# RESULTS

**Characteristics of the study population**

Participant characteristics are displayed in Table 3. Of all 85,048 individuals receiving Substance use Treatment (SUT) from 2010 to 2019, 70,863 individuals (83% of the total) were eligible to be matched with the Prosecutor’s Office database.

Among the total study population, 19,276 individuals (27%) achieved treatment completion status, 35,781 individuals (51%) had a late drop-out, and 15,797 individuals (22%) had an early drop-out. In terms of the covariates, it is notable that the group of individuals who completed treatment had a different profile than those who dropped out of treatment. They are statistically different in terms of every variable included in the analysis. Demographically, the main differences are that those who completed treatment, compared to those who dropped out, were, on average, older, less frequently unemployed, and attained higher education. Additionally, there are significant differences in terms of substance use. A lower proportion of those who completed treatment used cocaine base paste, developed substance use dependence, engaged in polysubstance use, and used substances with less intensity than the individuals who dropped out of treatment. Furthermore, comorbidity (psychiatric or physical) was more frequently diagnosed among those who completed treatment, which may be attributed to the fact that those who dropped out did not have the opportunity to be diagnosed with those conditions. Finally, individuals who completed treatment were less likely to have a history of criminal offenses of any kind compared to those who dropped out.

[Insert Table 3 here]

**Frequency of contact with the criminal justice system**

Regarding contact with the criminal justice system, 22,287 individuals (31.5%, incidence of 97 per 1,000 person-years) had at least one contact of any kind (Outcome 1), and 5,144 (7.3%, incidence of 17 per 1,000 person-years) had contact leading to imprisonment (Outcome 2). Notably, individuals that completed treatment had less contact of any kind (19.8%) than the people who dropped out of treatment late (34.4%) and early (38.8%). Likewise, those who completed treatment had significantly less (3.4%) contact with the justice system leading to imprisonment than those who dropped out of treatment late (7.7%) or early (10.8%).

**Association between SUT completion status and contact with the criminal justice system: any contact and contact leading to imprisonment.**

Individuals who completed SUT had higher probabilities of avoiding both any contact with the criminal justice system (Outcome 1, Table 4) and contact leading to imprisonment (Outcome 2, Table 5) than those who dropped out late and early of SUT at all time points. Even after 5 years after baseline, for those who completed SUT, the probability of avoiding any contact with the criminal justice system was 73.4% (95%CI: 72.7,74.2) which drops to a probability of 63.9% (63.4,64.5) for those who dropped out late, and again to a 62.2% (61.4,63.1) for those who dropped out early of SUT. This pattern also is observed in the case of the survival probabilities related to contacts that lead to imprisonment.

Regarding RMTL, which represents the average time lost until contact with the criminal justice system occurs, it follows a similar pattern. The RMTL values are lowest for the individuals who completed treatment, followed by those who dropped out late and early at each time point. The differences in RMTL between the groups with different SUT completion status are also provided, indicating that, on average, those who completed treatment took longer to contact the criminal justice system than those who dropped out. Differences are represented graphically in Figure 1, considering transition probabilities and differences in RMTL. The biggest gaps in survival time are the transition probabilities and RMTL between the group that dropped out of SUT early and those who completed SUT in terms of both outcomes. Finally, the observed differences tend to grow rapidly between groups within the first 2 years and stabilize around 5 years after treatment.

[Insert Table 4 and Table 5 here]

[Insert Figure 1 here]

**Sensitivity analysis**

E-values showed that an unmeasured confounder would need to be very large (i.e., a hazard ratio of at least 2.2) to explain away the observed association between early dropout and any contact with the criminal justice system at baseline (t=0). In contrast, an unmeasured confounder of at least 2.0 would explain the association between SUT completion and having any contact with the criminal justice system. Similarly, an unmeasured confounder would need to be of at least 2.4 to move the association between SUT completion status and contact with the criminal justice system leading to imprisonment to null. And the hazard ratio of an unmeasured confounder would be at least 2.0 to explain the association between SUT completion and having contact leading to imprisonment (Supplemental Material, Section X).

Our results were robust across different estimations and modelling options. Sensitivity analyses consistently showed equivalent differences in survival times and RMST between baseline SUT completion status and condemnatory sentence and imprisonment throughout models with complete cases and other imputation options (see Supplemental Material, Section X). Our findings were also corroborated after comparing the results with models that relaxed the proportionality assumption as well as using Cox regression assuming proportional hazards and without time-dependent coefficients.

Table 3. Characteristics of the study population

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

Notes. For categorical variables, frequencies (n) and percentages (%) in parenthesis; For continuous variables, median (Q2) and percentiles 25 (Q1) and 75 (Q3) in brackets. H= Kruskal-Wallis test for continuous variables; X2=Chi-square test for independence for categorical variables.

Table 4: Offending with Condemnatory Sentence Time

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Time** | **Complete Tr.** | **Late Dropout** | **Early Dropout** | **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 Dropout** | **Early Dropout** | **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 any contact with the criminal justice system(left) and contact leading to imprisonment(right)

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

Figure 1(alt): Differences in survival probabilities(up) and RMTLs(bottom) for time-to any contact with the criminal justice system(left) and contact leading to imprisonment(right)

Note. Panels A) and B) depict differences in transition probabilities; Panels C) and D) depicts differences in RMTLs.