSM
Physician characteristics									
Age	49.041	51.561	<0.001	-27.2	49.041	49.385	0.316	-3.7	86.3
Age^2	2488.8	2745.8	<0.001	-27.2	2488.8	2522.6	0.328	-3.6	86.8
Sex (% female)	0.417	0.375	0.030	8.5	0.417	0.422	0.768	-1.1	86.8
Rural (%)	0.057	0.027	<0.001	15.2	0.057	0.074	0.070	-8.4	44.7
IMG (%)	0.130	0.270	<0.001	-35.4	0.130	0.125	0.686	1.3	96.4
Group size	50.390	63.967	<0.001	-16.6	50.390	54.316	0.167	-4.8	71.1
Expected gain in income (1000 $)	110.060	67.230	<0.001	43.3	110.060	107.410	0.454	2.7	93.8
Patient characteristics (averaged per FP)									
Average age	46	45	<0.001	28.7	46	46	0.758	-1.1	96.1
Senior (%)	0.174	0.153	<0.001	25.5	0.174	0.174	0.915	0.4	98.4
Average ADG score	3.478	3.591	<0.001	-22.7	3.478	3.500	0.211	-4.4	80.7
Female (%)	56.655	55.205	0.010	10.1	56.655	56.906	0.643	-1.7	82.7
% in Q1 or Q2 of Deprivation Score (ONMARG)	48.708	44.320	<0.001	25.5	48.708	48.682	0.967	0.2	99.4
% in Q1 or Q2 of Ethnic Concentration Score (ONMARG)	33.728	22.237	<0.001	49.8	33.728	34.741	0.276	-4.4	91.2
% living in rural area	9.548	4.716	<0.001	28.2	9.548	10.347	0.320	-4.7	83.4
% with CMI	27.771	27.370	0.311	3.9	27.771	28.333	0.126	-5.5	-39.9
Baseline services (2007/08) per 1000 enrolled patients									
# of MH services	372.560	419.500	0.002	-11.7	372.560	394.890	0.074	-5.5	52.4
# enrolled patients with SMI	6.963	5.732	0.001	13.3	6.963	7.281	0.456	-3.5	74.1

ADG: Aggregated Diagnostic Groups from Johns Hopkins ACG Case-Mix System, version 10; IMG: international medical graduate; Q1: quintile 1 (lowest); Q2: quintile 2 (second lowest); ONMARG: Ontario Marginalization Index; CMI: chronic mental illness, defined as having had at least two outpatient or one inpatient visit for mental health reasons in the past two years; MH: mental health; SMI: serious mental illness, defined as psychosis or bipolar disorder

Figure A1.1: Estimated physician-specific time trend from HDFE model for number of psychiatric hospitalizations by male and female physicians (PS-weighted)

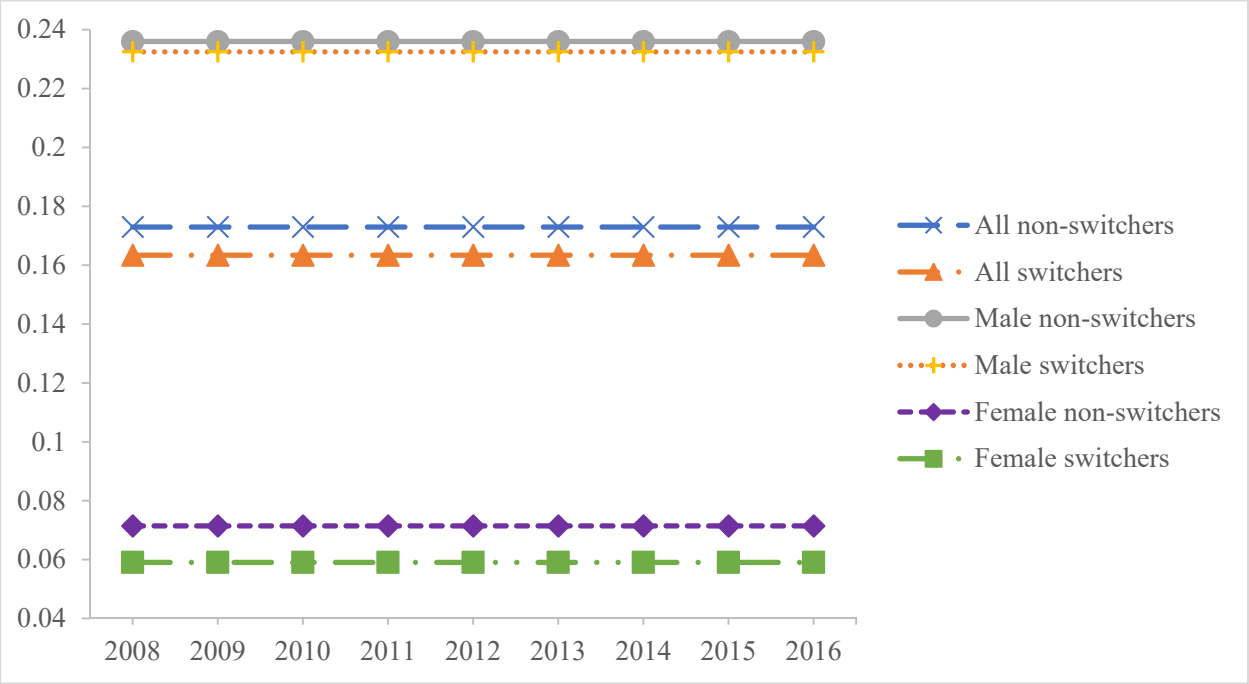


Figure A1.2: Estimated physician-specific time trend from HDFE model for number of hospitalized patients by male and female physicians (PS-weighted)

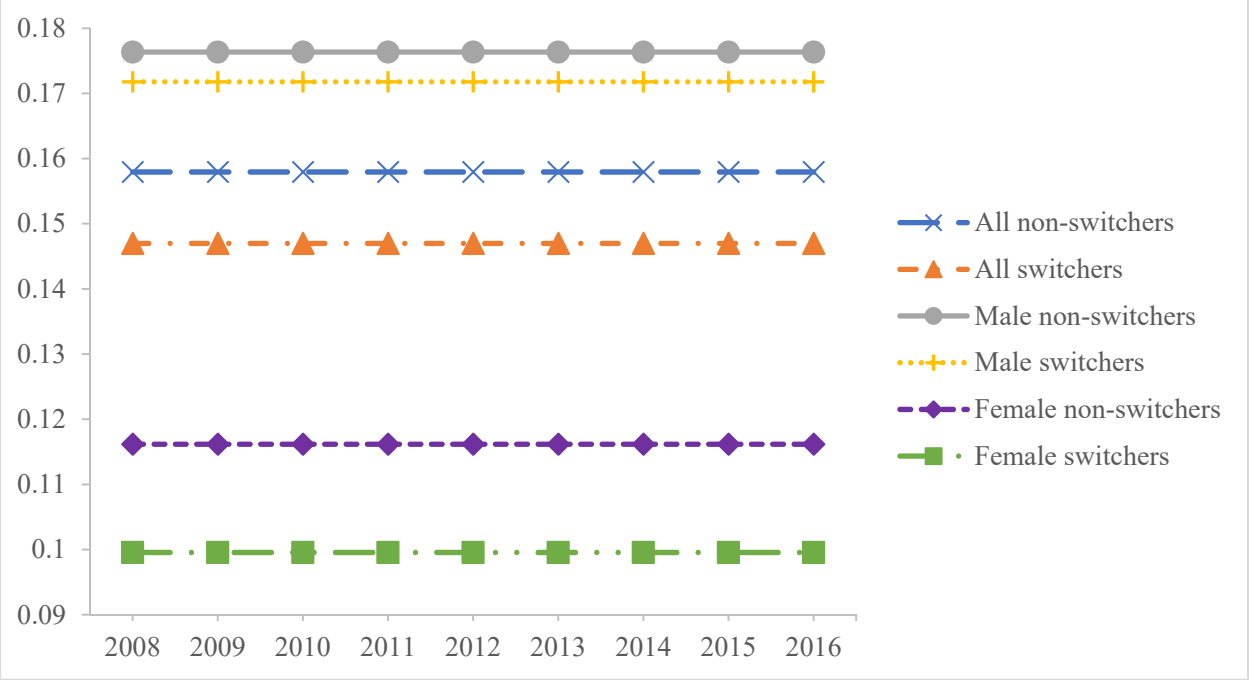


Figure A1.3: Estimated physician-specific time trend from HDFE model for number of psychiatric hospitalizations by younger (< 50 at start of study) and older (> 50 at start of study) physicians (PS-weighted)

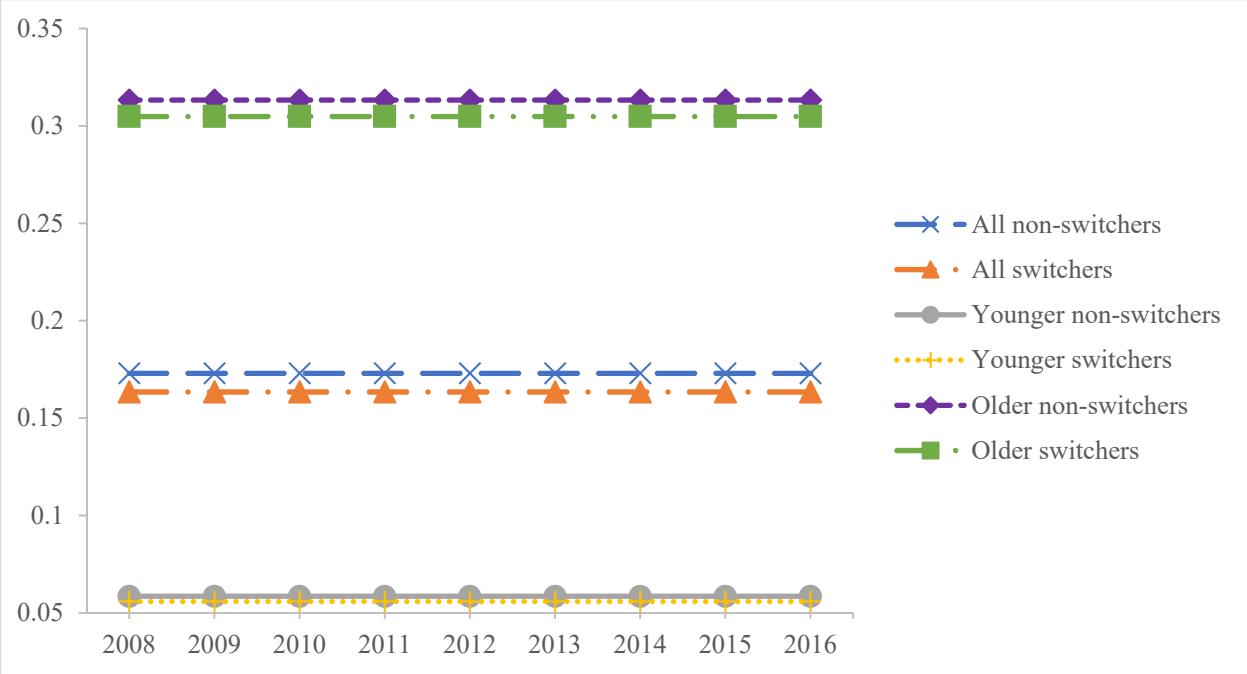


Figure A1.4: Estimated physician-specific time trend from HDFE model for number of hospitalized patients by younger (< 50 at start of study) and older (> 50 at start of study) physicians (PS-weighted)

