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**Predicting abstinence from methamphetamine use after residential rehabilitation:
findings from the Methamphetamine Treatment Evaluation Study (MATES)**

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Abstract

Introduction and Aims: We previously found that residential rehabilitation increased continuous abstinence from methamphetamine use one year after treatment. We examine what client and treatment characteristics predict this outcome.

Design and Methods:

Participants ($n = 176$) were dependent on methamphetamine and entering residential rehabilitation for methamphetamine use. Simultaneous logistic regression was used to identify independent predictors of continuous abstinence from methamphetamine use at one year follow-up. Measures included demographics, drug use, psychiatric comorbidity (DSM-IV major depression, social phobia, panic disorder, schizophrenia, mania, and conduct disorder), symptoms of psychosis and hostility, readiness to change, motivations for treatment, and treatment characteristics (duration, rapport, group and individual counselling).

Results: Participants stayed in treatment for a median of 8 weeks; 23% remained abstinent at one year. The only independent predictors of abstinence were more weeks in treatment (adjusted OR (AOR) 1.2, $p < .001$), better rapport with treatment providers (AOR 2.4, $p = .049$) and receipt of individual counselling (AOR 3.7, $p = .013$), whereas injecting methamphetamine predicted not achieving abstinence (AOR = 0.25, $p = .002$). Individual counselling and good rapport increased abstinence to 45%; for injectors, longer stays in treatment (13+ weeks) were additionally needed to produce similar abstinence rates (43%).

Discussions and Conclusions: Abstinence from methamphetamine use following residential rehabilitation could be significantly increased by providing individual counselling, maintaining good rapport with clients and ensuring longer stays for people who inject the drug.

Introduction

Providing effective treatment for methamphetamine dependence is a growing need. Globally, between 13.9 million and 53.4 million people are estimated to use amphetamines [1] of whom an estimated 17.2 million are dependent [2]. Residential rehabilitation is one of the primary modalities of treatment offered to people seeking treatment for methamphetamine use in a community setting [3]. These services are typically abstinence-based, long-stay, residential programs, and include therapeutic communities, but may also include a variety of other treatment models.

Residential rehabilitation services have been evaluated for the treatment of alcohol and opioid dependence [4-7], but their effectiveness for treating methamphetamine dependence has received relatively less attention [8]. Better treatment outcomes for methamphetamine use, and other drug use more generally, are predicted by longer retention in treatment (e.g. > 90 days) [9, 10], greater treatment satisfaction [11], therapeutic alliance [12], and motivation (e.g. readiness to change [13], abstinence goal at intake [14]), whereas more severe substance use on entry to treatment [10, 15] and chronic mental health disorders [11, 16-19] predict worse outcomes. Various client characteristics also predict treatment outcomes [9, 15]. It remains unclear whether these, or other predictors of treatment outcome, are mediated by longer retention in treatment [15].

Using data from the Methamphetamine Treatment Evaluation Study (MATES), we previously evaluated the outcomes for people entering residential rehabilitation for methamphetamine use against a matched quasi-control group [8]. Large reductions in methamphetamine use were seen at three months post-treatment, but benefits were substantially reduced at one year. Compared to the quasi-control group, the most significant

improvement in methamphetamine use at one year was seen for continuous abstinence, which was achieved by around one in five treatment attendees [8].

In this study, we use data from the MATES cohort to examine for whom these positive outcomes were most likely, and what treatment characteristics increased the probability of abstinence one year after residential rehabilitation. MATES includes comprehensive data on psychiatric comorbidity, health and criminal involvement prior to treatment entry, as well as several measures of treatment exposure, allowing a broad array of factors to be examined as predictors of treatment outcome. From this we examined factors previously found to be associated with better substance use outcomes, focussing on client characteristics (including comorbidity) and characteristics of the treatment episode.

