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Healthcare utilization costs of emerging adults with mood and anxiety disorders in an early intervention treatment program compared to a matched cohort

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v. Abstract and keywords

Aim

The First Episode Mood and Anxiety Disorder Program (FEMAP) provides treatment to emerging adults with mood and anxiety disorders in an accessible, youth-friendly environment. We sought to investigate FEMAP's impact on the costs of care.

Methods

We conducted a retrospective observational study of one-year health service costs using linked administrative datasets to compare emerging adults treated at FEMAP (FEMAP users) to propensity-score matched controls (non-users). Costs from the perspective of the Ontario Ministry of Health and Long-Term Care, included drug benefit claims, inpatient, physician and ambulatory care services. We used bootstrapping to perform unadjusted comparisons between FEMAP users and non-users, by cost category and overall. We performed risk-adjusted comparison of overall costs using generalized estimating equations.

Results

FEMAP users (n=366) incurred significantly lower costs compared to non-users (n=660), for inpatient services (-$784, 95% Confidence Interval (CI) -$1,765, -$28), ambulatory care services (-$90, 95% CI -$175, -$14) and drug benefit claims (-$47, 95% CI -$115,-$4) and significantly higher physician services costs ($435, 95% CI $276, $581) over one year. The unadjusted difference in overall costs was not significant (-$853, 95% CI -

$2,048, $142). Following adjustment for age, sex and age at first mental health diagnosis, the difference of -$914 (95% CI (-$2747, $919) was also not significant.

Conclusions

FEMAP was associated with significantly lower costs of inpatient and ambulatory care services, and higher costs of physician services, however we are unable to conclude that FEMAP is cost-saving overall.

Keywords: Anxiety disorders, Costs and Cost Analysis, Early medical intervention, Mood disorders, Young adult

vi. Main text

Introduction

The burden of morbidity associated with mood and anxiety disorders in emerging adults is high (Fergusson, Boden, & Horwood, 2007; Ratnasingham et al., 2013). Early detection and initiation of adequate treatment has the potential to reduce the lifelong impact of disease. Appropriate care can reduce use of high cost health services such as emergency department and inpatient services (Sewitch, Blais, Rahme, Bexton, & Galarneau, 2007). Unfortunately, access to treatment amongst emerging adults is poor – analysis of data from the Canadian Community Health Survey (CCHS) showed that amongst adolescents and young adults with depression and suicidality, 40% had not used any mental health services in the preceding 12 months (Cheung & Dewa, 2007).

The First Episode Mood and Anxiety Disorder Program (FEMAP) delivers treatment to emerging adults in a community-based setting, with no physician referral required, providing comprehensive mental health care in a single location (Osuch, Vingilis, Fisman, & Summerhurst, 2016). In addition to psychotherapy and pharmacotherapy, FEMAP offers counseling, social services, and individual and group behavioural therapy, according to Canadian practice guidelines (MacQueen et al., 2016). Psychiatric services provided at FEMAP are covered under the provincial health insurance plan. The additional costs of making psychiatric and non-psychiatric services available at the same location have largely been borne by private donors and research grant funding.

FEMAP's approach is unique. Elsewhere, emerging adults would typically pay privately for counseling and other services, and often only with the assistance of employer sponsored private insurance through their own or parents' workplace. FEMAP has been described in detail elsewhere and program evaluation shows improved quality of life scores and functioning after four months of treatment (Osuch et al., 2015). We sought to use administrative databases to determine whether FEMAP users incurred lower costs from the perspective of the Ontario Ministry of Health and Long-Term Care (OMOHLTC) compared with other emerging adults with mood and anxiety disorders over a one-year period.

Methods

Setting

FEMAP is the only early intervention program providing mental health services to emerging adults with mood and anxiety disorders in the Southwestern Ontario Local Health Integration Network (LHIN), which is one of 14 health jurisdictions in the province of Ontario. Individuals who meet the following eligibility criteria are accepted for treatment at FEMAP: (i) age 16 to 25 years; (ii) primary symptoms of mood or anxiety disorder; (ii) lifetime use of psychotropic medication totaling less than 18 months; (iv) absence of developmental delays, major medical comorbidities, or history of serious head injury; (v) absence of a primary substance use problem that preceded symptoms of mood or anxiety disorder based on patient history; and (vi) no legal issues requiring ongoing contact with the criminal justice system.

