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Recovery Monitoring for Substance Use Treatment in Ontario: Outcome Results from a Feasibility Assessment

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ABSTRACT

Objectives: The assessment of health outcomes of people participating in substance abuse treatment is considered an important element of performance measurement to complement controlled trials of clinical efficacy. We aimed to assess the feasibility of an outcome monitoring system for substance use treatment services in Ontario with a particular focus on the ability of a comprehensive tracking system and measures to determine change over time on relevant outcomes. **Method:** A total of 148 clients aged 16 and over were prospectively recruited at two treatment programs for baseline interview and a detailed follow-up tracking protocol. A group of 117 were located to determine 3 and 6 month-status. Outcomes were measured across multiple health and social domains as well as utilization and cost of health care and justice-related services. **Results:** There was a significant improvement in several indicators of substance use, including abstinence. Results also showed a significant decrease in severity over time in the areas of risk behaviour, crime and violence, and stress as well as overall indices of Life Problem Prevalence, and environmental risks to recovery. Overall quality of life improved. There was a reduction in health care utilization and justice involvement and an overall reduction in costs associated with these services. **Conclusions:** Study findings confirmed the success of the client tracking process and the diverse set of measures in a sub-set of programs where full implementation was possible, thus illustrating the value of scaling up routine outcome monitoring in other substance abuse treatment organizations or treatment systems.

Objectif : L'évaluation des résultats de santé des personnes participant au traitement de la toxicomanie est considérée comme un élément important dans la mesure de résultats en complément des essais cliniques contrôlés. Nous avons cherché à évaluer la faisabilité d'un système de suivi des résultats dans les services de traitement de la toxicomanie en Ontario, en mettant un accent particulier sur la capacité d'un système de suivi complet pour retracer et mesurer les changements au fil du temps sur les résultats pertinents. **Méthode :** Un total de 148 clients âgés de 16 ans et plus ont été recrutés de manière prospective dans deux programmes de traitement pour une entrevue de référence et un protocole de suivi détaillé. Un groupe de 117 ont été localisés pour déterminer des statuts de 3 et 6 mois. Les résultats ont été mesurés par rapport aux coûts et leur utilisation dans de multiples domaines de santé, de services sociaux, ainsi que des services liés à la justice. **Résultats :** Il y a eu une amélioration significative dans plusieurs indicateurs de la consommation de substances, y compris l'abstinence. Les résultats ont également démontré une diminution significative de la gravité au fil du temps dans des domaines connexes, tels la criminalité, la violence, le stress, de meilleurs indices de vie globale et moins de risques environnementaux menant au rétablissement. En général, il y a eu une nette amélioration de la qualité de vie. Il y a eu une réduction de l'utilisation des soins de santé et des démêlés avec la justice ainsi qu'une réduction globale des coûts associés à ces services. **Conclusions :** Les résultats des études ont confirmé le succès du processus de suivi des clients et l'ensemble des diverses mesures dans un sous-ensemble de programmes où la mise en œuvre complète était possible, illustrant ainsi la valeur de l'élargissement de suivi des résultats de routine dans d'autres organismes de traitement de la toxicomanie ainsi que les systèmes de traitement des abus.

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INTRODUCTION

An important element of health services research is the assessment of the effectiveness of health care interventions in the "real life" settings in which they are offered^{1,2}. This contrasts with, and complements, traditional clinical trials which aim to assess treatment efficacy in

tightly controlled conditions thereby isolating the potential influence of the intervention from other sources of variance in outcome. In the addiction field, strategies for outcome monitoring have been influenced by the important conceptual shift towards a chronic illness paradigm for severe addiction and its treatment³ and concomitant shifts in conceptual models of treatment process and outcome⁴ as well as specific evaluation models and measures⁵. The assessment of client outcomes, either during or post-treatment, is now considered an important element of wider performance measurement frameworks⁶, similar to the situation in the broader mental health field⁷.

Large scale outcome monitoring studies have been undertaken in the US and elsewhere through well-funded research projects⁸. In the US, researchers have led the way in developing processes for more routine post-discharge recovery monitoring check-ups (RMC)⁹⁻¹¹. Their work has highlighted the need to incorporate RMC instruments into baseline clinical assessment and the importance of intensive, systematic procedures to maintain contact and follow-up clients in order to maximize response rates¹². Their work has also produced important research findings regarding treatment and impact on health outcomes, including mortality¹³. Going beyond these important but well-funded research and development projects, only a small number of routinized, self-funded, post-discharge outcome monitoring systems exist among US treatment centres, for example, Hazeldon Addiction Treatment Centre¹⁴⁻¹⁵.

