

Identification of harm exposure levels based on user patterns among drug users in treatment and the role of predisposing, information and awareness factors

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## 1. Abstract

**Objectives:** We sought to identify clusters with different levels of harm exposure based on drug consumption patterns among drug users in treatment and assess the role of predisposing, information and awareness socio-demographic factors among the clusters identified.

**Methods:** This study was cross-sectional in its design. Drug users (n=410) completed questionnaires based on Treatment Demand Indicator as defined by the EMCDDA, after requesting a service or entering an inpatient or outpatient treatment setting (n=11) in Luxembourg throughout the year 2019. The study sample was described with regard to their socio-demographic characteristics and drug consumption patterns using descriptive statistics. Subsequently, a two-step cluster analysis was conducted to identify drug users with different levels of harm exposure based on their drug consumption patterns. Thereafter, the relevance of the identified clusters was assessed regarding various predisposing, information and awareness socio-demographic factors using ANOVA and Chi-square analysis.

**Results:** The study revealed three groups who differed on their levels of harm exposure based on age at first illegal drug consumption, polysubstance use, mode of consumption, frequency of consumption and overdose. With regards to predisposing, awareness and information factors, the three groups differed significantly on age, judicial situation, professional situation, living situation and age at the end of education. A higher level of drug exposure was associated with a more precarious judicial situation and an earlier ending of schooling.

**Conclusions:** The results of this study support the idea that groups of drug users with different levels of harm exposure exist. These differences in harm exposure should be taken into account to increase the effectiveness of proposed interventions. Moreover, the study reveals the significance of predisposing and awareness factors, as some socio-demographic characteristics act as protective factors including age, a more stable professional situation and living situation as these factors differed significantly among the three levels of harm exposure.

## 2. Introduction

Around 83 million or 28,9% of adults (aged 15-64) in the European Union are estimated to have used illicit drugs at least once in their lifetime (EMCDDA, 2021a). The social, health and economic impact of licit and illicit drugs on society are serious, while they vary largely depending on the type of drug. Cannabis, which is the most widely used drug in Europe, is probably the illicit substance causing most social and mental health suffering to societies (Frijns et al. 2013; EMCDDA, 2020). However, it is assumed to have a lighter economic impact than a drug like cocaine, even though the image of cocaine as a 'high-status drug' is declining (Frijns et al. 2013; Antoine et al. 2020). The patterns of drug use are increasingly complex, as consumers are exposed to a wider range of highly potent natural substances like cocaine whose purity has increased over the last decade and synthetic substances among which 400 new psychoactive substances were detected in 2019 alone (EMCDDA, 2021a.). User habits, including the mode of consumption and type of drug used highly depend on the user group.

Younger users in Europe, are often considered to consume drugs for recreational purposes, use of cannabis and MDMA (ecstasy) are most prevalent for this group, while these substances are usually smoked or swallowed. This applies to recreational cocaine use as well, as cocaine is generally 'snorted', whereas socially marginalised users generally show other consumption modes like smoking or injecting (Frijns et al. 2013). These are the most impactful modes of consumption, as they are related to impending social and economic harms as well as health consequences such as infectious diseases, and increase the probability of the user to require help and enter drug treatment services (EMCDDA, 2020)

People who are in contact with drug treatment services or specialist harm reduction services are usually defined as high-risk drug users. They are considered as persons whose recurrent drug use causes actual harm to the person (the dependence itself, but also other health, economic or social harms), thus placing the person at a high risk of suffering such harms (EMCDDA, 2020). These health and social harms can be provoked through syringe or equipment sharing, or drug-related crimes. An increase in polysubstance use is correlated with a higher probability of recurring harms (Schulte et al. 2014). To monitor these harms of high-risk drug use, the demands of treatment entrants and their patterns of drug consumption, the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) has developed an epidemiological indicator, called Treatment Demand Indicator (TDI). This is an indicator to collect information in a harmonised and comparable way across all Member States on the numbers and profiles of people entering drug treatment (clients) during each calendar year (EMCDDA, 2012). With the help of this indicator, new consumer trends of drugs and new health risk behaviours can be identified, like an increased use of cocaine and cocaine injection as well as a higher demand for treatment services related to cannabis products (Berndt et al. 2019).

Health risk behaviours, including the use of specific drugs like cocaine or cannabis, are mostly influenced by determinants of various levels. These determinants can be of socio-demographic nature that are directly or indirectly related to a certain drug use pattern. Research has revealed that the most common socio-demographic determinants positively associated with a higher risk of drug use are a male sex, first use at a young age, a low education level and low socio-economic status (Barrio et al. 2013; Barocas et al. 2019; Ilhan et al. 2016). Some determinants can act as countermeasures (i.e. reveal a negative association with drug use), like a higher socio-economic status, such as stable salary as a main legal income source and a higher level of education (Clarke et al. 2012). The study by Origer even revealed these factors to be protective factors against fatal overdoses (Origer et al. 2014). Up to now, most studies have tended to focus solely on socio-demographic determinants of drug use (Barocas et al. 2019; Ilhan et al. 2016), while few studies have attempted to establish a typology of drug users based on their socio-demographical characteristics or drug consumption patterns. The scientific absence regarding this type of typology may decrease the outcome success of treatment services and interventions as these may be too generic and insufficiently tailored to user characteristics (Mindrilla, 2016). The current study may contribute to filling an important gap in the literature by establishing such a typology using cluster analysis.

Whether drug users or subgroups with similar user profiles exist and can be categorized based on their patterns of use when in contact with harm reduction or treatment services remains largely unknown. Therefore, the primary aim of this study was to characterise drug users who have entered harm reduction or treatment services based on their socio-demographic characteristics and drug consumption patterns, to identify levels of harm exposure based on their drug consumption patterns through cluster analysis. Secondly, the study examined the role of predisposing (socio-demographic), awareness (socio-economic) and informational (educational) factors based on/in line with the Integrated Change Model (I-Change Model) and if they correlated with the levels of harm exposure. The study focused on a selective convenience sample of drug users in contact with harm reduction and in- and outpatient specialist treatment services in a small European country, namely Luxembourg. Luxembourg was chosen as a case example because it has a high coverage of drug users in touch with healthcare and social treatment services. The empirical findings of this project can be used to inform health practice and policy, as interventions may be developed that will be better tailored to the needs and demands of different types of drug users.

### 3. Existing Research & Theoretical Approach

#### Factors and stages of the I-Change Model (Integrated change model)

A health behaviour model that provided a good fit to underpin the research questions and a theoretical frame applicable to addictive health risk behaviours is the I-Change Model (Integrated change model). This behaviour change model has been used in multiple studies to explain and predict various health risk behaviours (smoking cessation, substance abuse and cancer treatment) (De Vries et al. 2003; Smit et al. 2018; Eiser et al. 2004). This interdisciplinary model includes several behaviour change concepts derived from the theory of planned behaviour, the social cognitive theory, as well as the health belief model and the transtheoretical model (Smit et al. 2018). Overall, it describes how the different predisposing, information and awareness factors influence the motivational state related to a certain health behaviour, which in turn influences the intention to work on a certain health risk behaviour. With regard to distal factors in particular, determinants of health behaviour are related to the influence of social networks, organisations in which individuals participate (education, work-places, religious organisations), the communities individuals belong to and the society in which they live (WHO, 2010). These factors are interconnected with each other, underlining the ecological application of influence between environments and individuals (De Vries, 2017; McKenzie et al. 2015).

