# Association of financial incentives with primary care enrollment of adults with serious mental illnesses in Ontario: a retrospective observational population-based study

| | |
|---|---|
| Journal: | *CMAJ Open* |
| Manuscript ID | CMAJOpen-2021-0190 |
| Manuscript Type: | Cohort (retrospective) |
| Date Submitted by the Author: | 22-Jul-2021 |
| Complete List of Authors: | Bayoumi, Imaan; Queen's University Faculty of Health Sciences, Family Medicine; Institute for Clinical Evaluative Sciences<br>Whitehead, Marlo; Institute for Clinical Evaluative Sciences, Institute for Clinical Evaluative Sciences; Queen's University<br>Kurdyak, Paul; Centre for Addiction and Mental Health; Institute for Clinical Evaluative Sciences, Mental Health and Addictions<br>Glazier, Richard; Institute for Clinical Evaluative Sciences, Primary Care and Population Health; University of Toronto, Family and Community Medicine |
| Keywords: | Family medicine, general practice, primary care, Health services research, Mental health |
| More Detailed Keywords: | Reimbursement, incentive, Primary care, Schizophrenia, Bipolar Disorder |
| Abstract: | Background: Financial incentives may improve primary care (PC) access for adults with schizophrenia or bipolar disorder (serious mental illness, SMI). We studied the association between receipt of a financial premium and rostering of adults with SMI among PC physicians in patient enrollment models (PEM).<br><br>Methods: Retrospective cohort study of insured Ontario adults with SMI in PEM practices, 2016-2018. Using negative binomial models with log link with and without SMI premium payment, we examined relationships between the proportion of rostered patients and PC model, and the contribution of the incentive and compared with adults with diabetes mellitus and the general population.<br><br>Results: Of 9730 PEM physicians, 50.9% (N=4866) received a premium and 88.4% of people with SMI in PEMs were rostered. Compared with enhanced fee for service, the likelihood of rostering people with SMI was 3.8% higher for patients in capitation with team based care (TBC) (aRR 1.038 95% CI 1.025, 1.051) and 1.4% higher for capitation without team based care (CAP) (aRR1.014 95% CI 1.003, 1.025). Rostering for |

| | |
|---|---|
| | people with diabetes to SMI in TBC was similar (aRR 1.034, 95% CI 1.023, 1.046) but higher for CAP (aRR 1.027, 95% CI 1.018, 1.037) and higher for the Ontario population (TBC 1.046, 95% CI 1.037, 1.056, CAP 1.061, 95% CI 1.049, 1.072;). No association was seen when premium payment was included in the model.<br><br>Interpretation: Incentives may have had a positive association with rostering SMI patients; nonetheless, there were still inequities. Additional policy measures are needed to promote rostering of this underserved population with complex needs. |
| | |

# Association of financial incentives with primary care enrollment of adults with serious mental illnesses in Ontario: a retrospective observational population-based study

Imaan Bayoumi MD, MSc, FCFP,[1,2] Marlo Whitehead MSc,[1] Paul Kurdyak MD, PhD,[1,3,4] Richard H. Glazier MD, MPH, FCFP[1,,5,6]

**Affiliations:**

[1]Institute for Clinical Evaluative Sciences
[2]Department of Family Medicine, Queen's University
[3]Centre for Addiction and Mental Health
[4]Department of Psychiatry, University of Toronto
[5]Deparment of Family and Community Medicine, University of Toronto and St. Michael's Hospital
[6]MAP Centre for Urban Health Solutions, St. Michael's Hospital

**Corresponding Author**: Imaan Bayoumi MD, MSc, FCFP, Department of Family Medicine, Queen's University, 220 Bagot St., P.O. Bag 8888, Kingston, ON K7L5E9, Canada; T (613) 533-9303, F (613) 544-0132; C (613) 331-2371; email bayoumi@queensu.ca

**Keywords:** Reimbursement, incentive, Primary care, Schizophrenia, Bipolar Disorder

**Funding Source:** This study was supported by ICES, which is funded by an annual grant from the Ontario Ministry of Health (MOH) and the Ministry of Long-Term Care (MLTC). This study also received funding from the Centre for Studies in Primary Care Research Initiation Grant, Queen's University. Parts of this material are based on data and information compiled and provided by the MOH, the Canadian Institute for Health Information (CIHI), Cancer Care Ontario and The Johns Hopkins ACG® System Version 10. The analyses, conclusions, opinions and statements expressed herein are solely those of the authors and do not reflect those of the funding or data sources; no endorsement is intended or should be inferred.

**Contributor's Statement:**
All authors take responsibility for the integrity of the data and the accuracy of the data analysis. All authors conceptualized and designed the study, interpreted the data, critically revised and reviewed the manuscript for important intellectual content, and approved the final manuscript. Dr. Bayoumi prepared the initial draft of the manuscript. Ms. Whitehead performed the statistical analysis.

## Abstract

**Background:** Financial incentives may improve primary care (PC) access for adults with schizophrenia or bipolar disorder (serious mental illness, SMI). We studied the association between receipt of a financial premium and rostering of adults with SMI among PC physicians in patient enrollment models (PEM).

**Methods:** Retrospective cohort study of insured Ontario adults with SMI in PEM practices, 2016-2018. Using negative binomial models with log link with and without SMI premium payment, we examined relationships between the proportion of rostered patients and PC model, and the contribution of the incentive and compared with adults with diabetes mellitus and the general population.

**Results:** Of 9730 PEM physicians, 50.9% (N=4866) received a premium and 88.4% of people with SMI in PEMs were rostered. Compared with enhanced fee for service, the likelihood of rostering people with SMI was 3.8% higher for patients in capitation with team based care (TBC) (aRR 1.038 95% CI 1.025, 1.051) and 1.4% higher for capitation without team based care (CAP) (aRR1.014 95% CI 1.003, 1.025). Rostering for people with diabetes to SMI in TBC was similar (aRR 1.034, 95% CI 1.023, 1.046) but higher for CAP (aRR 1.027, 95% CI 1.018, 1.037) and higher for the Ontario population (TBC 1.046, 95% CI 1.037, 1.056, CAP 1.061, 95% CI 1.049, 1.072;). No association was seen when premium payment was included in the model.

**Interpretation:** Incentives may have had a positive association with rostering SMI patients; nonetheless, there were still inequities. Additional policy measures are needed to promote rostering of this underserved population with complex needs.

Mental illnesses are prevalent, affecting 10-20% of adults per year[1,2] and up to 33% over their lifetime.[1] They are responsible for an estimated 22.9% of years lived with a disability[3] and a mortality gap estimated at 13-20 years,[4] of which 60% of deaths are attributable to chronic conditions including cardiovascular and respiratory disease.[4]

Primary care physicians are the most frequently consulted health care professionals by adults with schizophrenia and bipolar disorder, collectively referred to as serious mental illnesses (SMI).[5] However, adults with SMI are less likely to have an ongoing site of primary care,[6] and experience both difficulty accessing primary care[6,7] and lower quality of care.[8,9] Patient reported barriers to accessing care occur at the patient level (socioeconomic and mental health or medication related), provider level (perceived stigma and lack of willingness to address mental health concerns) and the health system level (difficulty finding a family physician, inadequate time during appointments to meet their health needs and poor collaboration with other health care providers).[7]

Since 2000, Ontario, Canada has implemented a broad suite of voluntary reforms in the delivery and payment of primary care, aimed at improving access, quality of care and retention of primary care physicians.[10] Most primary care physicians shifted from exclusive fee for service to new primary care models involving patient enrollment. The Patient Enrollment Models (PEMs) include the enhanced fee for service (eFFS) model – remunerated by fee for service payments with some bonuses for preventive care- and blended capitation models with and without integration of interdisciplinary team based care (TBC and CAP respectively) –remunerated by capitation payments based on age and sex for in basket services, and additional bonuses for comprehensive and preventive care. Previous work has demonstrated that fewer people with mental illnesses were enrolled in new models[11] and that people with serious mental illness who were enrolled in capitation models accessed fewer health services compared with enhanced fee for service models.[12]

Incentives to enroll patients with serious mental illness were included in the reforms in 2003. The Primary Care Serious Mental Illness Special Premium (PC-SMI) is an annual payment paid to physicians working in the Patient Enrollment Models defined above for providing comprehensive primary care to a minimum of five enrolled patients with diagnoses of bipolar disorder or schizophrenia. There are two levels of payment: $1,000 for the minimum first five enrolled patients and $1,000 for an additional five or more enrolled patients (maximum $2,000 annually). We examined the impact of the Serious Mental Illness premium on primary care rostering in different primary care models. We hypothesized that people with SMI would experience lower rates of rostering than those with another chronic disease (diabetes mellitus) and the Ontario population. We also hypothesize that premium payment would be associated with increased likelihood of rostering of adults with SMI.

