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Journal article

**Predictors of length of treatment, discharge reason, and re-admission to Aboriginal alcohol and other drug residential rehabilitation services in New South Wales, Australia**

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## Title

# **Predictors of length of treatment, discharge reason, and re-admission to Aboriginal alcohol and other drug residential rehabilitation services in New South Wales, Australia**

## Running title

Predictors of treatment in resi rehabs

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### Competing interest

None to declare

## **Abstract** (250 words max, currently 243)

### **Introduction**

Aboriginal clients accessing Aboriginal community controlled residential alcohol and other drug rehabilitation services in NSW Australia believe they have better outcomes due to culturally appropriate care. However there is a paucity of published treatment outcome data. This study aims to identify predictors of treatment outcomes based on client characteristics at intake.

### **Methods**

A cross-sectional, retrospective, observational study of 2326 admissions to six services between January 2011 to December 2016. The outcomes were: 1) leaving treatment early, 2) self-discharge or house discharge (by staff), and 3) re-admission within two years. The predictors examined were Aboriginal status, age, justice system referral and primary substance of concern. Competing risk and Poisson regression analyses were used to identify trends in the data.

### **Results**

The mean age of clients was 33 years, and the majority of clients (56%) stayed at least six weeks. Aboriginal clients whose primary substance of concern was stimulants were almost eight times more likely to re-admitted within two years than other clients (RR: 7.91;  $p < 0.001$ ). Aboriginal clients who were also referred from justice were more likely to self-discharge (RR: 1.87;  $p < 0.001$ ). Furthermore, Aboriginal clients who were aged older than 30 were less likely to have a re-admission (RR: 0.32;  $p < 0.001$ ).

## **Discussion and Conclusions**

This study showed client characteristics that are predictive of harmful outcomes include age under 30, justice client, primary substance of use and their interactions. Future research could build on these results to aid ongoing development of residential rehabilitation programs for Aboriginal peoples.

### Key words (5 max)

Aboriginal, Australia, residential rehabilitation, predictors, treatment

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# **Predictors of length of treatment, discharge reason, and re-admission to, Aboriginal alcohol and other drug residential rehabilitation services in New South Wales, Australia**

## **Introduction**

Due to legacies from colonization, Indigenous peoples, locally and internationally, experience more harms than the wider community [1, 2]. For example, in Australia, Aboriginal and Torres Strait Islander peoples (hereafter referred to as ‘Aboriginal Australians’) as recommended by the Aboriginal Health and Medical Research Council of New South Wales [NSW] [3] experience alcohol and other drug (AoD)-related harms at disproportionately higher rates than non-Aboriginal Australians [4] [5]. They also experience higher rates of harms that are associated with AoD misuse including mental illness, suicide and incarceration [6]. These harms are increased by colonisation and its sequelae, including institutional racism and inter-generational harm [1].

In responding to these harms, Aboriginal Australians have established a range of Aboriginal community controlled health services, including AoD residential rehabilitation services. The primary importance of Aboriginal community controlled AoD services is that they deliver care which is compatible with Aboriginal cultural beliefs and values [7-10]. Existing research has established a best-evidence model of care for Aboriginal residential rehabilitation services [10, 11], defined a potential standardised client assessment tool [12], and examined the characteristics of clients across multiple Aboriginal residential rehabilitation services [13, 14].

Worldwide, there is a range of AoD residential treatment services that vary widely in both length of treatment and program type. Programs offered, for example, can be one type of treatment, such as cognitive behavioural therapy (CBT) or mutual support programs (e.g. Smart Recovery or Alcoholics Anonymous), while others may include additional components, such as therapeutic communities. In Australia, there are two broad kinds of residential AoD treatment services: 1) therapeutic communities that provide community-based self-help and support to aid recovery; and 2) residential treatment services that offer activities to support re-integration back to community (e.g. education, counselling and life skills) [15-17].

There is some evidence that AoD residential treatment services generally provide benefits to communities, the economy, and improve recidivism rates [18]. There remains, however, some uncertainty about the impact of Aboriginal residential rehabilitation services on substance use outcomes. A systematic literature review, published in 2017 [19] identified just 17 studies of Indigenous alcohol and other drug residential rehabilitation services worldwide, of which 16 simply described client or treatment characteristics, and just one focused on treatment impact (a pre-post evaluation in one service) [20]. Given the lack of evidence on treatment outcomes in Aboriginal residential treatment services in Australia and internationally [19], this study aimed to identify the client characteristics associated with three key treatment related outcomes.

## **METHOD**

### **Design**

A cross-sectional, observational, retrospective study.

## **Ethics**

Ethical approval was granted by the Human Research and Ethics Committee of the Aboriginal Health and Medical Research Council of New South Wales (No. 1227/16). Each service consented to being identified.

## **Aboriginal leadership**

Study methods were developed in consultation with the Aboriginal Drug and Alcohol Residential Rehabilitation Network (ADARRN), a collaboration of the Chief Executive Officers (CEOs) of all of the participating study sites. ADARRN supported this research as they felt it could help inform care offered across their member services. The study was led by an Aboriginal man (DJ) who has 30 years of clinical experience working in Aboriginal residential rehabilitation services in NSW, Australia.

## **Settings**

The six currently operating Aboriginal residential rehabilitation services in NSW participated in this study. NSW is the state with the largest population of Aboriginal Australians (265,685 per capita or approximately 3.4% of the NSW population) [21]. Each service is governed by an Aboriginal community controlled board of management. All services are located in regional or remote locations, between 180 and 650 kilometres from the capital city of Sydney (NSW), Australia [13]. The names of each service (and the traditional country on which it is located, and number of years it has been operating) are: Namatjira Haven (Bundjalung, 26 years); The Glen Centre (Darkinjung, 26 years); The Weigelli Centre (Wiradjuri, 21 years); Orana Haven Drug and Alcohol Rehabilitation Centre (Ngemba, 32 years); Oolong House (Dharrawal, 40 years); and Maayu Mali (Kamilaroi, 2 years). Each service is tailored to, and draws on, the traditions of the Aboriginal peoples



on whose land each service is based [9, 10]. Culturally sensitive activities are described by the services as being important to the recovery process [22]. Each service involved in this study accepts referrals from both Aboriginal and non-Aboriginal clients. Aboriginal status was used to predict differences or as a confounder of treatment outcomes.