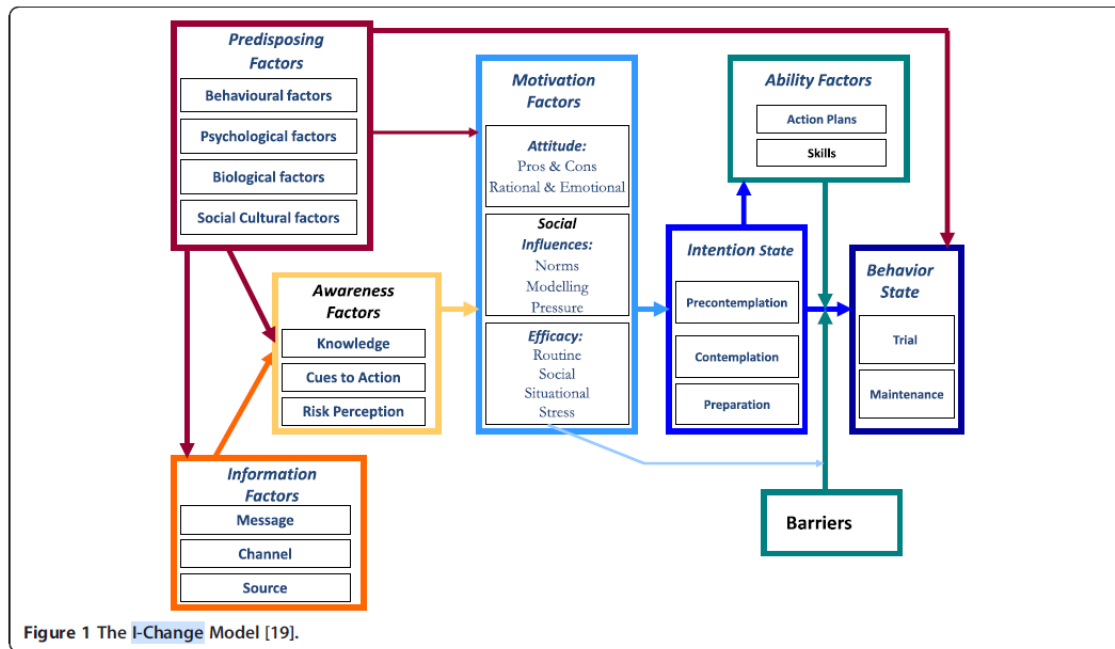


Figure 1 adapted from Ketterer et al, 2014.

The I-Change Model defines predisposing, information and awareness factors as factors that are related to motivational factors, including attitude, social influences (i.e. norms) and (self-)efficacy towards a certain health behaviour. The motivational factors thus influence phases of the intention state which can be more or less conducive to engaging in a certain health behaviour. The intention-behaviour gap may be moderated by perceived barriers or ability factors (i.e. skills) that hinder or facilitate the performance of a health risk behaviour. Predisposing factors can be classified as behavioural, psychological, biological and socio-cultural factors (e.g. lifestyles, personality, gender and genetic disposition, economic factors and policies). Awareness factors, can be classified as personal risk perception of one's risk towards using a drug, for example an increased or decreased risk perception through cues in their environment. Information factors can be classified as environmental factors, like educational channels, messages or source societies (e.g. a repressive educational approach towards drugs communicated in a group training session by the police or school). Predisposing, informational and awareness factors can be identified as more distal factors towards a certain health behaviour (Ketterer et al. 2014). Motivational factors are more proximal factors and generally consist of various social-cognitive constructs, including attitude, which includes rational and emotional thinking, social influences, like norms or pressure and (self-)efficacy. The intention state can be subdivided into several phases or stages of change, including precontemplation, contemplation and preparation (Kasten et al. 2019). The behaviour state, is the state in which a trial, like the attempt of quitting the use of a certain drug and its maintenance happens, when using the case of drug usage as an example. The intention towards changing a certain health risk behaviour can be initiated from mentioned recurring health, economic or social harms, as generally experienced by high-risk drug users. These harms are the most defining predictors of behavioural change. (Smit et al. 2018)

### Treatment demand indicator (TDI) and predisposing socio-demographic factors

The EMCDDA has developed an epidemiological indicator to be used across European countries to collect information in a harmonised and comparable way across all Member States on the numbers and profiles of people entering drug treatment (clients) during each calendar year (EMCDDA, 2012). This indicator specifically provides information on the number of people entering or requesting treatment for a drug problem while giving insight into general trends in problem drug use and the uptake of treatment facilities (EMCDDA, 2012). The Treatment Demand Indicator (TDI) provides an assessment of variables related to socio-demographic characteristics of drug users, patterns of drug use, outcome evaluation and general health condition (Antoine et al. 2016; EMCDDA, 2012). The TDI protocol proposes to assess socio-demographic factors and drug consumption patterns through the variables: living situation, educational level, professional situation, financial situation, judicial situation, state of health, psychological constitution, actual drug consumption, consumption by injection and present or past substitution treatment.

A Belgian study assessed the validity of the TDI and revealed that it provides sound variables to be included in further research. However, a selection bias concerning the sample population was determined. A lack of registration in the non-specialised sector (e.g. medical house, centres for mental health, private practice) could cause sample imbalances within datasets. For instance, service providers specifically addressing and treating opioid addictions could be overrepresented in the sample population (Antoine et al, 2016). Another European study based on variables assessed by means of the TDI yielded that male individuals were more prone to drug addiction and had none to low education while their surroundings could also be identified as low-economic status. The study also showed that population of opioid users decreased and aged, year per year, throughout Europe (Barrio et al, 2013; EMCDDA, 2020). Socio-demographical factors are also proposed to be assessed for monitoring purposes by the TDI protocol, it has been shown a male gender (predisposing factor), a low to no school education (information factor), and low socio-economic status (awareness factor) increased the risk of problematic drug use (Clarke et al.2012). In the context of the I-Change Model, socio-demographic factors assessed through TDI may hence be identified as predisposing factors, social environmental determinants as awareness factors, while educational level may be seen as Informational factors (Barter, 2010; Feustel et al. 2014).

Other socio-demographic factors presented in the TDI protocol could be classified into determinants of predisposing, awareness and information factors as proposed by the I-Change Model. As such, the male susceptibility to addiction can be classified as a biological determinant and a predisposing factor. As mentioned above, awareness factors, like employment status and living situation are related to the economic status, can likewise be extracted from the TDI. The education and the resulting enhancement of knowledge and cues to action can be classified as information factors.

### Cluster analysis and typology

Typologies are often used to identify and describe behaviours (Spellerberg, 2000). At its most basic level, there are different families of clustering procedures to identify profiles. These families include the hierarchical, two-step or k-means cluster analysis (Schendra, 2011). The two-step analysis may be the most promising for research as it enables to cluster mixed scale variables and a large amount of data. Other advantages are that this process treats statistical outliers and creates the optimal cluster solution by itself (Schendra, 2011).

A range of past studies on addictive smoking behaviours applied cluster analysis to classify subgroups in the different stages of behavioural change on the basis of expectation of a positive outcome as well as on situational temptations to addiction (Anatchkova, 2006; Berndt et al. 2012; Velicer et al. 2017). A research project from 2012 using cluster analysis among hospitalised cardiac patients revealed that risk groups of smokers could be identified based on motivational factors (smoking-related social cognitions). Moreover, the study found that predisposing factors, like socio-demographic and smoking and disease-related factors were linked to smoking after hospitalization (Berndt et al. 2012). Several studies identified subgroups of substance users in the general population based on motivational determinants regarding attitudes and self-efficacy, as also proposed by the I-Change Models. With regard to the addictive health risk behaviour of individuals, results revealed that stage-based smoked cessation interventions may be appropriate, though predisposing, information and awareness factors may vary depending on the intention or behaviour state (Smit et al. 2018; Berndt et al. 2012). A study about behavioural patterns of elementary school children found that typology through cluster analysis facilitated the identification of adjustment difficulties and helped practitioners make decisions easier about interventions (Mindrila, 2016).