## METHODS

### Design, setting and participants

We conducted a retrospective observational cohort study using population-level administrative data housed at ICES. ICES is an independent, non-profit research institute whose legal status

under Ontario's health information privacy law allows it to collect and analyze health care and demographic data, without consent, for health system evaluation and improvement. Study participants included all adult (age ≥ 18 years) Ontario residents eligible for universal health insurance diagnosed with schizophrenia or bipolar disorder, who were attached to primary care physicians working in patient enrollment models. Study inclusion dates were between April 1, 2016 to March 31, 2018. People with schizophrenia or bipolar disorder were included in the cohort if they had at least one outpatient visit at any time prior to the study period with a family physician or psychiatrist or an emergency department visit or an inpatient hospitalization billing the diagnostic codes Schizophrenia/ Schizoaffective Disorder (ICD-9: 295; ICD-10: F20, F25) or Bipolar Disorder (ICD-9: 296; ICD-10: F31).

In our study, primary care physicians were defined as those whose specialty was listed as general practitioner or family physician, plus any physician with a fulltime affiliation with a Patient Enrollment Model.

**Data sources and linkage**

Several datasets were linked using unique encoded identifiers and analyzed at ICES. To identify and describe the cohort we used: the Registered Persons Database (a registry of all Ontario residents eligible for the Ontario Health Insurance Plan [OHIP]); the National Ambulatory Care Reporting System (a registry of Emergency Department visits)[NACRS]; the Discharge Abstracts Database (a registry of inpatient hospitalizations)[DAD];and the Ontario Mental Health Reporting System (a registry of mental health care contacts including hospitalization)[OMHRS].

We identified primary care physicians and utilization using the Corporate Provider Database (a registry of all providers and provider groups eligible to bill OHIP for their services)[CPDB] and the Client Agency Program Enrolment database (which lists all patients enrolled with a primary care physician within a primary care group), and Primary Care Population (PCPOP), an ICES derived cohort. Patients were attributed to a physician if they were formally enrolled (rostered) or had attended a minimum of three visits with the same primary care provider during the study period (virtually-rostered). Previous work has virtually rostered patients to the physician who billed the largest dollar amount for primary care services in the preceding two years.[13] An alternative approach was to attribute the patient to a physician with whom they had continuity of care of 10% or more.[14] We selected a higher threshold for virtual rostering in light of the high needs of this population.

For comparative purposes, we identified adult Ontarians diagnosed with diabetes mellitus using the Ontario Diabetes Dataset, an ICES-derived cohort,[15] who had a diabetes related primary care visit in the three years prior to the study period (between April 1, 2013 and Mar. 31, 2016), and an adult general population comparison sample.

**Variable definition**

**Outcome**

The dependent variable was the percentage of adults with SMI, diabetes mellitus and in the general population who were rostered, defined at the physician level, during the study period.

**Exposure**

The primary independent variable was primary care physician model of care (eFFS, CAP, TBC). In order to assess the relative contribution of the SMI premium to rostering, we created models with and without SMI premiums to assess change in model estimates.

**Covariates**

We derived age, sex, rurality and recent migration status of people with SMI from the Registered Persons Database. We measured rurality using the postal code and the Rurality Index for Ontario (RIO), with categories of urban (score 0–9), suburban (score 10–39) and rural (score ≥ 40).[16] We derived neighbourhood income quintile using the postal code linked to census dissemination area. We identified recent migrants to Ontario as people who received an Ontario health card for the first time within the previous 10 years (about 75% of this group would be expected to be recent immigrants, and the remainder would be expected to have migrated from other Canadian provinces).[17] We used the Johns Hopkins Adjusted Clinical Groups System Version 10 to capture comorbidity according to Aggregated Diagnosis Groups (ADGs). We derived health service utilization from the OHIP, DAD, NACRS, OMHRS databases.

We derived physician characteristics (age, sex, panel size, years since graduation) from the CPDB. We derived payment of SMI premiums from the Architected Payments dataset.

**Statistical analysis**

We compared the demographic characteristics of people diagnosed with SMI, with those diagnosed with diabetes mellitus and with the adult Ontario population, including those who were rostered and virtually rostered using consistent approaches to rostering among all three populations. Next, we compared the characteristics of physicians receiving SMI premium payments with those who did not receive these payments in the study period. Finally, we developed negative binomial models with log link to examine the relationships between the proportion of rostered patients in the practice (by condition or the Ontario population) and the model of primary care. To examine the relative contribution of SMI premium payment status, we added this variable into each model to assess change in model estimates. We determined that the outcome (proportion of patients rostered) was overdispersed, and therefore used the negative binomial distribution. The unit of observation in the modelling was the primary care physician. Physicians with fewer than 100 patients in total (rostered or virtually rostered) were excluded. For the outcome of proportion rostered, patient data were aggregated at the physician level. The means for continuous variables and the frequencies in each category represented for categorical variables were calculated. We adjusted for a number of patient and physician characteristics as pre-specified covariates. Patient characteristics included in the model were age, sex, rurality, recent migration, neighbourhood income, comorbidity using ADGs, continuity of care (CoC) and health care utilization in the three years prior to the study period (primary care attachment,[14] number of primary care visits, and number of psychiatric hospitalization). CoC was determined

at the practice level for patients with at least 3 primary care visits in the study period and was defined as the proportion of primary care visits with the patient's own provider. Physician related covariates were physician age, sex, rurality, panel size, model of care, primary care visits in the study period. To address concerns about physicians with different practice sizes having the same weight in the analysis, we repeated the analyses weighing the observations by the sum of rostered and virtually rostered patients, both with and without panel size included as a covariate in the model. Finally, we did a weighted analysis including panel size but excluding SMI premium in the model.

**Ethics approval**

The study was approved by the Queen's University Health Sciences Research Ethics Board.

**RESULTS**

We identified 592,431Ontario adults with a SMI (212,369 with schizophrenia and 380,062 with bipolar disorder) between April 1, 2016 and Mar. 30, 2018, representing 5.7% of the Ontario general population (Table 1). People with schizophrenia and bipolar disorder were more likely to live in lower income neighbourhoods (particularly those with schizophrenia) and in urban centres, and less likely to be recent immigrants to Ontario than the general population. In contrast with those with diabetes, those with SMI were more likely not to have accessed any primary care and to have lower continuity of care.