The model of care used by Australian residential rehabilitation services has been described elsewhere [12, 13]. In brief, clients can be referred to an Aboriginal residential rehabilitation service by an external organisation (e.g. government or non-government), or by self-referral. A pre-entry assessment occurs before intake (typically by phone), followed by a detailed assessment on program entry. The treatment program has six core components: i) culturally healing (e.g. yarning circles, support from Elders); ii) case management (e.g. care planning); iii) education/life skills (e.g. literacy and numeracy, budgeting and job ready skills); iv) therapeutic activities (e.g. managing relapse triggers, anger management); v) time out from substances; and vi) aftercare planning and support [11]. Worldwide, there is a range of AoD residential treatment services that vary widely in both length of treatment and program type. The core components are informed by an agreed care plan, mid-program review and exit/discharge plan. Urine screens are conducted both randomly and at regular intervals across all services, and a positive sample may result in program discharge. Urine screening results may also be used to inform reports (for legal or court purposes) during a client's time in a program. Other than successful completion, program discharge can occur because a client chooses to leave ("self-discharge") or because of a house rules violation ("house discharge"). Reasons for house discharge include threats of harm to self or others, or a significant and obvious lack of participation in, or motivation for, the program.

## **Data source**

The data for this study are all recorded client admissions (intake data) from the six services from 1 January 2011 to 31 December 2016. One service (Maayu Mali), commenced operations in October 2015, so data were only available for this service from October 2015 to 31 December 2016. Each service used their own pen-and-paper intake (assessment) form on admission (by phone or in person). Client details were recorded on this intake form and then entered into an electronic patient management system or stored in hardcopy. Data for all services were de-identified prior to being exported into Microsoft Excel. Multiple Excel files for each service were merged and then imported into Stata (Version 15) for analysis [23].

## **Data analysis**

### *Selection of outcomes*

Outcome, or dependent, variables were: 1) leaving treatment early ( $\leq 28$  days in treatment), 2) self-discharge, 3) house discharge and 4) re-admission to the same service within two years of the observed prior admission. All outcomes were selected because they are clinically meaningful to the CEOs, staff and clients of their services, and are strongly related to outcomes and retention in treatment [15]. Outcomes 1 to 3 also had enough variability to optimise the likelihood of detecting any observed associations as being significant (Figure 1) (i.e. 33% of clients left treatment early (555/1683), 41% of clients self-discharged (337/826), and 30% of clients were house discharged (247/826).

### *Selection of predictor and confounder variables*

All available variables that may be predictors of treatment outcomes were included in this study including: age (30 years or less, >30 years), Aboriginal and Torres Strait Islander

status (yes or no), referral from the justice system (yes or no) and primary drug of choice (alcohol, cannabis, amphetamines, opioids, benzodiazepines). In addition, all possible interaction terms between any two predictors were included to identify synergistic effects between the selected predictors.

The minimum set of confounders was selected using a directed acyclic graph (DAG; see supplementary materials). A DAG helps the reader understand the basic mechanism behind the models used in this paper. This DAG was constructed from the experience and understanding of the first author (DJ) who has worked in the field for 30 years. The reason behind using a minimum set of confounders from the available variables was to reduce collider bias and improve power of the analysis [24].

### *Regression models*

To model reasons for discharge, competing risk regression (a type of survival analysis) was used [25]. Competing risk regression was selected as reasons for early discharge are mutually exclusive; clients must either be self- or house discharged (i.e. they are competing events). The risk ratio of early discharge for each outcome was modelled relative to its competing outcome in separate models (i.e. self-discharge with house discharge as a competing outcome and house discharge with self-discharge as a competing outcome). The measure of effect in this model is a sub-distribution hazard ratio (SHR) [25]. A SHR of a predictor is a causal estimate of effect, in that the SHR reflects the hazard ratio in the counter-factual setting, where all patients self-discharge or all patients house discharge respectively. Clients who stayed for at least 90 days (from admission to treatment discharge) were classified as having completed treatment. Therefore outcomes

of patients who were house discharged or who self-discharged beyond 90 days were censored.

Poisson regression was used to model other outcomes than reason for discharge. This model was selected because the outcomes do not incorporate a time to event (i.e. duration of stay). These outcomes are binary (yes or no) and this is a retrospective cohort study, meaning that a relative risk should be calculated. Poisson regression is more likely to converge than the usual log binomial regression used to calculate relative risk [26].

## **RESULTS**

### **Sample**

There were 2326 admissions to the six Aboriginal residential rehabilitation services between 1 January 2011 and 31 December 2016 (Figure 1). Of the 2326 admissions, 555 left early ( $\leq 28$  days), 337 self-discharged, 247 were house discharged, and 160 re-admitted to a service within two years.

(Insert Figure 1 here)

### **Client demographics**

Table 1, the mean age of clients was 33 years, with Aboriginal clients representing just under three-quarters (72%) of the total admissions ( $n=1613/2237$ ). Those aged 26-35 were the biggest proportion of clients (36%;  $n=809/2224$ ). Nearly one-third of clients were referred from the criminal justice system (30%;  $n=677/2220$ ). Alcohol and amphetamines were the most common primary substances of concern (39% and 36% respectively) and the majority of clients (56%) stayed in treatment for at least half the standard three-month

period of admission (at least 6 weeks). More clients were house discharged (41%), relative to either completed (29%) or self-discharged (30%), and a minority of clients were re-admitted to the same service within two years (7%).

(Insert Table 1 about here)

### **Characteristics of clients who self or house discharged**

Mean age and the proportion of Aboriginal clients were comparable between those who self-discharged, house discharged or who completed (Table 2). Being aged 26-35 years was the most common age group for all three categories.

Of those clients who house discharged 54% (n=133/247) were referred from the criminal justice system. One third (33%) of both the clients who self-discharged and of those who completed were referrals from the criminal justice system. Those who self-discharged typically had less time in treatment than those who were house discharged, as measured by both mean days in treatment (28 and 36 days, respectively) and the proportion who left treatment within 28 days (58% and 43% respectively).

The most common primary substance of concern was alcohol for those who self-discharged and completed (47% and 49% respectively) and amphetamines for those who were house discharged (47%).

Rates of self-discharge, house discharge and completion varied widely between services, with the highest proportion of clients who self-discharged or were house discharged being

from The Glen Centre (52% and 78% respectively), and the highest proportion of clients who completed from Oolong House (45%).

(Insert Table 2 about here)

### **Characteristics of clients who left early ( $\leq 28$ days)**

The average duration of stay for those who left early was 13 days compared with 72 days for those who did not leave early (Table 3). Those who left early were more likely to self-discharge than those who did not (65% and 27%, respectively). Excluding Maayu Mali (which had only been operating for about 12 months and had only one early discharge recorded), the proportion of clients who left early varied across services (range: 4%-38%), with the highest proportions associated with The Glen Centre (38%) and Weigelli Centre (31%). As summarised in Table 3, the percentage of those who self-discharged ( $\leq 28$  days) who were Aboriginal was comparable to those who did not (73% and 70% respectively). Similarly, the mean age of those who left early and those who did not was 32 and 33 years, respectively. Of those clients who left early, 25% were referred from the criminal justice system compared to 32% of those who did not.