In the UK, outcome monitoring has been operationalized in the national treatment system for some time¹⁶⁻¹⁸; various efforts have been initiated from time to time in Australia^{19,20}; and nascent efforts are evident in other countries (e.g., Chile²¹). The main lesson learned to date is that, to be both feasible and sustainable, the output of an outcome monitoring system must return information of value at multiple levels, including treatment system administrators and funders, treatment program managers and individual clinicians.

In Canada, an opportunity to build capacity for outcome monitoring emerged between 2009-2014 through Health Canada's Drug Treatment Funding Program²², a strategic national initiative that directed funding to the provinces and territories to enhance treatment systems and services for individuals with substance use problems. The Ontario DTFP portfolio (www.eenet.ca) included a project to assess the feasibility of implementing a dedicated outcome monitoring service for addiction treatment programs and the utility of a range of tools and processes for locating and following clients and measuring change over time. Project reports have focused on the implementation challenges and lessons learned from a process point of view²³⁻²⁴. In this paper, we briefly describe the

outcome monitoring project but with a particular focus on the ability to measure change over time on relevant client outcomes.

METHOD

Study Sites: Five study sites were involved in the overall recruitment and follow-up process. Three of the sites offered similar community-based, non-residential assessment and treatment services to adults, while the other two sites were a community withdrawal management program and a school-based adolescent treatment program. We experienced significant challenges recruiting clients in one of the community non-residential assessment and treatment services as a result of a high percentage of clients mandated to treatment. Both the youth program and the withdrawal management program also presented unique challenges which severely limited the number of clients available for follow-up. Therefore, our focus here is on the other two community non-residential programs both of which were located in mid-sized cities in predominantly rural parts of the province.

Participants and Recruitment Processes: Project participants were registered clients aged 16 or older, presenting for screening/assessment/treatment. Only clients who were in the intake stages of treatment and not currently receiving treatment services were eligible to participate. Clients included in the study were presenting for a substance use problem, had consented to participate, were able to speak or understand English and showed no evidence of cognitive impairment based on a structured, validated scale assessing this domain²⁵.

Recruitment was initiated in June 2012 and continued through the fall of that year. We aimed for consecutive quarterly follow-up interviews, and we obtained a prospective sample with baseline and both 3- and 6-month interviews, and a larger sample with baseline and at least one of the 3- and 6-month interviews.

Potential participants were approached by trained staff involved in their agency's intake and assessment function once some or all of their routine assessment processes were completed. The recruitment process typically began on the client's second visit with a description of the project via a Letter of Information and form requesting Consent to Participate followed by the cognitive impairment screener. All screened and consenting clients were then asked to complete a form which gathered detailed information to locate clients for follow-up interviews. Upon completion of this form, clients were connected by telephone to a member of the central follow-up team by the agency staff. Ethics approval was obtained from the Centre for Addiction and Mental Health, the project sponsoring organization.

Post-intake Follow-up: The central follow-up team was a group of four staff assembled to locate clients quarterly on the telephone and conduct the follow-up interviews. The follow-up system was an adaptation of the model developed by Scott¹² and incorporated into the overall recovery management strategy developed by Mike Dennis and colleagues at Chestnut Health Systems⁹⁻¹¹. This system of managing follow-up has proven to be successful with over 90% follow-up rates in studies involving addiction treatment populations across various cities of the U.S. and in various settings (e.g. residential and outpatient treatment, justice). While it is a comprehensive system some elements had to be omitted, including the use of paid community trackers to locate hard-to-reach clients (with photograph ID); payment for participation; and securing pre-approval from various community institutions to contact them during the follow-up to ask if clients have accessed their services. The implementation of the Ontario adaptation of the follow-up protocol and lessons learned are documented in a separate report²⁴.

Measures: Building upon a commissioned review of outcome models⁶ and extensive consultation with experts in the field and Ontario treatment system stakeholders, a set of criteria were developed to guide selection of the outcome measurement tool(s). This work was also synchronized with a parallel review of screening and assessment measures with a view to eventual provincial implementation²⁶. Also, following McClellan and colleagues⁵, these criteria included the ability to measure multiple domains of substance use, physical and mental health, social functioning, and public health and safety. In addition, it was expected that the instrumentation could also be used for clinical purposes for baseline assessment and treatment planning; be relevant for a variety of types of addiction services; and have good psychometric properties including reliability and validity across a wide age range and by gender.