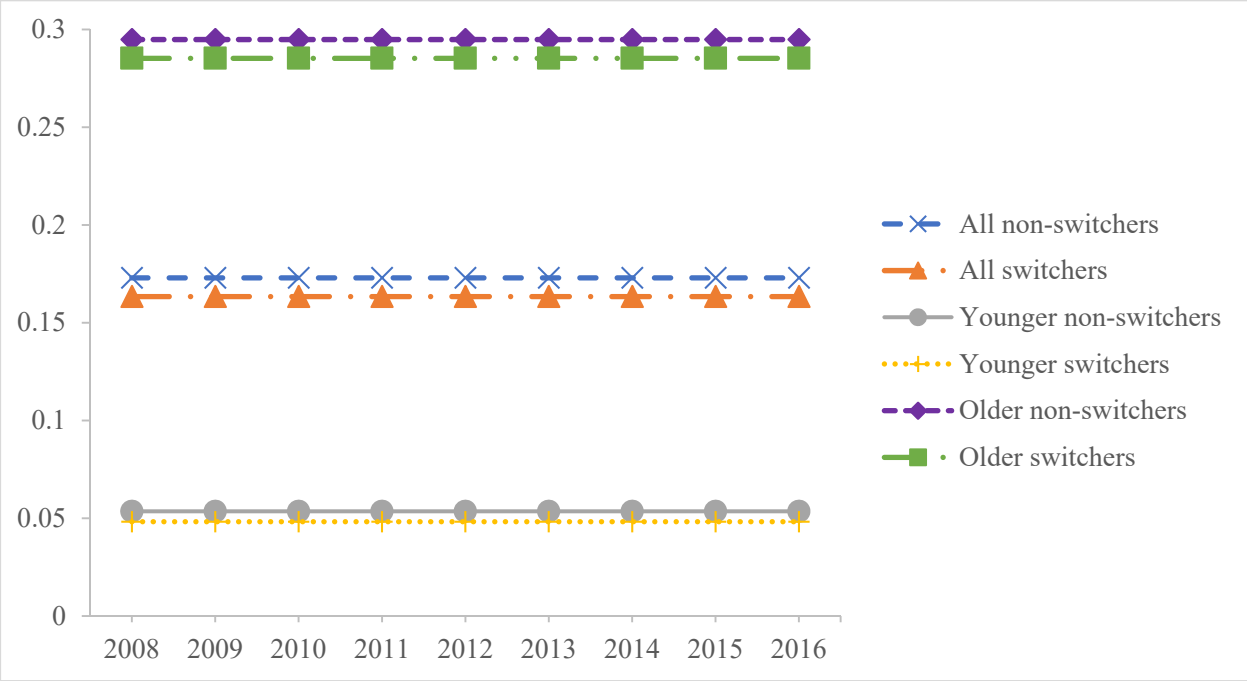


Figure A1.5: Estimated physician-specific time trend from HDFE model for number of psychiatric hospitalizations by early switchers (switched before April 1, 2009) and late switchers (switched on or after April 1, 2009) (PS-weighted)

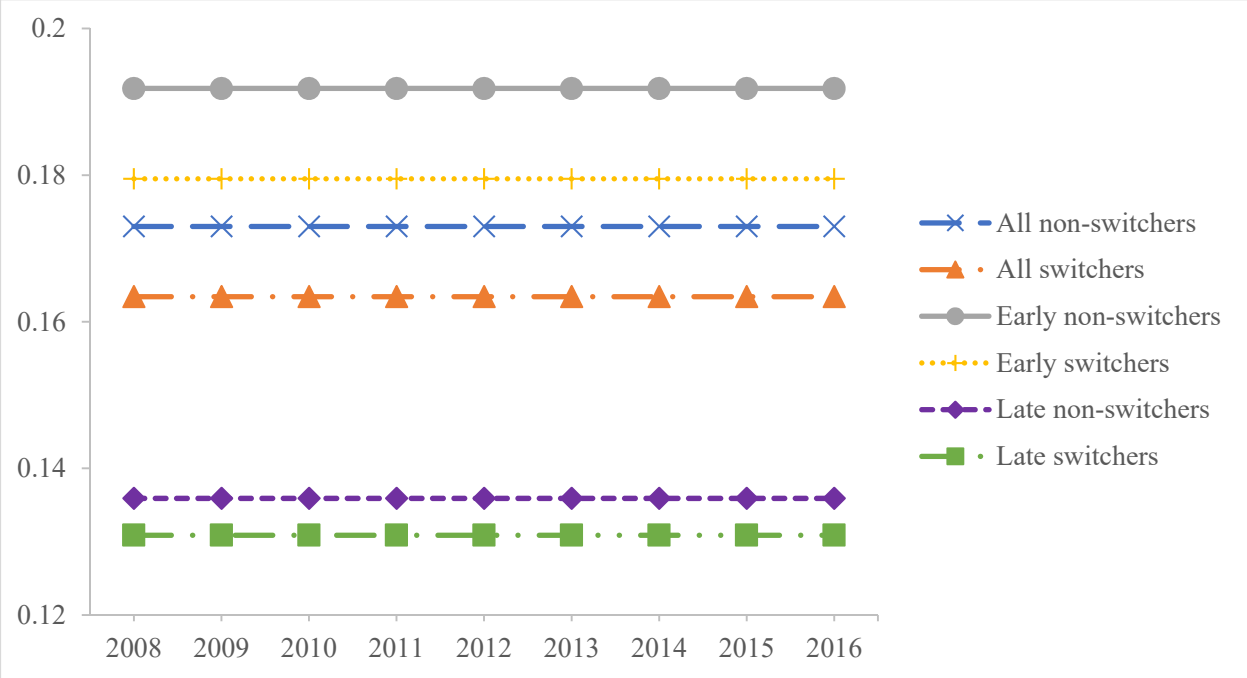
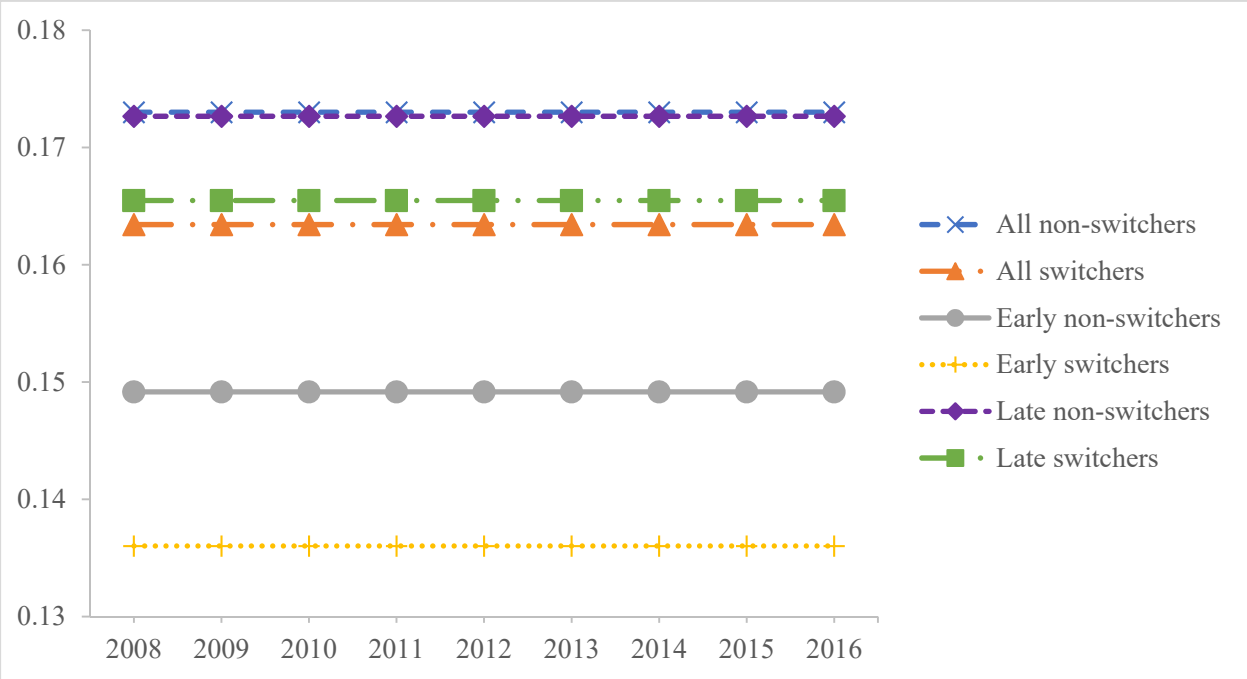


Figure A1.6: Estimated physician-specific time trend from HDFE model for number of hospitalized patients by early switchers (switched before April 1, 2009) and late switchers (switched on or after April 1, 2009) (PS-weighted)



Appendix A.2: Unweighted, PS-weighted, and EB-weighted main analyses

Table A2.1a: Number of hospitalizations (unweighted)