METHOD

Participants and procedure

Participants for this study (N = 176) were selected from the 248 participants who entered one of 21 residential rehabilitation facilities in Sydney and Brisbane, Australia, that participated in MATES. Participants were followed up at three months and one year after treatment entry (see McKetin et al. [8] for details). Residential rehabilitation was as defined in the Australian National Minimum Dataset on Alcohol and Other Drug Treatment Services: an intensive treatment program that integrates a range of services and therapeutic activities (e.g. counselling, behavioural treatment approaches, recreational activities, social and community living skills, group work and relapse prevention) which can provide a high level of support (i.e. up to 24 hours a day) and tends toward a medium to longer-term duration [20].

From this sub-sample of the MATES cohort, participants were excluded if they did not meet DSM-IV criteria of methamphetamine dependence on entry to treatment according to the Composite International Diagnostic Interview (CIDI) [21] ($n = 6$) or were not followed up at both three months and one year ($n = 66$). Loss to follow-up was associated with being male, being born outside of Australia, criminal justice involvement, lower education and income, and both lower levels of depression and psychological distress ($p < 0.05$). Other inclusion criteria for MATES were being at least 16 years old, comprehension of English, being willing to participate in follow-up interviews, and not having been in methamphetamine treatment, other inpatient drug treatment, or in prison, in the month prior to entering the study. These latter exclusion criteria were necessary in MATES to obtain a naturalistic baseline measure of drug use. Ineligibility was mainly due to drug treatment or incarceration in the month prior to recruitment, while 10% declined participation[8]. In most respects, the cohort was typical of methamphetamine treatment entrants more broadly [22].

All participants provided informed consent prior to participation and were reimbursed up to AU\$40 per interview. Ethics approval was provided by the University of New South Wales and ratified by all participating institutions.

Measures

Continuous abstinence

Continuous abstinence was defined as no methamphetamine use between the baseline and one year follow-up interview. This was assessed by asking participants how often they typically used methamphetamine since their previous interview (no use, less than weekly use, weekly use, twice weekly, three to four days weekly, five or more days per week). Eleven participants had re-entered treatment during the follow-up period despite being continuously abstinent.

Data from these participants was censored from the analysis because abstinence could not be attributed solely to their baseline episode of residential rehabilitation. Self-reported past month abstinence from methamphetamine was confirmed in 94% of cases in a sub-sample (n = 83) of the MATES cohort [8].

Characteristics of the treatment episode

Treatment characteristics included duration (completed weeks from intake to leaving treatment), self-reported completion of the treatment episode, number of group and individual counselling sessions (by drug use vs. other topics), participant's self-report of whether their treatment included a follow-up program and whether they completed this, the main drug for which they received help, and whether they received any medication during their treatment (antidepressants, antipsychotics, benzodiazepines, barbiturates, other). Rapport with the treatment staff was assessed using a five-item scale developed by Joe et al. [23] that included items measuring (1) staff support of patient goals, (2) staff sincerity, (3) ability to work together with the staff, (4) satisfaction with treatment, and (5) whether treatment matched expectations [23]. Each item was scored 1 to 4 (strongly disagree, disagree, agree, and strongly agree) yielding scores from 5 to 20 where higher scores reflect greater rapport.

Other variables

Other variables included demographics (age, sex, country of birth, net income in the past fortnight, living arrangement, accommodation, marital status, number of children, education, prison history), past treatment attempts and the Readiness to Change Questionnaire [24], which was used to categorise participants as being in the action, contemplation or pre-contemplation stages of change. Participants were also asked whether they were required to attend treatment for any legal reason, whether maintaining or regaining custody of children

was one of the reasons for their entering treatment, and their goal for their current treatment episode (complete abstinence, a break from use, a reduction in use, no change in use).

Other substance use measures included days of use for the past four weeks for all drug types, assessed using the Opiate Treatment Index [25]; methamphetamine Severity of Dependence Scale (SDS) score [26]; main route of methamphetamine administration (injecting, smoking, snorting or swallowing) for the month prior to treatment; and, age of first methamphetamine use. Polydrug use was a count of the number of other drug classes (heroin, other opioids, cocaine, ecstasy, hallucinogens, cannabis, alcohol, inhalants and tobacco) used in the past month.