The Global Assessment of Individual Needs Quick 3 Motivational Interviewing (GAIN-Q3 MI) was selected to establish baseline status; a parallel tool (GAIN-Q3 Standard) was used for follow-up purposes²⁷. The follow-up tool, implemented at three and six-months post intake, covers client demographics and nine screener sub-sections covering: substance use, mental health, physical health, school, employment, sources of stress, risk behaviours and trauma, crime and violence, and life satisfaction. The total number of items, including all items in many brief sub-scales, was 202. The baseline assessment (GAIN Q3-MI) included an additional 25

items tapping into motivation and readiness for change in each domain. The GAIN-Q3 instruments used for this project had undergone minor adaptations to the specific Ontario context²⁶. The in-person baseline interviews took approximately 60 minutes and the follow-up telephone interview 40 minutes. Scores of the screener sub-sections reflect the number of items endorsed in that domain - the higher the score, the higher problem severity. In accordance with the recommended data collection window of the GAIN-Q3 tools, the three and six-month follow-up interviews were scheduled up to one month before or after 90 and 180 days from the baseline interview.

The GAIN Q3 assessment and outcome instruments allow for conversion of the client's self-reported utilization of services to a "cost-to-society" by multiplying service events with cost-per-unit of service. We were able to obtain service unit costs for various Ontario-based health care service and justice services and applied the costs to the self-reported utilization data at baseline and follow-up. Some events captured in the GAIN instruments could not be costed including, days bothered by any health problem, days bothered by psychological problems, days in intensive outpatient programs for substance abuse, and days of missed school or training for any reason. Health care costs were obtained from the National Ambulatory Care Reporting System, Ontario Ministry of Health and Long-Term Care Health Data Branch's Health Indicators Tool (HIT); or for OHIP data for outpatient clinic visits, provided by personal communication from the Institute of Clinical Evaluative Sciences (ICES). Costs for jail/prison were obtained from www.prisonjustice.ca/politics/facts_stats.html and costs for probation/parole from www.prisonjustice.ca/downloads/behind_bars_leaflet.2011.pdf.

Analysis: Frequency tables (n and %) are provided for all categorical variables and outcomes of interest. In analyzing continuous variables, descriptive statistics including means, standard deviations, medians and quartiles were reported. Change over time in these variables was tested using the Generalized Estimating Equations (GEE) approach a flexible statistical approach for modeling correlated data such as repeated measures. Results of the analyses using GEE for continuous variables show the average rate of change in outcome for every additional follow-up period and, for categorical variables, the change in likelihood of outcomes. It allows more complete use of data by accommodating uneven number of repeated observations across individuals in a sample. The current analyses were conducted using SPSS v22.

RESULTS

Sample characteristics: The current sample consists of 148 clients who completed the baseline assessment at the two participating community assessment and treatment agencies in the recovery monitoring project. These clients were followed up quarterly for 6 months with 117 interviewed in at least one of the 3 or 6 month follow-ups. Descriptive analyses were performed on all available data in each of the three time periods. Rates of change over time were assessed based on the group of 117 who provided data in the follow-up period.

Table 1 shows the demographic and selected substance use characteristics of the sample of 148 participants. About 62% of the sample was male; about 75% were between 25 and 55 years of age and about 39% were married. Approximately 80% of the participants completed high school and about 42% had some employment. Almost all participants had a fixed address and the majority did not have any legal problems. Analyses reported in project reports (23,24,26) illustrated that, the study sample is reasonably representative of the demographics of clients at the participating sites and the overall Ontario substance use treatment system. There is a general trend, however, for the clients engaged in the project to be somewhat more stable. For example, compared to other clients in the participating agencies, those consenting were older and somewhat less likely to have legal problems. Compared to the overall treatment population in provincial community treatment services, project participants tended to: be married/partnered, have at least a high school degree, and present only with an alcohol use problem (i.e., less involvement of other drugs). Clients in our sample were also less likely to use substances on a daily basis.

Change in Substance Use: From baseline assessment there was a significant increase in the percentage of clients who reported total abstinence in the past 90 days, after taking into account days in controlled environment, such as a stay in hospital. At baseline, the percentage abstinent from any substance in the past 90 days was 9.4%; the sample at 3-months 25.8%, and at 6-months, 28.0%. In terms of the number and percentage of days abstinent from any substance during the 90 day reporting period (Table 2), a pattern of improvement was evident over both three and six months. Among participants, days with total abstinence on average increased by 11 days for every additional 3 months in the follow-up period ($B=11.04, \chi^2(1)=38.65, p<0.001$).

