**Poly-substance use, treatment completion, and contact with the justice system: a multistate analysis of treatments for substance use disorders between 2010-2019 in Chile**

# Background

Substance use disorders (SUD) are related to criminality, such as violence(Duke et al., 2018), arrests(Sugie & Turney, 2017) or incarceration (Thomas et al., 2022). A considerable proportion of people with SUD use multiple substances during active use in their lifetime(Liu et al., 2018),(Connor et al., 2014). People with polysubstance use (PSU) are considered a high-risk population not only due to its association with mortality(Gjersing & Bretteville-Jensen, 2018), relapse(Hassan & Le Foll, 2019) and other detrimental outcomes(Gjersing & Bretteville-Jensen, 2018; Quek et al., 2013; Wang et al., 2017), but also because of its high prevalence among people in contact with the criminal justice system (CJS)(Ford et al., 2022; Skjaervø et al., 2017). Importantly, the mediating role of treatment completion on the link between PSU and contact with CJS remains unclear.

Completing SUD treatment is associated with better outcomes, including preventing contact with CJS(Andersson et al., 2019; Rezai-Zadeh et al., 2019; Timko et al., 2020; White, n.d.). Although PSU has been used to predict contact with CJS(Beaudoin et al., 2019; Carbonneau et al., 2023; Lammers et al., 2014), the evidence regarding its role in treatment outcomes is mixed. Some studies report a lower likelihood of treatment completion among people with PSU(Andersson et al., 2021; Choi & DiNitto, 2020; Levola et al., 2021), while others found no association(Andersson et al., 2018) or higher completion rates(Basu et al., 2017). Thus, it is crucial to determine the role of treatment completion in order to improve outcomes in people with PSU.

The relationship between people with PSU, treatment completion, and contact with CJS can be affected by factors such as treatment goals, patient characteristics, resource availability, and SUD severity profiles which are highly contingent on treatment settings(Fiestas & Ponce, 2012; Reif et al., 2021; Tiet et al., 2007). Thus, analyses must account for differences in treatment settings.

Additionally, studying the role of treatment outcomes is challenging due to limited research on people with PSU in Latin America(Lalwani et al., 2022). Furthermore, like many studies in the global north, high-risk populations have often been overlooked(Reyes et al., 2013). An analysis of data from studies conducted in six Latin American countries found that 21% of participants were people with PSU, and males, people aged 18-34 from Chile, Uruguay, and Argentina, were more likely to report PSU(Reyes et al., 2013). Similarly, studies conducted in Chilean hard-to-reach populations have associated PSU with school dropout, unemployment, sexual risk, and antisocial behaviors(Olivari et al., 2022; Santis B et al., 2007; Vilugrón et al., 2022).

Although the relationship between SUD and contact with CJS is documented in the global north(Holloway et al., 2006), little is known about the effect of treatment outcomes among people with PSU in other contexts. This study aims to estimate the mediating effects of completing SUD treatment on the link between PSU and contact with CJS among adult patients admitted to SUD treatment programs in Chile during 2010-2019. Understanding this relationship could inform effective prevention and intervention strategies for PSU and provide insight into the effectiveness of SUD treatment in reducing the risk of contact with CJS among individuals with baseline PSU in Chile. This study contributes to a growing literature on the importance of addressing longitudinal dynamics in specific profiles of SUD patients.

# Research questions, aims, and hypothesis

* **Research question:** What are the mediating effects of completing SUD treatment on the relationship between baseline PSU and contact with CJS in Chile in the short (six months), middle (one year), and long term (three years)?
* **Aims:** Estimate the mediating effects of completing SUD treatment on the relationship between PSU at admission and contact with CJS among adult patients admitted to SUD treatment programs in Chile during 2010-2019. Specific: (1) To describe the prevalence of PSU, treatment completion, and contact with CJS in the sample, (2) to compare the risk of contact with CJS between people with poly and single-substance use, and (3) to estimate the proportion of the effect of PSU and treatment outcome on the contact with CJS.
* **Hypothesis:** Baseline PSU is related to lower treatment completion rates (1), baseline PSU is linked to a greater risk of contact with CJS (2), patients with PSU will have a differential risk of contact with CJS associated with treatment completion, and treatment completion will explain part of the relationship between PSU and contact with CJS (3).