Psychological distress in the month before treatment was assessed using the Kessler 10 [27]. The Brief Psychiatric Rating Scale (BPRS) [28] was used to assess hostility (score 4+ on the hostility item) and psychotic symptoms (score 4+ on the items of suspiciousness, unusual thought content or hallucinations) in the month before treatment. A DSM-IV diagnosis of conduct disorder was made using a modified version of the Diagnostic Interview Schedule [29, 30]. All other DSM-IV diagnoses were made using the CIDI [21]. Crime in the month prior to treatment was assessed using the OTI Crime Scale (dealing drugs, fraud, property crime and violent crime) [31].

Design and statistical analysis

Analysis were completed using Stata SE Version 14.1 [32]. All tests were two-sided. Significance was set at $p < 0.05$.

Comparisons of participants who were continuously abstinent at 12 months with those who were not were made using Chi-Square tests for categorical outcome variables, t-tests for normally distributed continuous measures and Kruskal Wallis tests for non-normally distributed continuous variables. To identify the most parsimonious set of predictors of abstinence at one year, variables that significantly predicted continuous abstinence at one year in bi-variate comparisons were included a backward elimination logistic regression model [33].

To examine whether the relationship between particular predictors of abstinence were mediated by treatment duration, we applied the principles proposed by Baron and Kenny [34]. For mediation to occur the following conditions must exist: (1) a significant relationship between the predictor and treatment duration; (2) a significant relationship between treatment duration and continuous abstinence; and (3) a significant relationship between the predictor and continuous abstinence. In addition, the relationship between the predictor variable and continuous abstinence needed to be reduced (or eliminated) by adjusting for treatment duration. The extent to which the relationship was mediated by treatment duration was assessed using the ‘explained fraction’ approach, as described by Whitehead et al. [35]. If OR_a represents the odds ratio (OR) for the unadjusted relationship between rapport and continuous abstinence, and OR_b represents the relationship between rapport and continuous abstinence after adjusting for psychotic symptoms, the explained fraction is $[(OR_a - 1) - (OR_b - 1)] / (OR_a - 1)$.

RESULTS

Participant characteristics

Participants had a median age of 30 years (inter-quartile range (IQR) 25-35 years) and were typically male (74%), unemployed (88%) and single (73%). One-quarter had not completed high school, 41% had a trade or technical qualification and only 6% had completed a university

degree. Nineteen per cent had no fixed address or were living in temporary accommodation and 32% had a prison history. Comorbid mental health disorders, symptoms of psychosis and hostility, and criminal involvement were common (Table 1).

All participants met DSM-IV criteria for past year methamphetamine dependence, they had used methamphetamine for a median of 11 years (IQR 7-16 years) and most (84%) had injected the drug. The median days of methamphetamine use in the month prior to entering treatment was 16 (IQR 8-23 days), with 5% of participants not having used during this time. Other drug use in the past month consisted largely of tobacco (94%, 90% daily), cannabis (81%, 37% daily) and alcohol (76%, 19% daily), with a minority using ecstasy (27%, 1% daily), cocaine (25%, 0% daily) or heroin (19%, 4% daily).

Most participants sought complete abstinence from methamphetamine use (91%) and the majority of participants were in the action stage (69%) according to the Readiness to Change Questionnaire.

Characteristics of the treatment episode

Admission to treatment was usually voluntary (85%) and methamphetamine was the main drug for which most participants received help (84%). Ninety percent received group counselling (mean (SD) of 7.4 (7.2) sessions/week) and 64% received individual counselling (mean (SD) of 0.8 (0.9) sessions/week). Thirty nine per cent of participants were given medication during treatment (22% antidepressants, 13% antipsychotics, and 11% benzodiazepines).

At the three month follow-up, participants had remained in treatment for a median of 59 days (inter-quartile range 29-98 days). The majority (78%) had left their initial treatment episode by this time. Of those who had left treatment, one third had completed the treatment program. The remainder (n = 91) had either transferred to another service (n = 10, 11%), had been removed from treatment involuntarily (n = 26, 29%), left either against advice or without notice (n = 27, 30%) or cited other reasons for leaving treatment (n = 26, 29%): these mostly including that the program did not suit their needs (n = 7), family/relationship issues (n = 7), or to fulfil other commitments (e.g. work, accommodation, legal or financial obligations, n = 6).