Source of Data

We conducted a retrospective observational cohort study using health administrative databases, which contain information on all health services covered under the universal Ontario Health Insurance Plan (OHIP). We linked the OHIP database, the Canadian Institute of Health Information (CIHI) Discharge Abstract Database (DAD), the Ontario Mental Health Reporting System (OMHRS), the National Ambulatory Care Reporting System (NACRS), the Ontario Drug Benefit (ODB) Formulary and the Registered Persons

Database (RPDB) using unique encoded identifiers derived from the OHIP number. All residents of Ontario qualify for 100% public financing of health services under OHIP, with the exception of migrants in the window of a three-month waiting period and students attending post-secondary school from out of province. Thus the data represent inpatient hospitalizations, emergency department visits, other ambulatory care, physician reimbursement and diagnostic tests for close to the entire population of Ontario. The ODB program covers pharmaceuticals mainly for residents 65 and older, thus coverage of medications for emerging adults, in this dataset is likely poor. The datasets were analyzed at the Institute for Clinical Evaluative Sciences (ICES).

Cohort Creation

We created a retrospective cohort of people with mood and anxiety disorders, who presented for services in the Southwestern Ontario LHIN, as identified by the six-digit postal code of the service provider. We included emerging adults between the ages of 16 and 25 years, inclusive, presenting for services between April 1, 2009 and March 31, 2015, and meeting at least one of the following diagnostic criteria: an inpatient hospitalization with a primary discharge diagnosis of a mood or anxiety disorder or at least two physician billing claims in OHIP or emergency department visits with a diagnostic code for a mood or anxiety disorder in any 12-month period (See Supplemental File 1). This algorithm has been shown to have a positive predictive value greater than 90% in health administrative datasets (Alaghehbandan, Macdonald, Barrett, Collins, & Chen, 2012; Solberg, Engebretson, Sperl-Hillen, Hroscikoski, & O'Connor, 2006). We

excluded those with an invalid identification number, missing age, sex or postal code (for rural/income data) and those with a history of nonaffective psychotic disorder prior to the index date.

Anonymyzed database linkage

We obtained anonymized primary data on patients treated at FEMAP from October 1, 2009 to March 31, 2015 from the program databases. We conducted a secure, anonymized linkage of this database to identify emerging adults who had been treated by the program within the study cohort, described above. Those who had been treated at FEMAP were classified as FEMAP users and all other individuals in the cohort were classified as non-users. We developed a propensity score model with FEMAP user as the dependent variable, in order to predict the probability of treatment at FEMAP, conditional on baseline covariates, including socio-demographic characteristics, clinical comorbidities and indicators of prior mental health service use (See Supplemental File 1). We then used the propensity score and year of index diagnosis to match two non-users to each FEMAP user, without replacement, using a greedy matching algorithm (a caliper width of 0.2 standard deviations) (Austin, 2014). We additionally hard-matched on the source of index diagnosis (inpatient, outpatient psychiatrist, and other physicians) and residence outside the program catchment area (yes/no), as these variables were not well-balanced after the initial matching attempts. We assigned the admission date of the FEMAP user to the matched non-users as the beginning of the follow-up period.

Rates of health care utilization

We compared the rates of utilization of physician services, ambulatory care services, and inpatient services, between FEMAP users and non-users, using the Poisson test.

Cost Analysis

In the cost analysis, only matched sets in which all three patients had at least one year of follow-up were included to ensure the same follow-up time across all patients. Through public financing, the Ontario MOHLTC reimburses the entire cost of health services recorded in the administrative databases. We used a validated algorithm to assign per patient costs during the one-year follow-up. The algorithm assigns unit costs to instances of health services utilization captures in the databases, based on the frequency, type of resource use and diagnostic codes recorded in the administrative databases (Wodchis, Bushmeneva, Nikitovic, & Mckillop, 2013). The algorithm assigns per patient costs incurred in the following categories: 1) Inpatient costs (due to separate funding mechanisms, the inpatient cost category includes nursing, allied health services, hospital equipment, overhead, utilities and administration but does not include physician services), 2) Ambulatory care costs (emergency department and other ambulatory care visits), 3) Ontario Drug Benefit Claims, and 4) Physician Services (inpatient and outpatient physician services, diagnostic tests and procedures). Thus, the cost perspective was that of the Ontario MOHLTC. For FEMAP users, the costs of physician services at FEMAP or elsewhere are reflected in the data along with the cost of inpatient, ambulatory care and

drug benefit claims. The cost of enhanced care provided at FEMAP, including counselors and psychotherapists, are not reflected in the dataset. In other words, the costs do not reflect FEMAP services that are not covered under the provincial health insurance plan. All costs were converted to a common reference year of 2014.