# Methodology

This research design is a retrospective cohort based on the administrative data's record linkage. The study will use data from Chilean SUTs programs and Prosecutor’s Office through a deterministic linkage process. We will request an amendment to an existing ethical approval from a study using the same data. The exposure variable will be the baseline PSU (using more than one main substance among alcohol and illicit drugs at admission to SUD treatment, whether sequential or concurrent)(Crummy et al., 2020; Font-Mayolas & Calvo, 2022), the mediator variable will be SUD treatment outcome (complete vs. dropout or spelled by misconduct), and the outcome will be contact with CJS (offense that led to a condemnatory sentence). The study will control for various confounding variables related to substance use, demographics, and social factors through weights generated through the inverse probability of PSU27. We will use the illness-death multistate model to simultaneously estimate transitions between admission and treatment outcome, treatment outcome and contact with CJS, and admission and contact with CJS (without completing treatment). We will then calculate the Aalen-Johansen estimator for transition probabilities at 6 months, 1 and 3 years(Crowther & Lambert, 2023). Secondary analyses will focus on mediation, estimating the effects of PSU given treatment outcome at 6 months, 1 and 3 years using a standard time-to-first-event approach. Proportions mediated will be estimated using the bootstrap method or m-estimation of standard errors. We also plan to run separate analyses on patients admitted to different treatment settings. Preliminary markdowns are available [here](https://fondecytacc.github.io/nDP/an_ser_2023_step_0.html).

# Project milestones

* **Progress report:** It will include: a theoretical framework and descriptive analyses exploring the connections between PSU, SUT outcome, and contact with CJS.
* **Paper:** Sent to a Substance Abuse, Criminology or Public Health international journal before month 12 of the study.
* **Presentation in Scientific meetings:** Our goal is to present this study at least at one international conference, such as the Society for Epidemiologic Research or similar, and in possible scientific community activities organized by Universidad de Chile or other national institutions.

# Research team

Our research team has experience in public health and criminology and skills in using large datasets in substance use epidemiology, program and policy evaluation, and treatment research (See Table 1). Previously, part of the team collaborated on SUT policy analysis publications.

**Table 1. Research team.**

| Name | Role | Expertise | Time spent |
| --- | --- | --- | --- |
| Andrés González | P.I. | Ph.D. student (School of Public Health, Universidad de Chile). He has worked as technical staff in research related to occupational health and SUD treatments. He has been working on the Treatment patient’s dataset since 2019, collaborating with Dr. Castillo-Carniglia o several papers | *6 hours per week* |
| José Ruiz-Tagle | Co-I | Ph.D. student (Public Policy, Universidad Mayor). He has worked on research projects related to substance use treatments. He also has been working on the dataset on Treatment patients since 2019 along with Dr. Castillo-Carniglia. He collaborated in the analysis of several papers linked to SUD. | *3 hours per week* |
| Mariel Mateo | Co-I | Ph.D. student (School of Criminology and Criminal Justice, Griffith University, Australia). She coordinated the first Outcome Study of Substance Use Treatment in Chile and led the Drug research area in the Justice and Society Studies Centre (Pontificia Universidad Católica) between 2015 and 2019. | *2 hours per week* |
| *Álvaro Castillo-Carniglia* | Sup | Ph.D., Associate professor, and Director of the Ph.D. Programme in Public Policy, Universidad Mayor. He has a background in epidemiology, and his main research areas are the measurement of SUDs in the population. He has co-directed several theses in public health related to treatment dropouts and readmissions. | *2 hours fortnight* |
| *Note: P.I.: Principal Investigator; Co-I: Co-Investigator; Sup.: Supervisor.* | | | |

# Timeline

Based on the work carried out in the 2022 intramural fund, we will delve into the transformation and processing of data following a longitudinal perspective of nested events by subjects. Additionally, a significant amount of time will be devoted to discussing and implementing knowledge of causal inference involved in the analysis. The process is summarized in Figure 1.