Of the 13,606 Ontario family physicians identified, 71.5% (N=9730) worked in PEMs and would have been eligible to receive the SMI premium and 50.9% (N=4866) of these received a premium in the study period based on having at least five SMI patients on their roster (Table 2a). Only 90 physicians were in a PEM and had at least five SMI patients in their roster, but did not receive the premium. Compared with PEM physicians who were ineligible for the premium by having too few patients, those who received the highest premium payments were more likely to be male, had larger patient panel size, and were more likely to work in capitation models (with and without team based care). The practices of PEM physicians who were ineligible for the premiums did not differ from those of physicians who received the premium or of non-PEM physicians by age and sex, but were more likely to be recent immigrants and to live in urban settings (Table 2b). Compared with practices of PEM physicians, patients of non-PEM physicians were more likely to live in low income neighbourhoods, be new immigrants, have higher morbidity, more primary care visits and greater continuity of care. In total, $12,750,400 was paid in SMI premiums during the study period.

Of people with serious mental illness receiving primary care through PEMs, 88.4% were formally rostered, compared with 93.3% of people with diabetes and 90.8% in the general population. (Table 3). The proportion of adults with SMI rostered was consistently lower than those for either people with diabetes or in the general population across all patient and physician characteristics and all models of care. For people with SMI, rostering ranged from 85.2% for eFFS models, 85.2% for team based capitation models and 91.0% for non-team based capitation, which were all less than rates observed for diabetes (90.6%- 95.2%) and the general population (86.1%-94.1%).

Adjusted negative binomial models of the proportion of patients rostered, weighted by practice size, determined that compared with eFFS, the likelihood of physicians rostering people with SMI was higher for those in capitation models with team based care (aRR 1.0389% confidence interval (CI) 1.025, 1.051) and higher for capitation models without team based care (aRR1.014 95% CI 1.003, 1.025). These parameter estimates are comparable to rostering of people with diabetes in capitation models with team based care (aRR 1.034, 95% CI 1.023, 1.046) but lower than that seen for capitation without team based care (aRR 1.02, 95% CI 1.018, 1.037) and lower than for the Ontario population (capitation with TBC 1.061, 95% CI 1.049, 1.072; capitation without TBC 1.06, 95% CI 1.037, 1.056). When SMI premium was included in the model, with an interaction term for SMI premium amount by model of care, no association was demonstrated between model of care and rostering.

## DISCUSSION

Thirteen years after introduction of reforms into the payment and structure of primary care, including a financial incentive to promote enrollment of people with serious mental illness, we found evidence of lower enrollment into new models for individuals with severe mental illnesses compared with both individuals with diabetes and the general population. Including the SMI premium payment attenuated the relationship between enrollment model and rostering, as anticipated since SMI premiums are an intermediate variable on the causal pathway rather than a confounder. Adjusting for intermediate variables on the path from exposure to outcome can bias overall effect estimates toward the null and may introduce overfitting of the model.[18] The change in model estimates when including premium payment provides indirect support that the payments may be associated with rostering.

People with SMI have complex needs and it is encouraging to observe that overall rostering was quite high. Nevertheless, inequitable access to new models was still observed. In Ontario, provincial quality improvement systems, including incentives and practice level reporting, for preventive care (such as cancer screening and immunization) apply only to rostered patients. Lower rostering of individuals with SMI may then translate into lower quality of preventive care and contribute to adverse outcomes in a high need population with elevated risks of chronic disease, including cancer.[8,19] Furthermore, the incentive structure itself may limit its impact. Once a provider has enrolled 10 patients with SMI, there is no additional incentive to enroll additional patients. Modified capitation as implemented in Ontario includes adjustments for age and sex, but not for case-mix, thereby embedding disincentives for enrollment of patients with complex needs.

Our findings are consistent with a substantial body of research demonstrating the limited impact of pay for performance measures. Pay for performance has been implemented in many countries, settings, and using different structures and targets. A recent systematic review found that most pay for performance programs target chronic disease management in primary care, and found evidence of short term improvements in process of care outcomes, but little or no impact was demonstrated for improved health outcomes (intermediate or patient important outcomes), or longer term improvements.[20] Older systematic reviews drew similar conclusions.[21,22] Few studies have examined pay for performance for mental health care. Rudoler et al. found no increased

provision of follow up care after psychiatric hospitalization or after suicide attempts after implementation of a financial incentive.[23] In the UK, financial incentives were associated with improvements in screening and intervention on physical health (weight, blood pressure, lipid and glucose screening) in people with psychosis in secondary care.[24] Gutacker et al. found that better performance on quality metrics of mental health care in the U.K. was associated with higher rates of psychiatric hospitalization.[25] A pay for performance program in Taiwan was associated with reduction in unscheduled outpatient visits and compulsory admissions but no change in emergency department visits, or acute psychiatric admissions or readmissions.[26] In British Columbia, incentives targeting primary mental health care for people with depression were associated with incremental improvements in the targeted domains but worsening continuity of care.[27] To our knowledge, no previous work has examined pay for performance for patient enrollment of people with SMI in primary care.

**Limitations**

Our study has some limitations. The administrative data used were not designed for research purposes. Only those with valid health care coverage were included which is limited to permanent residents of Ontario. The cross-sectional design precludes determination of whether premium payment was associated with increased enrollment of people with SMI into new models. In addition, the results may be biased by residual confounding, though we expect the impact to be limited as we feel we have been thorough in identifying relevant confounders. The diagnostic code to select for bipolar disorder has not been validated and may include individuals with major depressive disorder.

**Data Sharing Statement**

The dataset from this study is held securely in coded form at ICES. While legal data sharing agreements between ICES and data providers (e.g., healthcare organizations and government) prohibit ICES from making the dataset publicly available, access may be granted to those who meet pre-specified criteria for confidential access, available at www.ices.on.ca/DAS (email: das@ices.on.ca). The full dataset creation plan and underlying analytic code are available from the authors upon request, understanding that the computer programs may rely upon coding templates or macros that are unique to ICES and are therefore either inaccessible or may require modification.

**CONCLUSION**

This study found that incentives may have had a positive association with rostering SMI patients; nonetheless, there were still inequities in the likelihood to be rostered. Additional policy measures are needed to promote rostering of this underserved population with complex needs.

## REFERENCES


1. Statistics Canada. Rates of selected mental or substance use disorders, lifetime and 12 month, Canada, household population 15 and older, 2012. https://www150.statcan.gc.ca/n1/pub/82-624-x/2013001/article/tbl/tbl1-eng.htm. Published 2012. Accessed.
2. Center for Behavioral Health Statistics and Quality. *Behavioral health trends in the United States: Results from the 2014 National Survey on Drug Use and Health.* 2015.
3. Whiteford HA, Degenhardt L, Rehm J, et al. Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010. *The Lancet.* 2013;382(9904):1575-1586.
4. Planner C, Gask L, Reilly S. Serious mental illness and the role of primary care. *Current Psychiatry Reports.* 2014;16(8):458.
5. Kontopantelis E, Olier I, Planner C, et al. Primary care consultation rates among people with and without severe mental illness: a UK cohort study using the Clinical Practice Research Datalink. *BMJ Open.* 2015;5(12):e008650.
6. Bradford DW, Kim MM, Braxton LE, Marx CE, Butterfield M, Elbogen EB. Access to Medical Care Among Persons with Psychotic and Major Affective Disorders. *Psychiatric Services.* 2008;59:847-852.
7. Ross LE, Vigod S, Wishart J, et al. Barriers and facilitators to primary care for people with mental health and/or substance use issues: a qualitative study. *BMC Fam Pract.* 2015;16(1):135.
8. Kurdyak P, Vigod S, Duchen R, Jacob B, Stukel TA, Kiran T. Diabetes quality of care and outcomes: Comparison of individuals with and without schizophrenia. *General Hospital Psychiatry.* 2017;46:7-13.
9. Aggarwal A, Pandurangi A, Smith W. Disparities in Breast and Cervical Cancer Screening in Women with Mental Illness: A Systematic Literature Review. *American Journal of Preventive Medicine.* 2013;44(4):392-398.
10. Hutchison B, Glazier RH. Ontario's Primary Care Reforms Have Transformed the Local Care Landscape, But A Plan Is Needed For Ongoing Improvement. *Health Affairs.* 2013;32(4):695-703.
11. Steele LS, Durbin A, Sibley J, Glazier RH. Inclusion of persons with mental illness in patient-centred medical homes: cross-sectional findings from Ontario, Canada. *Open Medicine.* 2013;7(1):e9-e20.
12. Steele LS, Durbin A, Lin E, et al. Primary care reform and service use by people with serious mental illness in Ontario. *Healthcare Policy = Politiques de sante.* 2014;10(1):31-45.
13. Singh J, Dahrouge S, Green ME. The impact of the adoption of a patient rostering model on primary care access and continuity of care in urban family practices in Ontario, Canada. *BMC Fam Pract.* 2019;20(1):52.
14. Jaakkimainen L, Bayoumi I, Glazier R, et al. Development and validation of an algorithm using health administrative data to define patient attachment to primary care providers. *Journal of Health Organization and Management.* 2021.
15. Hux JE, Ivis F, Flintoft V, Bica A. Diabetes in Ontario: Determination of prevalence and incidence using a validated administrative data algorithm. *Diabetes Care.* 2002;25(3):512-516.
16. Kralji B. *Measuring Rurality- RIO2008 BASIC: Methodology and Results*