	OLS	**FE**	**HDFE**
FHO	-0.024 [-0.060,0.012]	-0.040* [-0.077,-0.003]	-0.053* [-0.104,-0.002]
Year	-0.001 [-0.006,0.003]	0.015 [-0.008,0.038]	
Age	-0.019* [-0.034,-0.004]		
Age^2	0.000* [0.000,0.000]	0.000 [-0.000,0.000]	-0.002* [-0.004,-0.000]
Sex (Female)	0.033 [-0.040,0.106]		
Rurality	0.276** [0.084,0.468]	0.079 [-0.252,0.410]	0.461*** [0.197,0.725]
IMG	-0.116*** [-0.161,-0.071]		
Group size	-0.000*** [-0.001,-0.000]	-0.000* [-0.001,-0.000]	-0.000^ [-0.001,0.000]
Avg. patient age	0.029*** [0.012,0.046]	-0.022* [-0.043,-0.001]	-0.044* [-0.079,-0.009]
% of patients ≥65	-1.485*** [-2.363,-0.606]	0.284 [-0.748,1.316]	2.793** [0.950,4.636]
Avg. ADG score	0.037^ [-0.007,0.081]	0.110*** [0.051,0.168]	0.170*** [0.094,0.246]
% of female patients	-0.008*** [-0.011,-0.005]	-0.001 [-0.010,0.007]	-0.013^ [-0.026,0.001]
% in Q1 or Q2 on Deprivation Score	-0.009*** [-0.010,-0.008]	-0.006* [-0.011,-0.001]	-0.010** [-0.018,-0.003]
% in Q1 or Q2 on Ethnic Concentration Score	0.004*** [0.003,0.005]	0.000 [-0.002,0.003]	-0.002 [-0.005,0.001]
% of rural patients	-0.007*** [-0.010,-0.005]	0.001 [-0.012,0.013]	-0.001 [-0.010,0.008]
% of patients with CMI	0.012*** [0.010,0.014]	0.007*** [0.004,0.011]	0.006* [0.001,0.011]
Constant	3.889 [-4.868,12.645]	-27.277 [-72.792,18.238]	
R^2	0.105	0.008	0.006
# physicians	2654	2654	2654
# observations	23886	23886	23886

Estimated coefficients and 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Table A2.1b: Number of hospitalizations (PS-weighted)

	OLS	**FE**	**HDFE**
FHO	-0.076*** [-0.116,-0.036]	-0.020 [-0.062,0.022]	-0.049^ [-0.102,0.004]
Year	-0.001 [-0.007,0.005]	-0.006 [-0.039,0.027]	
Age	-0.015^ [-0.032,0.001]		
Age^2	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	-0.002 [-0.004,0.001]
Sex (Female)	0.030 [-0.050,0.110]		
Rurality	0.394* [0.083,0.705]	0.094 [-0.236,0.425]	0.435** [0.170,0.701]
IMG	-0.077** [-0.131,-0.023]		
Group size	-0.001*** [-0.001,-0.000]	-0.000* [-0.001,-0.000]	-0.000^ [-0.001,0.000]
Avg. patient age	0.034** [0.011,0.056]	-0.017 [-0.044,0.010]	-0.043* [-0.084,-0.002]
% of patients ≥65	-1.717** [-2.886,-0.548]	-0.355 [-1.830,1.120]	2.822** [0.760,4.884]
Avg. ADG score	0.034 [-0.018,0.086]	0.108** [0.042,0.173]	0.160*** [0.065,0.256]
% of female patients	-0.009*** [-0.013,-0.006]	0.000 [-0.010,0.010]	-0.012 [-0.028,0.004]
% in Q1 or Q2 on Deprivation Score	-0.009*** [-0.010,-0.008]	-0.011** [-0.017,-0.004]	-0.014** [-0.024,-0.004]
% in Q1 or Q2 on Ethnic Concentration Score	0.004*** [0.002,0.005]	0.001 [-0.002,0.005]	-0.001 [-0.005,0.003]
% of rural patients	-0.008*** [-0.011,-0.004]	-0.003 [-0.017,0.011]	0.002 [-0.010,0.013]
% of patients with CMI	0.013*** [0.009,0.016]	0.009*** [0.005,0.012]	0.005^ [-0.000,0.011]
Constant	3.094 [-8.135,14.324]	14.040 [-50.476,78.556]	
R^2	0.122	0.010	0.006
# physicians	2654	2654	2654
# observations	23886	23886	23886

Estimated coefficients and 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Table A2.1c: Number of hospitalizations (EB-weighted)

	OLS	**FE**	**HDFE**
FHO	-0.072** [-0.120,-0.024]	-0.026 [-0.076,0.025]	-0.064* [-0.121,-0.007]
Year	-0.003 [-0.010,0.004]	-0.002 [-0.050,0.046]	
Age	-0.013 [-0.031,0.004]		
Age^2	0.000 [-0.000,0.000]	0.000 [-0.000,0.001]	-0.002 [-0.004,0.001]
Sex (Female)	0.044 [-0.050,0.138]		
Rurality	0.069 [-0.276,0.414]	0.067 [-0.268,0.402]	0.464*** [0.196,0.732]
IMG	-0.076** [-0.132,-0.020]		
Group size	-0.000* [-0.001,-0.000]	-0.000* [-0.001,-0.000]	-0.000^ [-0.001,0.000]
Avg. patient age	0.029** [0.008,0.050]	-0.023 [-0.055,0.010]	-0.051* [-0.100,-0.001]
% of patients ≥65	-1.394* [-2.485,-0.303]	-0.070 [-2.053,1.912]	3.234** [0.849,5.619]
Avg. ADG score	0.031 [-0.025,0.086]	0.115** [0.040,0.190]	0.178*** [0.084,0.271]
% of female patients	-0.009*** [-0.012,-0.006]	0.005 [-0.007,0.016]	-0.010 [-0.028,0.009]
% in Q1 or Q2 on Deprivation Score	-0.009*** [-0.010,-0.007]	-0.011** [-0.018,-0.003]	-0.012* [-0.022,-0.002]
% in Q1 or Q2 on Ethnic Concentration Score	0.003*** [0.002,0.005]	0.003 [-0.001,0.007]	-0.002 [-0.006,0.003]
% of rural patients	-0.005* [-0.010,-0.001]	0.001 [-0.010,0.012]	-0.003 [-0.015,0.009]
% of patients with CMI	0.010*** [0.007,0.013]	0.006** [0.002,0.011]	0.002 [-0.005,0.009]
Constant	7.196 [-6.624,21.015]	5.990 [-87.980,99.960]	
R^2	0.100	0.010	0.006
# physicians	2654	2654	2654
# observations	23886	23886	23886

Estimated coefficients and 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Table A2.2a: Number of unique patients hospitalized (unweighted)

	OLS	**FE**	**HDFE**
FHO	-0.011 [-0.041,0.018]	-0.028^ [-0.058,0.002]	-0.039^ [-0.081,0.004]
Year	-0.002 [-0.005,0.002]	0.011 [-0.007,0.030]	
Age	-0.017** [-0.029,-0.004]		
Age^2	0.000* [0.000,0.000]	0.000 [-0.000,0.000]	-0.002* [-0.003,-0.000]
Sex (Female)	0.035 [-0.026,0.095]		
Rurality	0.206* [0.041,0.370]	0.059 [-0.173,0.291]	0.243* [0.057,0.429]
IMG	-0.094*** [-0.131,-0.057]		
Group size	-0.000*** [-0.001,-0.000]	-0.000* [-0.000,-0.000]	0.000 [-0.001,0.000]
Avg. patient age	0.025*** [0.011,0.039]	-0.022* [-0.039,-0.005]	-0.038* [-0.066,-0.009]
% of patients ≥65	-1.301*** [-2.035,-0.567]	0.305 [-0.533,1.144]	2.647*** [1.144,4.150]
Avg. ADG score	0.041* [0.005,0.077]	0.095*** [0.047,0.143]	0.133*** [0.072,0.195]
% of female patients	-0.007*** [-0.009,-0.005]	-0.001 [-0.008,0.006]	-0.011* [-0.022,-0.000]
% in Q1 or Q2 on Deprivation Score	-0.008*** [-0.008,-0.007]	-0.006* [-0.010,-0.001]	-0.011*** [-0.017,-0.005]
% in Q1 or Q2 on Ethnic Concentration Score	0.004*** [0.003,0.005]	0.001 [-0.001,0.003]	0.000 [-0.003,0.002]
% of rural patients	-0.006*** [-0.008,-0.004]	-0.001 [-0.013,0.010]	-0.002 [-0.009,0.005]
% of patients with CMI	0.010*** [0.008,0.012]	0.006*** [0.003,0.009]	0.005* [0.001,0.009]
Constant	4.855 [-2.345,12.055]	-20.375 [-56.882,16.132]	
R^2	0.111	0.009	0.006
# physicians	2654	2654	2654
# observations	23886	23886	23886

Estimated coefficients and 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Table A2.2b: Number of unique patients hospitalized (PS-weighted)

	OLS	**FE**	**HDFE**
FHO	-0.054** [-0.088,-0.021]	-0.015 [-0.048,0.018]	-0.034 [-0.078,0.011]
Year	-0.001 [-0.005,0.004]	-0.006 [-0.031,0.019]	
Age	-0.013^ [-0.027,0.001]		
Age^2	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	-0.001 [-0.003,0.000]
Sex (Female)	0.036 [-0.032,0.103]		
Rurality	0.280* [0.012,0.549]	0.073 [-0.158,0.305]	0.234* [0.047,0.421]
IMG	-0.064** [-0.109,-0.019]		
Group size	-0.000*** [-0.001,-0.000]	-0.000* [-0.000,-0.000]	0.000 [-0.001,0.000]
Avg. patient age	0.028** [0.009,0.047]	-0.020^ [-0.042,0.001]	-0.044* [-0.078,-0.009]
% of patients ≥65	-1.465** [-2.464,-0.467]	0.022 [-1.045,1.089]	2.936*** [1.216,4.657]
Avg. ADG score	0.042^ [-0.002,0.086]	0.099*** [0.044,0.154]	0.139*** [0.063,0.216]
% of female patients	-0.008*** [-0.011,-0.006]	-0.001 [-0.009,0.008]	-0.011 [-0.024,0.003]
% in Q1 or Q2 on Deprivation Score	-0.007*** [-0.009,-0.006]	-0.010*** [-0.016,-0.004]	-0.015*** [-0.023,-0.007]
% in Q1 or Q2 on Ethnic Concentration Score	0.004*** [0.003,0.005]	0.002 [-0.001,0.005]	0.001 [-0.002,0.004]
% of rural patients	-0.006*** [-0.009,-0.003]	-0.004 [-0.016,0.007]	-0.002 [-0.010,0.006]
% of patients with CMI	0.011*** [0.008,0.014]	0.007*** [0.004,0.010]	0.004^ [-0.000,0.009]
Constant	2.493 [-6.823,11.810]	13.429 [-36.271,63.130]	
R^2	0.129	0.011	0.007
# physicians	2654	2654	2654
# observations	23886	23886	23886

Estimated coefficients and 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Table A2.2c: Number of unique patients hospitalized (EB-weighted)

