

# Individuals receiving addiction treatment: are medical costs of their family members reduced?

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## ABSTRACT

**Aims** To examine whether alcohol and other drug (AOD) treatment is related to reduced medical costs of family members. **Design** Using the administrative databases of a private, integrated health plan, we matched AOD treatment patients with health plan members without AOD disorders on age, gender and utilization, identifying family members of each group. **Setting** Kaiser Permanente Northern California. **Participants** Family members of abstinent and non-abstinent AOD treatment patients and control family members. **Measurements** We measured abstinence at 1 year post-intake and examined health care costs per member-month of family members of AOD patients and of controls through 5 years. We used generalized estimating equation methods to examine differences in average medical cost per member-month for each year, between family members of abstinent and non-abstinent AOD patients and controls. We used multilevel models to examine 4-year cost trajectories, controlling for pre-intake cost, age, gender and family size. **Results** AOD patients' family members had significantly higher costs and more psychiatric and medical conditions than controls in the pre-treatment year. At 2–5 years, each year family members of AOD patients abstinent at 1 year had similar average per member-month medical costs to controls (e.g. difference at year 5 = \$2.63;  $P > 0.82$ ), whereas costs for family members of non-abstinent patients were higher (e.g. difference at year 5 = \$35.59;  $P = 0.06$ ). Family members of AOD patients not abstinent at 1 year, had a trajectory of increasing medical cost (slope = \$10.32;  $P = 0.03$ ) relative to controls. **Conclusions** Successful AOD treatment is related to medical cost reductions for family members, which may be considered a proxy for their improved health.

**Keywords** Alcoholism and addictive behavior, cost analysis, family health, substance abuse.

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## INTRODUCTION

Family members of individuals with chronic illnesses and disabilities have increased risk of medical and mental health problems and related stress [1–3], which may affect their health care utilization [1]. Alcohol and drug dependence, among the most prevalent chronic illnesses, have epidemiological factors and disease trajectories similar to other chronic diseases [4]. Family members of individuals with alcohol and other drug (AOD) disorders have more medical and psychiatric conditions than families of individuals without AOD disorders, which can lead to high costs [5–8]. They also have higher costs than families of those with other chronic diseases, such as diabetes and asthma [9]. However, only a few studies have

examined whether family members' cost changes are related to whether the AOD patient was successful in treatment [10–13]. Some studies find improved health after recovery, others find increased costs related to problems masked previously. Studies in the 1970s and 1980s using US insurance claims [7,14] compared families of alcoholics to other families. A 1970 study using Blue Cross/Blue Shield data [7] found that costs decreased almost to the level of control families by 6 years. One study [15] found that family health improved if the primary patient was successful in treatment. Other studies in the 1980s and early 1990s found lowered costs after treatment [6,13,16]. These studies were often small, represented an earlier exclusively alcohol treatment system, did not always match patients or families

with other health plan members, and did not consider the AOD patient's treatment outcome [17].

We address factors that earlier research could not. This study's AOD patients attended treatment that reflects current US practice and includes patients with both alcohol and drug disorders. We matched AOD patients on age, gender and utilization to non-AOD patients and considered their treatment outcome in examining family members' cost data. Our statistical approach allows for clustered family effects, and we take into account age, gender, geography and family size.