2009.
17. Statistics Canada. Selected Demographic, Cultural, Educational, Labour Force and Income Characteristics, Mother Tongue, Age Groups and Sex for the Population of Canada, Provinces, Territories, Census Divisions and Census Subdivisions, 2006 Census. https://www12.statcan.gc.ca/census-recensement/2006/dp-pd/tbt/Rp-eng.cfm?LANG=E&APATH=3&DETAIL=0&DIM=0&FL=A&FREE=0&GC=0&GID=0&GK=0&GRP=1&PID=99015&PRID=0&PTYPE=88971,97154&S=0&SHOWALL=0&SUB=0&Temporal=2006&THEME=70&VID=0&VNAMEE=&VNAMEF=. Published 2006. Accessed August 21, 2019.
18. VanderWeele TJ. Commentary: On the Relative Nature of Overadjustment and Unnecessary Adjustment. *Epidemiology.* 2009;20(4):496-499.
19. Hippisley-Cox J, Vinogradova Y, Coupland C, Parker C. Risk of Malignancy in Patients With Schizophrenia or Bipolar Disorder: Nested Case-Control Study. *Archives of General Psychiatry.* 2007;64(12):1368-1376.
20. Mendelson A, Kondo K, Damberg C, et al. The Effects of Pay-for-Performance Programs on Health, Health Care Use, and Processes of Care: A Systematic Review. *Ann Intern Med.* 2017;166(5):341-353.
21. Campbell SM, Reeves D, Kontopantelis E, Sibbald B, Roland M. Effects of Pay for Performance on the Quality of Primary Care in England. *New England Journal of Medicine.* 2009;361(4):368-378.
22. Eijkenaar F, Emmert M, Scheppach M, Schöffski O. Effects of pay for performance in health care: a systematic review of systematic reviews. *Health Policy.* 2013;110(2-3):115-130.
23. Rudoler D, de Oliveira C, Cheng J, Kurdyak P. Payment incentives for community-based psychiatric care in Ontario, Canada. *Canadian Medical Association Journal.* 2017;189(49):E1509-E1516.
24. Crawford MJ, Huddart D, Craig E, et al. Impact of secondary care financial incentives on the quality of physical healthcare for people with psychosis: a longitudinal controlled study. *Br J Psychiatry.* 2019;215(6):720-725.
25. Gutacker N, Mason AR, Kendrick T, et al. Does the quality and outcomes framework reduce psychiatric admissions in people with serious mental illness? A regression analysis. *BMJ Open.* 2015;5(4).
26. Chen T-T, Yang J-J, Hsueh Y-SA, Wang V. The effects of a schizophrenia pay-for-performance program on patient outcomes in Taiwan. *Health services research.* 2019;54(5):1119-1125.
27. Puyat JH, Kazanjian A, Wong H, Goldner EM. Is the Road to Mental Health Paved With Good Incentives? Estimating the Population Impact of Physician Incentives on Mental Health Care Using Linked Administrative Data. *Med Care.* 2017;55(2):182-190.

**Table 1: Characteristics of patients with Serious Mental Illness, Diabetes Mellitus and Ontario Population 2016/17-2017/18**

| | | Schizophrenia | Bipolar Disorder | Diabetes Mellitus | Ontario Adult Population |
|---|---|---|---|---|---|
| **VARIABLE** | | **N=212,369 (2.03%)** | **N=380,062 (3.63%)** | **N=1,006,692 (9.62%)** | **N=10,461,874 (100%)** |
| **Age at index** | 18 - 44 | 93,280 (43.9%) | 161,255 (42.4%) | 93,775 (9.3%) | 4,589,401 (43.9%) |
| | 45 - 64 | 84,567 (39.8%) | 155,639 (41.0%) | 431,846 (42.9%) | 3,803,639 (36.4%) |
| | 65 - 74 | 21,315 (10.0%) | 41,890 (11.0%) | 274,731 (27.3%) | 1,211,001 (11.6%) |
| | 75 + | 13,207 (6.2%) | 21,278 (5.6%) | 206,340 (20.5%) | 857,833 (8.2%) |
| | Mean ± SD | 47.58 ± 16.74 | 47.91 ± 16.53 | 62.91 ± 13.68 | 48.03 ± 17.98 |
| **Female** | | 98,626 (46.4%) | 235,623 (62.0%) | 467,484 (46.4%) | 5,397,953 (51.6%) |
| **Income Quintile - Patient** | Q1 (low) | 73,707 (34.7%) | 92,670 (24.4%) | 237,113 (23.6%) | 2,030,502 (19.4%) |
| | Q2 | 47,013 (22.1%) | 81,074 (21.3%) | 222,131 (22.1%) | 2,082,736 (19.9%) |
| | Q3 | 36,487 (17.2%) | 72,861 (19.2%) | 207,886 (20.7%) | 2,102,894 (20.1%) |
| | Q4 | 28,362 (13.4%) | 65,775 (17.3%) | 180,353 (17.9%) | 2,077,038 (19.9%) |
| | Q5 (high) | 25,635 (12.1%) | 66,286 (17.4%) | 157,157 (15.6%) | 2,126,537 (20.3%) |
| **New Arrival to Ontario** | No | 206,128 (97.1%) | 369,832 (97.3%) | 957,290 (95.1%) | 9,723,602 (92.9%) |
| | Yes | 6,241 (2.9%) | 10,230 (2.7%) | 49,402 (4.9%) | 738,272 (7.1%) |
| **RIO Score Group - Patient** | Missing | 1,914 (0.9%) | 2,507 (0.7%) | 10,821 (1.1%) | 105,539 (1.0%) |
| | Rural | 14,123 (6.7%) | 24,417 (6.4%) | 74,753 (7.4%) | 770,884 (7.4%) |
| | Suburban | 36,615 (17.2%) | 76,131 (20.0%) | 186,413 (18.5%) | 2,020,218 (19.3%) |
| | Urban | 159,717 (75.2%) | 277,007 (72.9%) | 734,705 (73.0%) | 7,565,233 (72.3%) |
| **Total Core PC Visits in study period** | 0 visits | 30,794 (14.5%) | 33,178 (8.7%) | 37,080 (3.7%) | 1,626,541 (15.5%) |
| | 1 visit | 15,123 (7.1%) | 20,998 (5.5%) | 27,528 (2.7%) | 954,361 (9.1%) |
| | 2 visits | 14,445 (6.8%) | 23,002 (6.1%) | 36,122 (3.6%) | 960,777 (9.2%) |
| | 3 - 5 | 39,221 (18.5%) | 73,871 (19.4%) | 155,561 (15.5%) | 2,444,397 (23.4%) |
| | 6 - 10 | 47,922 (22.6%) | 100,963 (26.6%) | 327,580 (32.5%) | 2,449,347 (23.4%) |
| | 11 + | 64,864 (30.5%) | 128,050 (33.7%) | 422,821 (42.0%) | 2,026,451 (19.4%) |
| | Mean ± SD | 9.30 ± 11.65 | 9.70 ± 10.22 | 11.32 ± 9.55 | 6.50 ± 7.59 |
| **Continuity of care for patients with >2 primary care** | 0 - 40 | 35,922 (23.6%) | 62,539 (20.6%) | 110,932 (12.2%) | 1,386,998 (20.0%) |
| | 41 - 80 | 47,043 (30.9%) | 102,157 (33.7%) | 228,197 (25.2%) | 2,208,455 (31.9%) |