**Figure 1. Gantt chart of activities involved in research progress.**

Imagen que contiene Tabla

Descripción generada automáticamente

# Budget

Funds will be used to cover expenses for attending international conferences and a virtual computer (e.g., an annual subscription to DataCamp Teams). The cost of attending international conferences is between 2,000-4,000 USD(Sarabipour et al., 2020). Thus, the funds should cover a great portion of these expenses. Also, it can be used for workshops, manuscript editing (if needed), and as an incentive for the researchers.

# References

Andersson, H. W., Lauvsnes, A. D. F., & Nordfjærn, T. (2021). Emerging Adults in Inpatient Substance Use Treatment: A Prospective Cohort Study of Patient Characteristics and Treatment Outcomes. *European Addiction Research*, *27*(3), 206–215. https://doi.org/10.1159/000512156

Andersson, H. W., Steinsbekk, A., Walderhaug, E., Otterholt, E., & Nordfjærn, T. (2018). Predictors of Dropout From Inpatient Substance Use Treatment: A Prospective Cohort Study. *Substance Abuse: Research and Treatment*, *12*, 117822181876055. https://doi.org/10.1177/1178221818760551

Andersson, H. W., Wenaas, M., & Nordfjærn, T. (2019). Relapse after inpatient substance use treatment: A prospective cohort study among users of illicit substances. *Addictive Behaviors*, *90*, 222–228. https://doi.org/10.1016/j.addbeh.2018.11.008

Basu, D., Ghosh, A., Sarkar, S., Patra, B. N., Subodh, B. N., & Mattoo, S. K. (2017). Initial treatment dropout in patients with substance use disorders attending a tertiary care de-addiction centre in north India. *The Indian Journal of Medical Research*, *146*(Supplement), S77–S84. https://doi.org/10.4103/ijmr.IJMR\_1309\_15

Beaudoin, M., Potvin, S., Dellazizzo, L., Luigi, M., Giguère, C.-E., & Dumais, A. (2019). Trajectories of Dynamic Risk Factors as Predictors of Violence and Criminality in Patients Discharged From Mental Health Services: A Longitudinal Study Using Growth Mixture Modeling. *Frontiers in Psychiatry*, *10*. https://doi.org/10.3389/fpsyt.2019.00301

Carbonneau, R., Vitaro, F., Brendgen, M., & Tremblay, R. E. (2023). Longitudinal patterns of polysubstance use throughout adolescence: association with adult substance use and psychosocial outcomes controlling for preadolescent risk factors in a male cohort. *Social Psychiatry and Psychiatric Epidemiology*. https://doi.org/10.1007/s00127-023-02454-8

Choi, N. G., & DiNitto, D. M. (2020). Older-Adult Marijuana Users in Substance Use Treatment: Characteristics Associated with Treatment Completion. *Journal of Psychoactive Drugs*, *52*(3), 218–227. https://doi.org/10.1080/02791072.2020.1745966

Connor, J. P., Gullo, M. J., White, A., & Kelly, A. B. (2014). Polysubstance use. *Current Opinion in Psychiatry*, *27*(4), 269–275. https://doi.org/10.1097/YCO.0000000000000069

Crowther, M. J., & Lambert, P. (2023). *MULTISTATE: Stata module to perform multi-state survival analysis*. https://econpapers.repec.org/RePEc:boc:bocode:s458207

Crummy, E. A., O’Neal, T. J., Baskin, B. M., & Ferguson, S. M. (2020). One Is Not Enough: Understanding and Modeling Polysubstance Use. *Frontiers in Neuroscience*, *14*. https://doi.org/10.3389/fnins.2020.00569

Duke, A. A., Smith, K. M. Z., Oberleitner, L. M. S., Westphal, A., & McKee, S. A. (2018). Alcohol, drugs, and violence: A meta-meta-analysis. *Psychology of Violence*, *8*(2), 238–249. https://doi.org/10.1037/vio0000106