	OLS	**FE**	**HDFE**
FHO	-0.049* [-0.090,-0.008]	-0.019 [-0.060,0.021]	-0.048* [-0.096,-0.001]
Year	-0.002 [-0.008,0.003]	-0.002 [-0.040,0.035]	
Age	-0.011 [-0.026,0.004]		
Age^2	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	-0.002^ [-0.004,0.000]
Sex (Female)	0.052 [-0.028,0.132]		
Rurality	0.001 [-0.277,0.279]	0.052 [-0.187,0.290]	0.249* [0.059,0.440]
IMG	-0.066** [-0.112,-0.020]		
Group size	-0.000* [-0.001,-0.000]	-0.000* [-0.000,-0.000]	-0.000^ [-0.001,0.000]
Avg. patient age	0.024** [0.007,0.041]	-0.024^ [-0.051,0.002]	-0.053* [-0.095,-0.011]
% of patients ≥65	-1.182** [-2.074,-0.289]	0.156 [-1.320,1.633]	3.543*** [1.507,5.580]
Avg. ADG score	0.044^ [-0.002,0.090]	0.105*** [0.043,0.168]	0.143*** [0.067,0.219]
% of female patients	-0.008*** [-0.011,-0.005]	0.003 [-0.007,0.014]	-0.007 [-0.023,0.008]
% in Q1 or Q2 on Deprivation Score	-0.007*** [-0.008,-0.006]	-0.011*** [-0.017,-0.005]	-0.014** [-0.023,-0.006]
% in Q1 or Q2 on Ethnic Concentration Score	0.003*** [0.002,0.005]	0.003^ [-0.000,0.006]	0.001 [-0.003,0.004]
% of rural patients	-0.004* [-0.008,-0.000]	-0.002 [-0.012,0.008]	-0.005 [-0.014,0.004]
% of patients with CMI	0.009*** [0.006,0.011]	0.005* [0.001,0.009]	0.001 [-0.005,0.007]
Constant	5.967 [-5.653,17.587]	6.512 [-67.843,80.867]	
R^2	0.106	0.010	0.006
# physicians	2654	2654	2654
# observations	23886	23886	23886

Estimated coefficients and 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Table A2.3a: Marginal effects of follow-up visit within 14 days after a psychiatric hospitalization, without controlling for physician-specific means (unweighted)

	GLM	**GEE**
FHO	0.012* [0.002,0.022]	0.010^ [-0.001,0.022]
Year	-0.004*** [-0.006,-0.003]	-0.004*** [-0.006,-0.002]
Age	0.006** [0.002,0.010]	0.007** [0.002,0.012]
Age^2	-0.000*** [-0.000,-0.000]	-0.000** [-0.000,-0.000]
Sex (Female)	0.010 [-0.008,0.028]	0.011 [-0.011,0.034]
Rurality	0.008 [-0.036,0.052]	0.008 [-0.049,0.065]
IMG	-0.014* [-0.025,-0.003]	-0.014* [-0.028,-0.001]
Group size	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
# rostered patients	0.000*** [0.000,0.000]	0.000*** [0.000,0.000]
$(\#\text{ rostered patients})^2$	-0.000*** [-0.000,-0.000]	-0.000*** [-0.000,-0.000]
Avg. patient age	-0.001 [-0.005,0.003]	0.000 [-0.005,0.004]
% of patients ≥65	0.131 [-0.060,0.323]	0.084 [-0.149,0.318]
Avg. ADG score	0.043*** [0.032,0.053]	0.045*** [0.032,0.058]
% of female patients	0.000 [-0.001,0.000]	0.000 [-0.001,0.001]
% in Q1 or Q2 on Deprivation Score	0.001*** [0.000,0.001]	0.001*** [0.000,0.001]
% in Q1 or Q2 on Ethnic Concentration Score	0.001*** [0.001,0.001]	0.001*** [0.001,0.001]
% of rural patients	0.000 [-0.000,0.001]	0.000 [-0.001,0.001]
% of patients with CMI	0.000^ [-0.000,0.001]	0.000 [-0.000,0.001]
# physicians	2652	2652
# observations	22045	22045

Marginal effects and 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Table A2.3b: Marginal effects of follow-up visit within 14 days after a psychiatric hospitalization, without controlling for physician-specific means (PS-weighted)

	GLM	**GEE**
FHO	0.010^ [-0.002,0.021]	0.007 [-0.006,0.020]
Year	-0.003* [-0.005,-0.000]	-0.002* [-0.005,-0.000]
Age	0.006* [0.001,0.011]	0.008* [0.002,0.014]
Age^2	-0.000** [-0.000,-0.000]	-0.000** [-0.000,-0.000]
Sex (Female)	0.003 [-0.018,0.025]	0.003 [-0.023,0.030]
Rurality	0.060* [0.008,0.112]	0.059 [-0.012,0.130]
IMG	-0.010 [-0.022,0.003]	-0.010 [-0.025,0.005]
Group size	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
# rostered patients	0.000** [0.000,0.000]	0.000* [0.000,0.000]
(# rostered patients)^2	-0.000** [-0.000,-0.000]	-0.000* [-0.000,-0.000]
Avg. patient age	-0.005* [-0.010,-0.000]	-0.005 [-0.010,0.001]
% of patients ≥65	0.273* [0.037,0.509]	0.244^ [-0.043,0.531]
Avg. ADG score	0.041*** [0.028,0.054]	0.044*** [0.027,0.060]
% of female patients	0.000 [-0.001,0.001]	0.000 [-0.001,0.001]
% in Q1 or Q2 on Deprivation Score	0.001*** [0.000,0.001]	0.001** [0.000,0.001]
% in Q1 or Q2 on Ethnic Concentration Score	0.001*** [0.001,0.001]	0.001*** [0.001,0.001]
% of rural patients	0.000 [-0.001,0.000]	0.000 [-0.001,0.001]
% of patients with CMI	0.000 [-0.000,0.001]	0.000 [-0.000,0.001]
# physicians	2652	2652
# observations	22045	22045

Marginal effects and 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Table A2.3c: Marginal effects of follow-up visit within 14 days after a psychiatric hospitalization, without controlling for physician-specific means (EB-weighted)

	GLM	**GEE**
FHO	0.009 [-0.004,0.022]	0.005 [-0.010,0.020]
Year	-0.003* [-0.005,-0.000]	-0.002^ [-0.005,0.000]
Age	0.007* [0.001,0.012]	0.008* [0.002,0.015]
Age^2	-0.000** [-0.000,-0.000]	-0.000** [-0.000,-0.000]
Sex (Female)	-0.010 [-0.034,0.014]	-0.010 [-0.040,0.019]
Rurality	0.038 [-0.023,0.098]	0.041 [-0.050,0.131]
IMG	-0.003 [-0.016,0.010]	-0.003 [-0.021,0.014]
Group size	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
# rostered patients	0.000* [0.000,0.000]	0.000* [0.000,0.000]
(# rostered patients)^2	-0.000** [-0.000,-0.000]	-0.000* [-0.000,-0.000]
Avg. patient age	-0.006* [-0.011,-0.001]	-0.005 [-0.011,0.001]
% of patients ≥65	0.293* [0.033,0.554]	0.263^ [-0.044,0.569]
Avg. ADG score	0.041*** [0.026,0.056]	0.044*** [0.024,0.064]
% of female patients	0.000 [-0.001,0.001]	0.000 [-0.001,0.001]
% in Q1 or Q2 on Deprivation Score	0.001*** [0.000,0.001]	0.001** [0.000,0.001]
% in Q1 or Q2 on Ethnic Concentration Score	0.001*** [0.001,0.001]	0.001*** [0.001,0.001]
% of rural patients	0.000 [-0.001,0.001]	0.000 [-0.001,0.001]
% of patients with CMI	0.000 [-0.000,0.001]	0.000 [-0.001,0.001]
# physicians	2652	2652
# observations	22045	22045

Marginal effects and 95% confidence intervals (standard errors were clustered at the physician level).
*** p < 0.001; ** p < 0.01; * p < 0.05; ^ p < 0.10

Table A2.4a: Marginal effects of follow-up visit within 14 days after a psychiatric hospitalization and usage of the follow-up premium, controlling for physician-specific means (unweighted)

	GLM	**GEE**
FHO	0.012* [0.002,0.022]	0.010^ [-0.002,0.022]
Year	0.011^ [-0.001,0.023]	0.011^ [-0.001,0.023]
Age	0.004^ [-0.001,0.008]	0.004 [-0.002,0.009]
Age^2	-0.000*** [-0.000,-0.000]	-0.000*** [-0.000,-0.000]
Sex (Female)	0.009 [-0.009,0.028]	0.010 [-0.013,0.033]
Rurality	0.064 [-0.082,0.210]	0.067 [-0.054,0.188]
IMG	-0.013* [-0.024,-0.002]	-0.012^ [-0.026,0.001]
Group size	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
# rostered patients	0.000* [0.000,0.000]	0.000* [0.000,0.000]
$(\#\ \text{rostered patients})^2$	-0.000* [-0.000,-0.000]	-0.000** [-0.000,-0.000]
Avg. patient age	0.008 [-0.002,0.018]	0.007 [-0.003,0.018]
% of patients ≥65	-0.361 [-0.842,0.121]	-0.353 [-0.843,0.137]
Avg. ADG score	0.086*** [0.058,0.114]	0.086*** [0.058,0.113]
% of female patients	-0.001 [-0.004,0.003]	-0.001 [-0.004,0.003]
% in Q1 or Q2 on Deprivation Score	0.001 [-0.001,0.003]	0.001 [-0.001,0.003]
% in Q1 or Q2 on Ethnic Concentration Score	0.000 [-0.002,0.001]	0.000 [-0.002,0.001]
% of rural patients	0.002 [-0.003,0.006]	0.001 [-0.005,0.007]
% of patients with CMI	0.000 [-0.002,0.001]	0.000 [-0.002,0.001]
FP-averaged coefficients		
Age^2	0.000* [0.000,0.000]	0.000* [0.000,0.000]
Rurality	-0.057 [-0.210,0.097]	-0.060 [-0.194,0.075]
Group size	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
# of rostered patients	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]

