

Monitoring & Prediction of Illegal Drug Usage in Finland

A Data-Driven Approach for Sustainable Policy Making



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GitHub link: [Project](#)

Application link: [Finland Drug Usage Dashboard](#)

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1. Background and Objective

Recent reports indicate that illegal drug use in Finland has become increasingly prevalent, with drug-related deaths steadily rising throughout the 21st century [1]. This increase poses severe public health risks, including higher rates of addiction, overdose incidents, and the spread of infectious diseases among drug users. Social stability is also undermined as drug-related crimes lead to greater insecurity in communities and an increased burden on law enforcement. From an economic standpoint, the rising costs of healthcare, law enforcement, and rehabilitation services strain public resources, while reduced workforce productivity due to drug-related disabilities and premature deaths further hampers economic sustainability. The growing number of drug-induced fatalities, the rise in drug-related crimes, and the mounting strain on rehabilitation services highlight the urgent need for data-driven interventions. Addressing these challenges demands a comprehensive understanding of regional drug trends and an evidence-based approach to predict future risks.

Our project uses data science and time series analysis to support sustainable policymaking by providing actionable insights into drug usage patterns and associated risks. Drug use affects sustainability across multiple pillars. They are social, economic, and environmental. Substance abuse not only undermines the well-being of individuals and communities, leading to increased mental health issues, homelessness, and social instability, but it also imposes a heavy burden on healthcare and rehabilitation services [2]. This diversion of resources compromises workforce productivity, escalates unemployment, and inflates social welfare costs. Moreover, drug-related activities contribute to environmental degradation through chemical pollution and hazardous waste, further threatening the health of urban and natural ecosystems.

Our objective in this project is to develop an interactive dashboard that visualizes regional drug usage trends and forecasts key drug-related KPIs using time series prediction techniques. By using machine learning and historical regional data, we aim to identify high-risk areas and vulnerable age groups, providing early warnings for stakeholders such as policymakers, law enforcement agencies, and healthcare providers. Our solution will enable data-driven decision-making, optimize the allocation of public resources, enhance public safety, and mitigate both economic and social costs associated with drug usage.

Ultimately, by integrating computational techniques for social good, our project contributes to Finland's sustainability goals. It aspires to reduce drug-related harm and foster a healthier, more resilient society through transparent, evidence-based strategies.

2. Solution: Monitoring and Prediction Dashboard for Illegal Drug Usage in Finland

Our Monitoring and Prediction Dashboard for Illegal Drug Usage in Finland is designed to assist key stakeholders in addressing and mitigating drug-related challenges. With drug-related deaths increasing significantly, 287 recorded in 2021 and rising to 310 in 2023, including 91 fatalities among individuals under 25 [6, 8]. It is evident that data-driven strategies are essential. Our dashboard consolidates historical data, analyzes trends, and forecasts key drug-related indicators to support evidence-based policymaking. It provides insights into drug-related deaths, offences, price trends, regional usage patterns, and rehabilitation needs.

Our tool serves multiple stakeholders, including policymakers, healthcare professionals, researchers, and the general public. Policymakers can utilize data-driven insights to design and refine drug prevention policies, while healthcare professionals can optimize resource allocation and support services for individuals struggling with addiction. Researchers benefit from predictive analytics to study emerging trends and evaluate intervention strategies, while law enforcement agencies can leverage these insights to refine crime prevention efforts. Additionally, the general public can stay informed about drug trends and their societal impact, fostering greater awareness and community engagement in combating substance abuse.

Beyond its analytical capabilities, our dashboard also serves as a sustainability initiative, addressing the social, economic, and public health implications of drug abuse. As drug-related fatalities increase, the economic strain on healthcare systems and law enforcement continues to grow, making strategic planning more crucial than ever. By utilizing data analytics to predict future risks and trends, our project aligns with several United Nations Sustainable Development Goals (SDGs):

- **SDG 3: Good Health and Well-Being** – By tracking drug-related deaths and rehabilitation trends, this initiative supports efforts to reduce premature mortality due to substance abuse through early intervention and improved healthcare services.
- **SDG 11: Sustainable Cities and Communities** – The dashboard helps local authorities design safer, more resilient communities by identifying high-risk regions and implementing targeted intervention programs.
- **SDG 16: Peace, Justice, and Strong Institutions** – Through predictive analytics on drug-related offences and arrests, this initiative enhances law enforcement efficiency, policy transparency, and institutional capacity to combat substance abuse effectively [2].

Although our dashboard is not a real-time monitoring tool due to data limitations, it serves as a proof-of-concept, demonstrating how data science can enhance drug policy and intervention

strategies. By applying machine learning and historical data analysis, our tool helps identify high-risk regions and vulnerable demographics, optimizing resource allocation and supporting Finland's broader sustainability and public health objectives [2, 3, 9].