Given the literature on families who have a member with an AOD disorder [17–19], we hypothesized that medical costs and the prevalence of health conditions for family members of AOD patients would be higher prior to the patient's treatment than for family members of matched individuals without an AOD disorder. From the health plan's perspective, the key question is whether the AOD patient's treatment outcomes are associated with their family members' costs relative to costs of family members of non-AOD patients, i.e. bench-marking with other health plan members. We examined medical cost with and without psychiatric and AOD costs, as the mental health and substance use problems among family members of AOD patients are highly prevalent and have often developed into chronic problems requiring long-term treatment. We measured abstinence of the AOD patients at 1 year because of its clinical relevance. It is a reachable treatment goal, and programs seldom have longer contact with patients. Also, several studies found that 6- and 12-month abstinence predicts positive 5-year outcomes [20–22]. We examine family members' cost over 5 years, because immediately after the patient's treatment families may address their own medical needs. Further, 5 years is sufficient to avoid a possible regression-to-the-mean effect of lowered family costs immediately following the patient's treatment. Thus we hypothesized that family members of abstinent patients would have a downward trajectory of health care (particularly medical) costs in the post-abstinent period, and by 5 years the average cost per member-month of family members of abstinent AOD patients would be similar to that of family members of matched individuals, while family members of non-abstinent patients would not have such reduced costs.

## METHODS

Kaiser Permanente of Northern California (KPNC) is a non-profit, integrated health care delivery system providing health services to more than 3.4 million members, 41% of the insured population of the Sacramento catchment area studied here. We conducted two successive studies to determine the effectiveness of different treat-

ment modalities [23,24]. These 1947 patients represented more than 94% of the treatment population at the study sites during the two study periods. Subjects were interviewed in person at intake and by telephone at 1 year post-intake; 1220 had at least one family member. The baseline and follow-up interviews included Addiction Severity Index [25] measures of prior 30-day use of any alcohol, marijuana, barbiturates, sedatives, cocaine, crack, stimulants, tranquilizers, heroin, hallucinogens, opiates, pain killers and inhalants (non-prescribed use as well). Negative answers to all use items were defined as abstinence [23,24], and a random subsample was validated by breathalyzer and urinalysis. The 30-day abstinence measure was highly correlated with longest length of abstinence (Spearman's correlation coefficient = 0.82 for alcohol and 0.78 for drugs).

Demographic characteristics of those with a family member in the treatment sample were as follows: 33% were female, and the mean age was 37.5; 72% were white, 12% African American, and 12% Hispanic. Eighty-five per cent were high school graduates, 50% had family incomes of \$40 000 or more, 62% were employed, 59% were married, 24% separated or divorced and 17% never married. Thirty-one per cent were in managerial or professional positions, 22% craftsman or machine operators, 35% clerical, sales or service workers and 13% were laborers. Regarding clinical characteristics, 41% met criteria for alcohol dependence only, 29% drug dependence only, 18% both and 12% abuse only. The major dependence types were alcohol (59%), cannabis (18%), stimulants (24%), cocaine (9%) and narcotic analgesics (6%). Mean [standard deviation (SD)] ASI scores were alcohol, 0.42 (0.31); drug, 0.12 (0.12); legal, 0.09 (0.19); employment, 0.38 (0.25); family/social, 0.39 (0.29); and psychiatric, 0.38 (0.27); medical, 0.31 (0.38). Dependence type and ASI scores were similar for those with and without family members.

We examine the health care costs of the family members of these AOD patients and also of family members of KPNC members without an AOD disorder matched to the AOD patients (referred to hereafter as control family members), 1 year pre-intake and over the following 5 years. The study was approved by the Institutional Review Boards of the University of California, San Francisco and Kaiser Foundation Research Institute.

## Sample

Family members of AOD patients were identified using health plan membership account numbers that link the subscriber and dependents (spouses and children). The AOD patient's intake date was designated as the index date for family members. Patients who did not respond

to the 1-year follow-up ( $n = 164$ , 8.4%), and their family members, were excluded.

We obtained an age, gender and geographically matched sample of health plan members (five controls for every AOD patient) with an out-patient visit in the same month as the AOD patient's intake. (We note that we matched the control with the AOD patient.) We used the individual's out-patient visit date as the index date for their family members in summarizing cost data. Those with an AOD dependence or abuse diagnosis prior to the treatment intake date of their match were excluded. The final sample consisted of 1983 family members of AOD patients and 7336 control family members.