(# of rostered patients)^2	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
Avg. patient age	-0.011^ [-0.021,0.000]	-0.011^ [-0.022,0.001]
% of patients ≥65	0.604* [0.083,1.125]	0.602* [0.050,1.153]
Avg. ADG score	-0.050** [-0.080,-0.020]	-0.051** [-0.082,-0.020]
% of female patients	0.000 [-0.003,0.004]	0.000 [-0.003,0.004]
% in Q1 or Q2 on Deprivation Score	0.000 [-0.002,0.002]	0.000 [-0.002,0.002]
% in Q1 or Q2 on Ethnic Concentration Score	0.001* [0.000,0.003]	0.001* [0.000,0.003]
% of rural patients	-0.001 [-0.006,0.003]	-0.001 [-0.007,0.005]
% of patients with CMI	0.001 [-0.001,0.002]	0.001 [-0.001,0.002]
# physicians	2652	2652
# observations	22045	22045

Marginal effects and 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Table A2.4b: Marginal effects of follow-up visit within 14 days after a psychiatric hospitalization, controlling for physician-specific means (PS-weighted)

	GLM	**GEE**
FHO	0.010^ [-0.002,0.021]	0.007 [-0.006,0.020]
Year	0.019* [0.004,0.034]	0.019** [0.005,0.033]
Age	0.003 [-0.003,0.008]	0.002 [-0.004,0.009]
Age^2	-0.000*** [-0.000,-0.000]	-0.000*** [-0.000,-0.000]
Sex (Female)	0.003 [-0.019,0.025]	0.003 [-0.024,0.030]
Rurality	0.076 [-0.074,0.226]	0.079 [-0.039,0.197]
IMG	-0.009 [-0.021,0.004]	-0.008 [-0.024,0.007]
Group size	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
# rostered patients	0.000^ [-0.000,0.000]	0.000* [0.000,0.000]
$(\#\text{ of rostered patients})^2$	-0.000* [-0.000,-0.000]	-0.000* [-0.000,-0.000]
Avg. patient age	0.004 [-0.008,0.017]	0.004 [-0.008,0.016]
% of patients ≥65	-0.013 [-0.636,0.610]	0.011 [-0.576,0.599]
Avg. ADG score	0.086*** [0.053,0.119]	0.086*** [0.054,0.118]
% of female patients	0.000 [-0.004,0.004]	0.000 [-0.004,0.004]
% in Q1 or Q2 on Deprivation Score	0.000 [-0.003,0.002]	0.000 [-0.003,0.002]
% in Q1 or Q2 on Ethnic Concentration Score	0.000 [-0.002,0.001]	0.000 [-0.002,0.001]
% of rural patients	0.000 [-0.006,0.005]	0.000 [-0.007,0.006]
% of patients with CMI	0.000 [-0.002,0.002]	0.000 [-0.002,0.002]
FP-averaged coefficients		
Age^2	0.000** [0.000,0.000]	0.000** [0.000,0.000]
Rurality	-0.015 [-0.175,0.145]	-0.018 [-0.155,0.118]
Group size	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
# of rostered patients	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]

(# of rostered patients)^2	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
Avg. patient age	-0.011 [-0.025,0.003]	-0.011 [-0.024,0.002]
% of patients ≥65	0.379 [-0.296,1.053]	0.362 [-0.306,1.029]
Avg. ADG score	-0.053** [-0.088,-0.018]	-0.054** [-0.092,-0.017]
% of female patients	-0.001 [-0.005,0.004]	-0.001 [-0.005,0.003]
% in Q1 or Q2 on Deprivation Score	0.001 [-0.002,0.003]	0.001 [-0.002,0.003]
% in Q1 or Q2 on Ethnic Concentration Score	0.001 [-0.000,0.003]	0.001 [-0.000,0.003]
% of rural patients	0.000 [-0.005,0.005]	0.000 [-0.007,0.007]
% of patients with CMI	0.000 [-0.002,0.002]	0.000 [-0.002,0.002]
# physicians	2652	2652
# observations	22045	22045

Marginal effects and 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Table A2.4c: Marginal effects of follow-up visit within 14 days after a psychiatric hospitalization, controlling for physician-specific means (EB-weighted)

	GLM	**GEE**
FHO	0.009 [-0.004,0.022]	0.006 [-0.009,0.021]
Year	0.018* [0.002,0.034]	0.018* [0.004,0.033]
Age	0.003 [-0.002,0.009]	0.003 [-0.004,0.010]
Age^2	-0.000** [-0.000,-0.000]	-0.000*** [-0.000,-0.000]
Sex (Female)	-0.009 [-0.033,0.016]	-0.008 [-0.039,0.022]
Rurality	0.093 [-0.059,0.245]	0.097^ [-0.016,0.209]
IMG	-0.002 [-0.015,0.011]	-0.002 [-0.019,0.016]
Group size	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
# rostered patients	0.000^ [-0.000,0.000]	0.000^ [-0.000,0.000]
$(\#\text{ of rostered patients})^2$	-0.000* [-0.000,-0.000]	-0.000* [-0.000,-0.000]
Avg. patient age	0.005 [-0.008,0.019]	0.005 [-0.008,0.017]
% of patients ≥65	-0.042 [-0.716,0.631]	-0.008 [-0.592,0.575]
Avg. ADG score	0.087*** [0.052,0.122]	0.086*** [0.051,0.121]
% of female patients	0.001 [-0.003,0.006]	0.002 [-0.003,0.006]
% in Q1 or Q2 on Deprivation Score	0.000 [-0.003,0.002]	0.000 [-0.003,0.002]
% in Q1 or Q2 on Ethnic Concentration Score	0.000 [-0.002,0.001]	0.000 [-0.002,0.001]
% of rural patients	-0.002 [-0.008,0.004]	-0.003 [-0.012,0.007]
% of patients with CMI	0.001 [-0.001,0.003]	0.001 [-0.001,0.003]
FP-averaged coefficients		
Age^2	0.000* [0.000,0.000]	0.000** [0.000,0.000]
Rurality	-0.057 [-0.221,0.107]	-0.060 [-0.209,0.090]
Group size	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
# of rostered patients	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]

(# of rostered patients)^2	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
Avg. patient age	-0.013^ [-0.027,0.002]	-0.012^ [-0.027,0.002]
% of patients ≥65	0.431 [-0.305,1.168]	0.407 [-0.292,1.107]
Avg. ADG score	-0.055** [-0.093,-0.017]	-0.056** [-0.095,-0.016]
% of female patients	-0.001 [-0.006,0.003]	-0.001 [-0.006,0.003]
% in Q1 or Q2 on Deprivation Score	0.001 [-0.002,0.004]	0.001 [-0.001,0.004]
% in Q1 or Q2 on Ethnic Concentration Score	0.001 [-0.001,0.003]	0.001 [-0.000,0.003]
% of rural patients	0.002 [-0.004,0.008]	0.002 [-0.007,0.012]
% of patients with CMI	-0.001 [-0.003,0.001]	-0.001 [-0.003,0.001]
# physicians	2652	2652
# observations	22045	22045

Marginal effects and 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Subgroup Analyses

Table A2.7a: Coefficient of FHO on number of psychiatric hospitalizations and unique patients with a psychiatric hospitalization, by sex

	Male physicians			Female physicians		
	OLS	FE	HDFE	OLS	FE	HDFE
	Number of psychiatric hospitalizations			Number of psychiatric hospitalizations		
Unweighted	-0.031 (-0.077, 0.015)	-0.043^ (-0.086, -0.001)	-0.062* (-0.121, -0.004)	-0.036 (-0.094, 0.021)	-0.039 (-0.105, 0.026)	-0.043 (-0.134, 0.047)
PS-weighted	-0.100*** (-0.152, -0.047)	-0.035 (-0.084, 0.013)	-0.060^ (-0.121, -0.0003)	-0.066* (-0.127, -0.005)	-0.003 (-.0077, 0.071)	-0.038 (-0.133, 0.056)
EB-weighted	-0.086** (-0.148, -0.023)	-0.042 (-0.106, 0.021)	-0.080* (-0.147, -0.013)	-0.072* (-0.138, -0.005)	-0.004 (-0.081, 0.073)	-0.048 (-0.148, 0.052)
	Number of patients with a psychiatric hospitalization			Number of patients with a psychiatric hospitalization		
Unweighted	-0.016 (-0.054, 0.022)	-0.027 (-0.061, 0.008)	-0.039 (-0.087, 0.009)	-0.022 (-0.069, 0.026)	-0.033 (-0.088, 0.021)	-0.040 (-0.116, 0.037)
PS-weighted	-0.073** (-0.118, -0.028)	-0.027 (-0.064, 0.011)	-0.039 (-0.090, 0.012)	-0.048^ (-0.099, 0.003)	-0.003 (-0.062, 0.055)	0.031 (-0.110, 0.048)
EB-weighted	-0.059* (-0.114, -0.003)	-0.034 (-0.085, 0.017)	-0.056^ (-0.113, -0.001)	-0.051^ (-0.106, 0.004)	-0.00003 (-0.060, 0.060)	-0.042 (-0.124, 0.041)
Physicians	1,599	1,599	1,599	1,055	1,055	1,055
Observations	14,391	14,391	14,391	9,495	9,495	9,495

Estimated coefficients and associated 95% confidence intervals (standard errors were clustered at the physician level).

*** p < 0.001; ** p < 0.01; * p < 0.05; ^ p < 0.10

All regressions include full set of control variables and physician-specific means of covariates defined in Methods section.

Table A2.7b: Marginal effect of switching to FHO on follow-up visit, by physician sex

	Male physicians only		Female physicians only	
	GLM	GEE	GLM	GEE
	Follow-up visit		Follow-up visit	
Unweighted	0.0005 (-0.011, 0.013)	0.001 (-0.013, 0.015)	0.021* (0.003, 0.039)	0.018^ (-0.0003, 0.039)
PS-weighted	-0.002 (-0.015, 0.012)	-0.002 (-0.018, 0.013)	0.017 (-0.004, 0.037)	0.014 (-0.009, 0.036)
EB-weighted	-0.004 (-0.020, 0.012)	-0.006 (-0.023, 0.012)	0.009 (-0.008, 0.025)	0.017 (-0.007, 0.041)
Physicians	1,599	1,599	1,053	1,053
Observations	13,688	13,688	8,357	8,357

Marginal effects and associated 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

All regressions include full set of control variables and physician-specific means of covariates defined in Methods section.