Overall, the reviewed studies support the theoretical approach, of using cluster analysis with a range of behavioural factors to identify subgroups (Schendra, 2011) and using the I-Change Model to identify relevant factors of a certain behaviour or outcome based on its ecological framework. The outcomes of the studies named above support the use of cluster analysis to identify subgroups, thus easing the decision-making for interventions.

#### 4. Research question

The current study specifically aimed to examine the characteristics of drug users who have requested a service from inpatient, outpatient treatment service or harm reduction centres and to establish profiles of drug consumers based on their user characteristics and patterns. As mentioned in the introduction, the outcomes of the current study will help to identify profiles of different types of drug users who have entered treatment, as to date few studies examined this. This information will ultimately help drug treatment and harm reduction institutions to identify the levels of harm exposure and thereby adapt the delivered interventions/services. The I-Change Model, as a theoretical framework, was useful in this aspect as it helped with a deductive manner to determine which factors influenced the identified clusters. More specifically, if the predisposing (socio-demographical), information (education) and awareness (socio-economic) factors, varied on the different levels of harm exposure. Based on relevant constructs identified from the I-Change Model, the correlative value of predisposing, information and awareness factors, in comparison to the level of harm exposure will be examined.

The main research questions were as follows:

1. To what extent can levels of harm exposure be identified based on drug consumption patterns?
2. What are the associations of relevant predisposing, informational and awareness factors with the levels of harm exposure?

#### 5. Research methods

##### Design

The current study is cross-sectional in its design and is repeated annually among illicit drug users who enter harm reduction and/or specialised drug treatment services in the Grand-Duchy of Luxembourg. It is primarily conducted by Luxembourg Focal Point of the European Monitoring Centre for Drugs and Drug Addiction, EMCDDA to cover the epidemiological indicator of the 'Treatment Demand Indicator'. For more information concerning this indicator, please consult the website of the EMCDDA (EMCDDA, 2021b).

##### Setting and participants

Overall, four types of treatment providers can be distinguished in Luxembourg consisting of hospital-based, inpatient, outpatient treatment service and harm reduction sites. Hospital-based drug treatment units are at four sites (n=4) consisting of the psychiatric and/or addiction department of the main hospitals in Luxembourg (Hospital Centre of Luxembourg, Zitha Clinique, Hospital Centre Emile Meyrisch, Hospital Centre of the North). There exists merely one inpatient treatment service i.e. the national residential therapeutic centre at 'Syrdall Schlass' called 'Centre Thérapeutique de Manternach' (n=1). Moreover, there are several outpatient treatment services the 'Quai-57', the foundation 'Jugend- an Drogenhëllef' (JDH), the 'Alternative Berodungsstell' and 'Impuls' (n=4). These services generally offer psychological counselling, further transferring



to inpatient services or obtainment of a reference address. The JDH is the largest drug service provider in the country, whereas the service of 'Impuls' especially targets adolescents and young adults. Two harm reduction sites (n=2) exist in the country, one in the capital city of Luxembourg, i.e. the 'Abrigado' and one in the main city in the south of the country Esch-sur-Alzette, i.e. the 'Contact Esch'. The 'Contact Esch' is a particular service of the JDH (Berndt et al. 2020). On the institutional level, any national centre providing psychological, social or pharmacological aid and/or counselling specifically to drug users is eligible to conduct the study and recruit drug treatment clients for the evaluation of national treatment demand to respond to the TDI indicator. On the individual level to be eligible for the study, the following inclusion criteria's must apply: 1) individuals must be high-risk drug users according to the definition of the EMCDDA (EMCDDA, 2021c); 2) they must have entered an inpatient, outpatient specialist drug treatment service or be in contact with a harm reduction service as described above; 3) they must have sufficient comprehension for one of the three available survey languages (German, French and Portuguese) and be mentally stable to complete the questionnaire; and 4) the individual has to provide his/her informed consent to participate in the study and about the information being forwarded. These inclusion/exclusion criteria were defined by the TDI protocol and its adapted national guide, the so-called RELIS Guide.

#### Procedure

Data about drug users was collected using a self-administered paper pencil questionnaire. Overall, the questionnaire was administered to drug users and completed with the help and/or guidance of a staff member (nurse, social assistant or psychological therapist) of the treatment service or harm reduction institute. Generally, the questionnaire is to be completed within the first weeks when the drug user, i.e. client, has entered treatment to provide a representative picture of the user pattern before entering treatment (and changing habits). On average, it takes around 30 minutes to complete the questionnaire, while its completion may be done over one or a few treatment/contact sessions. On the national level, the standardised paper-pencil questionnaire (RELIS questionnaire) is based on the protocol of the 'Treatment Demand Indicator' as developed by the EMCDDA. It is based on general principles and implies data collection of a limited set of information in a regular and systematic fashion (EMCDDA, 2012). It explores basic information and guides the exploration of further investigations based on general findings of monitoring like socio-demographic characteristics and patterns of drug use. Further information on the purposes of the TDI has been published previously by the EMCDDA (EMCDDA, 2012). While assessing variables relevant for the epidemiological monitoring of annual treatment demand, the questionnaire is available in three languages: French, German and Portuguese. The data is collected on an annual basis for monitoring purposes and trend analysis. The current study was based on the data collected between January 1<sup>st</sup> and December 31<sup>st</sup> 2019. The study has previously obtained ethical approval by the national ethical research committee in Luxembourg (CNPD-commission national pour la protection des données) and by the ethical commission of the University of Utrecht.

### Variables and measures

Socio-demographic factors and drug consumption patterns were extracted as variables from the TDI. Hence, the data was already collected by individual third-party service or treatment providers for substance abuse (EMCDDA, 2012). On the national level, the RELIS questionnaire is structured in different modules, starting with socio-demographic factors including age, gender, country of birth, housing situation, educational level, professional situation, financial situation, judicial situation and state of health. Overall this part of the questionnaire totals twenty-five variables of which nineteen nominal ( $n=19$ ) and six continuous ( $n=6$ ). In this sense, seven relevant predisposing, information and awareness factors ( $n=7$ ) were identified as extractable from the questionnaire, being age and age at the end of schooling (predisposing), living situation and professional situation (awareness) and educational level, reason for judicial intervention and numbers of time in prison (informational). For the drug consumption patterns actual consumption, consumption by injection and present or past substitution treatment were examined. This parts totals overall twenty-one variables, composed of eighteen nominal variables ( $n=18$ ) and three continuous variables ( $n=3$ ).

### Data analysis

For the analysis, the statistical software SPSS 27 was used. In total, 443 respondents were included in the 2019 initial dataset, revealing that 443 questionnaires were completed by treatment entrants among drug treatment and harm reduction services. The data was subsequently cleaned using the following criteria's: respondents were excluded from the dataset when having more than 33% missing values on the total dataset, more than 33% missing values on individual items of variables, and when having more than 33% responses that could not be classified, hence being classified as incoherent. Moreover, respondents with an identical unique identifier (i.e. RELIS code) were excluded, while as a general rule those were kept within the dataset that were first included during the calendar year 2019 (i.e. first treatment demand within the calendar year, clients can move between treatment/harm reduction services and have several demands). In total, 381 respondents were included in the final dataset after the cleaning process.