Of those participants who had left treatment by their three month follow-up, 9% (n = 12) reported that their treatment did include an outpatient follow-up program, although only one participant had engaged in such a program.

Predictors of continuous abstinence

Predictors of continuous abstinence were longer duration treatment, better rapport with the treatment providers, receiving individual counselling sessions (for both drug use and other issues) and low income, whereas injecting methamphetamine was related to a lower probability of abstinence (Table 1). These significant predictors of continuous abstinence were included in a backward elimination model as main effects. Four variables were retained in the final model: more weeks of treatment (adjusted OR 1.2, 95% CI 1.1 – 1.3, $p < 0.001$), high rapport with the services providers (adjusted OR 2.4, 95% CI 1.0 – 5.6 $p = .049$) and individual counselling sessions (score ≥ 17 , adjusted OR 3.7, 95% CI 1.3 – 10.5 $p = .013$) all increased the odds of abstinence, whereas injecting methamphetamine was associated with lower odds of abstinence (adjusted OR 0.25, 95% CI 0.1 – 0.6, $p = .002$). Income was no

longer a significant predictor of abstinence and was therefore not included in the final model. The number of individual counselling sessions per week was positively correlated with abstinence ($r_s = 0.21$, $p = 0.006$), but this was not included in the regression model because too few participants received more than one individual counselling session per week.

We additionally examined whether there was any interaction between the four variables in the main model. There was a significant interaction between individual counselling and rapport, indicating that the effect of rapport was contingent on individual counselling being provided ($\chi^2_{df=1} = 3.97$, $p = 0.046$). Abstinence increased from 10% for no individual counselling to 18% with individual counselling but low rapport to 45% with both individual counselling and high rapport (Figure 1).

Although methamphetamine injectors had lower probability of abstinence overall, they still showed greater probability of abstinence with longer duration treatment and individual counselling (43% for 13+ weeks with individual counselling, Figure 2).

Mediation analysis

Neither the relationship between methamphetamine injection and abstinence, nor the relationship between individual counselling and abstinence, were mediated by longer treatment duration. Although methamphetamine injection was associated with a lower probability of continuous abstinence (Table 1), it was not significantly related to duration of treatment (8 vs. 9 weeks $\chi^2_{df=1} = 0.01$, $p = .912$), nor was participation in individual counselling (6 vs. 9 weeks, $\chi^2_{df=1} = 0.60$, $p = .438$). However, the effects of rapport on continuous abstinence were partially mediated by better retention in treatment. Not only was rapport associated with greater odds of continuous abstinence, it was also associated with

longer stays in treatment (12 vs. 6 weeks, $\chi^2_{df=1} = 8.75$, $p = .003$). Adjusting for treatment duration reduced the association between treatment rapport and continuous abstinence, although a significant relationship remained (unadjusted OR = 2.9, 95% CI 1.4 – 6.2, $p < 0.005$; adjusted OR = 2.3, 95% CI 1.1 – 5.1, $p = 0.037$). Using the explained fraction approach [35], treatment duration accounted for 32% of the relationship between treatment rapport and continuous abstinence $\{[(2.9 - 1) - (2.3 - 1)] / (2.9 - 1) = 0.32 \equiv 32\%\}$.

DISCUSSION

Our study adds to a small number of studies examining correlates of treatment outcomes for methamphetamine use, which have been conducted exclusively in the USA [9, 15, 17, 18], and it is the only study to prospectively examine methamphetamine outcomes for residential rehabilitation. Although our results are generally consistent with previous treatment outcomes studies for methamphetamine and other substance use, we failed to detect a relationship between many of the client characteristics previously associated with methamphetamine treatment outcomes (e.g., education, gender, Asian ethnicity, longer methamphetamine using career, past treatment attempts, methamphetamine-related psychosis and violence, parental substance use, selling drugs, psychiatric comorbidity[9, 15, 17, 18]), suggesting that these variables may be correlates of other more critical predictors of treatment outcomes, including the treatment process itself.