| | | | | | |
|---|---|---|---|---|---|
| | 81 + | 69,042 (45.4%) | 138,188 (45.6%) | 566,833 (62.6%) | 3,324,742 (48.0%) |
| **Sum of ADGs in look-back period** | 0 | 7,728 (3.6%) | 9,442 (2.5%) | | 695,482 (6.6%) |
| | 1 - 5 | 57,548 (27.1%) | 83,433 (22.0%) | 256,557 (25.5%) | 4,092,896 (39.1%) |
| | 6 - 10 | 81,085 (38.2%) | 158,263 (41.6%) | 439,434 (43.7%) | 3,992,407 (38.2%) |
| | 11 + | 66,008 (31.1%) | 128,924 (33.9%) | 310,701 (30.9%) | 1,681,089 (16.1%) |
| **Sum of Psychosocial ADGs in look-back period** | 0 | 38,749 (18.2%) | 89,647 (23.6%) | 622,203 (61.8%) | 6,951,222 (66.4%) |
| | 1 | 62,587 (29.5%) | 141,303 (37.2%) | 297,974 (29.6%) | 2,773,087 (26.5%) |
| | 2 | 78,617 (37.0%) | 113,992 (30.0%) | 73,167 (7.3%) | 619,047 (5.9%) |
| | 3 | 32,416 (15.3%) | 35,120 (9.2%) | 13,348 (1.3%) | 118,518 (1.1%) |
| **Psychiatry visits in the study period** | Mean ± SD | 3.68 ± 9.53 | 2.62 ± 9.01 | 0.34 ± 3.06 | 0.32 ± 3.26 |

RIO: Rurality Index of Ontario; PC: Primary Care; ADGs: Aggregated Diagnosis Groups

**Table 2a: Characteristics of Family Physician eligible for SMI premium 2016/17-2017/18**

| VARIABLE | VALUE | $3001 - $4000 | $2001 - $3000 | $1001 - $2000 | <= $1000 | Eligible (had at least 5 SMI pts) no premium | Ineligible (< 5 SMI pts) in an eligible model | Non-PEM physicians | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | N=1,767 | N=723 | N=1,310 | N=1,066 | N=90 | N=4,774 | N=3,876 | N=13,606 |
| **Age** | Mean ± SD | 51.07 ± 11.54 | 49.46 ± 12.20 | 48.90 ± 12.16 | 48.21 ± 12.82 | 49.02 ± 10.77 | 51.24 ± 12.71 | 49.28 ± 14.54 | 50.09 ± 13.06 |
| **Sex** | Missing/ Unknown | 0 (0.0%) | 0 (0.0%) | 19 (1.5%) | 33 (3.1%) | 0 (0.0%) | 162 (3.4%) | 245 (6.3%) | 459 (3.4%) |
| | Female | 699 (39.6%) | 343 (47.4%) | 647 (49.4%) | 547 (51.3%) | 43 (47.8%) | 2,180 (45.7%) | 1,567 (40.4%) | 6,026 (44.3%) |
| | Male | 1,068 (60.4%) | 380 (52.6%) | 644 (49.2%) | 486 (45.6%) | 47 (52.2%) | 2,432 (50.9%) | 2,064 (53.3%) | 7,121 (52.3%) |
| **Years from graduation** | Mean ± SD | 24.23 ± 12.21 | 22.55 ± 12.83 | 22.02 ± 12.72 | 21.37 ± 13.45 | 22.41 ± 11.43 | 24.36 ± 13.25 | 22.16 ± 15.02 | 23.16 ± 13.61 |
| **Rurality** | Missing | 0 (0.0%) | <=5 (0.1%) | 29 (2.2%) | 40 (3.8%) | 0 (0.0%) | 182 (3.8%) | 282 (7.3%) | 534 (3.9%) |
| | Urban | 1,328 (75.2%) | 547 (75.7%) | 978 (74.7%) | 724 (67.9%) | 53 (58.9%) | 3,494 (73.2%) | 2,872 (74.1%) | 9,996 (73.5%) |
| | Suburban | 346 (19.6%) | 132 (18.3%) | 217 (16.6%) | 206 (19.3%) | 26 (28.9%) | 750 (15.7%) | 474 (12.2%) | 2,151 (15.8%) |
| | Rural | 93 (5.3%) | 43 (5.9%) | 86 (6.6%) | 96 (9.0%) | 11 (12.2%) | 348 (7.3%) | 248 (6.4%) | 925 (6.8%) |
| **Panel size *** | Mean ± SD | 1,854.20 ± 859.92 | 1,694.31 ± 883.63 | 1,615.77 ± 775.60 | 1,532.64 ± 836.58 | 1,488.84 ± 630.98 | 1,528.04 ± 903.87 | 1,182.97 ± 763.88 | 1,596.97 ± 875.32 |
| **Enrollment Model** | Blended Capitation TBC | 649 (36.7%) | 264 (36.5%) | 487 (37.2%) | 341 (32.0%) | 42-46 (46.7 – 51.1%) | 1,015-1,019 (21.3%) | 0 (0.0%) | 2,802 (20.6%) |
| | Blended Capitation no TBC | 696 (39.4%) | 277 (38.3%) | 446 (34.0%) | 298 (28.0%) | 43 (47.8%) | 947 (19.8%) | 0 (0.0%) | 2,707 (19.9%) |
| | eFFS | 362 (20.5%) | 149 (20.6%) | 231 (17.6%) | 250 (23.5%) | 0 (0.0%) | 1,834 (38.4%) | 0 (0.0%) | 2,826 (20.8%) |
| | Other | 60 (3.4%) | 33 (4.6%) | 146 (11.1%) | 177 (16.6%) | <=5 (4.4%) | 974-978 (20.4-20.5%) | 3,876 (100.0%) | 5,271 (38.7%) |
| **Number of schizophrenia patients** | Mean ± SD | 32.72 ± 26.47 | 24.41 ± 17.46 | 19.68 ± 15.90 | 17.07 ± 14.56 | 16.87 ± 9.52 | 15.13 ± 13.90 | 6.18 ± 10.53 | 17.55 ± 18.49 |
| **Number of schizophrenia patients Rostered** | Mean ± SD | 28.90 ± 23.88 | 20.86 ± 15.51 | 16.59 ± 13.99 | 14.15 ± 13.08 | 13.67 ± 8.23 | 12.11 ± 11.83 | 0.00 ± 0.06 | 13.76 ± 16.62 |
| **Number of schizophrenia patients VR** | Mean ± SD | 3.82 ± 6.13 | 3.55 ± 5.12 | 3.09 ± 5.14 | 2.92 ± 4.73 | 3.19 ± 3.00 | 3.02 ± 5.38 | 6.18 ± 10.53 | 3.80 ± 6.81 |
| **Number of bipolar disorder patients** | Mean ± SD | 55.04 ± 39.05 | 45.84 ± 30.23 | 37.92 ± 29.94 | 33.67 ± 27.65 | 37.78 ± 25.65 | 30.52 ± 30.82 | 7.38 ± 11.53 | 31.59 ± 32.67 |
| **Number of bipolar disorder patients Rostered** | Mean ± SD | 49.79 ± 36.69 | 40.47 ± 28.76 | 33.05 ± 27.99 | 28.81 ± 26.24 | 32.62 ± 24.16 | 25.89 ± 27.54 | 0.01 ± 0.11 | 26.19 ± 30.65 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Number of bipolar disorder patients VR** | Mean ± SD | 5.26 ± 6.91 | 5.38 ± 6.62 | 4.87 ± 6.56 | 4.85 ± 6.56 | 5.16 ± 4.07 | 4.63 ± 8.56 | 7.37 ± 11.53 | 5.40 ± 8.64 |

*Panel size =rostered and virtually rostered patients in past 2 years; SMI: Serious mental illness; PEM: Patient Enrollment Model; TBC: Team-based Care; eFFS: Enhanced Fee for Service; VR: virtually rostered.