Table A2.8a Coefficient of FHO on number of psychiatric hospitalizations and unique patients who had a psychiatric hospitalization, by age group

	Younger physicians			Older physicians		
	OLS	FE	HDFE	OLS	FE	HDFE
	Number of psychiatric hospitalizations			Number of psychiatric hospitalizations		
Unweighted	0.014 (-0.003, 0.027)	-0.019 (-0.072, 0.035)	-0.034 (-0.104, 0.038)	-0.031 (-0.081, 0.020)	-0.071** (-0.123, -0.020)	-0.081* (-0.153, -0.010)
PS-weighted	-0.052^ (-0.107, 0.003)	0.014 (-0.047, 0.075)	-0.025 (-0.097, 0.048)	-0.101** (-0.158, -0.043)	-0.068* (-0.123, -0.013)	-0.086* (-0.162, -0.009)
EB-weighted	-0.013 (-0.039, 0.053)	0.009 (-0.069, 0.087)	-0.041 (-0.119, 0.037)	-0.121*** (-0.181, -0.062)	-0.077** (-0.136, -0.019)	-0.095* (-0.178, -0.012)
	Number of hospitalized patients			Number of hospitalized patients		
Unweighted	-0.003 (-0.045, 0.039)	-0.014 (-0.057, 0.029)	-0.022 (-0.080, 0.037)	-0.016 (-0.057, 0.025)	-0.051* (-0.092, -0.010)	-0.063* (-0.123, -0.002)
PS-weighted	-0.034 (-0.081, 0.014)	0.012 (-0.036, 0.060)	-0.013 (-0.074, 0.047)	-0.077** (-0.124, -0.029)	-0.054* (-0.098, -0.010)	-0.064^ (-0.128, 0.0003)
EB-weighted	-0.0001 (-0.058, 0.058)	0.008 (-0.054, 0.070)	-0.031 (-0.097, 0.035)	-0.090*** (-0.139, -0.042)	-0.061* (-0.107, -0.014)	-0.072* (-0.141, -0.004)
Physicians	1,366	1,366	1,366	1,288	1,288	1,288
Observations	12,294	12,294	12,294	11,592	11,592	11,592

Younger physicians were $\leq$ 50 years old at start of study, while older physicians were > 50 years old at start of study.

Estimated coefficients and associated 95% confidence intervals (standard errors were clustered at the physician level).

*** p < 0.001; ** p < 0.01; * p < 0.05; ^ p < 0.10

All regressions include full set of control variables and physician-specific means of covariates defined in Methods section.

Table A2.8b: Marginal effect of switching to FHO on follow-up visit including physician-specific averages, by age

	Younger physicians		Older physicians	
	GLM	GEE	GLM	GEE
	Follow-up visit within 14 days		Follow-up visit within 14 days	
Unweighted	0.012 (-0.003, 0.027)	0.012 (-0.005, 0.029)	0.011 (-0.003, 0.025)	0.008 (-0.008, 0.024)
PS-weighted	0.009 (-0.008, 0.026)	0.008 (-0.011, 0.027)	0.010 (-0.004, 0.025)	0.006 (-0.012, 0.025)
EB-weighted	0.014 (-0.005, 0.033)	0.012 (-0.009, 0.033)	0.009 (-0.008, 0.025)	0.004 (-0.016, 0.024)
Physicians	1364	1364	1288	1288
Observations	11225	11225	10820	10820

Younger physicians were $\leq$ 50 years old at start of study, while older physicians were > 50 years old at start of study.

Marginal effects and associated 95% confidence intervals (standard errors were clustered at the physician level).

*** p < 0.001; ** p < 0.01; * p < 0.05; ^ p < 0.10

All regressions include full set of control variables and physician-specific means of covariates defined in Methods section.

Table A2.9a: Coefficient of FHO on number of psychiatric hospitalizations, by time of switch (early or late)

	Early switchers			Late switchers		
	OLS	FE	HDFE	OLS	FE	HDFE
	Number of psychiatric hospitalizations			Number of psychiatric hospitalizations		
Unweighted	-0.039^ (-0.085, 0.006)	-0.047 (-0.105, 0.010)	-0.029 (-0.103, 0.046)	-0.033 (-0.078, 0.012)	-0.038^ (-0.083, 0.007)	-0.065* (-0.130, -0.0002)
PS-weighted	-0.085** (-0.133, -0.036)	-0.018 (-0.082, 0.045)	-0.029 (-0.103, 0.046)	-0.081** (-0.129, -0.032)	-0.017 (-0.068, 0.034)	-0.062^ (-0.129, -0.005)
EB-weighted	-0.086** (-0.145, -0.028)	-0.035 (-0.115, 0.046)	-0.029 (-0.103, 0.046)	-0.074** (-0.127, -0.020)	-0.023 (-0.084, 0.038)	-0.078* (-0.150, -0.007)
	Number of hospitalized patients			Number of hospitalized patients		
Unweighted	-0.025 (-0.062, 0.013)	-0.046^ (-0.093, 0.002)	-0.027 (-0.089, 0.034)	-0.019 (-0.056, 0.018)	-0.026 (-0.062, 0.010)	-0.050^ (-0.104, 0.0004)
PS-weighted	-0.061** (-0.102, -0.019)	-0.026 (-0.078, 0.026)	-0.027 (-0.089, 0.034)	-0.060** (-0.101, -0.019)	-0.012 (-0.052, 0.028)	-0.045 (-0.101, 0.010)
EB-weighted	-0.059* (-0.110, -0.008)	-0.040 (-0.107, 0.026)	-0.027 (-0.089, 0.034)	-0.052* (-0.098, -0.007)	-0.016 (-0.064, 0.032)	-0.062* (-0.121, -0.002)
Physicians	1,898	1,898	1,898	1,992	1,992	1,992
Observations	17,082	17,082	17,082	17,928	17,928	17,928

Analyses compared early switchers (switched in first two years; N = 662) to entire non-switcher group, or late switchers (switched in last seven years; N = 756) to entire non-switcher group (N=1236).

Estimated coefficients and associated 95% confidence intervals (standard errors were clustered at the physician level).

*** p < 0.001; ** p < 0.01; * p < 0.05; ^ p < 0.10

All regressions include full set of control variables and physician-specific means of covariates defined in Methods section.

Table A2.9b: Marginal effect of switching to FHO on follow-up visit: early and late switchers

	Early switchers		Late switchers	
	GLM	GEE	GLM	GEE
	Follow-up visit within 14 days		Follow-up visit within 14 days	
Unweighted	0.014* (0.002, 0.027)	0.013 (-0.003, 0.028)	0.006 (-0.007, 0.019)	0.006 (-0.009, 0.020)
PS-weighted	0.016* (0.001, 0.030)	0.013 (-0.004, 0.031)	0.001 (-0.013, 0.015)	-0.0004 (-0.016, 0.015)
EB-weighted	0.014^ (-0.002, 0.030)	0.012 (-0.008, 0.032)	0.0007 (-0.014, 0.016)	-0.002 (-0.019, 0.015)
Physicians	1,896	1,896	1991	1991
Observations	15,777	15,777	16595	16595

Analyses compared early switchers (switched in first two years; N = 662) to entire non-switcher group, or late switchers (switched in last seven years; N = 756) to entire non-switcher group (N=1236).

Marginal effects and associated 95% confidence intervals (standard errors were clustered at the physician level).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

All regressions include full set of control variables and physician-specific means of covariates defined in Methods section.

Appendix B: Fractional regression analyses

Table B1a: Marginal effects for follow-up within 14 days using fractional regression with a logit model

	Unweighted	PS-weighted	EB-weighted
FHO	0.057^ [-0.002,0.116]	0.046 [-0.021,0.113]	0.042 [-0.036,0.121]
Year	0.056^ [-0.004,0.115]	0.093** [0.025,0.160]	0.088* [0.018,0.159]
Age	0.020 [-0.007,0.047]	0.013 [-0.019,0.044]	0.016 [-0.018,0.051]
Age^2	-0.001*** [-0.001,-0.000]	-0.001*** [-0.002,-0.001]	-0.001*** [-0.002,-0.001]
Sex (Female)	0.046 [-0.066,0.157]	0.015 [-0.115,0.145]	-0.044 [-0.190,0.102]
Rurality	0.309 [-0.282,0.901]	0.362 [-0.200,0.924]	0.445 [-0.094,0.983]
IMG	-0.063^ [-0.130,0.004]	-0.042 [-0.116,0.032]	-0.009 [-0.094,0.076]
Group size	0.000 [-0.000,0.001]	0.000 [-0.001,0.001]	0.000 [-0.001,0.001]
# rostered patients	0.000^ [-0.000,0.001]	0.000^ [-0.000,0.001]	0.000^ [-0.000,0.001]
$(\#\text{ rostered patients})^2$	-0.000* [-0.000,-0.000]	-0.000* [-0.000,-0.000]	-0.000* [-0.000,-0.000]
Avg. patient age	0.036 [-0.014,0.086]	0.019 [-0.040,0.077]	0.023 [-0.038,0.085]
% of patients ≥65	-1.724 [-4.129,0.681]	-0.024 [-2.867,2.820]	-0.155 [-2.980,2.669]
Avg. ADG score	0.421*** [0.284,0.557]	0.414*** [0.258,0.569]	0.422*** [0.251,0.593]
% of female patients	-0.003 [-0.021,0.015]	0.002 [-0.017,0.020]	0.007 [-0.014,0.027]
% in Q1 or Q2 on Deprivation Score	0.004 [-0.006,0.014]	-0.001 [-0.012,0.011]	-0.002 [-0.014,0.010]
% in Q1 or Q2 on Ethnic Concentration Score	-0.002 [-0.008,0.004]	-0.001 [-0.008,0.006]	-0.001 [-0.008,0.007]
% of rural patients	0.007 [-0.021,0.036]	-0.002 [-0.034,0.030]	-0.014 [-0.059,0.032]
% of patients with CMI	-0.001 [-0.008,0.006]	0.000 [-0.008,0.009]	0.004 [-0.005,0.014]
FP-averaged coefficients			
Age^2	0.001* [0.000,0.001]	0.001** [0.000,0.002]	0.001** [0.000,0.002]
Rurality	-0.272 [-0.926,0.382]	-0.072 [-0.725,0.582]	-0.272 [-0.995,0.451]
Group size	0.000 [-0.001,0.001]	0.000 [-0.001,0.001]	0.000 [-0.001,0.002]
# of rostered patients	0.000 [-0.000,0.000]	0.000 [-0.001,0.000]	0.000 [-0.001,0.000]