A similar pattern of improvement was observed for the percentage of days with alcohol use and being drunk or drinking 5+ drinks. The percentage of days with alcohol use was estimated to decrease by about 7% every additional 3-month follow-up period ($B=-7.40, \chi^2(1)=16.17,$

$p<0.001$). The percentage of days being drunk or drinking 5+ drinks was also estimated to be decreasing around 7% every follow-up period ($B=-7.40, \chi^2(1)=22.80, p<0.001$).

For other substance use indicators, however, there was an improvement at the three-month mark, and then levelling off at six months. This pattern was evident for the proportion of clients reporting marijuana use, and proportion reporting any other drug or cocaine use. It was estimated that on average, participants were 30% less likely to use marijuana ($\text{Exp}(B)=0.70, \chi^2(1)=12.24, p<0.001$) and 40% less likely to use other drugs ($\text{Exp}(B)=0.60, \chi^2(1)=16.66$) and cocaine ($\text{Exp}(B)=0.57, \chi^2(1)=16.66, p<0.001$) respectively every additional 3-month follow-up period. The percentage of days in the 90 day reporting period with some opiate use declined through the study period.

Change in Screener Scores of Various Life Domains:

Table 3 presents the distribution of the number of items endorsed in each of the screener sub-scales in the GAIN-Q3. In general, the distributions showed a decreasing trend in severity over time in all problem areas except work and school. Further analyses showed a significant decrease in the severity level in the screeners for additional follow-up periods for all problem areas except school, work and stress. It was estimated that with each additional follow up period, participants were about 60% less likely to increase their severity level on the substance abuse screener ($\text{Exp}(B)=0.43, \chi^2(1)=39.25, p<0.001$).

A Problem Prevalence Index is also routinely calculated with the GAIN-Q3, which reflects the prevalence of problems across sections in the instrument and measured as the average of the proportion of problem days in the past 90 days. Scores in this index take on values in the range of 0 and 100, with higher scores representing higher prevalence of problems. At baseline, participants had on average 22% of the past 90 days as problem days across various problem areas, and a significant decrease was observed over time to 16.1% at 3 months and then 13.1% at 6-months. Analyses showed that the prevalence of problems decreased by 4% among participants for every additional follow-up period ($B=-4.20, \chi^2(1)=75.89, p<0.001$).

A Quality of Life – past 90 Days Index (QOL) is also obtained from the individual screeners. The QOL scores represent the reverse of the total of the screener scores; thus, the higher the QOL Index, ranging from 0-100, the better the quality of life the person is experiencing. The mean QOL Index increased from 49.6 to 56.2 at 3 months to 61.7 at 6 months. On average, participants reported a 6-point increase in the QOL Index in each additional follow-up period ($B=6.06, \chi^2(1)=36.76, p<0.001$).

Environmental Risks to Recovery: The GAIN-Q3 measures risks to recovery faced by clients in their immediate environment. The sub-scales shown in Table 4 indicate how many people the client lives with, or interacts with

vocationally or socially, who are involved in illegal activities, arguing or fighting, using substances or treatment, or are in recovery. Higher scores indicate more time spent with more people in high risk situations. The Overall Scale score as well as Living and Social scale scores decreased significantly in the 6-month follow-up period.

Service Utilization and Costs: The GAIN-Q3 collects self-reported service use of clients for physical health (PH), mental health (MH) and substance use (SU) problems. Table 5 reports the proportion of participants using each type of service during each of the three reporting periods. The data show a significant increase in the proportion of participants using outpatient services for physical health and substance use problems in the 6-month follow-up period. Analyses showed that participants were 44% more likely to use outpatient services for physical health ($\text{Exp}(B)=1.44, \chi^2(1)=8.11, p<0.01$) and twice as likely to use outpatient services for substance use problems ($\text{Exp}(B)=2.26, \chi^2(1)=30.91, p<0.001$) every additional follow-up period. On the other hand, a decrease was observed over the 6 months in the proportion of participants using hospitals for physical or mental health reasons as well as a reduction in use of residential substance use treatment services.

Based on unit costs in the Ontario health care and justice systems, the results showed that the overall cost to society for health care utilization and time in jail/prison or on probation or parole in the previous 90 days was, on average, about \$2,940 per participant at baseline. This declined over the study period to about \$2,200 per participant.