3. Discussion

3.1 Monitoring Tab

Our Monitoring Tab provides a detailed analysis of drug-related deaths by age group, drug price trends, and regional trends in drug-related offences, rehabilitation, and law enforcement interventions. These insights allow us to identify patterns in substance abuse and inform data-driven policies that mitigate the social and economic consequences of drug use in Finland. The COVID-19 pandemic significantly influenced drug consumption patterns, access to rehabilitation services, and law enforcement priorities, making it crucial to assess these trends within our dashboard.

3.1.1. Drug-Related Deaths by Age Group

Our analysis reveals a concerning increase in drug-related deaths, particularly among young adults. The 25-34 age group consistently reports the highest number of fatalities, followed closely by individuals aged 35-44, underscoring the long-term nature of substance abuse issues in Finland. Alarming, in 2023, drug-related deaths among 15-24-year-olds surged to 91 fatalities, the highest recorded in this demographic [6]. This trend suggests that younger individuals face greater exposure to high-risk substances, possibly due to increased accessibility and evolving social behaviors.

The COVID-19 pandemic intensified this problem, as lockdowns and social isolation contributed to increased substance use, particularly among young people who faced limited access to mental health support and rehabilitation services [3]. Our findings also indicate that while drug-related deaths among older age groups (45-54 and 55+) have remained relatively stable, they still represent a significant share of overall fatalities. This highlights the need for age-specific intervention programs that address both early-stage substance uses and long-term addiction management [8].

3.1.2. Drug Price Trends

Our dashboard also tracks drug price trends, offering insights into the availability and demand for illicit substances. We visualize two sets of trends: commonly used drugs and all drug types. Notably, Amphetamines (ATS Amphetamine) and MDMA (Ecstasy) have experienced significant price fluctuations, with sharp increases during the COVID-19 lockdowns. This is attributed to supply chain disruptions, border closures, and stricter law enforcement measures,

which led to shortages and subsequent price hikes [4]. These findings align with global reports on how the pandemic disrupted drug trafficking, reducing supply and inflating street prices.

Interestingly, cannabis prices remained relatively stable, suggesting that domestic production and local distribution networks were less affected by international trade restrictions. However, harder drugs such as heroin, LSD, and cocaine became significantly more expensive, indicating reduced availability and a shift in user preferences toward more accessible alternatives. Our findings suggest that during periods of limited access to illicit substances, many individuals may turn to prescription medications or synthetic opioids instead [2]. This underscores the need for ongoing drug market monitoring, allowing policymakers and law enforcement to anticipate shifts in drug usage patterns and respond with targeted interventions.

3.1.3. Regional Trends in Drug Offences and Rehabilitation

Our regional analysis provides insights into drug-related arrests, offences, rehabilitation efforts, and youth clinic visits across various regions in Finland. Our dashboard allows users to select specific key performance indicators (KPIs) to visualize trends in different areas. Some regions display persistently high rates of drug-related arrests and offences, while others show fluctuating patterns, likely influenced by law enforcement efforts, policy changes, and socio-economic factors [7].

During the COVID-19 pandemic, drug-related arrests initially declined as law enforcement agencies shifted priorities toward pandemic-related measures. However, as restrictions eased in 2021-2022, arrests rose once again, reflecting a rebound in drug-related criminal activity. Rehabilitation services also experienced significant challenges, including reduced capacity and delays in treatment access due to pandemic restrictions. Some high-risk regions continue to report low rehabilitation rates, indicating either a shortage of services or barriers to accessibility [4].

Furthermore, youth clinic visits remain below expected levels in several high-risk areas, highlighting gaps in outreach efforts. This is particularly concerning given the increasing rate of drug-related deaths among young individuals. Expanding youth-focused intervention programs and increasing access to rehabilitation services could play a vital role in reducing substance abuse risks among vulnerable demographics. Our findings reinforce the importance of targeted interventions, optimized law enforcement resource allocation, and enhanced rehabilitation strategies to address Finland's evolving drug crisis.

3.2 Prediction Tab

Our Prediction Tab provides a forward-looking analysis of drug-related offences, arrests, and drug-related deaths, categorized by region and age group. By using historical data and

advanced time series forecasting techniques, our tool enables policymakers, law enforcement agencies, and public health officials to anticipate trends and strategically allocate resources. The forecast spans 2024, 2025, and 2026, offering valuable insights into high-risk areas and vulnerable populations, allowing for proactive intervention strategies.

3.2.1. Forecasting Methods and Techniques

To generate predictions, we utilized the AutoARIMA (Auto-Regressive Integrated Moving Average) method, a widely recognized time series forecasting approach. AutoARIMA automatically optimizes model parameters based on historical yearly data, identifying underlying trends, seasonal patterns, and fluctuations. This ensures that our forecasts are robust and adaptable to changing drug-related dynamics.