Unadjusted cost comparison

We reported the mean, standard deviation, median, range and the percentage incurring costs for both FEMAP users and matched non-users, both for total cost and by cost category. We tested for skewness in the FEMAP user and non-user cost distributions. To test for differences in the mean costs overall and by cost category, we used bootstrapping to sample with replacement, creating 10,000 datasets of matched pairs. Bootstrapping was implemented with an outer and inner loop, where necessary. For the outer loop, we sampled with replacement from the FEMAP user group. If a sampled FEMAP user was matched to only one non-user, we kept the non-user as the matched pair. Otherwise, if a sampled FEMAP user was matched to two non-users, we used an inner loop to sample and retain one of the two non-users as the matched pair. We calculated the paired cost difference in each dataset (FEMAP user minus the paired non-user) and reported the mean, median and 95% confidence interval of the paired differences. In order to make inference about the cost differences, we conducted one-sided tests of significance with a critical p-value of 0.05. Thus we examined whether or not the proportion of datasets in which the mean paired cost was negative exceeded the critical threshold of 0.95, which is equal to one minus the critical p-value.

Risk-adjusted cost comparison

We performed a regression analysis to control for factors that would influence costs, using generalized estimating equations (GEEs), to account for the skewness of the cost data and the clustering of matched individuals (Pan, 2001; Zeger & Liang, 1986). We performed a modified Park test to identify the best family for the model (Manning & Mullahy, 2001). We tested the identity and log links, to determine the relationship between the mean cost and the cost distribution (Barber & Thompson, 2004). We tested four regression models, specified based on our clinical judgement and the results of preliminary regression analyses of log transformed cost, comparing model fit using the Quasilikelihood under the Independence model Criterion (QIC) criteria (Pan, 2001). We tested for deviance, leverage and influence at the cluster level (Pan, 2001). We examined individual observations within outlying clusters and used the QIC criteria to compare model fit with and without outlying clusters. A lower QIC is more desirable as it identifies the regression model with the best fit to the data. For risk-adjustment models, we used two-sided P-values, and considered P<0.05 statistically significant. After choosing the best fitting regression model, we used the method of recycled predictions to estimate the difference in cost between FEMAP users and non-users (Bieler, Brown, Williams, & Brogan, 2010; Graubard & Korn, 1999). To calculate a confidence interval for the risk-adjusted cost difference, we accounted for the prediction error by adding the variances of the predicted mean costs to the variances of the paired difference.

All analyses were performed using SAS Enterprise Guide (Cary, NC), version 7.12.

Research Ethics Approval

The Health Sciences Research Ethics Board at the University of Western Ontario granted approval for the study.

Results

We identified 29,886 emerging adults presenting for treatment with mood and anxiety disorders in the FEMAP catchment area between April 1, 2009 and March 31, 2015. Of a total of 554 who accessed services from FEMAP during the same time period, we successfully linked 497 (89.7%) to the health administrative data. The remaining 29,389 individuals were classified as non-users. We matched 490 FEMAP Users with 967 non-users. The standardized differences show the distribution of variables between the two groups to be balanced. (Table 1) FEMAP users had significantly higher utilization of physician services and significantly lower utilization of ambulatory care services than FEMAP non-users. Utilization rates for inpatient services were not significantly different between the two groups. After excluding clusters in which at least one individual had less than one year of follow-up, 366 FEMAP users and 660 matched non-users remained. Of those with less than one year of follow-up, none died, fewer than 4% emigrated out of the province, and the remainder reached the end of the study period prior to achieving one year of follow-up.

