**Title. Substance use treatment completion and criminal justice system contact in Chile: a retrospective data linked cohort study.**

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# Abstract

**Background and Aims** To examine the association between substance use treatment outcome and contact with the criminal justice system in Chile up to 10 years later among people admitted to Substance use Treatment (SUT). **Design:** Retrospective cohort study using survival analysis based on linked data from the Chilean Substance use treatment Agency and Prosecutor’s Office records from 2010 to 2019. **Setting** SUT is available at no cost through Chile’s publicly funded healthcare and is provided in ambulatory and residential modalities by public and private centres. **Participants** A total of 70,863 individuals received adult (+18 years) SUT. **Measurements** SUT completion status included Completion, Late (>=3 months) and Early Dropout (<3 months). Primary outcomes were (1) any contact with the criminal justice system and (2) contact leading to imprisonment after baseline treatment. **Findings** 31.5% of the participants had contacted the criminal justice system after their first SUT during the observed period, and 7.1% had one contact leading to imprisonment. Beneficiaries who completed SUT had lower risks of contact with the criminal justice system vs. those who dropped out of SUT late and early. **Conclusions** SUT completion in Chile was associated with a substantial reduction in contacting the criminal justice system risk up to 4 years after the first SUT.

**Key terms:** Substance use treatment; Criminal outcomes; Survival analysis; Contact with the criminal justice system; Imprisonment.

# INTRODUCTION

SUD-criminality; mechanisms of the relationship;

The association between substance use and crime is well-documented (Best & Colman, 2019). Evidence shows that a substantial proportion (40%-60%) of individuals presenting to substance use treatment (SUT) self-report recent offending (Holloway et al., 2006; Skjærvø et al., 2021). Also, it has been reported that criminal involvement and criminal networks can hinder substance use recovery, while drug abuse can be an obstacle to desistence from crime (Gossop et al., 2005; Skjærvø et al., 2021). However, the link between substance use disorders and crime is complex. Several theoretical models have been proposed, and one of the more prominent is Goldstein’s tripartite framework (1985) which proposes that problematic substance use leads to crime through three mechanisms. The first is psychopharmacological, suggesting that substance use directly triggers offending by lowering inhibitions and altering the users’ perceptions and decision-making. The economic-compulsive mechanism describes how some people who use substances need to generate money to pay for their habit, which might trigger specific types of offending (e.g., robbery, shoplifting). And the third mechanism refers to the systemic dimensions of substance use, highlighting how the use of illegal substances brings users and criminally-oriented individuals to contact the illicit drug market and the systemic violence involved in its regulation (4). Still, other models in the literature are empirically validated and offer contrary directionalities (crime leads to drug use), reciprocal relationship, no relationship, or more sophisticated explanations, including micro (individual characteristics), meso (familial and community networks), and macro-level factors (societal and global policy and regulations and conditions) (Reingle & Akers, 2018; Turnbull, 2019). In any case, if any of Goldstein’s mechanisms operate in practice (even partially) is then reasonable to expect that SUT could reduce offending by decreasing problematic patterns of substance use.

Role of SUT on criminality; role of tr. Completion? Less explored, siendo que tienen dificultades de adherencia criterio <90 days; más que días, más informativo alcanzar objetivos de tto.,; evidencia en completar vs. no-completar y outcomes.

In fact, consistent evidence shows that SUT programs can prevent crime and hence, reduce demand on the criminal justice system and the victim costs of crime (Garnick et al., 2014; Gossop et al., 2005; Havnes et al., 2012; Krebs et al.,2009; Kaskela & Pitkänen, 2020; Prendergast et al., 2002; Skjærvø et al.,2021; Smart & Reuter, 2022; Whitten et al., 2023). However, the role of SUT completion status in relation to crime prevention has been less explored (Kaskela & Pitkänen, 2020; Skjærvø et al., 2021; Zarkin et al., 2002). This gap is surprising considering that individuals usually experience difficulties in adhering to treatment (Andersson et al., 2019; Lappan et al., 2019; Morgan & Dennis, 2022; Stafford et al., 2022), which is associated with poorer health and criminal outcomes (Ruiz-Tagle et al., 2023; Teesson et al., 2015; Whitten et al., 2023). According to the National Institute on Drug Abuse (2018), treatment that lasts less than 90 days has limited effectiveness, recommending substantively longer lengths of treatment. Nevertheless, capturing the duration of treatment might not be as informative as treatment completion status because it indicates when a patient achieves the goals of treatment prescribed by professional advice (Zarkin, 2002). Thus, in the Finland context, it was documented that discontinued inpatient treatment episodes were more likely to be followed by criminality leading to imprisonment during a 5-year follow-up period, compared with completed treatment periods (Kaskela & Pitkänen, 2020). Similarily, the literature on drug courts has documented that failure to ‘graduate’ from drug courts (which implies non-completion of SUT) was associated with increased criminal outcomes (Koetzle & Listwan, 2019; Payne, 2008; Sheeran et al., 2022).

Se postulan confusores y dominios de confusión

Several factors are associated with SUT completion status. Nevertheless, the most salient obstacle for completing treatment is the nature of substance use disorders itself, as they are difficult to treat because episodes of relapse are common (Best & Colman, 2020). Furthermore, individual characteristics (sex, age, type of substance consumed, substance use patterns and profile, socioeconomic disadvantage, mental health problems, prior exposure to treatment, offending history, childhood trauma) and treatment features (setting, location, among others) have also an impact not only in completing SUT (Andersson et al., 2019; Brorson et al., 2013; Darke et al., 2012; Edelen et al., 2007; Godinet et al., 2020; Hawkins et al., 2008; Lappan et al., 2019; Lopez-Goñi et al., 2008; Mennis & Stahler, 2016; Mogan & Dennis 2022; Stafford et al., 2022; Stones & Dennis, 2023; Turan, R., & Yargic, 2012; Zarkin et al., 2002) but also in subsequent offending (Garnick et al., 2014; Gisev, et al., 2019; Kaskela & Pitkänen, 2020; Oliver et al., 2010; Skjærvø et al., 2021; Smart & Reuter, 2022; Whitten et al., 2023; Zarkin et al., 2002). Including these factors as possible confounders when assessing the association between substance use treatment completion and criminal outcomes seems crucial to avoid biased interpretations (Whitten et al., 2023).