**Table 2b: Characteristics of Patients Enrolled with Family Physician eligible for SMI premium 2016/17-2017/18**

| VARIABLE | VALUE | $3001 - $4000 | $2001 - $3000 | $1001 - $2000 | <= $1000 | Eligible (had at least 5 SMI pts) no premium | Ineligible (< 5 SMI pts) in an eligible model | Non-PEM physicians | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | N=2,307,819 | N=825,873 | N=1,304,148 | N=934,499 | N=88,890 | N=3,642,797 | N=373,489 | N=13,606 |
| **Age at index** | 18 - 44 | 954,450 (41.4%) | 347,823 (42.1%) | 548,041 (42.0%) | 397,114 (42.5%) | 36,363 (40.9%) | 1,590,094 (43.7%) | 138,273 (37.0%) | 4,012,158 (42.3%) |
| | 45 - 64 | 858,945 (37.2%) | 301,975 (36.6%) | 482,621 (37.0%) | 344,002 (36.8%) | 32,479 (36.5%) | 1,335,576 (36.7%) | 143,141 (38.3%) | 3,498,739 (36.9%) |
| | 65 - 74 | 286,368 (12.4%) | 101,979 (12.3%) | 158,648 (12.2%) | 114,185 (12.2%) | 11,745 (13.2%) | 422,858 (11.6%) | 51,108 (13.7%) | 1,146,891 (12.1%) |
| | 75 + | 208,056 (9.0%) | 74,096 (9.0%) | 114,838 (8.8%) | 79,198 (8.5%) | 8,303 (9.3%) | 294,269 (8.1%) | 40,967 (11.0%) | 819,727 (8.6%) |
| **Age at Index - Patient** | Mean ± SD | 49.03 ± 18.12 | 48.86 ± 18.09 | 48.76 ± 18.06 | 48.57 ± 17.99 | 49.34 ± 18.31 | 48.07 ±17.86 | 50.98 ± 18.31 | 48.64 ± 18.02 |
| **Female** | | 1,191,074 (51.6%) | 436,917 (52.9%) | 705,173 (54.1%) | 506,256 (54.2%) | 47,322 (53.2%) | 1,934,913 (53.1%) | 197,062 (52.8%) | 5,018,717 (53.0%) |
| **Income Quintile - Patient** | Q1 (low) | 462,482 (20.0%) | 154,425 (18.7%) | 236,646 (18.1%) | 161,755 (17.3%) | 15,002 (16.9%) | 659,526 (18.1%) | 92,058 (24.6%) | 1,781,894 (18.8%) |
| | Q2 | 466,334 (20.2%) | 165,135 (20.0%) | 255,402 (19.6%) | 178,764 (19.1%) | 15,900 (17.9%) | 716,594 (19.7%) | 80,561 (21.6%) | 1,878,690 (19.8%) |
| | Q3 | 459,216 (19.9%) | 167,933 (20.3%) | 261,031 (20.0%) | 190,827 (20.4%) | 17,480 (19.7%) | 750,051 (20.6%) | 74,611 (20.0%) | 1,921,149 (20.3%) |
| | Q4 | 441,416 (19.1%) | 162,172 (19.6%) | 265,909 (20.4%) | 197,063 (21.1%) | 18,485 (20.8%) | 763,377 (21.0%) | 66,202 (17.7%) | 1,914,624 (20.2%) |
| | Q5 (high) | 473,584 (20.5%) | 174,595 (21.1%) | 282,464 (21.7%) | 204,195 (21.9%) | 21,852 (24.6%) | 745,371 (20.5%) | 59,063 (15.8%) | 1,961,124 (20.7%) |
| | Missing | 4,787 (0.2%) | 1,613 (0.2%) | 2,696 (0.2%) | 1,895 (0.2%) | 171 (0.2%) | 7,878 (0.2%) | 994 (0.3%) | 20,034 (0.2%) |
| **New Arrival to Ontario** | No | 2,203,310 (95.5%) | 778,408 (94.3%) | 1,225,055 (93.9%) | 873,121 (93.4%) | 85,063 (95.7%) | 3,341,258 (91.7%) | 345,593 (92.5%) | 8,851,808 (93.4%) |
| | Yes | 104,509 (4.5%) | 47,465 (5.7%) | 79,093 (6.1%) | 61,378 (6.6%) | 3,827 (4.3%) | 301,539 (8.3%) | 27,896 (7.5%) | 625,707 (6.6%) |
| **Rurality - Patient** | Urban | 1,645,034 (71.3%) | 597,805 (72.4%) | 936,030 (71.8%) | 653,124 (69.9%) | 49,727 (55.9%) | 2,710,734 (74.4%) | 289,903 (77.6%) | 6,882,357 (72.6%) |
| | Suburban | 500,010 (21.7%) | 169,018 (20.5%) | 256,380 (19.7%) | 187,267 (20.0%) | 26,262 (29.5%) | 658,362 (18.1%) | 50,517 (13.5%) | 1,847,816 (19.5%) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Rural | 149,890 (6.5%) | 54,391 (6.6%) | 101,727 (7.8%) | 88,015 (9.4%) | 11,214 (12.6%) | 245,121 (6.7%) | 26,939 (7.2%) | 677,297 (7.1%) |
| | Missing | 12,885 (0.6%) | 4,659 (0.6%) | 10,011 (0.8%) | 6,093 (0.7%) | 1,687 (1.9%) | 28,580 (0.8%) | 6,130 (1.6%) | 70,045 (0.7%) |
| **Sum of ADGs in look-back period** | 0 | 91,519 (4.0%) | 30,267 (3.7%) | 50,933 (3.9%) | 36,092 (3.9%) | 3,601 (4.1%) | 145,728 (4.0%) | 6,648 (1.8%) | 364,788 (3.8%) |
| | 1 -- 5 | 897,827 (38.9%) | 319,607 (38.7%) | 512,007 (39.3%) | 358,194 (38.3%) | 37,015 (41.6%) | 1,384,168 (38.0%) | 114,154 (30.6%) | 3,622,972 (38.2%) |
| | 6 -- 10 | 921,573 (39.9%) | 332,292 (40.2%) | 523,081 (40.1%) | 378,056 (40.5%) | 34,458 (38.8%) | 1,483,288 (40.7%) | 165,320 (44.3%) | 3,838,068 (40.5%) |
| | 11 + | 396,900 (17.2%) | 143,707 (17.4%) | 218,127 (16.7%) | 162,157 (17.4%) | 13,816 (15.5%) | 629,613 (17.3%) | 87,367 (23.4%) | 1,651,687 (17.4%) |
| **Psychosocial ADGs in look-back period** | 0 | 1,458,436 (63.2%) | 530,378 (64.2%) | 848,479 (65.1%) | 609,479 (65.2%) | 59,651 (67.1%) | 2,405,454 (66.0%) | 202,272 (54.2%) | 6,114,149 (64.5%) |
| | 1 | 658,251 (28.5%) | 232,994 (28.2%) | 361,883 (27.7%) | 259,414 (27.8%) | 23,261 (26.2%) | 996,946 (27.4%) | 125,393 (33.6%) | 2,658,142 (28.0%) |
| | 2 | 159,368 (6.9%) | 52,723 (6.4%) | 79,046 (6.1%) | 55,698 (6.0%) | 5,056 (5.7%) | 204,210 (5.6%) | 36,605 (9.8%) | 592,706 (6.3%) |
| | 3 | 31,764 (1.4%) | 9,778 (1.2%) | 14,740 (1.1%) | 9,908 (1.1%) | 922 (1.0%) | 36,187 (1.0%) | 9,219 (2.5%) | 112,518 (1.2%) |
| **Psychiatric hospitalization in look-back period** | Mean ± SD | 0.02 ± 0.25 | 0.02 ± 0.24 | 0.02 ± 0.22 | 0.02 ± 0.21 | 0.01 ± 0.18 | 0.02 ± 0.22 | 0.04 ± 0.40 | 0.02 ± 0.24 |
| **Total Core PC Visits in study period** | 0 visits | 237,754 (10.3%) | 79,765 (9.7%) | 130,508 (10.0%) | 89,789 (9.6%) | 10,136 (11.4%) | 344,073 (9.4%) | 16,186 (4.3%) | 908,211 (9.6%) |
| | 1 visit | 222,485 (9.6%) | 79,499 (9.6%) | 124,800 (9.6%) | 85,956 (9.2%) | 9,873 (11.1%) | 330,709 (9.1%) | 9,381 (2.5%) | 862,703 (9.1%) |
| | 2 visits | 229,656 (10.0%) | 82,718 (10.0%) | 130,338 (10.0%) | 90,181 (9.7%) | 10,101 (11.4%) | 337,166 (9.3%) | 14,167 (3.8%) | 894,327 (9.4%) |
| | 3 -- 5 | 588,811 (25.5%) | 214,719 (26.0%) | 339,289 (26.0%) | 237,518 (25.4%) | 24,628 (27.7%) | 879,080 (24.1%) | 76,899 (20.6%) | 2,360,944 (24.9%) |
| | 6 -- 10 | 581,432 (25.2%) | 210,175 (25.4%) | 332,059 (25.5%) | 242,029 (25.9%) | 21,686 (24.4%) | 922,331 (25.3%) | 117,603 (31.5%) | 2,427,315 (25.6%) |
| | 11 + | 447,681 (19.4%) | 158,997 (19.3%) | 247,154 (19.0%) | 189,026 (20.2%) | 12,466 (14.0%) | 829,438 (22.8%) | 139,253 (37.3%) | 2,024,015 (21.4%) |
| **Continuity of care** | 0 – 40% | 290,431 (18.0%) | 107,264 (18.4%) | 174,785 (19.0%) | 147,292 (22.0%) | 581,342 (21.6%) | 35,981 (10.8%) | 1,337,095 (19.6%) | 290,431 (18.0%) |
| | 41 – 80% | 488,994 (30.2%) | 185,762 (31.8%) | 295,262 (32.1%) | 225,428 (33.7%) | 843,174 (31.3%) | 126,545 (37.9%) | 2,165,165 (31.8%) | 488,994 (30.2%) |
| | >80% | 838,499 (51.8%) | 290,865 (49.8%) | 448,455 (48.8%) | 295,853 (44.3%) | 1,265,113 (47.0%) | 171,229 (51.3%) | 3,310,014 (48.6%) | 838,499 (51.8%) |