The costs of care overall and by cost category are displayed in Table 3 for both FEMAP users and non-users, along with the mean, median, percentage incurring costs and mean for those incurring costs. Across the 10,000 bootstrapped datasets, the mean cost difference of the FEMAP user group compared to the non-user group was -$853 (95% Confidence Interval (CI) -$2,048, $142). (Table 4) The proportion of times the FEMAP user group had lower total costs than the non-user group was 94.9% (9,493 out of 10,000

bootstrapped datasets). The difference in overall costs was not significant using a one-sided critical p-value of 0.05. FEMAP users had significantly lower costs for inpatient services (-$784, 95% CI -$1,765, -$28). Amongst those hospitalized, the cost of inpatient care was similar for FEMAP users and non-users, suggesting that significant cost differences resulted from a lower percentage of FEMAP users admitted to hospital at least once during the one-year follow-up period. (Table 3) FEMAP users had significantly lower ambulatory care (-$90, 95% CI -$175, -$14) and Ontario Drug Benefit costs (-$47, 95% CI -$115,-$4) than non-users. (Table 4) FEMAP users had significantly higher physician services costs $435 (95% CI $276, $581) than non-users. (Table 4)

A generalized estimating equation regression model with gamma family and log link, with adjustment for age, sex and age at first mental health diagnosis had the best fit. (Supplemental File 2) Diagnostic tests revealed three influential clusters representing eight patients. In each cluster, one non-user incurred a high cost due to a lengthy inpatient hospitalization. Fitting a regression model without the influential clusters resulted in a higher QIC, signifying a poorer model fit. As a result, we kept the influential observations in the dataset. In the risk-adjusted model, the covariate for FEMAP user compared to non-user was not significant (p=0.088). (Table 5) Using the method of recycled predictions, risk adjusted costs for FEMAP users were $3,342, and $4,256 for FEMAP non-users, representing a difference of -$914 (95% CI (-$2747, $919). (Table 6) This difference was not significant.

Discussion

We compared the total cost of health services contrasting FEMAP users with a matched sample of non-users with mood and anxiety disorders. The cost perspective was the Ontario MOHLTC and the time horizon a period of one year post-FEMAP admission. In unadjusted analyses, we found FEMAP users incurred significantly lower inpatient, ambulatory care and Ontario drug benefit claims costs than FEMAP non-users in one year. FEMAP users also incurred greater physician services costs than non-users. Overall cost savings were not significant in unadjusted analyses. In regression models adjusted for age, sex and age at first mental health diagnosis, we did not find significant differences in overall costs between FEMAP users and non-users.

Our annual costs of care for both FEMAP users and non-users were broadly comparable to Ontario-based cost estimates for adults with major depressive disorders (Chiu, Lebenbaum, Cheng, de Oliveira, & Kurdyak, 2017). Chui and colleagues estimated the annual cost of care for adults with major depressive disorder in Ontario to be $3,210 in 2013 USD (95% CI: $2,413, $4,008) and the average annual hospitalization cost was $1,014 ($586–$1,441) in 2013 USD. Our study differs from that of Chui and colleagues in that we include emerging adults with both mood and anxiety disorders, and we did not distinguish amongst individuals with different levels of severity of depressive disorder.

Few studies have examined the health care utilization and cost impacts of a targeted care model for emerging adults with mood and anxiety disorders. In Germany, economic

evaluation of a home treatment program for children and adolescents discharged from mental health inpatient units, was conducted alongside a randomized controlled clinical trial. The program bears some similarity to FEMAP, in that program elements in the intervention arm were integrated and multi-disciplinary, including services such as group therapy and extensive crisis management (Boege, Corpus, Schepker, Kilian, & Fegert, 2015). Unlike FEMAP, day hospital, case management, hospital schooling, occupational and music therapy were provided in the intervention arm (Boege et al., 2015). Researchers found significant improvements in functioning and increases in non-healthcare costs, such as the cost of social support services, for intervention patients compared to control. Significant cost savings were achieved due to reductions in use of inpatient services. The findings are analogous to the results of our unadjusted cost comparison where we found significantly increased costs of physician services and significantly decreased costs of inpatient services. The study was dissimilar to ours in that patients had a range of mental illnesses, including obsessive compulsive disorder, psychosis, mood and anxiety disorder, and the trial population, enrolled after discharge from inpatient services, may have had higher acuity illness than our population. Unlike our study, overall costs of care for children and adolescents was significantly lower in the intervention group compared to controls.