### **Characteristics of clients who were re-admitted within two years**

Re-admission rates varied across all six services (range: 0%-57%), with two services having relatively high re-admission rates: Weigelli Centre (57%) and Namatjira Haven (27%). A higher proportion of those who had a re-admission were Aboriginal clients compared to those who did not (82% and 71% respectively; Table 4). The mean age of those who were re-admitted was similar (34 years and 33 years) to those who were not re-

admitted. Of those clients who re-admitted within two years, 17% were referred from the criminal justice system.

(Insert Table 4 about here)

## **Predictors of self-discharge, house discharge, leaving early and re-admission**

### *Self-discharge*

For Model 2, Table 5 shows that clients who were significant/ly less likely to be self-discharged were those who were both aged >30 years and were referred from the criminal justice system (SHR: 0.78;  $p=0.01$ ), or aged >30 years, whose primary primary substance of concern was cannabis (SHR: 0.65;  $p=0.03$ ) or stimulants (SHR: 0.60;  $p<0.001$ ).

Conversely, clients were significant/ly more likely to be self-discharged if they were Aboriginal and had stimulants as their primary substance of concern (SHR: 1.37;  $p=0.03$ ) or were referred from the criminal justice system (SHR: 1.87;  $p<0.001$ ). Clients referred from the criminal justice system with cannabis as a primary substance of concern were also significant/ly more likely to be self-discharged (SHR: 1.92;  $p=0.02$ ).

### *House discharge*

For Model 1, Table 5 shows that clients aged over 30 were less likely to be house discharged (SHR: 0.76;  $p=0.01$ ). Conversely, clients were significantly more likely to be house discharged if they were referred from the criminal justice system (SHR: 2.58;  $p<0.01$ ), or if their primary substance of concern was opioids (SHR: 2.20;  $p=0.01$ ) or stimulants (SHR: 1.88;  $p<0.001$ ), although the analysis of interaction terms suggests that the association with stimulant use may be concentrated among clients aged >30 years (SHR: 1.12;  $p<0.01$ ).

### *Leaving treatment early*

For Model 3, Table 5 shows that clients were significantly more likely to leave a program early if their primary substance of concern was stimulants (RR: 1.26;  $p=0.03$ ) or opioids (RR: 1.59;  $p<0.001$ ). Aboriginal clients who had stimulants as their primary substance of concern were also significantly more likely to leave early (RR: 1.48;  $p=0.04$ ). Conversely, clients aged 30 and over who had stimulants as their primary substance of concern were significantly less likely to leave early (RR: 0.76;  $p<0.001$ ), as were clients referred from the criminal justice system (RR: 0.79;  $p=0.01$ ).

### *Re-admission within two years of an original admission*

For Model 4, Table 5 shows that clients were significantly less likely to be re-admitted if their primary substance of concern was cannabis (RR: 0.39;  $p<0.001$ ), or if they were referred from the criminal justice system (RR: 0.46;  $p=0.04$ ), or if they were Aboriginal aged  $\geq 30$  years (RR: 0.32;  $p<0.001$ ). Conversely, Aboriginal clients with stimulants as their primary substance of concern were more likely to re-admit (RR: 7.91;  $p<0.001$ ), as were clients whose primary substance of concern was opioids (RR: 1.12;  $p=0.02$ ).

(Insert Table 5 about here)



## **DISCUSSION**

To our knowledge, this is the first study to examine predictors of self-discharge, house discharge, or re-admission to the same Indigenous alcohol and other drug residential rehabilitation service within two years, in Australia and internationally. This study is unique as it draws upon intake data from multiple Aboriginal community controlled health services to determine why clients might leave early or be re-admitted. Each outcome was chosen for its clinical relevance for the six services involved. This research will be useful to help guide program development in residential rehabilitation services (locally and internationally). The study was led by an Aboriginal researcher with extensive clinical experience in Aboriginal Australian residential AoD services.

### **Stimulant use**

Stimulant use has been shown to have devastating health impacts on individuals, their families and whole communities, irrespective of Aboriginal status [27]. With this in mind, the six study sites were keen to understand the relationship between stimulant use with discharge type, referral type and age. Irrespective of Aboriginal status, we found that clients whose primary substance of concern was stimulants were nearly two times more likely to be house discharged than those who did not use stimulants (SHR: 1.88;  $p < 0.001$ ; 1.44-2.66). While key international studies have found that clients who have used stimulants are more likely leave early compared to those who have not used stimulants, most studies do not consider Indigenous status in their analyses [28-31]. Just one study of Native Americans and other minority groups in the United States of America found that people who used stimulants as their primary substance of concern were more likely to leave early compared to those clients who did not use stimulants [32]. Our study is also unique in its focus on reasons for discharge type (e.g. leave early, self discharge or

house discharge) instead of 'drop out' rates [33, 34] across multiple residential rehabilitation services.

When age was added into our 'leave early (<28 days)' model, we found that clients who were older than 30 years, and who use stimulants as their primary drug of concern, irrespective of Aboriginal status, were less likely to leave early (SHR: 0.76;  $p < 0.001$ ; 0.65-0.88). Similarly, a study of 193 clients from an Australian therapeutic community found clients who used amphetamines and were between the ages of 25 and 50 were less likely to leave early compared to those who did not use stimulants [35]. Some reasons why clients age >30 may be less likely to leave early is that they may have had more life experience and be motivated to get their lives in order, with for example older clients often saying they feel "sick of being sick" [36].

The strongest finding in this study was that Aboriginal clients who used stimulants as their primary substance of concern were nearly eight times more likely to re-admit to the same residential AoD rehabilitation service within two years of an original admission, compared with those who did not use stimulants (IRR: 7.91,  $p < 0.001$ , CI 3.97-15.75). This could be due to a number of factors. Aboriginal clients might see the residential AoD rehabilitation services included in this study as culturally safe options compared with their experience of mainstream services [20, 37]. Hence, Aboriginal residential AoD rehabilitation services may be seen as a safe place where they may feel comfortable to continue working on their recovery [20]. Other motivating factors that might have prompted a re-admission could be support from a residential AoD rehabilitation service to help identify practical steps needed to re-establish relationships with family and community [20, 36]. There is however a dearth of literature that has examined factors that predict re-admission in mainstream or

Indigenous resi rehab services worldwide [33, 38, 39]. A lack of available data in our study meant that we were unable to examine variables typically included in models that set out to examine predictors of re-admission (e.g. employment or accommodation status).