The key metrics forecasted using our model include:

- Drug-related offences by region
- Number of arrests by region
- Drug-related deaths by age group

By applying AutoARIMA, our tool effectively detects historical patterns and projects future trends, providing stakeholders with actionable insights that can support evidence-based policy development and intervention strategies.

3.2.2. Regional Forecast: Arrests and Offences

Our regional forecasts highlight areas projected to experience an increase in drug-related offences and arrests. Predictions for 2025 indicate that regions such as Päijät-Häme, Pohjois-Pohjanmaa, and Etelä-Karjala are likely to see the highest increase in drug-related offences. Similarly, the greatest rise in arrests is expected in Päijät-Häme, Pohjois-Pohjanmaa, and Keski-Pohjanmaa. These forecasts are critical for law enforcement agencies and policymakers, enabling them to prioritize high-risk regions and optimize resource allocation.

Our high-risk region map for 2025 visually represents the expected spike in drug-related offences and arrests, allowing authorities to implement preventive measures before escalation. By integrating predictive analytics into crime prevention, law enforcement can develop more targeted strategies, such as increasing patrols, strengthening community outreach programs, and enhancing rehabilitation services [2].

3.2.3. Forecast of Drug-Related Deaths by Age Group

Our age-group specific forecasts provide insights into demographic trends in drug-related deaths over the next few years. The 2025 projections indicate that individuals under 24 will account

for the highest proportion of drug-related deaths (36.1%), followed by the 35-44 age group (23.3%). These findings align with recent reports highlighting an alarming increase in drug-related fatalities among younger individuals in Finland [6].

These predictions further reinforce the fact that younger individuals remain the most vulnerable demographic. As a result, there is an urgent need for strengthened youth-targeted intervention programs, comprehensive educational campaigns, and improved access to rehabilitation services. Our dashboard allows public health officials and policymakers to use these insights to develop tailored harm-reduction strategies, ensuring that at-risk populations receive the necessary support and intervention measures.

By offering detailed predictive insights, our tool equips stakeholders with the ability to make proactive, data-driven decisions, helping to curb the increasing trends of drug-related crime and fatalities in Finland.

3.3 Impact Tab

Our Impact Tab highlights the broader societal benefits of our Monitoring and Prediction Dashboard. By providing data-driven insights into drug-related trends, our tool serves as a valuable resource for policymakers, law enforcement agencies, healthcare professionals, researchers, and communities. It enables targeted interventions, enhances resource optimization, and supports the development of sustainable strategies to combat drug abuse in Finland.

This section outlines the key beneficiaries of our dashboard and how each group can leverage its insights for policy development, crime prevention, rehabilitation efforts, and public awareness campaigns. Additionally, it emphasizes how our initiative aligns with the United Nations Sustainable Development Goals (SDGs), showcasing how data analytics and predictive modeling contribute to a healthier, safer, and more sustainable society.

4. Conclusion

Our study underscores the pressing issue of drug abuse in Finland and the critical role of data-driven solutions in addressing its social, economic, and public health implications. Through our Monitoring and Prediction Dashboard, we provide key insights into drug-related deaths, offences, arrests, and price trends, equipping stakeholders with actionable intelligence to support proactive interventions. The ability to forecast future trends ensures that resources are strategically allocated to mitigate drug-related harm more effectively.

Despite its effectiveness, our initiative was constrained by data limitations. The dataset used in our study extended only until 2023, restricting long-term trend analysis. Additionally, some datasets lacked regional granularity, reducing the precision of location-specific forecasts.

Furthermore, the absence of gender-specific data prevented a deeper understanding of demographic disparities in drug use. These challenges emphasize the need for more comprehensive, high-resolution, and continuously updated datasets to improve the accuracy and impact of our dashboard.

To enhance our tool, future work should focus on integrating real-time data updates, enabling continuous monitoring and faster response strategies. The accuracy of time series forecasting could be further refined by incorporating monthly data, allowing for more precise short-term trend analysis. Additionally, the inclusion of gender-disaggregated data and expanded regional insights would refine our ability to support targeted interventions and develop more inclusive policies. By addressing these limitations, our project can evolve into a fully adaptive and scalable system for combating drug-related issues in Finland.

Ultimately, our project highlights the transformative potential of predictive analytics in public health and law enforcement. By integrating data science with policy development, we demonstrate how technology-driven solutions can contribute to sustainable, evidence-based decision-making. Strengthening data collection efforts and expanding analytical capabilities will be essential in ensuring the long-term impact and effectiveness of our initiative.

References

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