Our study has several limitations. The costs incurred represent the perspective of the Ontario MOHLTC and exclude the majority of drug costs for emerging adults as these are typically not covered under public drug plans. The costs also exclude privately financed medication costs, counseling services, and non-health costs bourne by patients and their

parents (da Silva Gdel et al., 2014; Gallo et al., 2017; Ray, Weisner, Taillac, & Campbell, 2017). Emerging adults may incur lost productivity for work, study or household activities, as a result of their symptoms (Evans-Lacko & Knapp, 2016; Rizvi et al., 2015). Individuals with moderate to severe depression who have had treatment, are more likely to be productive than those who have not had treatment (Dewa, Thompson, & Jacobs, 2011). We focused on patients with one full year of follow-up. However, given that the main reason for less than one year of follow-up was the end of the observation period, we feel bias introduced by this criterion is minimal. Our sample size may have been too small to detect significant differences in overall costs. The additional costs of uninsured services provided at FEMAP are funded through grants and private donations and these costs are not directly incorporated into this analysis. The findings may not be generalizable to emerging adults with different characteristics. FEMAP users self-selected to attend the program and may benefit more than those who are not inclined to use FEMAP. While the propensity score matching mitigated confounding in the analysis, we were unable to control for unmeasured factors.

Despite these limiations, the study has important policy implications. Decreased inpatient costs and increased costs of physician services, may represent more appropriate care for emerging adults treated at FEMAP. The educational element of the FEMAP approach may enhance client self-management and this requires further investigation. If the OMOHLTC were to fund FEMAP in its entirety, paying for counseling, psychotherapy and administrative staff, it is not clear that the Ministry would recuperate these costs over a one-year time horizon. We estimate the annual per-person investment as follows. Annual

personnel costs at FEMAP for clerical staff, an intake worker, addictions counselor, family therapist and clinical psychologist, total $215,000. Overhead costs for 6000 square feet of space are donated by the London Health Sciences Centre. With an estimate of $25 per square foot, these total $150,000 each year (Larsen, 2016). Thus staff and overhead costs total $365,000 over one year and when divided by 500 clients each year, this translates to approximately $730 per client. We provide these numbers as an informal estimate of the tradeoffs between the up-front per-person cost of investment ($730) and the potential magnitude of the per-person cost savings ($914). The tradeoffs are promising and require further investigation. An economic evaluation model with a long time horizon, estimating the incremental cost per quality adjusted life year, would provide more insight into the value for money associated with FEMAP. This type of analysis is crucial as the sustainability of FEMAP depends on making the case for continued funding from private donors and grants or from public financing.

Funders invest in health care services considered good value for money, even in the absence of cost savings. A cost-utility analysis of FEMAP was beyond the scope of the current study but would be the optimal way to determine whether FEMAP might produce health gains that would be worth the additional investment required from the ministry. Utilities are used to weight life years to estimate quality adjusted life years and account for improvements in quality of life derived from improved functioning and reduced symptoms. Unfortunately, we did not directly measure health utilities and thus a model would be required to incorporate utility information from other published studies. Economic evaluation also considers a longer time frame, typically beyond one year. A

model would be required to extrapolate costs and quality adjusted life years over the long-term. FEMAP provides early intervention for emerging adults with mood and anxiety disorders and similar programs of early intervention in psychosis have been shown to be cost-effective (Hastrup et al., 2013; McCrone, Craig, Power, & Garety, 2010; Mihalopoulos, Harris, Henry, Harrigan, & McGorry, 2009; Valmaggia et al., 2009). Treatment with anti-depressant therapy is cost-effective for emerging adults with depression (Barrett, Byford, & Knapp, 2005; Byford et al., 2007; Domino et al., 2009). Cognitive behavioural therapy (CBT) in combination with antidepressant therapy is good value for money when CBT is delivered by a psychologist (Byford et al., 2007; Goodyer et al., 2008; Haby, Tonge, Littlefield, Carter, & Vos, 2004). This may have implications for cost-utility analysis of FEMAP, where psychologist delivered psychotherapy is provided.

Conclusion

We estimated the costs of treatment for mood and anxiety disorders associated with FEMAP, a comprehensive, community-based program targeting emerging adults, compared to usual care from the perspective of the provincial ministry of health. This analysis of real-world evidence provides insights into the effects of FEMAP and even though the overall cost reductions we identified were not significant, the findings are promising and further investigation warranted. Canadian policy makers frequently invest in health care to improve outcomes in the absence of cost saving. Increased use of physician services, combined with access to a broader range of treatments including psychologist, counselor and social services, may make FEMAP a worthwhile investment.

viii. Conflict of interest statement:

The authors have no conflicts of interest.