The most striking finding from this study was that individual counselling was associated with a three to four fold increase in the odds of continuous abstinence at one year after a single episode of residential rehabilitation, even after adjusting for other predictors of abstinence (i.e., duration of treatment, rapport and not injecting methamphetamine). This is an

important finding because most participants sought abstinence from methamphetamine, but overall this was only achieved by a minority (23%).

A corollary of this finding is even though methamphetamine injectors had a low probability of abstinence overall, this increased substantially (to 43%) if they received individual counselling and stayed in treatment more than 12 weeks. Injectors comprise the majority of people entering residential rehabilitation for methamphetamine use in Australia, and arguably account for the overall high relapse rates seen post rehabilitation [8]. Our results indicate that better outcomes could be achieved for this treatment-resistant group if individual counselling was provided within residential rehabilitation, and if participants could be engaged in treatment for a lengthy period of time.

Treatment retention could potentially be improved by addressing some of the structural and cultural barriers to participation in residential rehabilitation programs. A substantial proportion of participants who left treatment early were removed from treatment involuntarily, left against advice, or left for personal reasons (e.g. obligations outside of treatment, missed their family, did not like the service), suggesting a poor fit between the treatment model and the client's characteristics and needs. Providing more flexible models of care would be one way to improve treatment retention [36]. This could involve out-patient support and follow-up care (which was rarely on offer for participants in this study) for clients who leave rehabilitation early, or who cannot stay in residential care for long periods of time due to personal commitments. Individual counselling offered through rehabilitation could be continued via day rehabilitation or by phone. Reducing the wait-time for entering treatment can also improve retention in treatment, as can involving family and partners in the treatment process [36]. Both are important considerations in the Australian context, with

reportedly long waiting lists for residential rehabilitation [37], and participants in this study citing lack of family contact as a reason for leaving treatment.

Poor treatment retention in residential rehabilitation can also result from a failure to identify with the therapeutic model [38], and this was found to be the case for a number of participants in this study. Clarity around the treatment model, goals and expectations prior to entering treatment may allow clients to self-select into services that best meet their needs. Other modalities of care (e.g. outpatient counselling, online or phone counselling) should be promoted for people for whom residential rehabilitation may not be appealing for cultural or practical reasons.

Consistent with previous research [39], better rapport with individual counsellors was associated with better treatment outcomes. Methods to optimise rapport include developing clinician skills, modifying the treatment model to facilitate rapport (e.g. client-centred approaches to decision making and goal setting, providing adequate clinician training and resourcing), and seeking client feedback. Negative stereotypes of people who use methamphetamine in Australia [40], and the lack of confidence that some clinicians feel in dealing with the complexity of methamphetamine-related presentations [41], may also undermine rapport with methamphetamine-using clients.

We found that counselling for non-drug related matters was just as strongly related to abstinence as counselling around drug use. This may reflect the high rate of comorbidity in the sample and multiple social needs (e.g. high rates of unemployment, unstable housing, and child custody issues), and may suggest that counselling to address these issues improves treatment outcomes for methamphetamine use. Interestingly, comorbid psychiatric disorders

did not reduce the probability of abstinence. This could be due to the remission of these disorders with drug treatment [42], although it could also reflect a ceiling effect from the high rates of comorbidity in our sample [43, 44].

Limitations

Our findings reflect average effects obtained from a disparate collection of residential rehabilitation services who participated in MATES. There was undoubtedly significant heterogeneity in the nature of these treatment services, and further research would be necessary to understand how other aspects of treatment (e.g. therapeutic model, type of counselling offered) influence treatment outcomes. Post-treatment events, not measured in this study, could also facilitate relapse (e.g. exposure to drug cues [45] and stress [46], staying connected with drug-using peers [47]), while other factors may be protective (e.g. family support [48], participation in mutual support groups [9, 49]). We were also reliant on participant's self-report about the nature of treatment provided (e.g. duration, completion, counselling received, reasons for leaving treatment).