No sé qué te parece, pero teniendo en cuenta la recomendación de tus revisoras, agregaría evidencia sobre tipo SUD más prevalente en Chile, y que eso a su vez tendría relación con el tipo de delito, ya que la prevalencia de distintas sustancias es distinta en Chile a USA.

The prevalence of opioid use appears to be lower among the Latin-American population compared to other regions, with alcohol and non-injected drug use (NIDU) being more common. Unlike other regions, Latin America and the Caribbean have a lower rate of Freebase use, while the consumption of cocaine paste base seems to be more prevalent. Given that substance use patterns may vary per offense types and offense types also vary in frequency, the relationship between SUT and criminal outcomes may differ.

Latin-American population exhibits a lower prevalence of opioid use compared to other regions, with a higher predominance of alcohol and non-injected drug us. Additionally and in contrast to other regions, Latin America and the Caribbean have lower rates of freebase use, while a greater prevalence of cocaine paste base. Given that patterns of substance use can fluctuate based on different types of offenses, and the frequency of these offenses also varies, the link between substance use tendencies (SUT) and criminal outcomes may differ to developed countries.

While the above-mentioned studies have made significant contributions to our knowledge, most of the prior evidence comes from developed Western countries and regions (e.g., the US and Western Europe), and results from other contexts are largely unknown (Klingemann, 2020; Mateo et al., 2022). The Chilean SUT policy is an interesting case of study as it is one of Latin America's oldest and most developed systems, and one of the few countries in the region that has a centralized data registry system that allows the emergence of local evidence (Marín-Navarrete et al., 2018; Mateo et al., 2022; Olivari et al., 2022). Unlike the global north, the Chilean SUT system employs multiple intervention approaches rather than specific interventions for specific substances. Thus, studying SUT outcomes in the Chilean context might contribute to the research gap not only in terms of SUT completion status on criminal outcomes but to address the limited research on addiction from the global south. Additionally, scholars have called for further research on SUT effectiveness from longitudinal, large-scale population and system-level treatment, as well as studies on administrative data-based outcomes (Babor, 2021; Krebs et al., 2009; Teesson et al., 2015). Hence, the current research aims to address those gaps by exploring the association of SUT completion status with the risk of contacting the criminal justice system in Chile, considering any contact and contacts leading to imprisonment, using linked administrative data of individuals in SUT treatment from 2010 to 2019.

# METHOD

## Design

This research relies on a retrospective data linked cohort design using population-based records from 2020-2019. This research protocol was approved by the Griffith University Human Research Ethics Committee (GUHREC) (GU Ref No: 2022/919).

## Data

The primary data source provided information on individuals enrolled in publicly funded Chilean SUT for the adult population between 2010 and 2019 from the Chilean Service for Prevention and Rehabilitation of Drug and Alcohol Consumption (SENDA). The second data source was obtained from the Prosecutor’s Office and provides information of official criminal charge records (including only finalised court outcomes) for the same individuals and period covered by the primary data source. A deterministic linkage process (using encryption of the Chilean Unique National ID, which is assigned to all Chilean citizens) was used to merge electronic records from the two mentioned sources. The encryption was performed by a third-party agency to maintain confidentiality.

**Setting and participants**

SUT is available at no cost through Chilean’s publicly funded healthcare (∼80% of the population eligible), with around 30,000 admissions for treatments each year; two-thirds correspond to treatment for the adult population, and the rest for adolescents in contact with the criminal system. Additionally, SUT delivery in Chile is based on multiple providers, public (coverage ∼71%) and private (∼29%), both financed by the Chilean State through a bidding process that requires them to follow technical protocols for quality assurance (e.g., infrastructure, treatment team composition). SUT includes ambulatory (∼85%) and residential (∼15%) treatment settings and treatment tailored for specific sub-groups, such as gender-specific or justice-involved populations. The data of this study includes all programs for the adult population, which includes programs oriented to the general population and women in the ambulatory and residential settings hosted by public and private providers.

We identified individuals receiving publicly funded Chilean SUT programs for the adult (+18 years) population between January 2010 to October 2019. We selected all individuals enrolled or ongoing their first publicly funded Chilean SUT programs for the adult population at any time between January 2010 to November 13th 2019 (hence, excluding individuals referred by other prior SUT or with ongoing SUT outside the mentioned period). We did not require any minimum duration of first SUT enrolment for study inclusion to reduce the risk of selection bias and strengthen the generalizability of results.

[Table 1. Sample flow chart]

|  |  |  |  |
| --- | --- | --- | --- |
| Order | Description | Total N | % Changed from the previous step |
| 1 | Individuals with ongoing SUT between 2010 and 2019 | 85,048 |  |
| 2 | Exclude enrollees with ongoing treatment each year between 2010 and 2019 | ? | ? |
| 3 | Exclude enrollees with ongoing treatment each year between 2010 and 2019 | 70,863 | -16.6% |