### **Referrals from the criminal justice system**

The next most relevant predictor relates to clients who were referred from the criminal justice system (prison, probation or parole, or a magistrate). Our study found that justice clients were more likely to leave early (including house discharge) or not be re-admitted compared to non-justice clients. This was in contrast with Maglione et al (2011) who found that coerced (justice) clients aged 40 years – who had less severe drug problems stayed longer. However, this previous study did not include re-admission in their analysis [28]. Several reasons might explain why justice clients in the current study might be more likely to house discharge. Some clients might find it easier to break the rules and be sent back to prison rather than needing to address their substance use issues (“rehab is hard, prison is easy”) [36, 40, 41]. In the present study, intake rates for justice clients varied with some services retaining justice clients for longer periods of time. More research is needed to ascertain successful program elements that could result in longer length of stay for justice clients (e.g. lived experience of staff, staff-client relationships).

The relationship between being referred from the justice system and self-discharge was nuanced. Clients who self-discharged were more likely referred from justice, younger (<30 years), Aboriginal and to have used cannabis as a primary substance of concern. It is possible that younger clients (<30 years) may not have as much experience as older clients in accessing treatment services. They also may not perceive their cannabis use as serious enough to warrant an extended stay in treatment compared to the justice system,

which made an order of treatment to address problematic drug use [33]. Irrespective of age, Aboriginal clients who were referred from justice were nearly two time more likely to self-discharge (SHR: 1.87;  $p < 0.001$ ; CI= 1.4-2.5). No other studies to our knowledge have included Aboriginal status as a predictor of leaving early, alongside factors such as justice referrals and age. Clinically, there may be factors that are beyond the control of the residential AoD rehabilitation service, which may result in some clients self-discharging. For example, being away from family or other loved ones may be too great a burden for some Aboriginal clients. Also, some Aboriginal clients may feel uncomfortable residing at a resi rehab which is located “off country” [11, 14]. For example, being “off country” may mean that the individual cannot fulfil their cultural commitments [37, 42]. Each service involved in this study accepts varying percentages of justice clients (5-90%). Robust data collection systems are needed to help inform analyses that can predict which clients are more likely to house discharge or to re-admit. Future research could then identify or develop program elements to better increase client retention rates.

## **Limitations**

We deemed that variables that contained 20% of missing observations were not usable and were discarded. Data in this study were collected over 5-years, during which time supply and patterns of drug use and other modifiable factors may have changed. These data are only from Aboriginal residential rehabilitation services in NSW, and are not generalisable to services nationally. However, NSW is the jurisdiction in Australia with the highest number of Indigenous peoples per capita [43]. Gender was not included as a predictor in the analyses due to the low percentage of females (10%) in the study with just two sites accepting female clients (Maayu Mali and Weigelli). These two services performed differently on many outcomes. There is an urgent need to increase residential

beds for Aboriginal women that can account for their experiences of trauma and other specific needs.

### **Implications for policy, practice and further research**

These analyses could be used to understand which client characteristics predict increased length of stay in treatment, and can help identify ways to tailor treatment programs [15].

The findings highlight the potential opportunity to further improve client-centred treatment by targeting areas of need (e.g. where primary drug of use is stimulants, for people aged under age 30, or for justice clients). Future research for clients who are transitioning from the justice system may be needed to help identify models of care that would assist in increasing retention rates for such groups. This research would need to be designed in consultation with the range of services who work with justice clients. This may help to identify program models that could increase retention rates and relapse prevention, via a combination of structured residential care and post-care support. Additional research is warranted to identify program elements that could inform what works best for clients with specific characteristics (e.g. age, Aboriginal status or primary substance of concern) that could increase retention rates. Multi-method studies that use qualitative interviews with staff and clients could help work out what program or treatment elements work best for this client group.

Research conducted previously in these same services developed a best evidence model of care comprised of six core treatment components [10, 11, 44]. Future research with Indigenous people and communities could consider how the findings from this study might be used to inform treatment planning for clients with different needs. Goals of future research might include identifying approaches that can lead to increasing length of stay,

reducing the number of clients who discharge before program completion, and reducing the number of clients who may need to re-admit to residential rehabilitation within two years. It would be important to consider analysis of client and treatment characteristics and their interactions with primary substance of concern to identify levels of support (pre-, during, and post-admission) to help maximise and consolidate any gains made. There is an opportunity to examine the role of culture in treatment, and extend it to discharge and post-discharge elements of care. An analysis of factors that affect outcomes for clients in treatment, including culture, will guide program improvements and lead to better outcomes for Aboriginal people with substance use problems.

This study also identified opportunities for the participating services to standardise their data collection with a view to undertaking an analysis with more complete data. It also demonstrates the value of robust data collection systems and how these can be used to better meet client needs and allow services to use resources more effectively. The ADARRN group, as the peak body for Aboriginal residential rehabilitation services in NSW, is in a unique position to facilitate standardised data collection across the six services in NSW. Future research could then evaluate the impact of data-driven modifications to treatment delivery, possibly through pragmatic wait-list randomised controlled trials embedded into service delivery [45, 46].

## **Conclusion**

We identified that clients come to AoD residential rehabilitation with a range of unique characteristics (e.g. age, primary substance of choice, referral pathway) that appear to influence their treatment outcomes. Data collected on intake can inform program development to help tailor program aspects to meet individual client needs. More robust

data collection systems could help inform treatment efforts to improve all four clinical outcomes examined in this study. Future research into client characteristics and their interaction with treatment outcomes could also help develop new assessment tools to support efforts to increase treatment retention. Such research could explore individual service elements to better understand variations in retention rates. Qualitative research is also needed that captures the views of clients, including those who self-discharge. This study may be useful even beyond the Australian context in relation to identifying predictors of outcomes for AoD treatment systems.