As regards the statistical analysis, first, the study sample population was described regarding their socio-demographic characteristics using basic descriptive statistics and frequencies starting with age, gender, country of birth, educational level, age at the end of schooling, with who the person is living, living status, professional situation, numbers of times in prison and reason for judicial interventions, in total twelve variables of which nine nominal ( $n=9$ ) and three continuous ( $n=3$ ). Second, drug consumption patterns of the study sample population were described using descriptive statistics and frequencies on primary & secondary drug, primary & secondary mode of consumption, age at the first use for primary & secondary drug, frequency of use, overdose, first illegal drug, age at first illegal drug consumption, polysubstance use of drugs, in total ten variables of which eight nominal ( $n=8$ ) and two continuous ( $n=2$ ). Subsequently, a cluster analysis was applied to identify the levels of harm exposure scoring similarly on selected variables. A two-step analysis was conducted as it enabled to cluster mixed scale variables and large amounts of data. Another advantage was that this process treats statistical outliers and creates the optimal clusters by itself (Schendra, 2011). The variables that were included for the cluster analysis to identify different levels of harm exposure were age at first illegal drug consumption,

mode of consumption of primary drug, frequency of primary drug use, overdose and polysubstance use of drugs (n=5). Subsequently, based on the outcome of the cluster analysis, the identified clusters were compared on core predisposing, awareness and information variables in line with the I-Change Model by means of chi-square and tests for categorical variables and by means of t-tests (two clusters) or ANOVA test (three clusters or more) for continuous variables to identify relevant significant differences and in order to validate the importance of the clusters. In accordance with the I-Change Model, predisposing factors related to age and age at the end of schooling whereas information factors related to educational level, numbers of times in prison and reason for judicial interventions and awareness factors related to living situation and professional situation.

#### Ethical considerations

The study was approved by the national ethical research committee (CNPD-commission nationale pour la protection des données). Moreover, the data collection and protection are in line with the revised European data protection guidelines (European Union, 2018). According to the RELIS protocol, the staff of treatment institutions first checked whether the clients met the inclusion criteria. Subsequently, they enrolled eligible drug users into the study, provided the necessary information regarding the study and its purposes, and administered the questionnaire to the clients. At the same time, clients provided written, informed consent about their information being forwarded to other institutions, under the umbrella of the Reitox Focal Point in Luxembourg and the Ministry of Health. Due to new European guidelines of data protection it is not allowed to cross datasets between institutions outside of the Ministry of Health. To ensure the anonymity of the study participants, the so-called RELIS code is used, which is a unique identifier code. This code is composed of three factors birthdate, country of birth and gender, so every participant has his/her individual code while the birthdate is not included in the questionnaire for data protection reasons. The unique identifier allows to identify and trace participants inside the RELIS system. The RELIS codes are calculated by the staff of the respective institutions and the algorithm of its calculations is unknown. As this dataset is not available to the general public, data protection guidelines had to be followed, to ensure the safety and confidentiality of the RELIS monitoring system, in particular as drug use is a sensitive topic. The protection of this data is critically important as it contains details about socio-demographics and drug consumption patterns of drug users. To ensure the protection of the data, storage and analysis was conducted on the VPN of Utrecht University.

## 6. Results

### Respondents characteristics

Table 1 illustrates the socio-demographical characteristics of the population. The mean age of the study population was 35 years, they were predominantly male, and two thirds of them were born in Luxembourg. Of the concerned study population around half had a primary education, a little more than a third had secondary education, only 1.3% were never schooled. The mean age at the end of schooling was 18 years. Regarding the housing situation more than a third of the study population were living alone, another third was living with family members and their respective partners. Concerning the living situation, just under two thirds of the sample population had a stable living situation. A little more than a quarter had no accommodation and/or unstable living situations. Just over half of the respondents were jobless or beneficiaries of social services. Of the study population, nearly half were detained for consumption of drugs, a little less than a third for the acquisition and trafficking of illicit goods. With regards to the judicial situation less than half of the gross population, had contact the law enforcement. Of these concerned respondents, almost two thirds were in jail multiple times, the rest was imprisoned once.

### Drug user patterns among the sample

Table 2 illustrates the descriptive statistics regarding the drug consumption patterns of the study population. The most primary prevalent drug used within the sample was heroin, followed by cannabis and cocaine. The mean age for primary drug consumption was 18 years. More than half of the population consumed by inhalation and just under a third applied an intravenous mode of administration. The secondary drug that was most prevalent related to cocaine succeeded by heroin and cannabis. The mean age for secondary drug consumption was 19 years. As regards frequency of use, just over half of the participants used their primary drug daily, a little less than a third used it weekly whereas the remaining study participants used it monthly. Regarding overdoses, more than a third of the gross study population reported overdoses, of these just under two thirds had overdosed once while the remaining third reported multiple overdoses. The mean age of first illegal drug consumption was 15 years. The most prevalent drug with regard to first illegal drug consumption was cannabis followed by heroin and cocaine. In total, just under a third of the respondents had a polysubstance use and used two drugs, the same proportion applies for the usage of three drugs and the other third used only one drug of choice, while 7.6% used four or more.

**Table 1.** Socio-demographic characteristics of the sample (N=410)

Variable	N	%
<b>Gender (Male)</b>	<b>317</b>	<b>77.3</b>
<b>Age (Mean/SD)</b>	<b>34.86</b>	<b>12.37</b>
<b>Country of birth</b>		
Luxembourg	275	67.1
EU	105	25.7
Non-EU	29	7.1
<b>Educational level</b>		
Primary education	217	54.3
Secondary education	166	41.5
University/higher-level education	12	3.0
Never schooled	5	1.3
<b>Age at end of schooling (Mean/SD)</b>	<b>18.24</b>	<b>3.89</b>
<b>Housing situation</b>		
Alone	152	37.7
With family members	75	18.6
With partner	66	16.4
In an institution	37	9.2
With friends	32	7.9
Other	22	5.5
In detention	19	4.7
<b>Living situation</b>		
Stable Living	256	63.2
With no accommodation	53	13.1
Instable Living	49	12.1
In other institution, not in prison	41	10.1
In detention	3	0.7
Other	3	0.7
<b>Professional situation</b>		
Beneficiary of social services	124	31.0
Student/ still in school	74	19.0
Jobless without social services	62	15.9
Stable employment	45	11.6
Other	45	11.6
Temporary employment	25	6.4
Jobless with social services	14	3.6
<b>Contact with law enforcement in the past (Yes)</b>	<b>306</b>	<b>75.7</b>
<b>Reason for judicial intervention</b>		
Detention/ use of drugs	136	46.7
Trafficking drugs	67	16.3
Offences related to the acquisition of drugs	63	15.4
Other reasons	99	33.9
<b>Numbers of time in prison</b>		
Multiple Times	103	59.2
One Time	71	40.8

Note: Missing values are excluded, therefore n<410 for some variables.