Looking more closely at the use of hospital and emergency services, a decline in use and a large cost saving was observed among a sub-sample of 22 participants that we selected based on any reported use of emergency rooms or hospitals at baseline and who provided data for both follow-up periods. The total number of days of ER use across these 22 participants decreased from 51 days to 37 days in three months, and further decreased to 20 days in six months. The total costs associated with ER use for this group decreased from \$12,593 at baseline to \$4,939 at 6-months follow-up.

The total number of days of inpatient hospital use across these same 22 participants decreased from 160 days to 77 days in three months, and further decreased to 30 days in 6 months. The total costs associated with hospital use for this group decreased from \$82,080 at baseline to \$15,390 at the six-month follow-up. When both ER and other inpatient hospital use are combined, the per participant cost-to-society for this group dropped from \$5,510 per

participant at baseline to \$2,451 per participant at six months.

DISCUSSION

The focus of this paper was on describing a client-level outcome monitoring system developed and pilot tested in a small number of community-based addiction treatment services with a view towards potential scale-up and sustained infrastructure. The work described here fits into a long-term process of building capacity for evaluation and performance measurement within a large provincial addiction treatment system²⁸⁻³⁰.

Implementation evaluation suggested the outcome monitoring system was not ready for provincial scale-up, needing more work specifically on client tracking procedures to reach more marginalized clients and those with a more complex substance use profile. That being said, the follow-up protocol was able to achieve a follow-up rate of 69% at 6 months and 79% for either 3 or 6 month interviews for all study sites combined. These are respectable follow-up rates given the resource constraints, short-term funding and privacy concerns that impacted achievement of the targeted 90% follow up found with full implementation of the follow-up protocol^{12,23,24}.

Following a careful process of review and consultation, the GAIN-Q3 was chosen as the outcome measure for pilot testing and the results shown here highlight the veracity of this tool. In short, the tool “worked” in providing a sweeping picture of outcomes across several domains and the ease with which it yielded useful outcome indices and individual indicators. For example, from a clinical point of view, it is important to note the improvements that occurred in many life areas while achieving complete abstinence from alcohol and other drugs in about 30% of clients at 3 and 6 months. This is consistent with a broad harm reduction approach to service delivery and reasonable expectations regarding treatment outcome. It is also consistent with the now prevailing view that achieving complete abstinence, an important goal for many clients, may require multiple treatment attempts as in other chronic disease treatment and management paradigms. Our results also showed that this diversity of outcome indicators needs to be tracked for at least a 6-month follow up period to gain a sense of sustainability and no doubt longer if resources permit. In the present case, project funding was cut short unexpectedly and we had to truncate a planned one-year follow up.

From an attribution point of view such data are, of course, limited in terms of linking the changes observed to the specific assessment or treatment provided by the participating addiction agencies. Strong statements of causal attribution are usually beyond the scope of such recovery monitoring systems and for this reason they are considered complementary to randomized controlled trials and recommendations based on the results are more focused on program accountability and ongoing quality improvement. As this was a feasibility and pilot testing project, one must project the potential of results such as obtained here if the outcome monitoring program were to be implemented on a larger scale. With sufficient sample size and appropriate linkage to the specific treatment interventions received, it would be possible to use multivariate statistical methods to deal with many of the challenges of attribution. There would also be high value for benchmarking expected outcomes across different levels of care and implementing case-costing protocols with case-mix adjustment, as in other areas of health care. All these routine aspects of decision support are available in many other areas of health but sadly lacking in the addiction field.

In addition to the results of value to clinicians and program managers, the GAIN-Q3 MI and Standard yield estimates of health care and other service utilization on a routine basis with built-in cost data customized to the specific jurisdiction. We showed a significant decline in service utilization and cost, results consistent with extant research on the cost-offset of addictions treatment³¹. We note, however, that consistent with other studies of the cost-offset of substance use treatment, neither the cost of the treatment intervention or the implementation of the outcome monitoring protocol are included in the calculation of the cost offset. A more detailed tracking of resource utilization was beyond the scope of this feasibility assessment. This potential limitation notwithstanding we highlight the capacity of a scaled-up outcome monitoring system to show these results routinely for health planning districts; results that are clearly of value in making the business case for increased investment in substance use treatment in a given jurisdiction.