Yo la haría en función de PO 🡪 por cierto, esto debería ir en el suplementario LEJOS

|  |  |  |  |
| --- | --- | --- | --- |
| Order | Description | Total patients | % Changed from the previous step |
| 1 | Individuals with ongoing SUT between 2010 and 2019 | 85,048 |  |
| 2 | Patients that had records in Prosecutor’s Office | 74,833 | 88% |
| 3 | Exclude records with dates of commission after November 13th, 2019 (n= 47) | 74,786 | 99.9% |
| 4 | Erased records with missing information, discrepancies in ages between SENDA, and aberrant ages of commission | 74,745 | 99.9% |
| 5 | Exclude records with at least one of the conditions: administrative annulment, grouped to another criminal case (16,341), commission dates earlier than January 01, 2010 (n=17,506); duplicated records (n=7) | 74,535 | 99.7% |
| 6 | Exclude records of patients with at least one of the following conditions: found as a victim (n=20,624), if the patient did not receive a sentence (n=23,667) | 49,970 | 67% |
| 7 | Joined SENDAs database, but discarded records with missing dates of birth (n= 7) | 85,041 | 99.9% |
| 8 | Discarded patients where the first treatment corresponded to external referrals (n=), or ongoing treatments at the date of retrieval (November 13th, 2019) (n=8,657) | 70,863 | 83% |
| 9 | Excluded patients without treatment outcomes (n=7) | 70,854 | 99.9% |

## Measures

*Time to contact with the criminal justice system (Outcome 1)*

We used the recorded date of the first contact with the criminal justice system, after the first SUT for each participant, according to official records provided by the Chilean Prosecutor’s Office from 2010 to 2019. We defined ‘contact’ with the criminal justice system as any finalised court outcome that was (1) adjudicated with a guilty verdict (ranging from fines to imprisonment) or (2) diverted from further proceedings (a Chilean legal figure called Conditional Suspensions of Proceedings). Hence, we are not considering the acquitted outcome as ‘contact’. However, we considered diverted outcomes (2) as ‘contact’ because it represents the criminal justice response to individuals that committed minor crimes (e.g., burglary, shoplifting) for the first time. If more than one contact was recorded on the same date, we considered only the first one. Time was coded in years and calculated as the difference between the age at offense and the age of treatment discharge.

*Time to contact with the criminal justice system leading to imprisonment (Outcome 2)*

We used the recorded date of the first contact with the criminal justice system leading to imprisonment, after the first SUT for each participant, according to official records provided by the Chilean Prosecutor’s Office from 2010 to 2019. Time was coded in years and calculated as the difference between the age at offense and the age of treatment discharge.

*SUT completion status (Exposure variable)*

We defined the key independent variable as SUT completion status. It was calculated using the dates of admission and exit of first SUT (or baseline), and the information of reasons for discharge of SUT. Thus, this variable was categorised as SUT completion, late dropout (>= 3 months of SUT) and early dropout (<3 months). Early and late dropout involves interrupted treatment due to voluntary or involuntary causes (e.g., interruptions due to serious misconduct against treatment norms).

*Other covariates*

Covariates for all regression analyses covered four dimensions (I-IV). First, (I) demographic information: (i) Sex (Women, Men); (ii)Age (Numeric); (iii) Poverty of the Municipality of residence(Percentage);(iv) Urbanicity of the commune of residence(Urban, Rural, Mixed); (v) Employment (Unemployed, Employed, Inactive); (vi)Education (More than high school, Completed high school or less, Completed primary school or less); (vii) Tenure status of household (Owner, Other); (viii) Having children (Yes, No); (ix) Cohabitation (Family, Others, Alone). Second, (II) treatment level factors: (x) Modality of treatment (Inpatient, Outpatient); (xi) Geographical area (South, Centre, North); (xii) Year of SUT admission (Numerical). Third, (III) the health information included: (xiii) Substance use onset age (Numerical); (xiv) Type of substance use onset (Alcohol, Cannabis, Cocaine, Cocaine base paste, Others); (xv) Substance use severity (Low, Middle, High); (xvi) Primary substance at admission (Alcohol, Cannabis, Cocaine, Cocaine base paste, Others); (xvii) Frequency of use of primary substance at admission (Less than 1 day a week, 1 day a week or more, 2 to 3 days a week, 4 to 6 days a week, Daily) ;(xviii) Poly-substance use (Yes, No); (xix) Psychiatric comorbidity (Yes, No); (xx) Severe physical comorbidity (Yes, No). And finally, (IV) criminal history: (xxi) Number of previous violent offences (Numeric); (xxii) Number of previous acquisitive offences (Numeric); (xxiii) Number of previous drug-related offences (Numeric); (xxiv) Number of previous other offences (Numeric).

## Statistical analysis

*Survival analysis*

We aimed to estimate the association between the SUT completion status and contact with the criminal justice system. However, given that hazards were not proportional in both models, we calculated the association between SUT completion status and Contact with the criminal justice system through Royston-Parmar models while adjusting for several covariates. Models were evaluated over the entire follow-up period and the degrees of freedom of restricted cubic splines of the baseline log hazard functions and time-varying coefficients were determined using the Akaike information criterion (AIC) and the Bayesian information criterion (BIC). Additionally, we obtained the standardized survival curves and restricted mean survival times (RMST) and their differences between treatment outcomes at 56 equally spaced numbers between 0 and 7, but focused on 1, 3 and 5 years, through the *stpm2* command in Stata. (Detailed information, available in the Supplemental Material).

To address potential sources of bias, the models adjust for a wide range of covariates. Also, missing data were imputed using multiple imputations with regression trees from *missRanger* R package.

*Sensitivity Analysis*

We compared models using complete case analysis and other imputation options (results included in Supplementary material 1). Additionally, secondary analyses included e-values of the strength of confounding needed to take away the associations between treatment outcome and contact with CJS. Codes are available at bit.ly/40cMATs.

# RESULTS

## Characteristics of the study population

* Participant characteristics are displayed in Table 3.
* Of the 109,756 SUT records of admissions (85,048 individuals), 70,863 individuals (83% of the individuals’ total) were eligible to be matched with the Prosecutor’s Office database, as we decided to exclude individuals with ongoing treatments or treatments that ended in referrals.
* Of the total study population, 19,276 (27%) individuals achieve treatment completion status, 15,797 (22%) had an early drop-out, and 35,781 (51%) had a late drop-out.
* Regarding the involvement with the criminal justice system, 22,287 individuals (31%) had at least one contact (Outcome 1). And those that had contact that led to imprisonment (Outcome 2) were 5,144 individuals (7%).
* In terms of covariates, it stands out that SUT completion status is statistically associated to older age, have a later age of onset of use, alcohol as main substance (rather than cocaine), prevalence of physical co-morbidity, stable housing situation and less pre-treatment criminality.