**Table 2.** Descriptive on drug consumption patterns of sample (N=410)

Variable	N	%
<b>Primary drug</b>		
Heroin	186	45.5
Cannabis (resin and/or herb)	132	32.3
Cocaine	85	20.8
Substitution products	2	0.5
Amphetamines	2	0.5
Alcohol	1	0.2
Benzodiazepines	1	0.2
<b>Age at first use of primary drug (Mean/SD)</b>	<b>18.04</b>	<b>5.41</b>
<b>Mode of consumption of primary drug</b>		
Inhalation	225	54.9
Injection	121	29.5
Other	33	8.0
<b>Secondary drug</b>		
Cocaine	122	42.5
Heroin	70	24.4
Cannabis (resin and/or herb)	46	16.0
Alcohol	39	13.6
Substitution products	4	1.4
Benzodiazepines	4	1.4
MDMA (ecstasy)	2	0.7
<b>Age at first use secondary drug (Mean/SD)</b>	<b>19.01</b>	<b>6.40</b>
<b>Frequency of primary drug use</b>		
Daily	206	50.2
Weekly	127	31.0
Monthly	77	18.8
<b>Overdose</b>		
Never	235	57.3
Once	102	24.9
More than once	61	14.9
<b>Age at first illegal drug consumption (Mean/SD)</b>	<b>15.48</b>	<b>3.87</b>
<b>First illegal drug ever used</b>		
Cannabis (resin and/or herb)	318	80.1
Heroin	45	11.3
Cocaine	22	5.5
MDMA (ecstasy)	9	2.3
Crack	1	0.3
Amphetamines	1	0.3
LSD	1	0.3
<b>Polysubstance use of products</b>		
Two drugs	135	32.9
Three drugs	124	30.2
One drugs	120	29.3
Four drugs or more	31	7.6

Note: Missing values are excluded, therefore n<410 for some variables.

### Cluster analysis

The two-step cluster analysis produced a sample (n=345) that contained a silhouette measure of cohesion and diversification of 0.2. A part of this population (n=65) respondents were excluded from the cluster analysis due to at least one missing value on one of the variables used as an input for the cluster analysis. Five variables were used to identify relevant clusters, namely four categorical (polysubstance use of drugs, mode of consumption, frequency of primary drug use and overdose) and one continuous (age at first illegal drug consumption). The most convenient cluster solution was a three cluster solution with three clusters being identified in the data set. The three clusters were compared on their input variables using ANOVAs with post-hoc Tukey HSD analysis for continuous variables and  $\chi^2$  for categorical variables. The results revealed that the clusters differed significantly on each of the five variables, illustrating the importance of each cluster (see table 3).

The first cluster (n=135; 39.1%) can be defined as the 'High Harm Exposure Cluster' as respondents clustered to this group started using drugs at a particularly young age with an age of almost 15 years (14.70; SD=3.12). This group also has significantly higher scores for polysubstance use compared to the other clusters. Their preferred mode of consumption is by intravenous injection. The frequency of use is mostly on a daily and weekly basis. This cluster has the highest occurrence of overdoses, for once or more than once.

The second cluster (n=118; 34.2%) can be labelled as the 'Medium Harm Exposure Cluster'. This group has started using drugs at an average age slightly above of 15 years (15.40; SD=4.63). Respondents of this cluster mostly use one to two drugs. Most of them indicate inhalation as their main consumption mode, while few use an injection mode. Frequency of use in this group is mostly on a daily basis, while some also use it weekly. Members of this cluster, have not yet experienced any overdoses.

The third cluster (n=92; 26.7%) can be classified, as the 'Low Harm Exposure Cluster'. This group has started using drugs slightly above the average age of 16 (16.33; SD=3.30). The polysubstance use of drugs ranges quite equally from one drug to four or more drugs, while single drug usage is the most prevalent. The majority of this group consumes by inhalation. The frequency of use is largely monthly, while the numbers for overdoses are balanced between no overdose and one overdose.

**Table 3.** Comparison of the cluster solution on variables used to identify subgroups (n=345)

Variable	Cluster 1 (n=135)	Cluster 2 (n=118)	Cluster 3 (n=92)	$\chi^2$ (df)	F (df)	Tukey HSD pattern
<b>Age at first illegal drug consumption (SD)</b>	14.70 (3.12)	15.40 (4.63)	16.33 (3.30)		5.44 (2)‡	1 < 2,3‡ 2<3
<b>Polysubstance use of drugs (%)</b>				185.41(6)*		
One	2.9	25.2	71.8			
Two	38.9	13.9	47.2			
Three	68.2	1.9	29.9			
Four or more	63.0	3.7	33.3			
<b>Mode of consumption of primary drug (%)</b>				135.68(4)*		
Injection	75.2	23.0	1.8			
Inhalation	15.5	39.5	45.0			
Other	59.4	40.6	0.0			
<b>Frequency of primary drug use (%)</b>				135.46(4)*		
Daily	41.6	54.7	3.7			
Weekly	42.6	26.1	31.3			
Monthly	27.5	0.0	72.5			
<b>Overdose (%)</b>				214.04(4)*		
Never	9.9	58.4	31.7			
Once	61.8	0.0	38.2			
More than once	92	0.0	8.0			

†P&lt;.05

‡P&lt;.01

\*P&lt;.001

Comparison of the clusters regarding relevant predisposing, awareness and information factors

As illustrated in Table 4, participants in the first cluster are likely to be older than the ones belonging to the second and third cluster. Participants of the first cluster had higher educational levels even though their average age at the end of schooling was the lowest in comparison to the second cluster and the third cluster. Altogether, the results of the ANOVA revealed that age at the end of schooling differed substantially among the three clusters. Post hoc analysis using Tukey HSD showed that members of cluster 3 were older than members of cluster 2 and 1, and cluster 2 were younger than cluster 3, however these findings were not significant. Members of the first cluster were more likely to have had contacts with law enforcement for use of drugs, trafficking drugs and offences related to the acquisition of drugs, they were also more likely to have spent time in jail once or multiple times. Members of the first and second cluster revealed to have stable employment while also having the highest values for unemployment and for beneficiary of social services. Most members of the third cluster seem to be students or still in school. Concerning living situation, members of the first and second cluster appear to have the highest rates for being homeless or being housed in specialised institutions, whilst also having high values for stable living and other.



**Table 4.** Comparing the clusters regarding relevant predisposing, awareness and information factors (n=345)

Variables	Cluster 1	Cluster 2	Cluster 3	$\chi^2$ (df)	F (df)	Tukey HSD pattern
<b>Age (SD)</b>	39.10 (9.52)	34.46 (10.82)	26.98 (14.41)		30.56(2)*	1>2‡,3* 2>3*
<b>Educational level (%)</b>				31.65(6)*		
Never schooled	50	25	25			
Primary education	29.5	32.2	38.3			
Secondary Education	50.0	37.1	12.9			
University/higher-level education	63.6	27.3	9.1			
<b>Age at the end of schooling (%)</b>	17.82 (3.47)	18.05 (3.69)	19.30 (4.10)		3.34 (2)†	1<2,3† 2<3
<b>Professional situation (%)</b>				140.88(12)*		
Temporary Employment	15.8	42.1	42.1			
Stable Employment	44.7	42.1	13.2			
Student / in School	1.5	20.6	77.9			
Unemployed with Social services	41.7	41.7	16.7			
Unemployed without social services	44.6	42.9	12.5			
Beneficiary of social Services	62.5	28.1	9.4			
Other	48.8	41.5	9.8			
<b>Living situation (%)</b>				43.12(10)*		
Stable Living	33.3	30.5	36.2			
Instable Living	28.6	57.1	14.3			
With no accommodation	63.8	31.9	4.3			
In detention	100	0	0			
In other institution, not in prison	48.6	35.1	16.2			
Other	66.7	33.2	0			
<b>Reason for judicial intervention (%)</b>						
Detention/ use of Drugs	35.2	32.8	32.0	17.81(2)*		
Trafficking drugs	46.8	37.1	16.1	1.19(2)		
Offences related to the acquisition of drugs	63.5	30.8	5.8	13.19(2)‡		
Other reasons	46.4	41.7	11.9	6.80(2)†		
<b>Numbers of time in prison (%)</b>				.25(2)		
Multiple Times	55.7	34.1	10.2			
One Time	51.7	37.9	10.3			