(# of rostered patients)^2	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
Avg. patient age	-0.052^ [-0.106,0.002]	-0.053 [-0.117,0.012]	-0.061^ [-0.132,0.010]
% of patients ≥65	2.947* [0.242,5.651]	1.817 [-1.404,5.039]	2.062 [-1.323,5.447]
Avg. ADG score	-0.245** [-0.397,-0.093]	-0.254** [-0.436,-0.073]	-0.267** [-0.458,-0.076]
% of female patients	0.002 [-0.016,0.021]	-0.002 [-0.022,0.017]	-0.006 [-0.027,0.015]
% in Q1 or Q2 on Deprivation Score	-0.001 [-0.011,0.009]	0.004 [-0.008,0.015]	0.005 [-0.007,0.017]
% in Q1 or Q2 on Ethnic Concentration Score	0.007* [0.000,0.013]	0.006 [-0.001,0.013]	0.005 [-0.002,0.013]
% of rural patients	-0.007 [-0.036,0.022]	0.000 [-0.032,0.032]	0.013 [-0.033,0.059]
% of patients with CMI	0.003 [-0.005,0.012]	0.002 [-0.007,0.011]	-0.004 [-0.014,0.007]
# physicians	2652	2652	2652
# observations	22045	22045	22045

Table B1b: Marginal effects for follow-up within 14 days using fractional regression with a probit model

	Unweighted	PS-weighted	EB-weighted
FHO	0.034^ [-0.001,0.070]	0.028 [-0.012,0.068]	0.026 [-0.021,0.073]
Year	0.032^ [-0.004,0.069]	0.055** [0.014,0.095]	0.052* [0.010,0.095]
Age	0.011 [-0.005,0.028]	0.008 [-0.011,0.026]	0.010 [-0.011,0.030]
Age^2	-0.000*** [-0.001,-0.000]	-0.001*** [-0.001,-0.000]	-0.001*** [-0.001,-0.000]
Sex (Female)	0.028 [-0.039,0.095]	0.009 [-0.070,0.088]	-0.026 [-0.114,0.062]
Rurality	0.189 [-0.167,0.544]	0.222 [-0.118,0.561]	0.272 [-0.053,0.596]
IMG	-0.037^ [-0.077,0.003]	-0.025 [-0.069,0.019]	-0.005 [-0.056,0.046]
Group size	0.000 [-0.000,0.001]	0.000 [-0.000,0.000]	0.000 [-0.001,0.000]
# rostered patients	0.000^ [-0.000,0.000]	0.000^ [-0.000,0.000]	0.000^ [-0.000,0.000]
(# rostered patients)^2	-0.000* [-0.000,-0.000]	-0.000* [-0.000,-0.000]	-0.000* [-0.000,-0.000]
Avg. patient age	0.022 [-0.008,0.052]	0.012 [-0.023,0.047]	0.015 [-0.022,0.052]
% of patients ≥65	-1.063 [-2.517,0.391]	-0.038 [-1.751,1.674]	-0.124 [-1.826,1.578]
Avg. ADG score	0.253*** [0.171,0.335]	0.251*** [0.157,0.345]	0.255*** [0.152,0.357]
% of female patients	-0.002 [-0.013,0.009]	0.001 [-0.010,0.013]	0.004 [-0.008,0.017]
% in Q1 or Q2 on Deprivation Score	0.003 [-0.004,0.009]	-0.001 [-0.008,0.006]	-0.001 [-0.008,0.006]
% in Q1 or Q2 on Ethnic Concentration Score	-0.001 [-0.005,0.002]	-0.001 [-0.005,0.003]	0.000 [-0.005,0.004]
% of rural patients	0.004 [-0.012,0.021]	-0.001 [-0.019,0.017]	-0.007 [-0.031,0.017]
% of patients with CMI	0.000 [-0.005,0.004]	0.000 [-0.005,0.005]	0.003 [-0.003,0.009]
FP-averaged coefficients			
Age^2	0.000* [0.000,0.001]	0.001** [0.000,0.001]	0.001** [0.000,0.001]
Rurality	-0.167 [-0.561,0.228]	-0.043 [-0.440,0.353]	-0.167 [-0.605,0.272]
Group size	0.000 [-0.001,0.000]	0.000 [-0.000,0.001]	0.000 [-0.000,0.001]
# of rostered patients	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
(# of rostered patients)^2	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]

Avg. patient age	-0.031^ [-0.064,0.001]	-0.032 [-0.071,0.007]	-0.037^ [-0.080,0.006]
% of patients ≥65	1.781* [0.146,3.416]	1.102 [-0.838,3.042]	1.260 [-0.780,3.300]
Avg. ADG score	-0.147** [-0.239,-0.055]	-0.155** [-0.264,-0.045]	-0.160** [-0.276,-0.045]
% of female patients	0.001 [-0.010,0.012]	-0.002 [-0.013,0.010]	-0.004 [-0.016,0.009]
% in Q1 or Q2 on Deprivation Score	-0.001 [-0.007,0.005]	0.002 [-0.005,0.009]	0.003 [-0.005,0.011]
% in Q1 or Q2 on Ethnic Concentration Score	0.004* [0.000,0.008]	0.003 [-0.001,0.008]	0.003 [-0.001,0.008]
% of rural patients	-0.004 [-0.021,0.012]	0.000 [-0.018,0.017]	0.007 [-0.018,0.031]
% of patients with CMI	0.002 [-0.003,0.007]	0.001 [-0.005,0.007]	-0.002 [-0.008,0.004]
# physicians	2652	2652	2652
# observations	22045	22045	22045

Table B1c: Marginal effects for follow-up within 14 days using fractional regression with a logit model, with interaction terms

	Unweighted	PS-weighted	EB-weighted
FHO	0.063* [0.002,0.124]	0.059^ [-0.009,0.127]	0.047 [-0.032,0.127]
Year	0.034 [-0.049,0.118]	0.119* [0.025,0.214]	0.117* [0.014,0.221]
Age	0.059 [-0.055,0.174]	-0.035 [-0.166,0.096]	-0.032 [-0.171,0.107]
Age^2	-0.001 [-0.005,0.003]	-0.001 [-0.005,0.004]	0.001 [-0.005,0.006]
Sex (Female)	0.032 [-0.081,0.144]	0.003 [-0.128,0.134]	-0.067 [-0.209,0.076]
Rurality	0.537 [-0.263,1.336]	0.579 [-0.246,1.404]	0.586 [-0.253,1.426]
IMG	-0.042 [-0.109,0.026]	-0.022 [-0.097,0.053]	0.005 [-0.082,0.092]
Group size	0.000 [-0.001,0.000]	-0.001 [-0.002,0.000]	-0.001* [-0.003,-0.000]
# rostered patients	0.000 [-0.000,0.001]	0.000 [-0.000,0.001]	0.000 [-0.000,0.001]
(# rostered patients)^2	-0.000** [-0.000,-0.000]	-0.000* [-0.000,-0.000]	-0.000* [-0.000,-0.000]
Avg. patient age	0.166** [0.064,0.267]	0.125^ [-0.004,0.254]	0.115 [-0.058,0.288]
% of patients ≥65	-2.816* [-5.440,-0.192]	-1.153 [-4.269,1.963]	-1.378 [-4.655,1.899]
Avg. ADG score	0.566*** [0.286,0.846]	0.802*** [0.381,1.224]	1.039*** [0.506,1.572]
% of female patients	0.002 [-0.018,0.022]	0.006 [-0.016,0.028]	0.016 [-0.007,0.040]
% in Q1 or Q2 on Deprivation Score	0.008 [-0.003,0.019]	0.003 [-0.009,0.016]	0.006 [-0.007,0.019]
% in Q1 or Q2 on Ethnic Concentration Score	-0.003 [-0.010,0.004]	-0.002 [-0.010,0.006]	-0.002 [-0.010,0.007]
% of rural patients	0.004 [-0.025,0.033]	-0.007 [-0.041,0.028]	-0.017 [-0.065,0.031]
% of patients with CMI	0.010* [0.001,0.019]	0.009^ [-0.001,0.020]	0.010^ [-0.001,0.021]
FP-averaged coefficients			
Age^2	0.001 [-0.003,0.004]	0.001 [-0.003,0.006]	0.003 [-0.003,0.008]
Rurality	-0.085 [-1.347,1.178]	0.055 [-1.199,1.309]	-0.183 [-1.407,1.040]
Group size	-0.001 [-0.002,0.000]	0.000 [-0.002,0.001]	0.000 [-0.002,0.001]
# of rostered patients	0.000 [-0.001,0.000]	0.000 [-0.001,0.000]	0.000 [-0.001,0.000]
(# of rostered patients)^2	0.000	0.000	0.000

	[-0.000,0.000]	[-0.000,0.000]	[-0.000,0.000]
Avg. patient age	0.074 [-0.027,0.174]	0.055 [-0.075,0.185]	0.033 [-0.138,0.203]
% of patients ≥65	2.144 [-0.785,5.073]	0.652 [-2.791,4.094]	0.859 [-2.709,4.428]
Avg. ADG score	-0.112 [-0.382,0.157]	0.101 [-0.290,0.493]	0.321 [-0.190,0.832]
% of female patients	0.006 [-0.014,0.027]	0.002 [-0.020,0.024]	0.004 [-0.020,0.028]
% in Q1 or Q2 on Deprivation Score	0.002 [-0.009,0.014]	0.008 [-0.005,0.021]	0.012^ [-0.001,0.026]
% in Q1 or Q2 on Ethnic Concentration Score	0.006 [-0.002,0.014]	0.005 [-0.003,0.014]	0.002 [-0.007,0.011]
% of rural patients	-0.009 [-0.039,0.021]	-0.002 [-0.036,0.032]	0.013 [-0.035,0.061]
% of patients with CMI	0.013** [0.004,0.022]	0.009 [-0.002,0.021]	0.002 [-0.011,0.016]
Interaction terms			
Age	-0.001 [-0.008,0.007]	0.000 [-0.009,0.009]	-0.003 [-0.013,0.008]
Age^2	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
Rurality	-0.592 [-2.282,1.099]	-0.527 [-2.270,1.215]	-0.341 [-2.068,1.385]
Group size	0.000* [0.000,0.000]	0.000^ [-0.000,0.000]	0.000* [0.000,0.000]
# of rostered patients	0.000* [0.000,0.000]	0.000^ [-0.000,0.000]	0.000 [-0.000,0.000]
$(\#\text{ of rostered patients})^2$	-0.000^ [-0.000,0.000]	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
Avg. patient age	-0.003** [-0.005,-0.001]	-0.002^ [-0.005,0.000]	-0.002 [-0.005,0.002]
% of patients ≥65	6.045* [1.416,10.674]	5.680^ [-0.331,11.690]	5.415 [-2.715,13.545]
Avg. ADG score	-0.040 [-0.104,0.024]	-0.108* [-0.213,-0.004]	-0.174* [-0.311,-0.038]
% of female patients	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	-0.000^ [-0.000,0.000]
% in Q1 or Q2 on Deprivation Score	0.000 [-0.000,0.000]	-0.000^ [-0.000,0.000]	-0.000* [-0.000,-0.000]
% in Q1 or Q2 on Ethnic Concentration Score	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
% of rural patients	0.000* [0.000,0.000]	0.000^ [-0.000,0.000]	0.000 [-0.000,0.000]
% of patients with CMI	-0.000*** [-0.000,-0.000]	-0.000* [-0.000,-0.000]	0.000 [-0.000,0.000]
# physicians	2652	2652	2652
# observations	22045	22045	22045