[AGS: Table. Survival coefficients of the selected models]

| **Table 3.** | | **Overall** | **Treatment completion** | **Treatment non-completion (Early dropout)** | **Treatment non-completion (Late dropout)** | **Statistic** | **P value** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **\*\*70863\*\*** | **\*\*19276\*\*** | **\*\*15797\*\*** | **\*\*35781\*\*** |  |  |
| Outcome 1. Contact with the criminal justice system | Yes | 22287 (31.5) | 3825 (19.8) | 6130 (38.8) | 12326 (34.4) | X²(2, 70863)= 1750; p<0,001 |  |
| Outcome 2. Contact leading to imprisonment | Yes | 5144 (7.3) | 664 (3.4) | 1711 (10.8) | 2766 (7.7) | X²(2, 70863)= 728; p<0,001 |  |
| Treatment Modality (%) | Ambulatory | 60398 (85.2) | 15605 (81.0) | 12661 (80.1) | 32129 (89.8) | X²(2, 70863)=1200; p<0,001 |  |
| Residential | 10397 (14.7) | 3656 (19.0) | 3115 (19.7) | 3620 (10.1) |  |  |
| [Missing] | 68 ( 0.1) | 15 ( 0.1) | 21 ( 0.1) | 32 ( 0.1) |  |  |
| Age (admission to treatment) (median [IQR]) |  | 34.06 [27.39, 42.91] | 37.55 [29.58, 47.19] | 31.91 [25.95, 39.67] | 33.49 [27.12, 41.90] | H(2)=2037.6, p<0,001 |  |
| Sex (%) | Men | 54048 (76.3) | 14232 (73.8) | 12242 (77.5) | 27568 (77.0) | X²(2, 70863)=88; p<0,001 |  |
| Women | 16815 (23.7) | 5044 (26.2) | 3555 (22.5) | 8213 (23.0) |  |  |
| Age of Onset of Substance Use (median [IQR]) |  | 15.00 [14.00, 18.00] | 16.00 [14.00, 18.00] | 15.00 [13.00, 17.00] | 15.00 [14.00, 18.00] | H(2)=471.9, p<0,001 |  |
| Educational Attainment (%) | 3-Completed primary school or less | 20249 (28.6) | 4996 (25.9) | 4801 (30.4) | 10448 (29.2) | X²(4, 70863)=438; p<0,001 |  |
| 2-Completed high school or less | 39038 (55.1) | 10272 (53.3) | 8852 (56.0) | 19910 (55.6) |  |  |
| 1-More than high school | 11259 (15.9) | 3926 (20.4) | 2073 (13.1) | 5260 (14.7) |  |  |
| [Missing] | 317 ( 0.4) | 82 ( 0.4) | 71 ( 0.4) | 163 ( 0.5) |  |  |
| Primary Substance (admission to treatment) (%) | Alcohol | 23863 (33.7) | 8520 (44.2) | 3967 (25.1) | 11373 (31.8) | X²(8, 70863)=2149; p<0,001 |  |
| Cocaine hydrochloride | 13243 (18.7) | 3279 (17.0) | 2891 (18.3) | 7071 (19.8) |  |  |
| Cocaine paste | 27791 (39.2) | 5635 (29.2) | 7810 (49.4) | 14343 (40.1) |  |  |
| Marijuana | 4748 ( 6.7) | 1326 ( 6.9) | 937 ( 5.9) | 2484 ( 6.9) |  |  |
| Other | 1217 ( 1.7) | 516 ( 2.7) | 192 ( 1.2) | 509 ( 1.4) |  |  |
| [Missing] | 1 ( 0.0) | 0 ( 0.0) | 0 ( 0.0) | 1 ( 0.0) |  |  |
| Frequency of Substance Use (Primary Substance) (%) | Less than 1 day a week | 3495 ( 4.9) | 1062 ( 5.5) | 578 ( 3.7) | 1855 ( 5.2) | X²(8, 70863)=467; p<0,001 |  |
| 2 to 3 days a week | 20061 (28.3) | 5502 (28.5) | 3906 (24.7) | 10652 (29.8) |  |  |
| 4 to 6 days a week | 11612 (16.4) | 3035 (15.7) | 2620 (16.6) | 5956 (16.6) |  |  |
| 1 day a week or more | 4780 ( 6.7) | 1488 ( 7.7) | 795 ( 5.0) | 2497 ( 7.0) |  |  |
| Daily | 30560 (43.1) | 8101 (42.0) | 7812 (49.5) | 14640 (40.9) |  |  |
| [Missing] | 355 ( 0.5) | 88 ( 0.5) | 86 ( 0.5) | 181 ( 0.5) |  |  |
| Occupational Status (f) (%) | Employed | 35367 (49.9) | 9788 (50.8) | 6878 (43.5) | 18698 (52.3) | X²(10, 70863)=698; p<0,001 |  |
| Inactive | 7169 (10.1) | 2363 (12.3) | 1356 ( 8.6) | 3449 ( 9.6) |  |  |
| Looking for a job for the first time | 159 ( 0.2) | 49 ( 0.3) | 37 ( 0.2) | 73 ( 0.2) |  |  |
| No activity | 3558 ( 5.0) | 986 ( 5.1) | 1060 ( 6.7) | 1512 ( 4.2) |  |  |
| Not seeking for work | 713 ( 1.0) | 214 ( 1.1) | 203 ( 1.3) | 295 ( 0.8) |  |  |
| Unemployed | 23896 (33.7) | 5876 (30.5) | 6263 (39.6) | 11753 (32.8) |  |  |
| [Missing] | 1 ( 0.0) | 0 ( 0.0) | 0 ( 0.0) | 1 ( 0.0) |  |  |
| Co-occurring Substance Use Disorders (Polysubstance use) (%) | 0 | 18443 (26.0) | 6403 (33.2) | 3387 (21.4) | 8653 (24.2) | X²(4, 70863)=23423; p<0,001 |  |
| 1 | 52420 (74.0) | 12873 (66.8) | 12410 (78.6) | 27128 (75.8) |  |  |
| Number of Children (dichotomized) (%) | 0 | 16428 (23.2) | 4448 (23.1) | 3807 (24.1) | 8172 (22.8) | X²(2, 70863)= 9; p=0,009 |  |
| 1 | 53831 (76.0) | 14668 (76.1) | 11873 (75.2) | 27282 (76.2) |  |  |
| [Missing] | 604 ( 0.9) | 160 ( 0.8) | 117 ( 0.7) | 327 ( 0.9) |  |  |
| Housing Situation (Tenure Status) (%) | Illegal Settlement | 749 ( 1.1) | 193 ( 1.0) | 212 ( 1.3) | 344 ( 1.0) | X²(8, 70863)=313; p<0,001 |  |
| Others | 2003 ( 2.8) | 518 ( 2.7) | 428 ( 2.7) | 1057 ( 3.0) |  |  |