Using data from the outcomes studies, we examined abstinence of the index AOD patient at 1 year (62% were abstinent) [23,24] and created a dichotomous indicator of abstinence status (1 = abstinent, 0 = non-abstinent). Family members of the index treatment patient were linked to whether the patient was abstinent or non-abstinent at 1 year.

### Costs

For each family member, enrollment, age, gender and all medical services including medications, diagnoses, laboratories and procedures are recorded in automated databases linked by a unique medical record number. Health plan pharmacy data capture about 97% of member prescriptions [26]. We obtained each family member's health care costs for 1 year prior to 5 years after the index date (the study window spanned April 1994 to December 2003). We extracted costs for services at KPNC facilities from the Cost Management Information System, which integrates utilization data with the financial ledger. Costs (including most overhead) were generated for each service using standard accounting methods. Data pertaining to medical services outside the health plan but paid for by KPNC were obtained from billing/claims databases also linked by medical record number. Dental costs, out-of-pocket expenses, home health costs and administrative costs associated with health plan membership (such as marketing expenses) were excluded. We used the Consumer Price Index to adjust all costs to 2004 dollars. For each study period, we constructed average monthly costs using member-months as the denominator to account for varying length of enrollment.

### Statistical analysis

We compared the costs of family members of AOD patients and control family members prior to intake, using annualized average cost per member-month as the dependent variable in all analyses. We hypothesized that in the year prior to treatment intake, costs would be higher for family members of AOD patients than

for control family members. For our analysis of family members' costs, family members of AOD patients were divided into two groups based on the patient's abstinence status at 1 year post-intake. Gender, age and family size of the AOD and control family members were included as independent predictors of costs, as the two groups may differ in these characteristics. (We matched on the index AOD patients and not on their family members.) Average medical cost of family members excluding and including psychiatric and AOD treatment costs were examined, as were disaggregated components of total cost such as in-patient, out-patient and psychiatric and AOD costs. We used logistic regression to compare the pre-intake prevalence of medical conditions between family members of AOD patients and controls.

Using two approaches, we examined trends in costs of family members and the effect of abstinence status at 1 year post-intake. We compared two groups to control family members: family members of abstinent and non-abstinent AOD patients. We examined average costs over the 2–5-year period post-intake (called the post-abstinence period because it begins with the 1-year abstinence status). For each year, we examined post-abstinence differences in average medical cost per member-month and overall average cost including psychiatric and AOD treatment cost, controlling for demographic characteristics and pre-intake costs of the family member. Including pre-intake average cost as a covariate enabled us to account for extreme (high or low) costs prior to treatment that might regress to the average and account for differences between the groups post-intake. We expected that the cost difference between the control families and families of abstinent AOD patients would become smaller and statistically insignificant by year 5. Because these analyses involve correlations within families, we used generalized estimating equation methods for clustered data, where the correlation within clusters is treated as a nuisance parameter [27–29].

In addition, cost trajectories were examined over the post-abstinence period using a multilevel modeling strategy, with four repeated measures of average cost per member-month for the post-abstinence period. This is one source of correlation among observations belonging to the same individual. In addition, utilization and cost patterns for members within a family may be correlated [30–32], whereas those between families are likely to be independent, suggesting that the use of simple linear regression techniques is inappropriate. As there are repeated observations nested within individuals, further nested within families, we used a three-level hierarchical model to account for the two types of correlations [33]. In these analyses, the factors that predict individual differences in slope are particularly of interest. These include individual level-2 characteristics (e.g. age and gender) and

level-3 family characteristics (e.g. abstinence status of AOD patient, family size). The objective is to determine if the coefficient of the variable indicating abstinence status of the AOD patient is significantly different for family members of abstinent and non-abstinent AOD patients relative to family members of controls (reference group).