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x. Tables

Table 1: Baseline characteristics of propensity score matched FEMAP users and non-users

Variable	Value	FEMAP users (n = 490)	Non-users (n = 967)	Standardized Difference[‡]
		n (%)[†]	n (%)[†]	
Age at Index Date	Mean ± SD	19.3 ± 2.4	19.2 ± 2.4	5%
Male Gender		158 (32.2%)	320 (33.1%)	2%
Rural Residence		25 (5.1%)	49 (5.1%)	0%
Income Quintile	1 (lowest quintile)	86 (17.6%)	162 (16.8%)	2%
	2	84 (17.1%)	178 (18.4%)	3%
	3	81 (16.5%)	171 (17.7%)	3%
	4	102 (20.8%)	187 (19.3%)	4%
	5 (highest quintile)	137 (28.0%)	269 (27.8%)	0%
Migrant Status	Non-Migrants	465 (94.9%)	927 (95.9%)	5%
	Immigrant	<25 (<5%)	31 (3.2%)	7%
	Refugee	<6 (<1.2%)	9 (0.9%)	4%
Age at First Mood or Anxiety Disorder Diagnosis	Mean ± SD	18.5 ± 3.1	18.3± 3.0	5%
Age at First Mental Health Diagnosis	Mean ± SD	12.7 (6.5)	12.3 (6.2)	5%
Index Diagnosis	Mood Disorder	209 (42.7%)	364 (37.6%)	10%
	Anxiety Disorder	281 (57.3%)	603 (62.4%)	10%
Source of Index Diagnosis	Inpatient	16 (3.3%)	31 (3.2%)	0%
	Outpatient Psychiatrist	418 (85.3%)	824 (85.2%)	0%
	Other Physician	56 (11.4%)	112 (11.6%)	0%

Variable	Value	FEMAP users (n = 490)	Non-users (n = 967)	Standardized Difference‡
Prior Alcohol-Related Disorder		14 (2.9%)	29 (3.0%)	1%
Prior Substance-Related Disorder		16 (3.3%)	31 (3.2%)	0%
Family Physician Visit in Previous 6 Months		291 (59.4%)	581 (60.1%)	1%
Psychiatrist Visit in Previous 6 Months		38 (7.8%)	72 (7.4%)	1%
Mental Health Emergency Department Visit in Previous 6 Months		63 (12.9%)	142 (14.7%)	5%
Self-Harm Attempt in Previous 6 Months		<6 (<1.2%)	<6 (<1.2%)	6%
Psychiatric Hospitalization in Previous 6 Months		10 (2.0%)	17 (1.8%)	2%

† Unless otherwise indicated
‡ Standardized differences of >10% suggest significant between-group differences

SD indicates standard deviation

Table 2: Comparison of rates of health service utilization between FEMAP users (n=490) and matched non-users (n=967)

Health Services Category	Health Services Group	Person-Years of Follow-Up	Number of Health Services Contacts	Rate of Health Service Contacts per Person Year	Rate Ratio	95% Confidence Interval	p-value[†]
Physician Services	FEMAP user	478	4169	8.72			
	FEMAP non-user	944	4007	4.24	2.05	1.97, 2.15	<0.0001
Ambulatory Care Services	FEMAP user	478	68	0.14			
	FEMAP non-user	944	199	0.21	0.67	0.50, 0.89	0.0043
Inpatient Services	FEMAP-user	478	111	0.23			
	FEMAP non-user	944	232	0.25	0.94	0.75, 1.19	0.6478

† Rates of health service utilization compared using the Poisson test

‡ Ambulatory care costs include same-day-surgery and emergency department visits

Table 3: Cost of health services for those with complete one year follow-up, amongst FEMAP users (n=366) and matched non-users (n=660)