| Owner/Transferred dwellings/Pays Dividends | 24816 (35.0) | 7724 (40.1) | 4955 (31.4) | 12133 (33.9) |  |  |
| Renting | 12095 (17.1) | 3283 (17.0) | 2703 (17.1) | 6105 (17.1) |  |  |
| Stays temporarily with a relative | 27142 (38.3) | 6674 (34.6) | 6209 (39.3) | 14258 (39.8) |  |  |
| [Missing] | 4058 ( 5.7) | 884 ( 4.6) | 1290 ( 8.2) | 1884 ( 5.3) |  |  |
| Macro Administrative Zone in Chile (%) | Center | 53683 (75.8) | 13616 (70.6) | 11817 (74.8) | 28245 (78.9) | X²(4, 70863)=1034; p<0,001 |  |
| North | 10486 (14.8) | 2933 (15.2) | 2955 (18.7) | 4598 (12.9) |  |  |
| South | 6678 ( 9.4) | 2724 (14.1) | 1014 ( 6.4) | 2937 ( 8.2) |  |  |
| [Missing] | 16 ( 0.0) | 3 ( 0.0) | 11 ( 0.1) | 1 ( 0.0) |  |  |
| Violent Criminal Offenses (Pre-Treatment) (%) | 0 | 58947 (83.2) | 16582 (86.0) | 12704 (80.4) | 29652 (82.9) | X²(2, 70863)=200; p<0,001 |  |
| 1 | 11916 (16.8) | 2694 (14.0) | 3093 (19.6) | 6129 (17.1) |  |  |
| Acquisitive Criminal Offenses (Pre-Treatment) (%) | 0 | 58088 (82.0) | 16984 (88.1) | 11968 (75.8) | 29129 (81.4) | X²(2, 70863)=911; p<0,001 |  |
| 1 | 12775 (18.0) | 2292 (11.9) | 3829 (24.2) | 6652 (18.6) |  |  |
| Substance-Related Criminal Offenses (Pre-Treatment) (%) | 0 | 58430 (82.5) | 16373 (84.9) | 12466 (78.9) | 29582 (82.7) | X²(2, 70863)=220; p<0,001 |  |
| 1 | 12433 (17.5) | 2903 (15.1) | 3331 (21.1) | 6199 (17.3) |  |  |
| Other Criminal Offenses (Pre-Treatment) (%) | 0 | 58603 (82.7) | 16678 (86.5) | 12390 (78.4) | 29526 (82.5) | X²(2, 70863)=399; p<0,001 |  |
| 1 | 12260 (17.3) | 2598 (13.5) | 3407 (21.6) | 6255 (17.5) |  |  |
| Psychiatric Comorbidity (ICD-10) (%) | Without psychiatric comorbidity | 27922 (39.4) | 9251 (48.0) | 2945 (18.6) | 15725 (43.9) | X²(4, 70863)=23423; p<0,001 |  |
| Diagnosis unknown (under study) | 13273 (18.7) | 353 ( 1.8) | 9505 (60.2) | 3415 ( 9.5) |  |  |
| With psychiatric comorbidity | 29668 (41.9) | 9672 (50.2) | 3347 (21.2) | 16641 (46.5) |  |  |
| SUD Severity (Dependence status) (%) | Drug dependence | 51166 (72.2) | 13401 (69.5) | 12105 (76.6) | 25654 (71.7) | X²(2, 70863)=228; p<0,001 |  |
| Hazardous consumption | 19696 (27.8) | 5875 (30.5) | 3692 (23.4) | 10126 (28.3) |  |  |
| [Missing] | 1 ( 0.0) | 0 ( 0.0) | 0 ( 0.0) | 1 ( 0.0) |  |  |
| Socioeconomic Classification (%) | Urbana | 58276 (82.2) | 15287 (79.3) | 13598 (86.1) | 29383 (82.1) | X²(4, 70863)=298; p<0,001 |  |
| Mixta | 6835 ( 9.6) | 2069 (10.7) | 1288 ( 8.2) | 3477 ( 9.7) |  |  |
| Rural | 5750 ( 8.1) | 1920 (10.0) | 909 ( 5.8) | 2921 ( 8.2) |  |  |
| [Missing] | 2 ( 0.0) | 0 ( 0.0) | 2 ( 0.0) | 0 ( 0.0) |  |  |
| Percentage of people in poverty (median [IQR]) |  | 0.12 [0.07, 0.17] | 0.11 [0.07, 0.17] | 0.11 [0.07, 0.15] | 0.12 [0.08, 0.17] | H(2)=346.6, p<0,001 |  |
| Primary Substance (initial diagnosis)   (%) | Alcohol | 38412 (54.2) | 11793 (61.2) | 7626 (48.3) | 18989 (53.1) | X²(8, 70863)=932; p<0,001 |  |
| Cocaine hydrochloride | 2605 ( 3.7) | 566 ( 2.9) | 649 ( 4.1) | 1390 ( 3.9) |  |  |
| Cocaine paste | 3311 ( 4.7) | 631 ( 3.3) | 1041 ( 6.6) | 1639 ( 4.6) |  |  |
| Marijuana | 19142 (27.0) | 4123 (21.4) | 5132 (32.5) | 9883 (27.6) |  |  |
| Other | 1606 ( 2.3) | 480 ( 2.5) | 378 ( 2.4) | 748 ( 2.1) |  |  |
| [Missing] | 5787 ( 8.2) | 1683 ( 8.7) | 971 ( 6.1) | 3132 ( 8.8) |  |  |
| Corrected birth year (median [IQR]) |  | 1980.00 [1971.00, 1987.00] | 1976.00 [1967.00, 1984.00] | 1982.00 [1975.00, 1988.00] | 1980.00 [1972.00, 1987.00] | H(2)=2147.6, p<0,001 |  |
| Cohabitation status (Recoded) (f) (%) | Alone | 6688 ( 9.4) | 2015 (10.5) | 1636 (10.4) | 3035 ( 8.5) | X²(8, 70863)=313; p<0,001 |  |
| Family of origin | 29340 (41.4) | 7453 (38.7) | 6843 (43.3) | 15040 (42.0) |  |  |
| Others | 6109 ( 8.6) | 1611 ( 8.4) | 1502 ( 9.5) | 2996 ( 8.4) |  |  |
| With couple/children | 28725 (40.5) | 8197 (42.5) | 5816 (36.8) | 14709 (41.1) |  |  |
| [Missing] | 1 ( 0.0) | 0 ( 0.0) | 0 ( 0.0) | 1 ( 0.0) |  |  |
| Physical Comorbidity (ICD-10) (%) | Without physical comorbidity | 28053 (39.6) | 7939 (41.2) | 6005 (38.0) | 14104 (39.4) | X²(4, 70863)=248; p<0,001 |  |
| Diagnosis unknown (under study) | 38395 (54.2) | 9804 (50.9) | 9053 (57.3) | 19535 (54.6) |  |  |
| One or more | 4415 ( 6.2) | 1533 ( 8.0) | 739 ( 4.7) | 2142 ( 6.0) |  |  |