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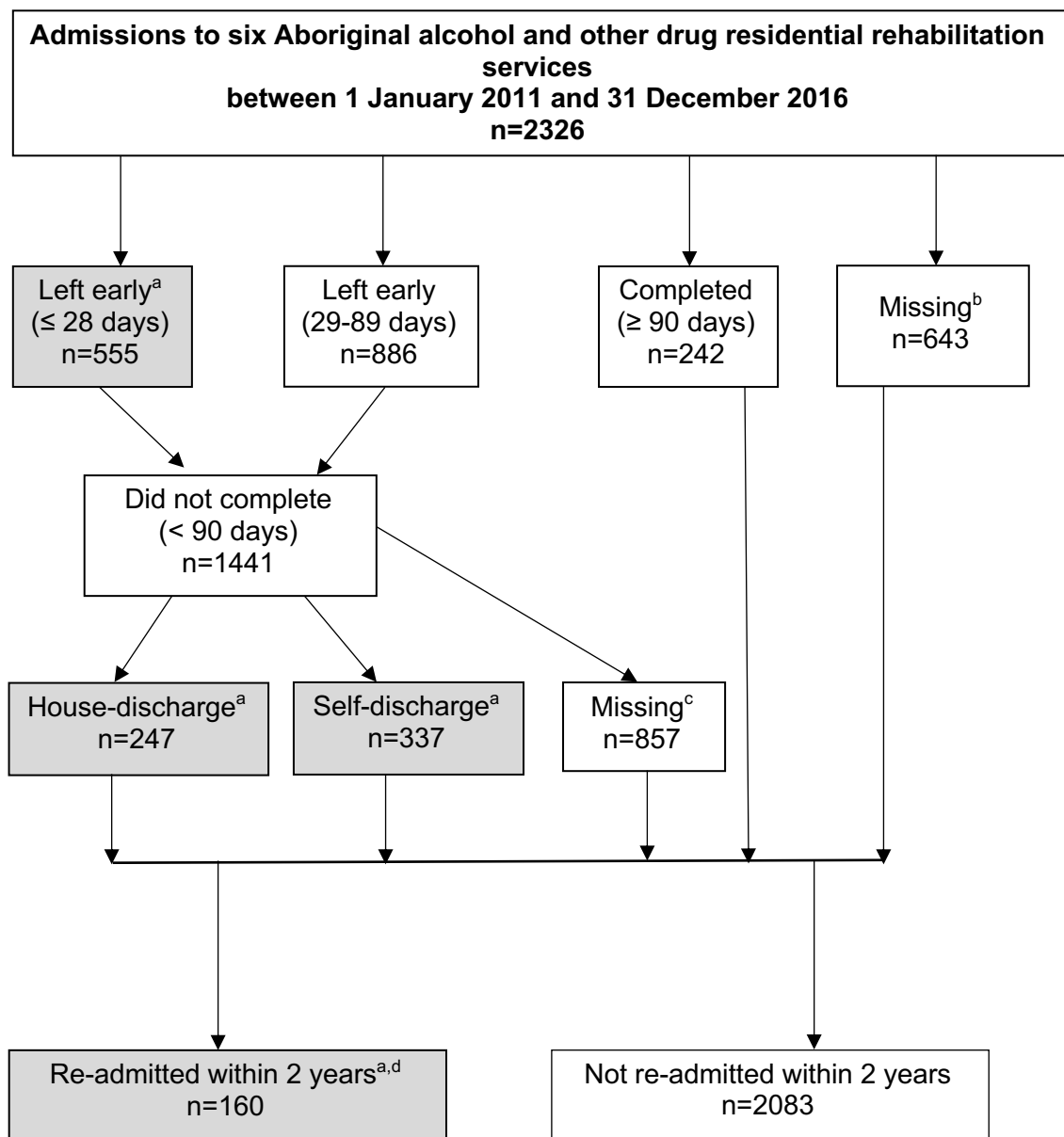
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**Figure 1: Flow chart of clients admitted to six Aboriginal alcohol and other drug residential rehabilitation services in New South Wales, Australia**



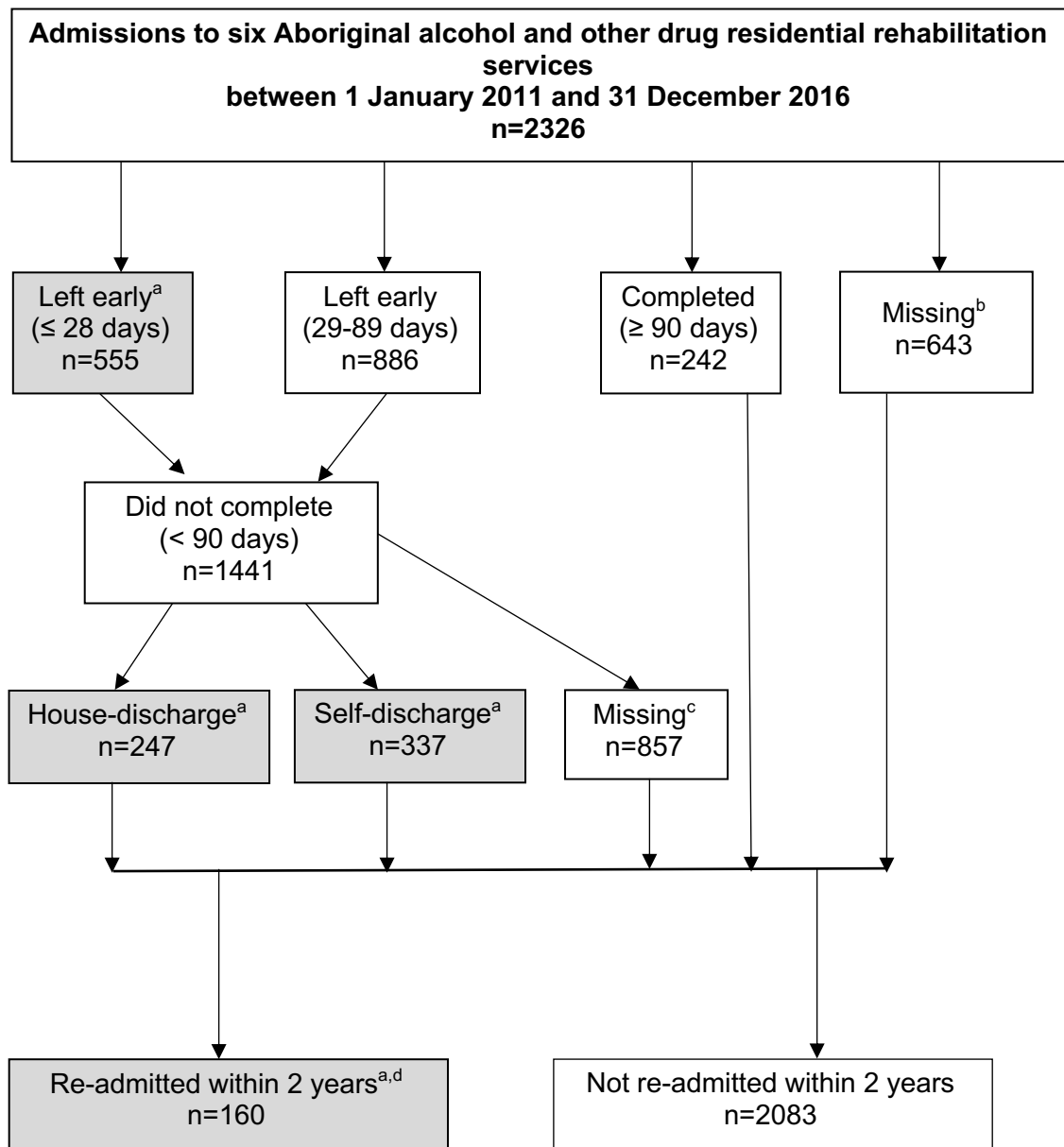
<sup>a</sup> Shaded boxes indicate the four outcome variables.