A limitation of our approach was that we only considered participants who were followed-up at one year after treatment. Participants who were not followed-up had characteristics that may forebode worse treatment outcomes (incarceration, lower education, comorbid mental disorders, prison history [8]). Therefore our findings are biased toward participants who are more likely to have more positive treatment outcomes. Although we relied on self-reported methamphetamine use, this is reliable when confidentiality is assured [50] as it was in our study, and it was also confirmed against hair toxicology [8].

Conclusion

Our results suggest that individual counselling within residential rehabilitation, for both substance use and other issues, substantially enhances the probability of abstinence from methamphetamine use, particularly when the client has good rapport with the treatment provider. This coupled with long-stays in residential rehabilitation can produce promising outcomes even for people who inject the drug, who otherwise have low probability of achieving continuous abstinence.

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Table 1. Participants characteristics by continuous abstinence from methamphetamine use at one year after residential rehabilitation

	Continuous abstinence		P value	Total (N = 165)
	No (n = 127)	Yes (n = 38)		
Demographics				
Age (median)	30	30	.978	30
Male (%)	77	66	.158	74
Unemployed (%)	91	79	.055	88
Born outside of Australia (%)	11	18	.230	13
Did not complete high school (%)	28	21	.423	25
Tertiary qualifications (%)	47	63	.085	51
Unstable accommodation (%)	22	8	.050	19
Prison history (%)	34	26	.382	32
Single (%)	72	74	.880	72
Had children (%)	50	50	.966	51
Income (median)	450	363	.001	465
Methamphetamine use history				
Age first use (median)	17	18	.240	17
Years of use (median)	12	8	.243	11
Past treatment attempt (%)	48	39	.353	46
No. past treatment attempts (median)	1	1	.521	1
Methamphetamine use in the month before treatment				
Days of use (median)	16	14	.588	16
Severity of dependence (median)	10	9	.669	10
Injecting (%)	75	45	.000	68
Polydrug use ^a in the month before treatment (median)	4	4	.801	4
Psychiatric comorbidity				
Major depression ^b (%)	41	50	.323	44
Social Phobia ^b (%)	21	29	.323	24
Panic Disorder ^b (%)	28	42	.109	31
Schizophrenia or mania ^c (%)	16	18	.696	17
Conduct disorder ^c (%)	83	74	.176	81
Psychiatric symptoms in the month before treatment				
Psychotic symptoms (%)	56	55	.944	57
Hostility (%)	74	71	.717	72
Psychological distress (median K10 score)	33	35	.121	34
Criminal involvement				
Dealing drugs (%)	46	45	.852	45
Other crime (%)	55	53	.787	53
Readiness to change (action stage) (%)	67	79	.157	69
Motives for treatment				
Seeking complete abstinence (%)	89	97	.114	91
Legal reason for treatment (%)	17	11	.365	16

Attending to keep/regain custody of children (%)	19	29	.184	22
Characteristics of treatment episode				
Methamphetamine main drug treated (%)	83	84	0.913	84
Duration of treatment (weeks)	6	13	< .001	8
Participated individual counselling (%)	56	84	.002	64
Drug-focussed	40	61	.027	47
Other issues	31	61	.001	38
Participated in group counselling (%)	89	97	.141	90
Drug-focussed	75	89	.063	77
Other issues	61	83	.013	66
Given medication as part of treatment (%)	39	37	.779	39
Treatment rapport (median)	15	17	.008	16

^a Number of other drug classes used in the past month (heroin, other opioids, cocaine, ecstasy, hallucinogens, cannabis, alcohol, inhalants and tobacco) ^bPast year, ^cLifetime