Fiestas, F., & Ponce, J. (2012). Eficacia de las comunidades terapéuticas en el tratamiento de problemas por uso de sustancias psicoactivas: una revisión sistemática. *Revista Peruana de Medicina Experimental y Salud Pública*, *29*(1), 12–20. https://www.redalyc.org/articulo.oa?id=36323255003

Font-Mayolas, S., & Calvo, F. (2022). Polydrug Definition and Assessment: The State of the Art. *International Journal of Environmental Research and Public Health*, *19*(20), 13542. https://doi.org/10.3390/ijerph192013542

Ford, J. A., Ortiz, K., Schepis, T. S., & McCabe, S. E. (2022). Types of criminal legal system exposure and polysubstance use: Prevalence and correlates among U.S. adults in the National Survey on Drug Use and Health, 2015–2019. *Drug and Alcohol Dependence*, *237*, 109511. https://doi.org/10.1016/j.drugalcdep.2022.109511

Gjersing, L., & Bretteville-Jensen, A. L. (2018). Patterns of substance use and mortality risk in a cohort of ‘hard-to-reach’ polysubstance users. *Addiction*, *113*(4), 729–739. https://doi.org/10.1111/add.14053

Hassan, A. N., & Le Foll, B. (2019). Polydrug use disorders in individuals with opioid use disorder. *Drug and Alcohol Dependence*, *198*, 28–33. https://doi.org/10.1016/j.drugalcdep.2019.01.031

Holloway, K. R., Bennett, T. H., & Farrington, D. P. (2006). The effectiveness of drug treatment programs in reducing criminal behavior: a meta-analysis. *Psicothema*, *18*(3), 620–629.

Lalwani, K., Whitehorne-Smith, P., Walcott, G., McLeary, J.-G., Mitchell, G., & Abel, W. (2022). Prevalence and sociodemographic factors associated with polysubstance use: analysis of a population-based survey in Jamaica. *BMC Psychiatry*, *22*(1), 513. https://doi.org/10.1186/s12888-022-04160-2

Lammers, S. M. M., Soe-Agnie, S. E., de Haan, H. A., Bakkum, G. A. M., Pomp, E. R., & Nijman, H. J. M. (2014). [Substance use and criminality: a review]. *Tijdschrift Voor Psychiatrie*, *56*(1), 32–39.

Levola, J., Aranko, A., & Pitkänen, T. (2021). Psychosocial difficulties and treatment retention in inpatient detoxification programmes. *Nordic Studies on Alcohol and Drugs*, *38*(5), 434–449. https://doi.org/10.1177/14550725211021263

Liu, Y., Williamson, V., Setlow, B., Cottler, L. B., & Knackstedt, L. A. (2018). The importance of considering polysubstance use: lessons from cocaine research. *Drug and Alcohol Dependence*, *192*, 16–28. https://doi.org/10.1016/j.drugalcdep.2018.07.025

Olivari, C. F., Gaete, J., Rodriguez, N., Pizarro, E., Del Villar, P., Calvo, E., & Castillo-Carniglia, A. (2022). Polydrug Use and Co-occurring Substance Use Disorders in a Respondent Driven Sampling of Cocaine Base Paste Users in Santiago, Chile. *Journal of Psychoactive Drugs*, *54*(4), 348–357. https://doi.org/10.1080/02791072.2021.1976886

Quek, L.-H., Chan, G. C. K., White, A., Connor, J. P., Baker, P. J., Saunders, J. B., & Kelly, A. B. (2013). Concurrent and Simultaneous Polydrug Use: Latent Class Analysis of an Australian Nationally Representative Sample of Young Adults. *Frontiers in Public Health*, *1*. https://doi.org/10.3389/fpubh.2013.00061

Reif, S., Stewart, M. T., Torres, M. E., Davis, M. T., Dana, B. M., & Ritter, G. A. (2021). Effectiveness of value-based purchasing for substance use treatment engagement and retention. *Journal of Substance Abuse Treatment*, *122*, 108217. https://doi.org/10.1016/j.jsat.2020.108217

Reyes, J. C., Perez, C. M., Colon, H. M., Dowell, M. H., & Cumsille, F. (2013). Prevalence and Patterns of Polydrug Use in Latin America: Analysis of Population-based Surveys in Six Countries. *Review of European Studies*, *5*(1). https://doi.org/10.5539/res.v5n1p10