**Notes. H= Kruskal-Wallis test for continuous variables; X2=Chi-square test for independence for categorical variables.**

## *Intervention measures on any contact with the criminal justice system (Outcome 1) and contacts leading to imprisonment (Outcome 2)*

* Intervention measures on Outcome 1 and Outcome 2 are displayed in Table 4, Table 5, and Figure 1.
* Compared to those receiving almost no treatment (early dropout), those completing SUT had a longer average period before both committing an offence that led to a conviction (outcome 1) and committing an offence that led to imprisonment (outcome 2).
* Similarly, compared to receiving some treatment (late dropout), those completing SUT took longer to have any contact with the criminal justice system and to have one contact leading to imprisonment. However, the gap between the group that completed treatment and those who had a late drop out of SUT is smaller than the gap between the first group and who had an early dropout of SUT considering both outcomes.
* Additionally, the difference was also lower when we compared those who received some treatment (late dropout) with those with almost no treatment (early dropout) regarding the time to have any contact with the criminal justice system and to have one contact leading to imprisonment.
* However, it is important to notice that the gap of time to contact the criminal justice system between Early vs Late dropout did not overlap the null in Tables 4 & 5, which means that receiving some treatment (even when not completing it) has the effect of delaying the contact with the criminal justice system.
* Contrasting the association between SUT completion according to each outcome of interest...