Table B1d: Marginal effects for follow-up within 14 days using fractional regression with a probit model, with interaction terms

	Unweighted	PS-weighted	EB-weighted
FHO	0.038* [0.001,0.074]	0.036^ [-0.005,0.077]	0.029 [-0.019,0.077]
Year	0.018 [-0.031,0.068]	0.069* [0.013,0.125]	0.068* [0.006,0.129]
Age	0.037 [-0.030,0.105]	-0.018 [-0.095,0.060]	-0.015 [-0.097,0.066]
Age^2	0.000 [-0.003,0.002]	-0.001 [-0.003,0.002]	0.000 [-0.003,0.003]
Sex (Female)	0.020 [-0.047,0.088]	0.003 [-0.076,0.082]	-0.039 [-0.124,0.047]
Rurality	0.326 [-0.165,0.817]	0.354 [-0.143,0.851]	0.366 [-0.127,0.858]
IMG	-0.025 [-0.065,0.015]	-0.014 [-0.059,0.031]	0.003 [-0.049,0.055]
Group size	0.000 [-0.001,0.000]	0.000 [-0.001,0.000]	-0.001* [-0.001,-0.000]
# rostered patients	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
(# rostered patients)^2	-0.000** [-0.000,-0.000]	-0.000* [-0.000,-0.000]	-0.000* [-0.000,-0.000]
Avg. patient age	0.099*** [0.041,0.158]	0.078* [0.002,0.154]	0.072 [-0.030,0.174]
% of patients ≥65	-1.694* [-3.256,-0.131]	-0.724 [-2.584,1.136]	-0.868 [-2.825,1.089]
Avg. ADG score	0.340*** [0.171,0.509]	0.479*** [0.226,0.731]	0.622*** [0.303,0.941]
% of female patients	0.001 [-0.011,0.014]	0.003 [-0.010,0.017]	0.010 [-0.004,0.024]
% in Q1 or Q2 on Deprivation Score	0.005 [-0.002,0.011]	0.002 [-0.006,0.010]	0.004 [-0.004,0.012]
% in Q1 or Q2 on Ethnic Concentration Score	-0.002 [-0.006,0.003]	-0.001 [-0.006,0.004]	-0.001 [-0.006,0.004]
% of rural patients	0.002 [-0.014,0.019]	-0.003 [-0.022,0.015]	-0.008 [-0.033,0.016]
% of patients with CMI	0.006* [0.001,0.012]	0.006^ [-0.000,0.012]	0.006^ [-0.001,0.013]
FP-averaged coefficients			
Age^2	0.000 [-0.002,0.003]	0.001 [-0.002,0.003]	0.002 [-0.002,0.005]
Rurality	-0.055 [-0.820,0.710]	0.035 [-0.729,0.800]	-0.097 [-0.836,0.641]
Group size	0.000 [-0.001,0.000]	0.000 [-0.001,0.000]	0.000 [-0.001,0.001]
# of rostered patients	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	0.000 [-0.001,0.000]
(# of rostered patients)^2	0.000	0.000	0.000

	[-0.000,0.000]	[-0.000,0.000]	[-0.000,0.000]
Avg. patient age	0.044 [-0.015,0.102]	0.034 [-0.043,0.111]	0.021 [-0.081,0.123]
% of patients ≥65	1.284 [-0.475,3.043]	0.376 [-1.689,2.440]	0.511 [-1.637,2.660]
Avg. ADG score	-0.065 [-0.228,0.098]	0.059 [-0.176,0.295]	0.193 [-0.113,0.500]
% of female patients	0.004 [-0.008,0.016]	0.001 [-0.012,0.014]	0.002 [-0.012,0.016]
% in Q1 or Q2 on Deprivation Score	0.001 [-0.006,0.008]	0.005 [-0.003,0.013]	0.007^ [-0.001,0.016]
% in Q1 or Q2 on Ethnic Concentration Score	0.004 [-0.001,0.008]	0.003 [-0.002,0.008]	0.001 [-0.004,0.007]
% of rural patients	-0.006 [-0.023,0.011]	-0.002 [-0.020,0.017]	0.006 [-0.018,0.031]
% of patients with CMI	0.008** [0.002,0.013]	0.006 [-0.001,0.012]	0.001 [-0.007,0.009]
Interaction terms			
Age	0.000 [-0.005,0.004]	0.000 [-0.005,0.005]	-0.002 [-0.008,0.005]
Age^2	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
Rurality	-0.356 [-1.387,0.675]	-0.324 [-1.379,0.732]	-0.231 [-1.253,0.792]
Group size	0.000* [0.000,0.000]	0.000^ [-0.000,0.000]	0.000* [0.000,0.000]
# of rostered patients	0.000* [0.000,0.000]	0.000^ [-0.000,0.000]	0.000 [-0.000,0.000]
$(\#\text{ of rostered patients})^2$	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
Avg. patient age	-0.002** [-0.003,-0.001]	-0.001^ [-0.003,0.000]	-0.001 [-0.003,0.001]
% of patients ≥65	3.601** [0.911,6.290]	3.497^ [-0.064,7.057]	3.349 [-1.464,8.161]
Avg. ADG score	-0.024 [-0.063,0.014]	-0.064* [-0.127,-0.002]	-0.104* [-0.186,-0.023]
% of female patients	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	-0.000^ [-0.000,0.000]
% in Q1 or Q2 on Deprivation Score	0.000 [-0.000,0.000]	-0.000^ [-0.000,0.000]	-0.000* [-0.000,-0.000]
% in Q1 or Q2 on Ethnic Concentration Score	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]	0.000 [-0.000,0.000]
% of rural patients	0.000* [0.000,0.000]	0.000^ [-0.000,0.000]	0.000 [-0.000,0.000]
% of patients with CMI	-0.000*** [-0.000,-0.000]	-0.000* [-0.000,-0.000]	0.000 [-0.000,0.000]
# physicians	2652	2652	2652
# observations	22045	22045	22045

Appendix C: Usage of the aftercare incentive

Figure C1. Proportion of eligible follow-up visits that billed the incentive code, per FP (PS-weighted)

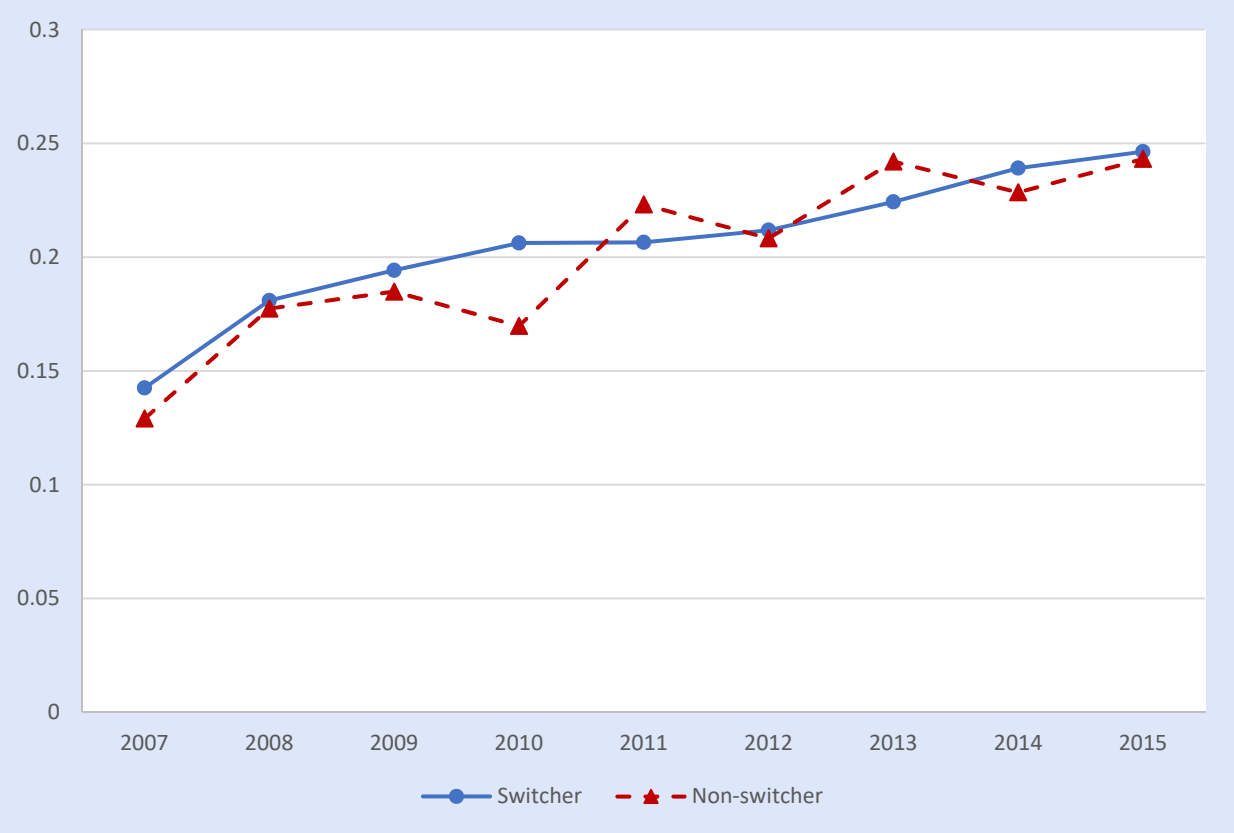


Table C1: Marginal effects of FHO and year on usage of follow-up incentive (PS-weighted)

	Without physician-specific means		**With physician-specific means**	
	GLM	**GEE**	**GLM**	**GEE**
FHO	0.023** (0.008, 0.038)	0.019^ (-0.0003, 0.038)	0.021** (0.006, 0.036)	0.015 (-0.004, 0.034)
Year	0.015*** (0.012, 0.018)	0.015*** (0.012, 0.018)	0.005 (-0.014, 0.024)	0.005 (-0.015, 0.025)
Physicians	2605	2605	2605	2605
Observations	14128	14128	14128	14128

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$

Marginal effects and 95% confidence intervals (standard errors were clustered at the physician level). All regressions include the same control variables used for follow-up visit within 14 days, defined in Methods section.