†P&lt;.05

‡P&lt;.01

\*P&lt;.001

## 7. Discussion

### Conclusion

The results from this study suggest that drug users, that are in contact with harm reduction services, inpatient or outpatient treatment services can be clustered on their drug consumption patterns. Drug consumption patterns were assessed by means of variables as suggested by the Treatment Development Identification (TDI). Three clusters were identified among a sample of drug users in treatment during the year 2019 in Luxembourg through five variables (age at first illegal drug consumption, mode of consumption of primary drug, frequency of primary drug use, overdose and polysubstance use of drugs) that varied significantly among the clusters, revealing the importance of each cluster. When comparing the three identified clusters on their socio-demographic characteristics, significant variations in age, educational levels, reason for judicial interventions, professional situation and living situation can be detected, while age at the end of schooling showed substantial variation. Based on their differences regarding drug consumption patterns and relevant predisposing, awareness and information factors, the first cluster could be labelled as 'High Harm Exposure', the second as 'Medium Harm Exposure' and the third as 'Low Harm Exposure'.

The first of these clusters, the 'High Harm Exposure', cluster includes drug users that have the highest health risk behaviour and are the most susceptible to suffering economic, social and health harms. This group can be classified as hardcore drug users (Morrall et al. 2000). Users of this cluster distinguish themselves by having a polysubstance use of drugs, the most harmful modes of consumption, daily to nearly daily consumption and earliest age at first illegal drug consumption when compared to the other clusters. The second cluster represents the 'Medium Harm Exposure' cluster. This group is exposed to harms on an intermediate level. If individual changes occur in a respondents' socio-demographic characteristics, these changes could influence their exposure to impending/recurring harms and reallocate their harm exposure to either the 'Low- or High Harm Exposure' cluster. The 'Medium Harm Exposure' subgroup can therefore be identified as At-Risk consumers. In contrast to the first cluster, members of the third cluster are the 'Low Harm Exposure' cluster due to relatively low scores on frequency of drug use and polysubstance use. They may be classified, as recreational drug users where the use of one single substance is most prevalent with a less harmful mode of consumption i.e. often smoked/inhaled, on an irregular to monthly basis most of the time. Members of this clusters seem to have milder drug consumption patterns, resulting in a greater likelihood to experience less economic, social and health harms (Berndt et al. 2021).

The importance of each cluster solution identified throughout the current study is revealed when comparing each cluster with regard to relevant predisposing (socio-demographic), awareness (socio-economic) and informational (educational) factors as proposed by the I-Change Model (De Vries et al. 2003). Significant variations can be identified when comparing the socio-demographics to the levels of harm exposure with age (predisposing factor), educational levels, reason for judicial interventions (information factors), professional situation and living situation (awareness factors), while age at the end of schooling showed substantial variation.

### Connection to existing research

Socio-economic status was defined through living and professional situation. The socio-economic status among the 'High Harm Exposure' cluster was notably low when compared to the 'Medium-and Low Harm Exposure' clusters. Taken together, and in line with the study findings by Origer, these results suggest that some socio-demographic characteristics can act as protective factors. Origer found in particular that these factors may reduce the risk of overdose among subgroups of injecting drug users (Origer et al. 2014). In addition, with the earlier age at the end of schooling and early initiation of drug use, these empirical findings are in line with the existing research affirming that low socio-economic status and no to low education are linked to greater exposure to higher risk drug use (Barrio et al. 2013; Barocas et al. 2019; Clarke et al. 2014). Higher risk of drug use can lead to polysubstance use of drugs and a higher probability of impending/recurring harms (Schulte et al. 2014).

This study implies that predisposing, awareness and information factors influence drug consumption patterns, which in turn influence the degree of exposure to impending/recurring harms. A previous study evaluating the first injection initiation event among different drugs found, earlier age at drug consumption to be associated with an earlier age of intravenous initiation, leading to an increased likeliness for higher risk drug use, homelessness and having low educational level. These findings reflect the empirical results of our study. (Lankenau et al. 2010) Validating the use of the I-Change Model to explain and eventually predict health risk behaviours, through socio-demographic factors with predisposing (Age and age at the end of schooling), information (Educational level and judicial situation) and awareness factors (Living situation and professional situation) (De Vries, 2017; McKenzie et al. 2015).

### Limitations

The findings of this study were subject to some limitations and biases. First, it is important to be aware of the primary limitation of a cross-sectional study design, namely that the exposure and outcome are simultaneously assessed indicating generally no evidence of a temporal relationship between exposure and outcome. Future studies may conduct longitudinal research to be able to make more valid statements about the role of predisposing factors among drug users clusters. Second, the collection of the data was subject to convenience sample of drug users and selection bias as certain service providers do not include everyone as a subject to the questionnaire, which can cause an imbalance in the characteristics of the sample size. This may mean that the study sample and the outcome of our research are not generalisable to other populations of high-risk drug users. However, we assume that the outcomes are valid for the population studied and moreover, it is challenging to conduct research among drug users as it remains an illegal behaviour and a marginalised population. Thirdly, it is likely that we dealt with self-report bias, as some questions within the RELIS questionnaire are sensitive and therefore respondents are more likely to provide socially desirable answers. This means that drug use and other data may be underreported among the sample. This may be prevented in future research using more objective measures to assess drug use, for example laboratory testing to confirm the absence or presence of certain drugs (e.g. hair analysis, blood test). Fourth, the study did not include any variables that could be used for motivational factors, which can be identified as a content limitation when

connected to the I-Change Model. Variables that could be used as motivational factors could be desired effects of consumption or reasons to seek treatment. Fifth, a limitation of this study is that the power of the dataset was hampered since 65 respondents were excluded because they had missing values on the variables that were included within the cluster analysis. To prevent this the staff members surveying the conduction of the questionnaire should closely monitor the respondents so the prevalence of missing values will decrease. Nevertheless, the size of the dataset can be identified as a strength as it is very difficult to collect reliable data on a precarious population such as high-risk drug users.

#### Recommendations and take-home message

Furthermore, the identification of harm exposure levels in relation to predisposing, awareness and information factors shows that marginalised people may be identified earlier. This typology of harm exposure levels could be used as preventive knowledge to inform health practice and policy. So interventions may be developed to improve services by adapting action plans and strategies in relation to these empirical findings. Considerably more research will need to be done to determine the impact of early initiation of drug consumption. The age at first illegal drug consumption became substantially lower from the Low Harm-to the High Harm Exposure clusters and thus also having a significant influence on socio-economic status and judicial situation and educational status. Therefore, a key policy priority should be to develop a national overarching modular prevention/intervention system spanning over the national curriculum for education starting at primary education accompanying students up to secondary and/or university education, as there is no overarching modular prevention/intervention system in Luxembourg at this moment.

Further research is required to validate the statistical process of creating clusters through drug consumption patterns, as the Treatment Demand Indicator is collected by the 27 member states of the European Union. The Focal Points of each member state can replicate this study to validate its outcomes. These member states can make use of the same statistical process to establish harm exposure levels to see if there are variations within these harm exposure clusters on a European level, based on the selected variables for the cluster analysis, as most of these variables are mandatorily included into the TDI by the EMCDDA, except for the overdose variable.

#### Acknowledgement

Thanks are to the EMCDDA Focal Point Luxembourg at the Directorate of health, Luxembourg for providing empirical data and all the participating third parties for their determined efforts to collect and maintain the quality of data provided to the national RELIS surveillance system. Hence making it possible to identify harm exposure levels based on drug consumption patterns and exposing the influence of predisposing, awareness and information factors.