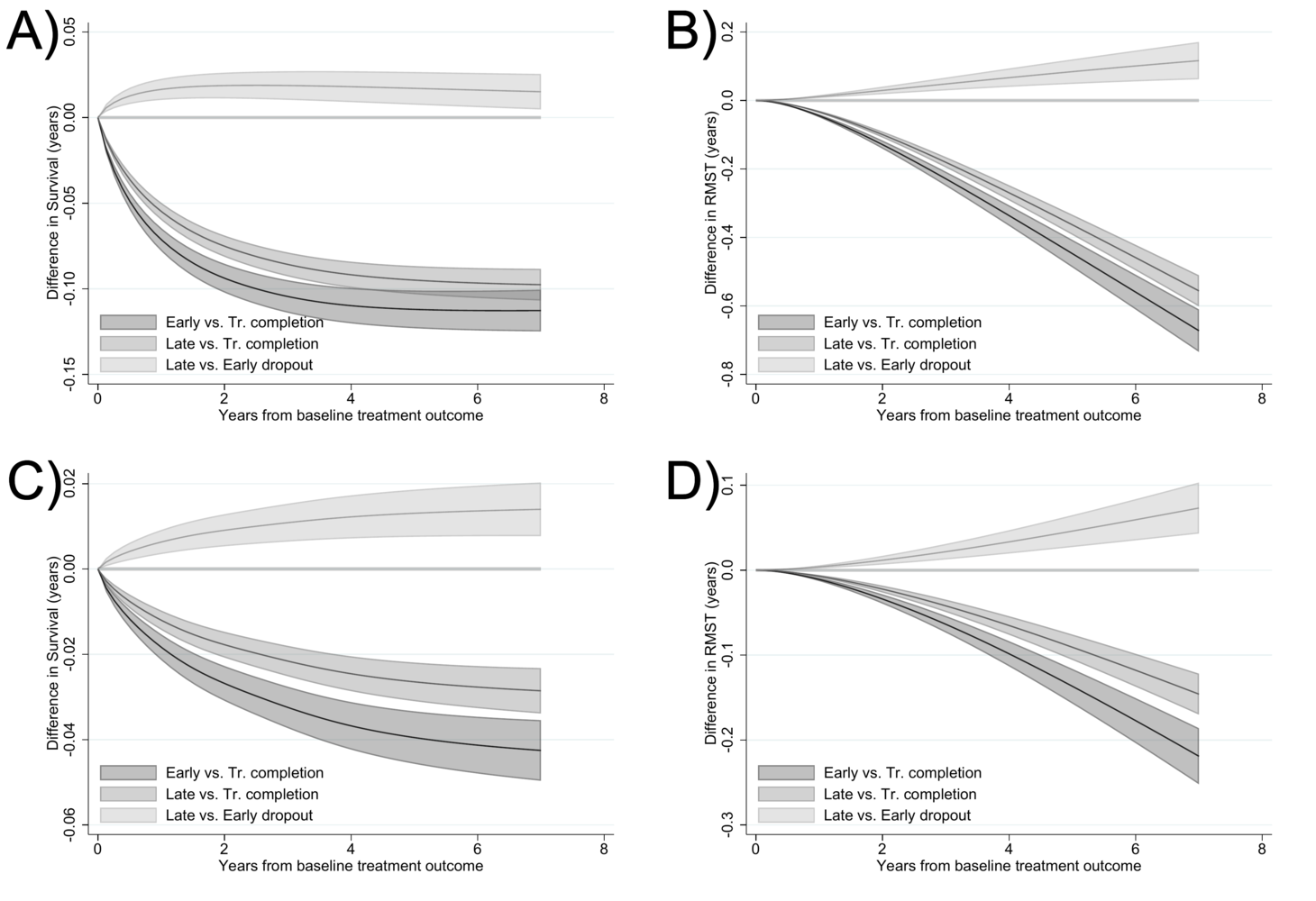
Table 4: Offending with Condemnatory Sentence Time

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Time** | **Complete Tr.** | **Late Disch.** | **Early Disch.** | **Comp. vs Late** | **Comp. vs Early** | **Early vs Late** |
| *Probs.* |  |  |  |  |  |  |
| 1\_yr | 90.0 (89.6,90.4) | 84.4 (84.1,84.8) | 82.8 (82.3,83.3) | -5.5 (-6.0,-5.0) | -7.2 (-7.9,-6.5) | 1.7 (1.0,2.3) |
| 3\_yrs | 79.4 (78.8,80.0) | 70.9 (70.4,71.3) | 69.0 (68.3,69.7) | -8.6 (-9.3,-7.9) | -10.4 (-11.4,-9.5) | 1.9 (1.0,2.7) |
| 5\_yrs | 73.4 (72.7,74.2) | 63.9 (63.4,64.5) | 62.2 (61.4,63.1) | -9.5 (-10.3,-8.7) | -11.2 (-12.3,-10.1) | 1.7 (0.8,2.7) |
| *RMST* |  |  |  |  |  |  |
| 1\_yr | 0.962 (0.959,0.965) | 0.928 (0.925,0.930) | 0.916 (0.912,0.920) | -0.034 (-0.038,-0.031) | -0.046 (-0.051,-0.041) | 0.012 (0.007,0.016) |
| 3\_yrs | 2.622 (2.610,2.635) | 2.442 (2.433,2.452) | 2.394 (2.379,2.410) | -0.180 (-0.195,-0.164) | -0.228 (-0.248,-0.207) | 0.048 (0.029,0.067) |
| 5\_yrs | 4.172 (4.148,4.197) | 3.807 (3.788,3.825) | 3.722 (3.692,3.752) | -0.366 (-0.395,-0.336) | -0.450 (-0.491,-0.410) | 0.085 (0.049,0.121) |

**Table 5: Offending with imprisonment Time**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Time** | **Complete Tr.** | **Late Disch.** | **Early Disch.** | **Comp. vs Late** | **Comp. vs Early** | **Early vs Late** |
| *Probs*. |  |  |  |  |  |  |
| 1\_yr | 98.4 (98.3,98.6) | 97.2 (97.1,97.4) | 96.6 (96.3,96.8) | -1.2 (-1.4,-1.0) | -1.9 (-2.2,-1.5) | 0.6 (0.4,0.9) |
| 3\_yrs | 96.4 (96.1,96.7) | 94.3 (94.0,94.5) | 93.2 (92.8,93.6) | -2.2 (-2.5,-1.8) | -3.2 (-3.7,-2.8) | 1.1 (0.6,1.5) |
| 5\_yrs | 94.9 (94.5,95.3) | 92.3 (92.0,92.6) | 91.0 (90.5,91.4) | -2.6 (-3.1,-2.2) | -4.0 (-4.6,-3.3) | 1.3 (0.8,1.9) |
| *RMST* |  |  |  |  |  |  |
| 1\_yr | 1.010 (1.008,1.011) | 1.002 (1.001,1.003) | 0.998 (0.997,1.000) | -0.007 (-0.009,-0.006) | -0.011 (-0.013,-0.009) | 0.004 (0.002,0.006) |
| 3\_yrs | 2.931 (2.925,2.936) | 2.889 (2.884,2.893) | 2.867 (2.860,2.875) | -0.042 (-0.049,-0.035) | -0.063 (-0.073,-0.054) | 0.022 (0.013,0.031) |
| 5\_yrs | 4.878 (4.865,4.890) | 4.786 (4.777,4.796) | 4.740 (4.724,4.755) | -0.091 (-0.107,-0.076) | -0.138 (-0.158,-0.117) | 0.046 (0.027,0.065) |

**Figure 1: Differences in survival probabilities(up) and RMSTs(bottom) for time-to condemnatory sentence(left) & imprisonment(right)**