## RESULTS

### Pre-intake/pre-index date cost

Family members of AOD patients had higher per member-month emergency room (ER), primary care, psychiatry/AOD, out-patient and total costs (with and without psychiatric and AOD service cost) than control family members (data not shown). They had higher average costs per member-month (\$90.65 versus \$62.47;  $P < 0.01$ ) and average overall costs, including psychiatric and AOD (\$96.50 versus \$63.29;  $P < 0.01$ ), than control family members; they also had almost five times higher psychiatry/AOD costs and more than twice the ER cost. For both groups, more than 40% of total costs were attributable to in-patient stays. Although family members of AOD patients had more than 50% higher average in-patient cost per member-month than control family members (\$44.41 versus \$27.92), the difference was only marginally significant ( $P < 0.10$ ), due to the (typical) high variability in hospital cost.

### Medical conditions

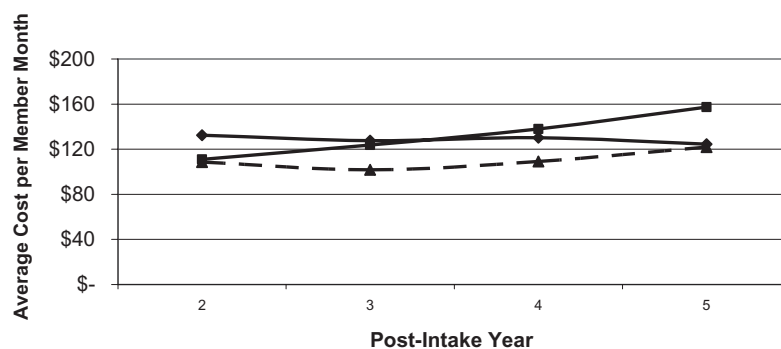
We examined the prevalence of medical conditions in the 1-year pre-index date period [34] among family members of AOD patients and control family members of one of the study's two samples for which data were available. We selected 24 conditions shown to account for about 80% of medical costs in the health plan [35]. Family members of AOD patients had higher ( $P < 0.05$ ) prevalence of medical conditions such as congestive heart failure, ischemic heart disease, diabetes, asthma, lower back

pain, injuries, poisoning and hepatitis C. They also had much higher odds of having any psychiatric diagnosis [odds ratio (OR) = 2.13,  $P < 0.0001$ ], including depression (OR = 3.06,  $P < 0.0001$ ), major psychosis (OR = 4.23,  $P = 0.002$ ) and personality disorder (OR = 7.82,  $P = 0.0012$  (data not shown)). Depression was the second most common medical diagnosis after injuries and poisoning, whereas it was the fifth most common condition among control family members. There were no pre-intake differences in medical conditions between family members of AOD patients who were abstinent 1 year later versus family members of those who were not.

### Analysis of average costs by year

Figure 1 shows the trend in average medical cost (excluding psychiatric and AOD treatment) per member-month for family members of the 1-year abstinent and non-abstinent AOD patients and control family members, adjusting for age, gender and pre-intake cost. Average medical costs were similar for all groups in the year after intake and increased in the second year post-intake, but costs for family members of abstinent patients changed little until year 5 (\$132.50 at year 2 to \$124.45 at year 5). Average cost for family members of abstinent patients approached the average cost of control family members (\$121.83) by year 5. Average cost per member-month for family members of non-abstinent patients continued rising (from \$110.95 in year 2 to \$157.42 by year 5), and were higher than controls at year 5.

Table 1 shows that the excess cost of family members of abstinent AOD patients relative to controls is statistically not different from zero (i.e. average cost per member-month for the two groups are similar) for any year (e.g. at 5 years post-intake (difference = \$2.63;  $P > 0.82$ ). Non-abstinent family members had higher costs than controls beginning in year 3 and the excess cost increased monotonically (difference at year 5 = \$35.59;  $P = 0.06$ ). Family members of non-abstinent patients had signifi-



**Figure 1** Adjusted average medical cost per member month [excluding alcohol and other drug (AOD) and psychiatry costs]. ◆ Family members of abstinent AOD patients; ■ family members of non-abstinent AOD patients; ▲ family members of controls