## 8. References

- Anatchkova, M., Velicer, W., & Prochaska, J. (2005). Replication of subtypes for smoking cessation within the contemplation stage of change. *Addictive Behaviors*, 30(5), 915-927. DOI: 10.1016/j.addbeh.2004.09.011
- Antoine, J., De Ridder, K., Plettinckx, E., Blanckaert, P., & Gremeaux, L. (2016). Treatment for substance use disorders: The Belgian Treatment Demand Indicator registration protocol. *Archives of Public Health*, 74(1), 27. DOI: 10.1186/s13690-016-0139-7
- Antoine, J., Berndt, N., Astudillo, M., Cairns, D., Jahr, S., Jones, A., . . . Montanari, L. (2020). Cocaine treatment demands in 10 western European countries: Observed trends between 2011 and 2018. *Addiction (Abingdon, England)*, 29 August 2020. DOI: 10.1111/add.15237
- Barocas, J., Wang, J., Marshall, B., Larochelle, M., Bettano, A., Bernson, D., . . . Walley, A. (2019). Sociodemographic factors and social determinants associated with toxicology confirmed polysubstance opioid-related deaths. *Drug and Alcohol Dependence*, 200, 59-63. DOI: 10.1016/j.drugalcdep.2019.03.014
- Barrio, G., Montanari, L., Bravo, M., Guarita, B., De La Fuente, L., Pulido, J., & Vicente, J. (2013). Trends of heroin use and heroin injection epidemics in Europe: Findings from the EMCDDA Treatment Demand Indicator (TDI). *Journal of Substance Abuse Treatment*, 45(2013), 19-30. DOI: 10.1016/j.jsat.2012.11.002
- Barter, E. (2010). Return to Education for Recovering Drug Addicts: The Soilse Project. *Adult Learner: The Irish Journal of Adult and Community Education*, 132-149 Retrieved from <https://files.eric.ed.gov/fulltext/EJ907237.pdf>
- Berndt, N., Bolman, C., Mudde, A., Verheugt, F., De Vries, H., & Lechner, L. (2012). Risk groups and predictors of short-term abstinence from smoking in patients with coronary heart disease. *Heart & Lung*, 41(4), 332-343. DOI: 10.1016/j.hrtlng.2012.03.001
- Berndt, N., Seixas R. & Origer A. (2019). The drug phenomenon in the grand duchy of Luxembourg : Trends and Developments. *Luxembourg : Point Focal Luxembourgeois de Directorate of Health, Ministry of Health*. Retrieved from <https://gouvernement.lu/dam-assets/documents/actualites/2020/02-fevrier/RELIS-Rapport-2019-ENG.pdf>
- Berndt, N., Seixas R. & Origer A. (2020). The drug phenomenon in the grand duchy of Luxembourg : Trends and Developments. *Luxembourg : Point Focal Luxembourgeois de Directorate of Health, Ministry of Health*. Retrieved from <https://sante.public.lu/fr/actualites/2021/04/relis/index.html>
- Berndt, N., Paulos ,C. & Seixas, R. (2021) Mini-European Web Survey on Drugs (EWSD) : Impact of COVID-19 on Drug use, Acquisition behaviour and the Drug Market in Luxembourg : *Point Focal Luxembourgeois de Directorate of Health, Ministry of Health*. Retrieved from <https://sante.public.lu/fr/actualites/2021/04/enquete-drogues/report-mini-ewsd.pdf>
- Clarke, Ross J, Clarke, Elizabeth A, Roe-Sepowitz, Dominique, & Fey, Richard. (2012). Age at Entry into Prostitution: Relationship to Drug Use, Race, Suicide, Education Level, Childhood Abuse, and Family Experiences. *Journal of Human Behavior in the Social Environment*, 22(3), 270-289. DOI: 10.1080/10911359.2012.655583
- De Vries, H (2017). An integrating Approach for Understanding Health Behavior; The I-Change Model as an Example. *Department of Health Promotion, Maastricht University, Europe*. 09 March 2017. DOI: 10.19080/PBSIJ.2017.02.555585
- De Vries, H., Mudde, A., Leijts, I., Charlton, A., Vartiainen, E., Buijs, G., et al. (2003). The European Smoking prevention Framework Approach (EFSA): An example of integral prevention. *Health Education Research*, 18(5), 611-626. DOI: 10.1093/her/cyg031
- EMCDDA (2012). Treatment Demand Indicator (TDI) standard protocol 3.0 : Guidelines for reporting data on people entering drug treatment in European countries. *Lisbon: EMCDDA*. Retrieved from [https://www.emcdda.europa.eu/system/files/publications/675/EMCDDA-TDI-Protocol-3.0\\_392671.pdf](https://www.emcdda.europa.eu/system/files/publications/675/EMCDDA-TDI-Protocol-3.0_392671.pdf)

EMCDDA (2020). EMCDDA trendspotter briefing May 2020: Impact of COVID-19 on drug services and help-seeking in Europe. *Lisbon : EMCDDA* Retrieved from [https://www.emcdda.europa.eu/system/files/publications/13073/EMCDDA-Trendspotter-Covid-19\\_Wave-1-2.pdf](https://www.emcdda.europa.eu/system/files/publications/13073/EMCDDA-Trendspotter-Covid-19_Wave-1-2.pdf)

EMCDDA (2021a). European Drug Report 2021. Retrieved June 2021, Retrieved from <https://www.emcdda.europa.eu/edr2021>

EMCDDA (2021b). Treatment demand. Retrieved April 2021, Retrieved from [https://www.emcdda.europa.eu/topics/treatment-demand\\_en](https://www.emcdda.europa.eu/topics/treatment-demand_en)

EMCDDA (2021c). Problem drug use. Retrieved May 2021, Retrieved from [https://www.emcdda.europa.eu/topics/problem-drug-use\\_en](https://www.emcdda.europa.eu/topics/problem-drug-use_en)

European Union (2018). REGULATION (EU) 2018/1725 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2018. *Official Journal of the European Union, L 295*, 39-98. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R1725&from=EN>

Ilhan, A., Kotan, T., Pinarci, T., et al. (2016). Prevalence and Socio-Demographic Determinants of Tobacco, Alcohol, substance Use and Drug Misuse in General Population in Turkey/Türkiye'de Genel Populasyonda Tütün, Alkol, Madde Kullanımı ve İlaç Yanlısı Kullanımının Prevalansı ve Sosyo-Demografik Belirleyicileri. *Noro-Psikyatri Arsivi*, 53(3), 205-212. DOI: 10.5151/npa.2015.10050

Feustel, R. Schmidt, H., Bröckling, U. (2019). Handbuch Drogen in sozial- und kulturwissenschaftlicher Perspektive. Springer Verlag. Bremen, Deutschland. *Springer Verlag*. DOI: 10.1007/978-3-658-22138-6

Frijns, T., Van Laar, M., Trautmann, Franz, Kilmer, Beau, & Turnbull, Paul. (2013). Amphetamine, ecstasy and cocaine : Typology of users, availability and consumption estimates. *Further insights into the aspects of the EU illicit drugs market*, 183-242 DOI: 10.2838/92919

Stefanie Kasten, Liesbeth van Osch, Math Candel, & Hein de Vries. (2019). The influence of pre-motivational factors on behavior via motivational factors: A test of the I-Change model. *BMC Psychology*, 7(1), 1-12. DOI : 10.1186/s40359-019-0283-1