<sup>b</sup> People were admitted into a program but data on their specific admission or discharge date was unclear, meaning their duration of stay by days could not be calculated.

<sup>c</sup> People did not complete a program but their reason for discharge was not recorded.

<sup>d</sup> Of the total number of re-admitted clients (n=243), 83 were excluded because their re-admission date was not recorded, meaning it is unclear if they re-admitted within 2 years.

**Figure 2: Flow chart of clients admitted to six Aboriginal alcohol and other drug residential rehabilitation services in New South Wales Australia**



<sup>a</sup> Shaded boxes indicate the four outcome variables.

<sup>b</sup> People were admitted into a program but data on their specific admission or discharge date was unclear, meaning their duration of stay by days could not be calculated.

<sup>c</sup> People did not complete a program but their reason for discharge was not recorded.

<sup>d</sup> Of the total number of re-admitted clients (n=243), 83 were excluded because their re-admission date was not recorded, meaning it is unclear if they re-admitted within 2 years.

**Table 1: The characteristics of clients admitted to one of six Aboriginal alcohol and other drug residential rehabilitation services in NSW, Australia, from 1 January 2011 – 31 December 2016 (n=2326)**

<b>Characteristics</b>	<b>Mean or %</b>
Age <sup>a</sup> (mean)(SD)	33 (9.5)
Age groups (%)	
18-25 years	22
26-35 years	36
36-45 years	28
≥ 46 years	13
Aboriginal or Torres Strait Islander <sup>b</sup> (%)	72
Primary substance of concern <sup>c</sup> (%)	
Alcohol	39
Cannabis	12
Amphetamines	36
Opioids	12
Benzos	<1
Referral source <sup>d</sup> (%)	
Criminal justice system	30
Not justice	69
Length of treatment stay <sup>e</sup> (%)	
less than 4 weeks	32
4 to less than 6 weeks	12
6 to less than 8 weeks	9
8+ weeks	47
Discharge type <sup>f</sup> (%)	
Completed	29
Self-discharge	30
House discharge	41
Re-admission to the same service in 2 years <sup>g</sup> (%)	
Yes	7

<sup>a</sup> Missing n=102. Data not available from all services.

<sup>b</sup> Missing n=89. Data not available from all services.

<sup>c</sup> Substances reported as primary substance of concern by <1% of clients were excluded.

<sup>d</sup> Missing data n=106. Data not available from all services.

<sup>e</sup> Missing n=643. Data not available from all services.

<sup>f</sup> Missing n=857. Data not available from all services.

<sup>g</sup> Missing n=83. Data not available from all services.

**Table 2: The characteristics of clients who self-discharge or are house discharged from an Aboriginal alcohol and other drug residential rehabilitation service in NSW, 1 January 2011–31 December 2016 (n=826)**

Characteristics <sup>a</sup>	Self-discharge n=337	House discharge n=247	Complete n=242
<b>Socio-demographics</b>			
Age <sup>b</sup> : mean years (SD)	33.2 (9.6)	31.5 (9.4)	34.0 (10.1)
Age groups (%)			
18-25	23	27	21
26-35	34	37	34
36-45	29	28	27
46+	15	9	17
Aboriginal or Torres Strait Islander (%) <sup>c</sup>	73	63	64
<b>Treatment<sup>d</sup></b>			
Referral source – criminal justice system (%)	33	54	33
Mean days in treatment (SD) <sup>e</sup>	27.6 (23.7)	36.0 (22.5)	110.9 (12.0)
% left early (≤28 days)	58	43	NA
Re-admission within 2 years (%) <sup>f</sup>	4	2	4
<b>Services<sup>g</sup></b>			
<i>Namatjira Haven</i>	15	3	10
<i>The Glen Centre</i>	52	78	24
<i>Oolong House</i>	24	14	45
<i>Weigelli</i>	0	0	10
<i>Orana Haven</i>	9	6	10
<i>Maayu Mali</i>	0	0	1
<b>Primary substance of concern (%)<sup>h</sup></b>			
<i>Alcohol</i>	47	28	49
<i>Cannabis</i>	14	1.3	9.7
<i>Amphetamines</i>	7.6	46.8	31.3
<i>Opioids</i>	31	12.6	9.2

<sup>a</sup> Data for Maayu Mali were available from October 2015 to December 2016 when this service opened. Missing data n=538 for discharge type.

<sup>b</sup> Missing data: self-discharge n=1, house discharge n=4, complete 90.

<sup>c</sup> Missing data: self-discharge n=1, house discharge n=2, complete n=84.

<sup>d</sup> Missing data: self-discharge n=0, house discharge n=0, complete n=90.

<sup>e</sup> Missing data n=560.

<sup>f</sup> Missing data: self-discharge n=0, house discharge n=0, complete n=83.

<sup>g</sup> Missing data: self-discharge n=0, house discharge n=0, complete n=83.

<sup>h</sup> Missing data: self-discharge n=16, house discharge n=33, complete n=327. Only substances reported by a minimum 10% of clients presented.

**Table 3: The characteristics of clients who left early, compared to those who did not, from an Aboriginal alcohol and other drug residential rehabilitation services in NSW, from 1 January 2011–31 December 2016 (n=1683)**

Characteristics <sup>a</sup>	Left early (≤ 28 days) n=555	Did not leave early (29-89 days) or completed n=1128
<b>Socio-demographics</b>		
Age <sup>b</sup> : mean years (SD)	32.2 (9.2)	33.3 (9.6)
Age groups (%) <sup>b</sup>		
18-25	25	22
26-35	35	36
36-45	29	28
≥ 46	11	14
Aboriginal or Torres Strait Islander (%) <sup>c</sup>	73	70
<b>Treatment</b>		
Referral source: criminal justice system (%) <sup>d</sup>	25	32
Mean days in treatment (SD)	12.7 (8.0)	72.3 (26.9)
Reason for early discharge (%)		
<i>Self-discharge</i>	65	27
<i>House-discharge</i>	35	27
<i>Completed</i>	NA	46
Re-admission within 2 years <sup>e</sup>	8	8
<b>Service (%)<sup>f</sup></b>		
Namatjira Haven	10	14
The Glen Centre	38	39
The Weigelli Centre	31	24
Orana Haven	4	6
Oolong House	16	16
Maayu Mali	1	1
<b>Primary substance of concern (%)<sup>g</sup></b>		
Alcohol	35	45
Cannabis	14	12
Amphetamines	36	34
Opioids	15	9

<sup>a</sup> Missing data: n=643. Data for Maayu Mali were available from October 2015 to December 2016 when this service opened.