**Table 1** Excess medical cost per member-month adjusting for pre-intake cost and age.

Year after intake	Family members of abstinent AOD patients relative to control family members		Family members of non-abstinent patients relative to control family members	
	Excess cost (\$)	P-value	Excess cost (\$)	P-value
2	23.91	0.22	2.35	0.84
3	25.87	0.10	21.97	0.04
4	21.04	0.07	28.95	0.03
5	2.63	0.82	35.59	0.06

**Table 2** Multilevel analysis of average medical costs per member-months [excluding psychiatric services and alcohol and other drug (AOD) treatment costs].

Fixed effect		Coefficient	Standard error	P-value
Intercept* ( $\pi_0$ )	Intercept ( $\beta_{00} = \gamma_{000}$ )	63.40	9.42	<0.01
	Age group ( $\beta_{01} = \gamma_{010}$ ) (reference group: age $\leq 18$ )	46.02	10.94	<0.01
	Pre-intake cost* ( $\beta_{02} = \gamma_{020}$ )	0.37	0.04	<0.01
Year (slope)*( $\pi_1$ )	Intercept ( $\beta_{10}$ )			
	Intercept ( $\gamma_{100}$ )	-4.82	4.10	0.24
	Non-abstinent family member ( $\gamma_{101}$ )	10.32	4.72	0.03
	Abstinent family member ( $\gamma_{102}$ ) (reference group: control family member)	5.60	3.59	0.12
	Age group ( $\beta_{11} = \gamma_{110}$ ) (reference group: age $\leq 18$ )	16.11	6.12	0.01
Random effects	Variance component	Degrees of freedom	P-value	
Level-1 (temporal) variance	400.94			
Level-2 (individual within families) variance				
Initial status	384.31	4552		0.00
Slope	238.06	8153		0.00
Level-3 (between families) variance	0.46	3600		0.00

cantly higher primary care (internal medicine, gynecology, pediatrics, family practice and general medicine) and all out-patient costs (excluding psychiatry and AOD costs) than controls, whereas there were no significant differences in these costs between abstinent and control family members except ER (data not shown). In addition, hospital costs of family members of abstinent patients were slightly lower, and family members of non-abstinent patients were higher (however, with neither group statistically different) than controls. Both groups continued to have higher psychiatry costs (\$3.73 and \$2.95, respectively) than controls at 5 years post-intake.

#### Five-year trends in average cost

To evaluate whether the trends in average medical costs were different between family members of AOD patients (and controls), we used the multilevel model described earlier. At the individual level (level-2), we controlled for

pre-intake cost and age of the family member (gender was not included, as preliminary results showed no significant difference by gender) and at the family level (level-3), we included the abstinence status of the AOD family member as a predictor. Family size was not a significant predictor and was dropped from the model. The results are presented in Table 2. The coefficients of the intercept pertain to the year 1 post-abstinence period (year 2 post-intake). Average cost per member-month at 1 year post-abstinence was about \$46 higher for family members 18 years or older relative to younger family members ( $P < 0.01$ ). Pre-intake cost was associated positively with cost at 1 year post-abstinence. There was no statistically significant difference between family members of abstinent and non-abstinent AOD treatment patients relative to controls at 1 year post-abstinence.

The coefficient of the variable YEAR denotes slope characteristics of the average medical cost trajectory. The slope of abstinent family members was not significantly

**Table 3** Multilevel analysis of average medical costs per member-months [including psychiatric services and alcohol and other drug (AOD) treatment costs].