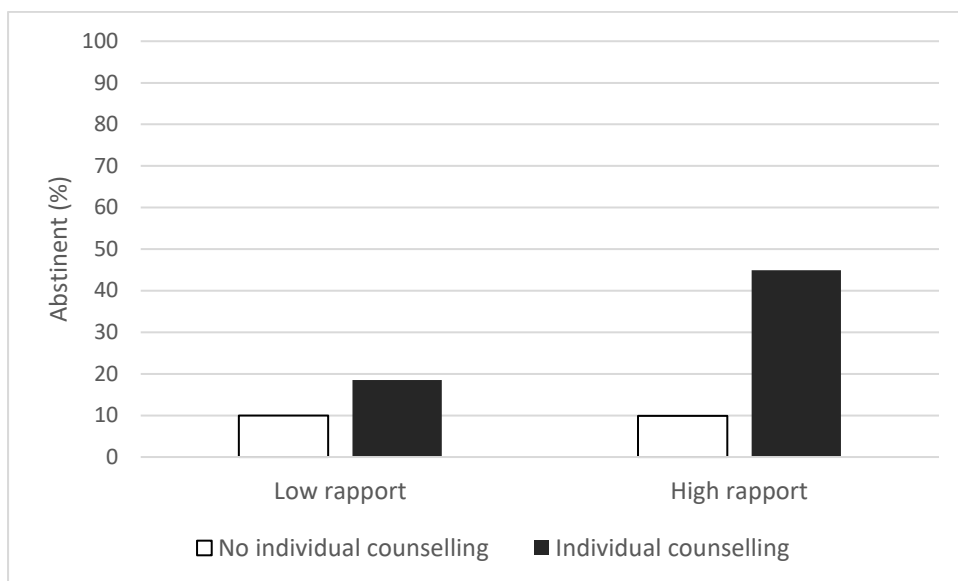


Figure 1. Continuous abstinence from methamphetamine use at one year after residential rehabilitation by treatment rapport and participation in individual counselling.

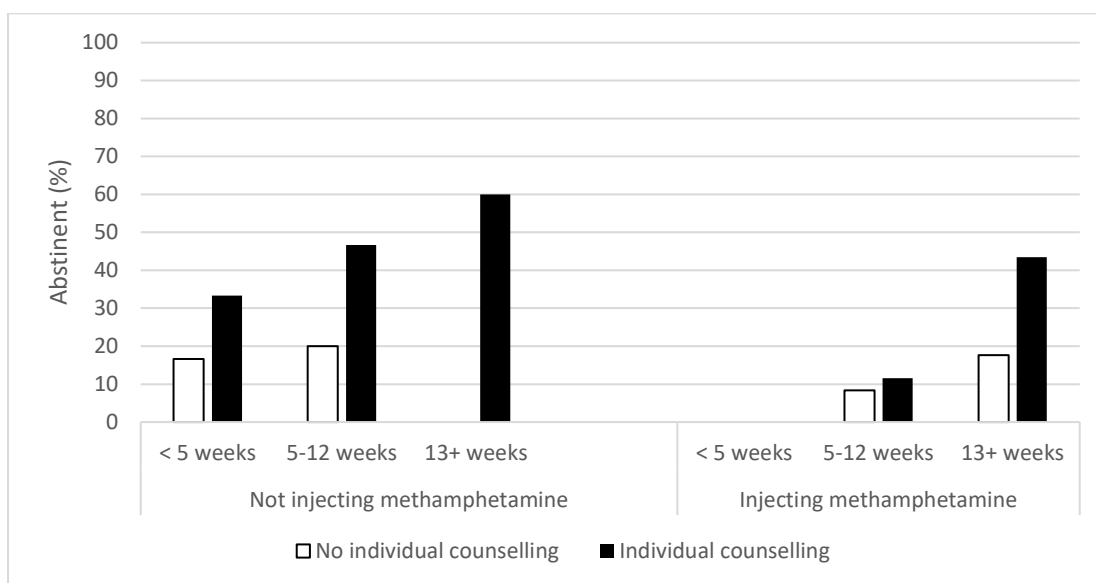


Figure 2. Continuous abstinence from methamphetamine use at one year after residential rehabilitation by treatment duration, methamphetamine injection prior to treatment and participation in individual counselling.