Cost Category	Health Services Group	Mean (SD)	Median (range)	Percentage incurring costs[‡]	Mean (SD) for those incurring costs
Total Cost	FEMAP users	$3,308 ($6,352)	$1,720 ($0 to $68,641)	92%	$3,318 ($6,359)
	Non-users	$4,244 ($10,584)	$1,258 ($0 to $106,115)	99%	$4,270 ($10,611)
Inpatient	FEMAP users	$1099 ($4,995)	$0 ($0 to $51,336)	7%	$13,678 ($11,949)
	Non-users	$1,860 ($7,383)	$0 ($0 to $69,117)	14%	$13,060 ($15,439)
Ambulatory Care[†]	FEMAP users	$286($589)	$0 ($0 to $ 4,415)	41%	$637 ($742)
	Non-users	$430 ($805)	$ 1,621 ($0 to $ 7,763)	57%	$754 ($946)
Ontario Drug Benefit Claims	FEMAP users	$38 ($187)	$0 ($0 to $1,746)	13%	$272 ($435)
	Non-users	$177 ($972)	$0 ($0 to $16,622)	23%	$772 ($1,921)

Cost Category	Health Services Group	Mean (SD)	Median (range)	Percentage incurring costs‡	Mean (SD) for those incurring costs
Physician Services	FEMAP users	$1,739 ($1,452)	$1299 ($0 to $12109)	92%	$1,744 ($1,451)
	Non-users	$1,205 ($1,799)	$691 ($0 to $32,498)	99%	$1,216 ($1,803)

SD indicates standard deviation

† Ambulatory care costs include same-day-surgery and emergency department visits

‡ Percentage who used the health service at least once

Table 4: Difference in cost of FEMAP users compared to non-users using a non-parametric percentile method of inference[†]

	Mean (SD) of difference in cost for FEMAP users compared to non-users (CDN$)	Median	2.5 percentile	97.5 percentile	Non-parametric p-value (Proportion of mean cost differences <0)
Total Cost	-$853(564)	-$818	-$2048	$142	0.9493
Inpatient Cost	-$784 (439)	-$743	-$1765	-$28	0.9794
Ambulatory Care[‡]	-$90(41)	-$88	-$175	-$14	0.9902
Ontario Drug Benefit Claims	-$47 (30)	-$42	-$115	-$4	0.9891
Physician Services	$435 (77)	$438	$276	$581	0

† A total of 10,000 bootstrapped datasets were created sampling with replacement from n=366 FEMAP users, and the paired non-user. If the FEMAP user was paired with two FEMAP non-users, we randomly sampled one matched control. For each dataset, the mean paired cost difference was calculated. We report the overall mean of the paired cost differences, 2.5 and 97.5 percentiles.

‡ Ambulatory care costs include same-day-surgery and emergency department visits

SD indicates standard deviation

Table 5: Generalized Estimating Equation Model Parameter Estimates[†]

Parameter	Estimate	Lower 95% Confidence Limit	Upper 95% Confidence Limit	P-value
FEMAP user	0.79	0.60	1.04	0.0876
Age	0.98	0.90	1.06	0.5895
Female sex	1.02	0.74	1.41	0.9059
Age at First Mental Health Diagnosis	0.98	0.95	1.00	0.0396

† All models included the total cost as the dependent variable and were estimated using a log link and gamma family

Table 6: Summary of predicted costs derived from recycled predictions

Variable	Number of Observations	Mean	Standard Deviation	Median	Minimum	Maximum
FEMAP user[†]	996	$3342	$570	$3219	$2112	$4732
FEMAP non-user[‡]	996	$4256	$725	$4099	$2689	$6026
Paired difference (FEMAP user – FEMAP non-user)[§]	996	-$914	$156	-$880	-$1294	-$577

† All n=996 observations in the dataset were coded FEMAP user=0 and the original values of the variables Age, Female sex and Age at First Mental Health Diagnosis were retained.

‡ All n=996 observations in the dataset were coded FEMAP user=1 and the original values of the variables Age, Female sex and Age at First Mental Health Diagnosis were retained.

§ Paired differences were calculated by taking the predicted cost derived from FEMAP user =1 and subtracting the corresponding predicted cost for FEMAP user=0. To calculate the confidence interval for the paired difference we account for the prediction error by adding the variances of the predicted mean costs for FEMAP user=0, FEMAP user=1 and the paired difference. Thus the variance of the incremental cost (ic) is calculated using the formula:

Variance(ic) = 570^2 + 725^2 + 156^2 = 874,861

Standard deviation(ic) = $\sqrt{874{,}861}$ = 935

The 95% Confidence Interval for the incremental cost is calculated using the formula:

-914 +/- 1.96(935)

Thus the incremental cost (95% Confidence Interval) is -$914 (-$2747, $919)