Fixed effect		Coefficient	Standard error	P-value
Intercept* ( $\pi_0$ )	Intercept ( $\beta_{00} = \gamma_{000}$ )	66.14	9.45	<0.01
	Age group ( $\beta_{01} = \gamma_{010}$ ) (reference group: Age $\leq 18$ )	49.65	10.98	<0.01
	Pre-intake cost* ( $\beta_{02} = \gamma_{020}$ )	0.37	0.04	<0.01
Year (slope)*( $\pi_1$ )	Intercept ( $\beta_{10}$ )			
	Intercept ( $\gamma_{100}$ )	-4.98	4.10	0.22
	Family member of non-abstinent AOD patient ( $\gamma_{101}$ )	11.75	4.80	0.01
	Family member of abstinent AOD patient ( $\gamma_{102}$ ) (reference group: control family member)	7.49	3.67	0.04
	Age group ( $\beta_{11} = \gamma_{110}$ ) (reference group: age $\leq 18$ )	15.29	6.13	0.01
Random effects		Variance component	Degrees of freedom	P-value
Level-1 (temporal) variance		402.40		
Level-2 (individual within families) variance				
	Initial status	385.87	4552	0.00
	Slope	238.16	8158	0.00
Level-3 (between families) variance		0.44	3605	0.00

different ( $P > 0.05$ ) from that of the control family members, which in turn was not significantly different from zero, indicating a flat trajectory. Family members of non-abstinent patients had a significantly positive slope (\$10.32;  $P = 0.03$ ) relative to the controls. We tested for a non-linear trend by including YEAR-squared, but neither the fixed effect (coefficient of the variable) nor the variance component was significantly different from zero, and therefore we used a linear model of average cost trajectory. The variance components from the final model showed that there remained significant residual variation after accounting for age, pre-intake cost and abstinence status.

We replicated these analyses using overall average cost including psychiatric and AOD treatment costs. With these costs included, the cost trajectories of family members of both abstinent and non-abstinent patients had a positive slope relative to control family members after controlling for age and pre-intake cost (Table 3). At 5 years, out-patient costs accounted for a greater share (approximately 40%) of total costs than in-patient costs (ranging from 24% to 33%) for family members of abstinent AOD patients.

**DISCUSSION**

We examined the effect of successful AOD treatment on medical costs of family members, comparing family members of AOD patients abstinent and not abstinent with family members of controls, accounting for age,

gender, geographic location, family size, index date utilization and probable correlation in utilization and cost within families. Consistent with other research, family members of both abstinent and non-abstinent AOD patients had significantly higher costs than controls prior to treatment. Average medical costs per member-month for family members of non-abstinent AOD patients continued upwards for 5 years and were significantly higher than for control family members. However, the medical cost differences between family members of abstinent patients and control family members began narrowing after year 2 post-intake and costs were not significantly different in the post-abstinence period. For the health plan, this represents a significant benefit. The opposite trend was observed among family members of non-abstinent AOD patients. This suggests that the AOD patient’s abstinence (or continued use) begins to manifest as reduced (or increasing) cost among family members over time. Therefore, family costs should be an important consideration for health plans in understanding AOD treatment costs more clearly. Five years later, out-patient costs for family members of abstinent patients accounted for a greater share of total cost than in-patient costs, suggesting that these family members were using more appropriate and preventive services. However, both groups of family members of AOD patients continued to have higher psychiatric and AOD costs than controls, suggesting ongoing mental health problems. Non-abstinent family members had more than 25% higher costs than control family members at year 5 (excess

cost = \$35.59). AOD treatment costs of family members of abstinent patients were higher than those of controls, while those of family members of non-abstinent patients were not, suggesting that family members of abstinent patients were receiving needed services. We note that family members of both abstinent and non-abstinent AOD patients had equal rates of AOD and psychiatric disorders in the pre-treatment year.