The outcome monitoring protocol was implemented and evaluated in concert with the implementation of the

new screening and assessment protocol which was used for baseline assessment. Therefore, participating clients consented to complete the standard assessment package AND the new assessment package AND agree to be followed up for outcome determination. This resulted in unique challenges in study recruitment in three of the five study sites (e.g., a high percentage of mandated clients; assessments of high risk youth in school settings conducted over multiple sessions; access to service in a remote area) and we elected to omit three programs in the present study in large part because the outcome component itself never got a fair chance to be implemented and their program context was unique. We suggest additional work on outcome monitoring for mandated clients, high risk youth in school settings and community withdrawal management services in rural/remote areas.

In the context of our "real world" implementation of an outcome monitoring protocol it should also be noted that the substance-related and other outcomes were exclusively based on self-report, without verification. Further, although the study attrition is not unusual for this population, retention bias should also be acknowledged (i.e., patients who could be contacted and who agreed to continue with the project probably represent a subsample with the most favorable outcome). An intent-to-treat analysis, carrying forward the last observation would be a more conservative analytic approach.

Overall, this provincial pilot test of an outcome monitoring system for addiction services was a successful step in a longer term process of enhancing capacity for performance measurement and evaluation for the Ontario treatment system. We encourage Canada's provincial and territorial governments, and their respective regional health authorities to continue to build upon our work. Individual addiction service providers can also adopt and adapt the practices employed here and continue to shine the light on the importance of client-level outcome monitoring for addiction services (see Costello et al., in this issue³²). More work is also needed to monitor outcomes of services people with substance use challenges receive outside the specialized addiction sector, work that can be achieved through appropriate data linkage and administrative data sets as well as prospective system-level monitoring studies^{33,34}.

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TABLE 1: DEMOGRAPHIC AND SUBSTANCE USE CHARACTERISTICS OF CLIENTS (N = 148)

	n	%
Gender		
Female	55	37.2
Male	93	62.8
Age		
<= 24 years	14	9.5
25 - 34 years	45	30.4
35 - 44 years	36	24.3
45 - 54 years	33	22.3
55 + years	20	13.5
Relationship status		
Married/partnered/common law	56	38.6
Single (never married)	60	41.4
Separated or divorced	29	20.0
Employment status		
Employed full time	47	31.8
Employed part time	15	10.1
Unemployed	43	29.1
Other	43	29.1
Education		
< High School	34	23.0
Completed secondary or High School	46	31.1
Some post-secondary	25	16.9
Completed College or University	43	29.1
Legal status		
No problem	101	68.2
Awaiting trial or Sentencing	25	16.9
Probation	19	12.8
Fixed address (postal code)		
No fixed address	5	3.4
Unknown	2	1.4
Fixed address	141	95.3
Presenting Problem Substance		
Alcohol only	71	49.0
Other substance(s) only + no alcohol	41	28.3
Alcohol and other substance(s)	33	22.7
Frequency of Substance Use		
1-3 times monthly	7	6.0
1-2 times weekly	19	16.2
3-6 times weekly	27	23.0
Daily	49	41.9

TABLE 2. SUMMARY OF SUBSTANCE USE IN PAST 90 DAYS BY BASELINE AND FOLLOW-UP PERIODS

Indicators of Alcohol or Other Drug Use	Baseline Mean (std) [25th, 50th, 75th] (n=148)	3-Months Mean (std) [25th, 50th, 75th] (n=99)	6-Months Mean (std) [25th, 50th, 75th] (n=89)	B [95% C.I.]	Statistical Significance
Days with total abstinence ^c	38.0 (30.3) [7.0, 35.0, 66.0]	48.8 (35.1) [10.0, 51.0, 87.0]	59.2 (31.0) [30.75, 69.5, 90.0]	11.04 [7.56, 14.52]	$\chi^2(1) = 38.65^{***}$
Days with any substance use	48.4 (31.7) [17.5, 50.0, 80.0]	38.3 (35.1) [0.0, 30.0, 78.0]	29.4 (30.7) [0.0, 20.0, 56.0]	-9.82 [-13.29, -6.35]	$\chi^2(1) = 30.77^{***}$
% of days with total abstinence ^c	44.8 (35.8) [8.3, 41.7, 79.0]	55.7 (39.8) [11.1, 58.9, 100.0]	66.8 (34.7) [37.8, 77.8, 100.0]	11.50 [7.60, 15.40]	$\chi^2(1) = 33.38^{***}$
Alcohol use					
Days with alcohol use	30.1 (29.7) [2.0, 20.0, 50.0]	23.6 (30.4) [0.0, 5.5, 45.0]	20.6 (26.7) [0.0, 5.0, 41.25]	-6.42 [-9.56, -3.27]	$\chi^2(1) = 15.97^{***}$
% of days with alcohol use ^c	34.9 (33.7) [4.2, 22.9, 58.9]	28.6 (37.5) [0.0, 6.7, 50.0]	23.4 (30.4) [0.0, 5.6, 50.0]	-7.40 [-11.10, -3.80]	$\chi^2(1) = 16.17^{***}$
Days being drunk or 5+ drinks	21.1 (25.9) [1.0, 10.0, 30.0]	12.5 (20.4) [0.0, 3.0, 17.5]	10.1 (19.0) [0.0, 0.0, 10.0]	-6.46 [-9.06, -3.86]	$\chi^2(1) = 23.80^{***}$