Rezai-Zadeh, K. P., Engstrom, R. N., Sharma, A., Chen, Y., Chu, J., Cox, R. P., & Lee, M.-L. T. (2019). Generational trends and patterns in readmission within a statewide cohort of clients receiving heroin use disorder treatment in Maryland, 2007–2013. *Journal of Substance Abuse Treatment*, *96*, 82–91. https://doi.org/https://doi.org/10.1016/j.jsat.2018.10.010

Santis B, R., Hidalgo C, C. G., Hayden C, V., Anselmo M, E., Rodríguez T, J., Cartajena de la M, F., Dreyse D, J., & Torres B, R. (2007). Consumo de sustancias y conductas de riesgo en consumidores de pasta base de cacaína no consultantes a servicios de rehabilitación. *Revista Médica de Chile*, *135*(1). https://doi.org/10.4067/S0034-98872007000100007

Sarabipour, S., Khan, A., Seah, S., Mwakilili, A., Mumoki, F., Sáez, P., Schwessinger, B., Debat, H., & Mestrovic, T. (2020). *Evaluating features of scientific conferences: A call for improvements*. bioRxiv. https://doi.org/10.1101/2020.04.02.022079

Skjaervø, I., Skurtveit, S., Clausen, T., & Bukten, A. (2017). Substance use pattern, self-control and social network are associated with crime in a substance-using population. *Drug and Alcohol Review*, *36*(2), 245–252. https://doi.org/10.1111/dar.12406

Sugie, N. F., & Turney, K. (2017). Beyond Incarceration: Criminal Justice Contact and Mental Health. *American Sociological Review*, *82*(4), 719–743. https://doi.org/10.1177/0003122417713188

Thomas, E. G., Spittal, M. J., Taxman, F. S., Puljević, C., Heffernan, E. B., & Kinner, S. A. (2022). Association between contact with mental health and substance use services and reincarceration after release from prison. *PLOS ONE*, *17*(9), e0272870. https://doi.org/10.1371/journal.pone.0272870

Tiet, Q. Q., Ilgen, M. A., Byrnes, H. F., Harris, A. H. S., & Finney, J. W. (2007). Treatment setting and baseline substance use severity interact to predict patients’ outcomes. *Addiction*, *102*(3), 432–440. https://doi.org/10.1111/j.1360-0443.2006.01717.x

Timko, C., Nash, A., Owens, M. D., Taylor, E., & Finlay, A. K. (2020). Systematic Review of Criminal and Legal Involvement After Substance Use and Mental Health Treatment Among Veterans: Building Toward Needed Research. *Substance Abuse: Research and Treatment*, *14*, 117822181990128. https://doi.org/10.1177/1178221819901281

Vilugrón, F., Molina G., T., Gras-Pérez, M. E., & Font-Mayolas, S. (2022). Precocidad de inicio del consumo de sustancias psicoactivas y su relación con otros comportamientos de riesgo para la salud en adolescentes chilenos. *Revista Médica de Chile*, *150*(5), 584–596. https://doi.org/10.4067/s0034-98872022000500584

Wang, L., Min, J. E., Krebs, E., Evans, E., Huang, D., Liu, L., Hser, Y.-I., & Nosyk, B. (2017). Polydrug use and its association with drug treatment outcomes among primary heroin, methamphetamine, and cocaine users. *International Journal of Drug Policy*, *49*, 32–40. https://doi.org/10.1016/j.drugpo.2017.07.009

White, W. (n.d.). *Recovery/remission from substance use disorders: an analysis of reported outcomes in 415 scientific reports, 1868–2011. 2012*. Philadelphia Department of Behavioral Health and Intellectual DisAbility Services and the Great Lakes Addiction Technology Transfer Center: Chicago, Illinois & Philadelphia, PA. Retrieved March 13, 2023, from https://www.naadac.org/assets/2416/whitewl2012\_recoveryremission\_from\_substance\_abuse\_disorders.pdf