The study has several limitations. Results are limited in their generalizability to other health care settings, and future work should aim to replicate the findings using a similar methodology. Because this is a population with good health care access, prevalence of medical conditions and cost differences may be lower than in general populations. The study did not measure quality of life or costs to other systems, such as the work-place or criminal justice. The confidence intervals for adjusted average cost and slope coefficient of the post-abstinence period trajectory for abstinent and non-abstinent family members overlap, although findings indicated that family members of abstinent patients had similar costs to controls, and non-abstinent family members had significantly higher costs and a significantly increasing trajectory over 5 years relative to controls. Nevertheless, the findings from the two different ways of examining cost trends (i.e. slope of cost trajectory as well as annualized average cost) point consistently to higher average medical costs of family members of non-abstinent AOD patients relative to a sample of family members without AOD problems. We also examined the potential impact of outliers on the results. Overall, the percentage of observations with costs of >\$100 000 dollars (a threshold that we chose from examining the univariate and frequency distributions of average costs) was <0.02% (11 instances over 4 years) of all encounters in any given year. These were distributed among the family members of abstinent AOD patients and control family members (there was none among family members of non-abstinent AOD patients) and over the 4 years after the 1-year abstinence was measured. The study does not address causal relationships; clearly individuals cannot be randomized to receive successful treatment or not.

Our sample is large and the methodology is more conservative than earlier studies for several reasons. The criteria for obtaining the matched controls are more stringent. Index AOD patients and index controls are matched on multiple measures, and age, gender, family size, index utilization and family clustering effects are taken into account. The AOD patients (whose costs decrease after treatment) and index patients are excluded from our analyses. We also excluded the first year after intake from our analyses, as this period is likely to have high costs for family members of AOD patients similar to that observed among AOD patients. Including this period

might show an artificial downward trajectory of costs for the family members of AOD patients relative to the control family members. Our approach to including outliers is conservative, because the family members of the non-abstinent AOD patients had none and excluding the outliers for the controls may actually show an inflated upward trend for the non-abstinent group relative to controls.

This study has significant implications for health policy and clinical practice. It focuses upon the relationship between treatment outcomes of AOD patients and their family members' health services use and cost. The study design we have chosen allows us to make this comparison in a way that is informative for shaping health plan policy. Thus, instead of comparing family members of abstinent and non-abstinent AOD patients directly, both of whom may have higher costs than family members of non-AOD patients, we have chosen to compare these two groups to a sample of family members of health plan members who were matched demographically to the addiction patient, and therefore provide a benchmark of average cost for the health plan. We have used a slice-of-time approach as well as a dynamic approach to observe the impact of the addiction patient's abstinence on his/her family members' cost. Thus, we present the results in terms of adjusted annualized average cost per member-month as well as use a statistical method (hierarchical three-level model) for examining the trajectory of average cost in the post-abstinence period. Both these approaches lead us to conclude that non-abstinence of the addiction patient has significant negative consequence for their family members' health as seen by their health services use and cost. *Post-hoc* analyses revealed that family members of both groups (abstinent and non-abstinent AOD patients) continue to have higher mental health services cost than control family members. The magnitude of the average medical cost-difference between family members of AOD patients and control patients varies between 3% and 30%, although this percentage remained around 20% or higher beyond 2 years post-intake (1 year post-abstinence) for the family members of non-abstinent patients (finding from the yearly comparison of cost). The trajectory of average costs for the family members of non-abstinent patients also shows an increasing trend (in the 4 years since abstinence measured) relative to control family members, and this speaks to the need for continued intervention to engage non-abstinent addiction patients in treatment as a means to control health care costs. The findings strongly support the business case for better AOD treatment coverage, for services for family members and for earlier screening and treatment services for individuals with AOD problems. We note that AOD treatment outcomes are equal or better than those for other chronic diseases [4].

The findings on family member costs and utilization also have implications for AOD treatment. Because the family members of these patients manifest high levels of psychiatric and other medical conditions, AOD programs should adopt clinical interventions that motivate and retain patients in treatment. The medical cost reductions of family members may be considered a proxy for their improved health, partly a consequence of family members receiving needed addiction and mental health services. The study points to the substantial improvement in quality of life, health and costs for families of individuals with AOD disorders when those individuals are treated successfully.

#### Declarations of interest

None.

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