% of days being drunk or 5+ drinks ^a	24.5 (29.5) [1.1, 11.1, 37.4]	14.8 (24.3) [0.0, 3.3, 22.2]	11.7 (22.4) [0.0, 0.0, 11.1]	-7.40 [-10.50, -4.40]	$X^2(1) = 22.80$ ***
Drug use	Baseline % (n)	3-Months % (n)	6-Months % (n)	Exp(B) [95% C.I.]	Statistical Significance
% reported use of marijuana	44.0 (62)	30.9 (29)	28.0 (23)	0.70 [0.57, 0.85]	$X^2(1) = 12.24$ ***
% reported use of any other drug (not alcohol or marijuana)	39.0 (55)	22.6 (21)	19.5 (16)	0.60 [0.47, 0.77]	$X^2(1) = 16.66$ ***
% reported use of cocaine or crack	25.0 (34)	8.6 (8)	9.8 (8)	0.57 [0.42, 0.77]	$X^2(1) = 13.44$ ***
% reported use of heroin / methadone/ opioid	19.9 (27)	11.8 (11)	7.3 (6)	0.56 [0.39, 0.80]	$X^2(1) = 10.15$ **

^aTaking into account days in controlled environment. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 3. SCREENER SCORES IN PROBLEM AREAS BY BASELINE AND FOLLOW-UP PERIODS

Screener Sub-Scales	Baseline (n=148)		3-Month (n=99)		6-Month (n=89)		Exp(B) ^a [95% C.I.]	Statistical Significance
	n	%	n	%	n	%		
Substance Use								
0 events ²	14	9.8	28	29.8	31	37.8	0.43 [0.33, 0.56]	$X^2(1) = 39.25$ ***
1-2 events	27	18.9	25	26.6	23	28.0		
>2 events	102	71.3	41	43.6	28	34.1		
Mental Health Internalizing								
0 events	14	9.7	7	7.2	13	15.7	0.70 [0.56, 0.88]	$X^2(1) = 9.73$ **
1-2 events	23	16.0	30	30.9	23	27.7		
>2 events	107	74.3	60	61.9	47	56.6		
Mental Health Externalizing								
0 events	27	18.8	34	35.1	27	32.9	0.66 [0.54, 0.81]	$X^2(1) = 16.68$ ***
1-2 events	52	36.1	30	30.9	34	41.5		
>2 events	65	45.1	33	34.0	21	25.6		
Risk Behaviour								
0 events	43	30.1	33	34.0	32	38.1	0.77 [0.64, 0.93]	$X^2(1) = 7.24$ **
1-2 events	59	41.3	47	48.5	40	47.6		
>2 events	41	28.7	17	17.5	12	14.3		
Crime and Violence								
0 events	72	52.2	74	78.7	72	87.1	0.36 [0.25, 0.50] ³	$X^2(1) = 31.42$ ***
1-2 events	60	43.5	20	21.3	10	12.2		
>2 events	6	4.3	0	0.0	0	0.0		
Physical Health								
0 events	25	17.1	18	18.6	19	22.4	0.81 [0.66, 0.99]	$X^2(1) = 4.32$ *
1-2 events	58	39.7	39	40.2	38	44.7		
>2 events	63	43.2	40	41.2	28	32.9		
Work								
0 events	107	72.8	72	74.2	60	70.6	1.01 [0.80, 1.29]	$X^2(1) = 0.01$
1-2 events	24	16.3	15	15.5	18	21.2		
>2 events	16	10.9	10	10.3	7	8.2		
School								
0 events	142	96.6	86	90.5	77	91.7	1.57 [1.01, 2.45] ³	$X^2(1) = 4.00$
1-2 events	4	2.7	7	7.4	6	7.1		
>2 events	1	0.7	2	2.1	1	1.2		
Stress								
0 events	29	19.9	14	14.4	14	16.7	0.81 [0.66, 1.00]	$X^2(1) = 3.78$
1-2 events	47	32.2	36	37.1	46	54.8		
>2 events	70	47.9	47	48.5	24	28.6		