<sup>b</sup> Missing data: left early n=3, did not leave early n=10.

<sup>c</sup> Missing data: left early n=2, did not leave early n=3.

<sup>d</sup> Missing data: left early n=7, did not leave early n=11.

<sup>e</sup> Missing data: left early n=253, did not leave early n=604.

<sup>f</sup> Missing data: left early n=0, did not leave early n=266.

<sup>g</sup> Missing data: left early n=0, did not leave early n=327. Only substances reported by a minimum 10% of clients presented here.

**Table 4: The characteristics of clients who are re-admitted to the same Aboriginal alcohol and other drug residential rehabilitation service in NSW within two years, compared to those who did not, from 1 January 2011–31 December 2016 (n=2243)**

Characteristics <sup>a</sup>	Re-admission status	
	Re-admit within 2 years n=160	Did not re-admit within 2 years n=2083
<b>Socio-demographics</b>		
Age <sup>b</sup> : mean years (SD)	33.6 (10.3)	33.0 (9.4)
Age groups (%) <sup>b</sup>		
18-25	25	22
26-35	29	37
36-45	30	28
≥ 46	17	13
Aboriginal or Torres Strait Islander (%)	82	71
<b>Treatment</b>		
Referral source: criminal justice system (%) <sup>c</sup>	17	32
Mean days in treatment (SD)	47 (29.5)	54 (36.7)
% left early (≤28 days)	34	33
Discharge reason (%) <sup>d</sup>		
<i>Self-discharge</i>	37	29
<i>House discharge</i>	15	30
<i>Complete</i>	37	41
<b>Service (%)<sup>e</sup></b>		
<i>Namatjira Haven</i>	27	9
<i>The Glen Centre</i>	0	35
<i>Weigelli</i>	57	25
<i>Orana Haven</i>	1	15
<i>Oolong House</i>	9	16
<i>Maayu Mali</i>	6	1
<b>Primary substance of concern (%)<sup>f</sup></b>		
<i>Alcohol</i>	44	39
<i>Cannabis</i>	5	13
<i>Amphetamines</i>	36	37
<i>Opioids</i>	15	11



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<sup>a</sup> Missing n=554. Data for Maayu Mali were available from October 2015 to December 2016 when this service opened.

<sup>b</sup> Missing re-admit within 2 years n=1, did not re-admit n=83

<sup>c</sup> Missing re-admit within 2 years n=10, did not re-admit n=13

<sup>d</sup> Missing re-admit within 2 years n=81, did not re-admit n=390

<sup>e</sup> Missing re-admit within 2 years n=0, did not re-admit n=0

<sup>f</sup> Missing re-admit within 2 years n=1, did not re-admit n=18. Only substances reported by a minimum 10% of clients presented here.

**Table 5: The characteristics of clients that predict leaving treatment early, self-discharge, house discharge or re-admission in Aboriginal alcohol and other drug residential rehabilitation services in NSW, from 1 January 2011–31 December 2016**

<b>Model 1: Competing risk regression: House discharge</b>	<b>Sub- distribution hazard ratio</b>	<b>Robust Standard Error</b>	<b>P-value</b>	<b>95%CI</b>	<b>Confounders</b>
<b><i>Individual predictors</i></b>					
Aboriginal	0.75	0.17	0.22	0.48 - 1.18	N/A
Age (>30) *	0.76	0.07	0.01	0.63 - 0.92	Aboriginal
Justice client **	2.58	0.76	<0.001	1.45 - 4.61	Aboriginal, > age30
Primary substance (reference: alcohol)	1.00				
<i>Cannabis</i>	1.45	0.37	0.14	0.88 - 2.39	
<i>Stimulants</i> **	1.88	0.26	<0.001	1.44 - 2.46	
<i>Opioid</i> **	2.20	0.69	0.01	1.19 - 4.08	
<b><i>Interaction terms</i></b>					
Aboriginal & > age30	1.07	0.24	0.76	0.69 - 1.65	
Aboriginal & primary substance (reference: alcohol)	1.00				>age 30, justice client
<i>Cannabis</i>	1.07	0.14	0.60	0.83 - 1.39	
<i>Stimulants</i>	1.03	0.13	0.79	0.81 - 1.32	
<i>Opioid</i>	0.62	0.18	0.11	0.35 - 1.11	
Justice client & Aboriginal	0.79	0.11	0.08	0.61 - 1.03	>age 30
>Age30 & justice client	0.90	0.12	0.41	0.69 - 1.16	Aboriginal
Primary substance & age >30 (reference: alcohol)	1.00				Justice client, Aboriginal
<i>Cannabis</i>	1.10	0.28	0.69	0.67 - 1.81	
<i>Stimulants</i> **	1.12	0.04	<0.001	1.04 - 1.21	
<i>Opioid</i>	1.05	0.29	0.85	0.62 - 1.79	
Primary substance & justice client (reference: alcohol)	1.00				

<b>Model 1: Competing risk regression: House discharge</b>	<b>Sub- distribution hazard ratio</b>	<b>Robust Standard Error</b>	<b>P-value</b>	<b>95%CI</b>	<b>Confounders</b>
<i>Cannabis</i>	1.12	0.36	0.72	0.60 - 2.11	
<i>Stimulants</i>	1.51	0.43	0.15	0.86 - 2.65	
<i>Opioid</i>	1.27	0.19	0.11	0.95 - 1.69	

\* Statistically significantly less likely to be house discharged.

\*\* Statistically significantly more likely to be house discharged.