SMI: Serious mental illness; PEM: Patient Enrollment Model; PC: Primary Care; ADGs: Aggregated Diagnosis Groups

**Table 3. Proportion of patients rostered to primary care by patient and provider characteristics**

| | | SMI Patients | Diabetes Mellitus Patients | Ontario Population |
|---|---|---|---|---|
| **VARIABLE** | | **Rostered** | **Rostered** | **Rostered** |
| | **N, Total %** | **N=448,319 (4.29%)** | **N=854,668 (8.17%)** | **N=8,135,246 (77.8%)** |
| | **Group %** | **88.40%** | **93.30%** | **90.80%** |
| **Age at index** | 18 - 44 | 186,077 (86.4%) | 75,707 (90.3%) | 3,388,208 (88.7%) |
| | 45 - 64 | 184,472 (89.2%) | 364,188 (92.8%) | 3,029,283 (91.8%) |
| | 65 - 74 | 50,514 (91.4%) | 236,718 (94.1%) | 1,005,245 (93.6%) |
| | 75 + | 27,256 (91.7%) | 178,055 (94.4%) | 712,510 (94.0%) |
| **Age at Index - Patient** | Mean ± SD | 48.34 ± 16.61 | 63.16 ± 13.53 | 48.91 ± 17.97 |
| **Sex** | Male | 186,458 (87.5%) | 456,420 (93.2%) | 3,799,657 (90.1%) |
| | Female | 261,861 (89.0%) | 398,248 (93.3%) | 4,335,589 (91.5%) |
| **Income Quintile - Patient** | Missing | 1,168 (79.2%) | 1,348 (85.1%) | 14,808 (79.0%) |
| | Q1 (low) | 117,950 (86.6%) | 195,392 (92.3%) | 1,477,462 (89.2%) |
| | Q2 | 96,584 (88.3%) | 188,533 (93.3%) | 1,602,289 (90.6%) |
| | Q3 | 84,809 (89.2%) | 178,112 (93.6%) | 1,657,195 (91.2%) |
| | Q4 | 74,650 (89.6%) | 155,313 (93.7%) | 1,666,417 (91.5%) |
| | Q5 (high) | 73,158 (89.6%) | 135,970 (93.7%) | 1,717,075 (91.6%) |
| **New Arrival to Ontario** | Yes | 11,349 (84.9%) | 39,709 (89.6%) | 511,661 (86.8%) |
| | No | 436,970 (88.5%) | 814,959 (94.3%) | 7,634,585 (91.9%) |
| **Rurality** | Missing | 2,365 (84.2%) | 7,243 (90.8%) | 53,855 (87.1%) |
| | Rural | 28,440 (88.9%) | 62,534 (94.0%) | 587,390 (92.6%) |
| | Suburban | 87,323 (89.2%) | 162,483 (94.3%) | 1,631,452 (92.2%) |
| | Urban | 330,191 (88.2%) | 622,408 (92.9%) | 5,862,549 (90.3%) |
| **Sum of ADGs in look-back period** | 0 | 6,884 (89.8%) | | 321,924 (90.8%) |
| | 1 - 5 | 101,956 (88.5%) | 217,459 (93.8%) | 3,114,293 (90.0%) |
| | 6 - 10 | 187,590 (88.9%) | 376,133 (93.6%) | 3,303,576 (91.5%) |
| | 11 + | 151,889 (87.7%) | 261,076 (92.4%) | 1,395,453 (91.2%) |
| **Psychosocial ADGs in look-back period** | 0 | 92,430 (89.8%) | 534,174 (93.9%) | 5,307,675 (91.1%) |
| | 1 | 160,749 (89.6%) | 251,122 (92.8%) | 2,263,334 (91.1%) |
| | 2 | 147,070 (87.6%) | 59,281 (90.8%) | 480,171 (88.7%) |
| | 3 | 48,070 (84.4%) | 10,091 (87.6%) | 84,066 (84.4%) |
| **PC attachment in look-back period** | Attached | 444,994 (89.2%) | 852,469 (93.5%) | 8,040,316 (92.2%) |
| | Unattached | 3,325 (39.5%) | 2,199 (49.3%) | 94,930 (40.2%) |
| **Primary care visits in the look-back period (PC utilization)** | Mean ± SD | 22.80 ± 26.04 | 23.48 ± 19.01 | 13.92 ± 15.73 |
| **Psychiatric hospitalization in look-back period** | 0 | 403,260 (88.9%) | 845,144 (93.3%) | 8,058,855 (90.9%) |
| | 1 | 27,809 (85.1%) | 6,865 (89.0%) | 54,145 (85.9%) |
| | >= 2 | 17,250 (83.1%) | 2,659 (85.1%) | 22,246 (83.3%) |
| **Psychiatry visits in the study period** | Mean ± SD | 3.03 ± 9.23 | 0.33 ± 2.97 | 0.32 ± 3.27 |
| **Psychiatric hospitalizations in the study period** | 0 | 415,028 (88.8%) | 846,442 (93.3%) | 8,074,434 (90.9%) |
| | 1 | 21,934 (84.4%) | 6,429 (89.1%) | 45,620 (85.6%) |
| | ≥2 | 11,357 (82.3%) | 1,797 (85.9%) | 15,192 (82.8%) |