¹ Reference category: 0 events ²“Events” represent the frequency in which a problem/symptom was endorsed within a screener subscale. ³Statistical test was performed on combined categories 0 events vs >0 events due to low cell counts in the original categories. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 4. ENVIRONMENTAL RISKS SCALE SCORES BY BASELINE AND FOLLOW-UP PERIODS

Environment Risk Scale	Baseline Mean (std) [25 th , 50 th , 75 th] (n=117)	3-Months Mean (std) [25 th , 50 th , 75 th] (n=99)	6-Months Mean (std) [25 th , 50 th , 75 th] (n=89)	B [95% C.I.]	Statistical Significance
Overall (out of 84)	36.3 (11.0) [27.5, 35.0, 43.5]	33.6 (8.7) [28.0, 32.0, 37.0]	32.1 (7.7) [26.75, 32.0, 36.0]	-2.01 [-2.95, -1.06]	$X^2(1) = 17.27^{***}$
Living (out of 28)	12.2 (4.4) [9.0, 12.0, 15.0]	11.3 (3.4) [8.0, 11.0, 12.0]	10.9 (3.1) [8.0, 10.0, 12.0]	-0.64 [-1.06, -0.21]	$X^2(1) = 8.48^{**}$
Vocational (out of 28)	10.9 (3.8) [8.0, 10.0, 12.0]	11.1 (3.8) [8.0, 11.5, 12.25]	9.6 (3.1) [8.0, 9.0, 11.0]	-0.60 [-1.21, 0.00]	$X^2(1) = 3.80$
Social (out of 28)	12.6 (3.8) [9.0, 12.0, 16.0]	11.0 (2.5) [9.0, 11.0, 12.0]	10.8 (2.6) [8.25, 11.0, 12.0]	-0.95 [-1.35, -0.56]	$X^2(1) = 22.36^{***}$

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 5. PERCENTAGE OF RESPONDENTS USING VARIOUS SERVICES BY BASELINE AND FOLLOW-UP

Services	Baseline (n=148)		3-Months (n=99)		6-Months (n=89)		Exp(B) [95% C.I.]	Statistical Significance
	n	%	n	%	n	%		
PH - ER	41	28.1	20	20.6	16	18.6	0.75 [0.54, 1.05]	$X^2(1) = 2.87$
PH - Hospital	18	12.3	5	5.2	4	4.7	NA ¹	NA ²
PH - Outpatient	63	43.2	57	58.8	52	50.5	1.44 [1.12, 1.85]	$X^2(1) = 8.11^{**}$
MH - ER	17	11.8	6	6.3	5	6.1	NA ¹	NA ²
MH - Hospital	16	11.1	5	5.3	5	6.1	NA ¹	NA ²
MH - Outpatient	40	27.8	30	31.6	27	32.9	1.06 [0.83, 1.35]	$X^2(1) = 0.20$
SU - Residential	14	9.9	5	5.3	6	7.3	NA ¹	NA ²
SU - Outpatient	43	30.1	57	60.6	55	67.1	2.26 [1.70, 3.01]	$X^2(1) = 30.91^{***}$
SU - Detox	10	7.0	5	5.3	4	4.9	NA ¹	NA ²
SU - ER	21	14.7	7	7.4	3	3.7	NA ¹	NA ²
ER (PH, MH & SU)	51	34.9	23	23.7	19	22.1	0.70 [0.53, 0.94]	$X^2(1) = 5.52^*$
Hospital (PH, MH)	24	16.4	6	6.2	7	8.1	0.54 [0.36, 0.83]	$X^2(1) = 8.13^{**}$
CV - Probation / Parole	21	14.4	13	13.8	8	9.8	0.88 [0.65, 1.19]	$X^2(1) = 0.69$
CV - Jail/Prison	17	12.4	5	5.3	2	2.4	NA ¹	NA ²

Acronyms: PH= Physical Health, ER= Emergency Room, MH= Mental Health, SU= Substance Use; CV= Crime and Violence

1. Statistical tests were not performed due to low cell counts.

2. Statistical tests were not performed due to low cell counts, but were performed for combined days of ER and hospital use.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$