<b>Model 2: Competing risk regression: self-discharge</b>	<b>Sub- distribution hazard ratio</b>	<b>Robust Standard Error</b>	<b>P- value</b>	<b>95%CI</b>	<b>Confounders</b>
<b><i>Individual predictors</i></b>					
Aboriginal	1.19	0.2	0.31	0.85 -1.66	N/A
Age >30	0.99	0.06	0.83	0.88 -1.10	Aboriginal
Justice client	0.87	0.37	0.75	0.38 -1.99	Aboriginal, >age 30
Primary substance (reference: alcohol)					Aboriginal, >age 30, justice client
<i>Cannabis</i>	1.05	0.12	0.68	0.83 -1.32	
<i>Stimulants</i>	0.84	0.16	0.35	0.58 -1.21	
<i>Opioid</i>	0.70	0.14	0.08	0.47 -1.05	
<b><i>Interaction terms</i></b>					
Aboriginal & age >30	1.06	0.22	0.78	0.71 -1.59	
Aboriginal & primary substance (reference:alcohol)					>age 30, justice client
<i>Cannabis</i>	1.18	0.38	0.60	0.63 -2.21	
<i>Stimulants</i> **	1.37	0.20	0.03	1.03 -1.83	
<i>Opioid</i>	1.31	0.30	0.24	0.84 -2.06	
Justice client & Aboriginal **	1.87	0.28	<0.001	1.40 -2.50	
Age >30 & justice client *	0.78	0.07	0.01	0.66 -0.93	Aboriginal
Primary substance & age >30 (reference: alcohol)					>age 30, justice client
<i>Cannabis</i> *	0.65	0.13	0.03	0.44 -0.96	
<i>Stimulants</i> *	0.60	0.06	<0.001	0.50 -0.73	
<i>Opioid</i>	0.60	0.30	0.31	0.22 -1.60	
Primary substance & justice client (reference: alcohol)					>age 30, Aboriginal
<i>Cannabis</i> **	1.92	0.54	0.02	1.11 -3.33	

<b>Model 2: Competing risk regression: self-discharge</b>	<b>Sub- distribution hazard ratio</b>	<b>Robust Standard Error</b>	<b>P- value</b>	<b>95%CI</b>	<b>Confounders</b>
<i>Stimulants</i>	1.24	0.47	0.56	0.59 -2.61	
<i>Opioid</i>	1.31	0.56	0.53	0.56 -3.05	

\*Statistically significantly less likely to self discharge.

\*\*Statistically significant more likely to self discharge.

<b>Model 3: Poisson regression: leaving treatment early</b>	<b>Relative Risk</b>	<b>Robust Std. Error</b>	<b>P-value</b>	<b>95%CI</b>	<b>Confounders</b>
<b><i>Predictors</i></b>					
Aboriginal	1.12	0.07	0.32	0.89 -1.42	N/A
Age >30	0.92	0.13	0.11	0.84 -1.02	Aboriginal
Justice client *	0.79	0.07	0.01	0.65 -0.95	Aboriginal, >age 30
Primary substance (reference: alcohol)					Aboriginal, >age 30, Justice client
<i>Alcohol baseline</i>	1.00				
<i>Cannabis</i>	1.27	0.19	0.11	0.95 -1.71	
<i>Stimulants **</i>	1.26	0.13	0.03	1.02 -1.56	
<i>Opioid **</i>	1.59	0.20	<0.001	1.24 -2.02	
<b><i>Interaction terms</i></b>					
Aboriginal & > age30	1.00	0.19	0.98	0.69 -1.46	N/A
Aboriginal & primary substance (reference: alcohol)					>age 30, justice client
<i>Alcohol (baseline)</i>	1.00				
<i>Cannabis</i>	1.01	0.15	0.93	0.76 -1.36	
<i>Stimulants **</i>	1.48	0.29	0.04	1.01 -2.17	
<i>Opioid</i>	1.06	0.12	0.57	0.86 -1.32	
Justice client & Aboriginal	0.71	0.15	0.10	0.47 -1.07	>age 30
> Age30 & justice client	0.91	0.05	0.09	0.83 -1.01	Aboriginal
Primary substance & age (reference: alcohol)					justice client, Aboriginal
<i>Alcohol (baseline)</i>	1.00				
<i>Cannabis</i>	0.98	0.14	0.86	0.74 -1.28	
<i>Stimulants *</i>	0.76	0.06	<0.001	0.65 -0.88	
<i>Opioid</i>	0.91	0.10	0.42	0.73 -1.14	
Primary substance & justice client (reference: alcohol)					>age 30, Aboriginal
<i>Alcohol (baseline)</i>	1.00				

<b>Model 3: Poisson regression: leaving treatment early</b>	<b>Relative Risk</b>	<b>Robust Std. Error</b>	<b>P-value</b>	<b>95%CI</b>	<b>Confounders</b>
<i>Cannabis</i>	1.07	0.24	0.77	0.69 -1.65	
<i>Stimulants</i>	1.00	0.09	0.99	0.84 -1.20	
<i>Opioid</i>	1.17	0.15	0.21	0.91 -1.51	

\*Statistically significantly less likely to leave treatment early.

\*\*Statistically significant more likely to leave treatment early.



<b>Model 4: Poisson regression – re-admission</b>	<b>Relative risk</b>	<b>Robust Std Err</b>	<b>P-value</b>	<b>95%CI</b>	<b>Confounders</b>
<b>Individual predictors</b>					
Aboriginal	1.75	0.77	0.21	0.74 -4.14	N/A
> Age30	1.02	0.15	0.90	0.76 -1.36	Aboriginal
Justice client *	0.46	0.17	0.04	0.22 -0.95	Aboriginal, >age 30
Primary substance (reference: alcohol)					Aboriginal, >age 30, Justice client
<i>Cannabis</i>	0.39	0.13	<0.001	0.20 -0.74	
<i>Stimulants</i>	0.97	0.17	0.87	0.69 -1.38	
<i>Opioid</i> **	1.12	0.06	0.02	1.02 -1.23	
<b>Interaction terms</b>					
Aboriginal & > age30 *	0.32	0.07	<0.001	0.21 -0.49	N/A
Aboriginal & primary substance (reference: alcohol)					>age 30, justice client
<i>Cannabis</i>	1.75	0.58	0.09	0.91 -3.36	
<i>Stimulants</i> **	7.91	2.78	<0.001	3.97 -15.75	
<i>Opioid</i>	1.18	1.31	0.88	0.13 -10.46	
Justice client & Aboriginal	0.67	0.48	0.58	0.16 -2.74	>age 30
> Age30 & justice client	1.41	0.47	0.30	0.73 -2.72	Aboriginal
Primary substance & >age30 (reference: alcohol)					Justice client, Aboriginal
<i>Cannabis</i>	3.06	2.15	0.11	0.77 -12.10	
<i>Stimulants</i>	1.24	0.57	0.64	0.50 -3.06	
<i>Opioid</i>	0.92	0.30	0.79	0.48 -1.74	
Primary substance & justice client (reference: alcohol)					>age 30, Aboriginal
<i>Cannabis</i>	3.32	2.19	0.07	0.91 -12.10	
<i>Stimulants</i>	1.26	1.28	0.74	0.32 -5.00	
<i>Opioid</i>	2.54	0.89	0.06	0.95 -6.80	

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**Model 4: Poisson regression –  
re-admission****Relative risk****Robust  
Std Err****P-value****95%CI****Confounders**

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***Individual predictors***

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\*Statistically significantly less likely to re-admit.

\*\*Statistically significant more likely to re-admit.