| | | | | |
|---|---|---|---|---|
| **Physician sex** | Female | 180,920 (89.4%) | 294,295 (93.6%) | 3,272,627 (91.5%) |
| | Male | 267,399 (87.7%) | 560,373 (93.1%) | 4,862,619 (90.4%) |
| **Physician age** | Mean ± SD | 51.87 ± 11.63 | 53.30 ± 11.46 | 52.39 ± 11.37 |
| **Rurality** | Missing | 701 (83.1%) | 1,859 (87.9%) | 14,078 (87.9%) |
| | Rural | 22,932 (89.6%) | 51,201 (94.7%) | 460,515 (93.3%) |
| | Suburban | 77,781 (89.3%) | 147,931 (94.6%) | 1,447,933 (92.7%) |
| | Urban | 346,905 (88.1%) | 653,677 (92.9%) | 6,212,720 (90.3%) |
| **Panel size** | Mean ± SD | 1,957.03 ± 1,025.16 | 2,091.80 ± 1,055.08 | 2,034.42 ± 1,036.28 |
| **Total Core PC Visits in study period** | 0 visits | 30,482 (100.0%) | 21,561 (100.0%) | 871,124 (100.0%) |
| | 1 visit | 24,629 (80.3%) | 20,651 (86.1%) | 711,475 (83.9%) |
| | 2 visits | 27,961 (84.8%) | 29,263 (89.6%) | 762,917 (87.5%) |
| | 3 - 5 | 90,066 (87.8%) | 133,167 (92.3%) | 2,027,137 (90.0%) |
| | 6 - 10 | 121,877 (89.3%) | 288,343 (94.0%) | 2,075,481 (91.6%) |
| | 11 + | 153,304 (88.2%) | 361,683 (93.3%) | 1,687,112 (91.4%) |
| | Mean ± SD | 9.93 ± 10.30 | 11.38 ± 9.25 | 6.92 ± 7.43 |
| **Continuity of care** | 0 – 40 % | 79,427 (89.5%) | 95,283 (93.3%) | 1,163,249 (91.2%) |
| | 41 – 80 % | 110,935 (84.5%) | 184,573 (90.4%) | 1,736,926 (87.7%) |
| | >80% | 174,885 (90.6%) | 503,337 (94.6%) | 2,889,555 (93.0%) |
| **Attachment by collapsed Model of Care** | Blended Capitation TBC | 147,487 (91.0%) | 240,428 (95.2%) | 2,517,934 (94.1%) |
| | Blended Capitation no TBC | 149,674 (88.7%) | 294,021 (94.5%) | 2,862,906 (92.6%) |
| | eFFS | 145,252 (85.2%) | 312,141 (90.6%) | 2,677,226 (86.1%) |
| | Other | 5,906 (100.0%) | 8,078 (100.0%) | 77,180 (100.0%) |
| | | | | |

SMI: Serious mental illness; PC: Primary Care; ADGs: Aggregated Diagnosis Groups

**Table 4. Adjusted models of proportion of patients rostered, weighted by practice size**

| | | SMI | | Diabetes Mellitus | | Ontario population | |
|---|---|---|---|---|---|---|---|
| | | **Estimate (CI)** | **P-value** | **Estimate (CI)** | **P-value** | **Estimate (CI)** | **P-value** |
| **Regression Model without SMI Premium** | | | | | | | |
| **Enrollment model (Ref=eFFS)** | FHT | 1.038 ( 1.025 - 1.052) | < 0.0001 | 1.034 ( 1.023 - 1.046) | < 0.0001 | 1.061 ( 1.050 - 1.072) | < 0.0001 |
| | CAP | 1.015 ( 1.004 - 1.026) | 0.01 | 1.028 ( 1.018 - 1.038) | < 0.0001 | 1.047 ( 1.037 - 1.056) | < 0.0001 |
| | OGP | 1.044 ( 1.006 - 1.084) | 0.02 | 1.022 ( 0.990 - 1.056) | 0.18 | 1.0278( 0.997 - 1.060) | 0.08 |
| **Regression Model with SMI Premium** | | | | | | | |
| **Enrollment model - (Ref=eFFS)** | FHT | 1.017 ( 0.989 - 1.045) | 0.24 | 1.024 ( 0.999 - 1.049) | 0.06 | 1.048 ( 1.024 - 1.072) | < 0.0001 |
| | CAP | 0.992 ( 0.965 - 1.019) | 0.55 | 1.012 ( 0.989 - 1.037) | 0.31 | 1.029 ( 1.006 - 1.053) | 0.01 |
| | OGP | 1.042 ( 0.897 - 1.211) | 0.59 | 1.003 ( 0.878 - 1.146) | 0.96 | 1.013 ( 0.895 - 1.147) | 0.84 |

SMI: Serious mental illness; FHT: Family Health Team; CAP: Capitation Model; OGP: Other Group; eFFS: Enhanced Fee for Service

STROBE Statement—checklist of items that should be included in reports of observational studies

| | Item No | Recommendation | Page No |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 3 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 3 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 3,4 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 3,4 |
| Participants | 6 | (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up<br>*Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls<br>*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants | 3-5 |
| | | (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed<br>*Case-control study*—For matched studies, give matching criteria and the number of controls per case | |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | *4* |
| Bias | 9 | Describe any efforts to address potential sources of bias | 6 |
| Study size | 10 | Explain how the study size was arrived at | NA |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 5,6 |
| | | (*b*) Describe any methods used to examine subgroups and interactions | No subgroup analysis was completed |

| | |
|---|---|
| (*c*) Explain how missing data were addressed | Only complete data were used in modelling |
| (*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed<br>*Case-control study*—If applicable, explain how matching of cases and controls was addressed<br>*Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy | NA |
| (*e*) Describe any sensitivity analyses | |

Continued on next page

| | | | |
|---|---|---|---|
| **Results** | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 6 |
| | | (b) Give reasons for non-participation at each stage | NA |
| | | (c) Consider use of a flow diagram | |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 6, Table 1 |
| | | (b) Indicate number of participants with missing data for each variable of interest | Table 1 |
| | | (c) *Cohort study*—Summarise follow-up time (eg, average and total amount) | |
| Outcome data | 15* | *Cohort study*—Report numbers of outcome events or summary measures over time | 6,7,Table 3 |
| | | *Case-control study*—Report numbers in each exposure category, or summary measures of exposure | |
| | | *Cross-sectional study*—Report numbers of outcome events or summary measures | |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 7, Table 4 |
| | | (*b*) Report category boundaries when continuous variables were categorized | |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | 7, Table 4 |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 7 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 8 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 7,8 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 8 |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 1 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.