***Note. Panels A) and B) depict differences in transition probabilities; Panels B) and D) depicts differences in RMSTs.***

# DISCUSSION

This study assessed the association between SUT outcome and contact with the criminal justice system in Chile, considering any type of contact and contact leading to imprisonment across a 5-years follow-up. Our findings show that achieving SUT completion status is associated with longer time to contact the criminal justice system comparing with dropping-out treatment, suggesting that SUT has a protective effect on criminal involvement that is consistent up to 5 years post treatment. Previous research has shown the association between substance use treatment outcome and subsequent health outcomes such as mortality and hospitalisations (Andersson et al., 2019; Decker et al., 2017; Mckay & Weiss, 2001; Olivari et al., 2023; Ruiz-Tagle, 2023). Our findings show that treatment completion status is also associated with a reduction of criminal justice contact, confirming the conclusions claimed by few studies with this emphasis in the context of global north (Kaskela & Pitkänen, 2020; Skjærvø et al., 2021). More specifically, the current study also corroborates that completing treatment may not just prevent any contact with the criminal justice system, but more importantly, contacts leading to imprisonment (Kaskela & Pitkänen, 2020).

Instead of focusing on the effect of treatment duration or length of stay on criminal justice involvement outcomes (Garnick et al., 2014; Gisev et al., 2019; Havnes et al., 2012; Oliver et al., 2010; Whitten et al., 2023), our work has the peculiarity of focusing on substance use treatment completion, which provides insights regarding the importance of capturing the achievement of individual therapeutic goals as prescribed by professional advice (Zarkin, 2002). In terms of the factors associated with completing SUT, our results from the Chilean context show that, in general, older age, higher education attainment, employment, and not having a criminal history are associated with completing SUT, confirming what has been highlighted by international research (Andersson et al., 2019; Brorson et al., 2013; Darke et al., 2012; Edelen et al., 2007; Godinet et al., 2020; Hawkins et al., 2008; Lappan et al., 2019; Lopez-Goñi et al., 2008; Mennis & Stahler, 2016; Mogan & Dennis, 2022; Stafford et al., 2022; Stones & Dennis, 2023; Turan & Yargic, 2012; Zarkin et al., 2002).

Besides the importance of completing SUT, our work identified that even having some treatment (late dropout) is related to a lower risk of criminal justice contact than having almost no treatment (early drop out). This indicates that individuals can obtain benefits of SUT even if they do not complete treatment, which might have implications for policymaking in terms of enhancing the practices oriented to treatment retention, related to staff rapport and management of peer misbehaviour and improvements to program structure (Lappan et al., 2019; Whitten et al., 2023).

A key strength of this study was the use of linked administrative data of a population-based cohort of SUT patients in Chile. Consequently, our findings are likely to be representative of SUT users in Chile. It is noteworthy that the observed findings regarding the protective effect of completing SUT on criminal justice involvement remain significant throughout the various follow-up time points analysed (1, 3, and 5 years). The lack of long-term observations and population-based studies to assess the validity and lasting outcomes of SUT has been a concern in previous research (Babor, 2021; Hubbard, 2003; Teesson et al., 2015). Another advantage of this current research is that it provides insights into outcomes associated with an integrated approach to SUT, which is the case in Chile and other Latin American countries. This contributes to the existing knowledge base, which typically focuses on specific approaches or substances of treatment (Babor, 2021), primarily in the context of the global north (Klingemann, 2020; Mateo et al., 2022).

However, this research is not without limitations. First, we acknowledge administrative data constraints, as we were unable to control for potential confounding factors, such as history of child maltreatment (Stones & Dennis, 2023; Whitten et al., 2023), self-control (Skjærvø et al.,2021) and motivation to change (Oliver et al., 2010; Stones & Dennis, 2023). Secondly, failing to account for multiple treatment attempts after the first treatment and before contact with the criminal justice system might increase the success of the first treatment. Third, this research could not consider some sources of censoring, such as pre-treatment criminality information before 2010 and receiving adolescent SUT, and mortality and open legal proceedings. In a similar line, given that not all offences are reported to police and not all of them prosecuted by the criminal justice system (especially minor offences), the true rates of offending are likely to have been underestimated (Gisev et al.,2019; Havnes et al., 2012). Arguably, offenses with a sentence of imprisonment could preclude from occurring a less restrictive and more ample offense with a condemnatory sentence, thus considering that would be a suitable competing risk to account when estimating the probability of an event. However, these events are not totally complementary because offenses only account for a quarter of the offenses with a condemnatory sentence; and given that the offense date differs and the application of judiciary measures, many patients could commit offenses with different judiciary outcomes in parallel.

Standardization of survival probabilities and restricted mean survival times often involve assumptions about the data (e.g., no measurement error, independence of observations, correct specification of the functional form of the time to event models), which may not be fully accountable in an observational design. However, we believe that the sample size, nationwide records (multicentre and across all administrative regions), the number considerable of covariates, testing several model specifications in terms of fit to the data and parsimony may ameliorate these limitations.

Regarding the generalizability of results, studying the case of Chile seeks to be informative to other countries in Latin America, even though we recognize that the economic and social context can vary within the region. However, we propose that our findings might be more pertinent to the mentioned region than current evidence from the global north. Finally, this research recognises that the reasons related to offending are multifactorial, offenses themselves can be very heterogeneous, and although SUT provides important benefits in terms of health and crime prevention, it is not feasible to expect that SUT by itself can address the broader social issues that triggers criminality, including structural factors such as social inequality, poverty and drug control legal frameworks (Best & Colman, 2019; Gisev et al, 2019; Turnbull, 2019).

# CONCLUSIONS

Our findings collectively show that SUT is associated with a significant reduction in contact with the criminal justice system, and that its protective effect is optimized when the patients achieve SUT completion status. Therefore, an increased focus on encouraging retention in SUT is essential to maximise the long-term benefits of SUT.

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