Ketterer, F., Symons, L., Lambrechts, M., Mairiaux, P., Godderis, L., Peremans, L. (2014). What factors determine Belgian general practitioners' approaches to detecting and managing substance abuse? A qualitative study based on the I-Change Model. *BMC Family Practice*, 15(1), 119. BioMed Central (2014). DOI: 10.1186/1471-2296-15-119

Lankenau, S., Wagner, K., Bloom, J., Sanders, B., Hathazi, D., & Shin, C. (2010). The First Injection Event: Differences among Heroin, Methamphetamine, Cocaine, and Ketamine Initiates. *Journal of Drug Issues*, 40(2), 241-262. DOI: 10.117/002204261004000201

Mindrila, D. (2016). A typology of child school behaviour: Investigation using latent profile analysis and cluster analysis. *Psychology in the Schools*, 53(5), 471-487. DOI: 10.1002/pits.21917

Morrall, A., Mccaffrey, D., & Iguchi, M. (2000). Hardcore drug users claim to be occasional users: Drug use frequency underreporting. *Drug and Alcohol Dependence*, 57(3), 193-202. DOI: 10.1016/S0376-8716(99)00048-4

Origer, A., Bihan, E., Baumann, M. (2014). Social and economic inequalities in fatal opioid and cocaine related overdoses in Luxembourg: A case-control study. *International Journal of Drug Policy*, 25, 911-915. Elsevier Science (2014). DOI: 10.1016/j.drugpo.2014.05.015

Schulte, M., Hser, Y. (2014). *Substance use and associated health conditions throughout the lifespan*. Public Health Reviews, 35(2), 1-27. DOI:10.1007/BF03391702

Schendera, C. (2011). Clusteranalyse mit SPSS : Mit Faktorenanalyse. *Oldenbourg Verlag München*. DOI: 10.1524/9783486710526

Spellerberg, A. (2000). Werner Georg: Soziale Lage und Lebensstil. Eine Typologie. *KZfSS Kölner Zeitschrift Für Soziologie Und Sozialpsychologie*, 52(2), 376-377. DOI: 10.1007/s11577-000-0050-6

Smit, E., Brinkhues, S., De Vries, H., & Hoving, C. (2018). Subgroups Among Smokers in Preparation: A Cluster Analysis Using the I-Change Model. *Substance Use & Misuse*, 53(3), 400-411. DOI: 10.1080/10826084.2017.1334062

Velicer, W., Redding, C., Anatchkova, M., Fava, J., & Prochaska, J. (2007). Identifying cluster subtypes for the prevention of adolescent smoking acquisition. *Addictive Behaviors*, 32(2), 228-247. DOI: 10.1016/j.addbeh.2006.03.041

WHO (2010), A conceptual Framework for Action on the social determinants of health. *World Health Organisation*. Retrieved from [https://www.who.int/sdhconference/resources/ConceptualframeworkforactiononSDH\\_eng.pdf](https://www.who.int/sdhconference/resources/ConceptualframeworkforactiononSDH_eng.pdf)

WHO (2011), Global Health Risks, Mortality and burden of disease attributable to selected major risks. *World Health Organisation*. Retrieved from [https://www.who.int/healthinfo/global\\_burden\\_disease/GlobalHealthRisks\\_report\\_full.pdf](https://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf)

## 9. Appendices

### 9.1 Ethical approval

<b>P.O. Box 80140, 3508 TC Utrecht</b>  The Board of the Faculty of Social and Behavioural Sciences Utrecht University P.O. Box 80.140 3508 TC Utrecht	<b>Faculty of Social and Behavioural Sciences</b>  Faculty Support Office Ethics Committee  <b>Visiting Address</b>  Padualaan 14 3584 CH Utrecht
<b>Our Description</b>	21-1746
<b>Telephone</b>	030 253 46 33
<b>E-mail</b>	FETC-fsw@uu.nl
<b>Date</b>	04 June 2021
<b>Subject</b>	Ethical approval

#### ETHICAL APPROVAL

Study: Levels of drug use and predictors/characteristics for people requiring a service for outpatient or an inpatient treatment

Principal investigator: O. Michels

Supervisor:

The study is approved by the Ethical Review Board of the Faculty of Social and Behavioural Sciences of Utrecht University. The approval is based on the documents sent by the researchers as requested in the form of the Ethics committee and filed under number 21-1746. The approval is valid through 30 June 2021. The approval of the Ethical Review Board concerns ethical aspects, as well as data management and privacy issues (including the GDPR). It should be noticed that any changes in the research design oblige a renewed review by the Ethical Review Board.

Yours sincerely,

Peter van der Heijden, Ph.D.  
Chair

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## 9.2 Syntax for the statistical analysis

### Descriptives on socio-demographic characteristics / Table 1

```
FREQUENCIES VARIABLES=Sexe_rec PAYSNAISS_EU Sco_niveau_rec AvecQuilIMPULS LieuVie_rec Prof_rec  
JudCon_rec  
  JudRais1_rec JudRais2_rec JudRais3_rec JudRais4_rec JudSej_rec  
/STATISTICS=STDDEV MINIMUM MAXIMUM MEAN  
/FORMAT=DFREQ  
/ORDER=ANALYSIS.
```

```
DESCRIPTIVES VARIABLES=Age_Rec AgeFinSco_rec  
/STATISTICS=MEAN STDDEV MIN MAX.
```

### Descriptives on drug consumption patterns / Table 2

```
FREQUENCIES VARIABLES=Prod1_rec Prod2_rec  
Prod1conso_rec Prod2conso_rec FreqCon_rec PolyCon_rec  
  PolyConProd1_rec PolyConProd2_rec Prod1erCon_rec Heroin_rec TraitSub_rec TraitAvAutre_rec  
Prod_SUMUP  
/STATISTICS=STDDEV MINIMUM MAXIMUM MEAN  
/FORMAT=DFREQ  
/ORDER=ANALYSIS.
```

```
DESCRIPTIVES VARIABLES=Prod1age_rec Prod2age_rec  
  Age1erCon_rec IVAge_rec Age_PrTraitSubs_rec  
/STATISTICS=MEAN STDDEV MIN MAX.
```

### Two-Step cluster analysis / Table 3

```
TWOSTEP CLUSTER  
/CATEGORICAL VARIABLES=OD_rec Prod_Con_Total Prod1conso_3cat FreqCon_3cat  
/CONTINUOUS VARIABLES=Age1erCon_rec  
/DISTANCE LIKELIHOOD  
/NUMCLUSTERS AUTO 15 BIC  
/HANDLENOISE 0  
/MEMALLOCATE 64  
/CRITERIA INITHRESHOLD(0) MXBRANCH(8) MXLEVEL(3)  
/VIEWMODEL DISPLAY=YES  
/PRINT IC COUNT SUMMARY  
/SAVE VARIABLE=TSC_5134.
```

```
ONEWAY Age1erCon_rec BY Lvl_Drug_Consumption  
/STATISTICS DESCRIPTIVES HOMOGENEITY BROWNFORSYTHE  
/MISSING ANALYSIS  
/CRITERIA=CILEVEL(0.95)  
/POSTHOC=TUKEY LSD BONFERRONI ALPHA(0.05).
```

```
CROSSTABS  
/TABLES=Lvl_Drug_Consumption BY OD_rec Prod_Con_Total Prod1conso_3cat FreqCon_3cat  
/FORMAT=AVALUE TABLES  
/STATISTICS=CHISQ PHI  
/CELLS=COUNT ROW COLUMN TOTAL  
/COUNT ROUND CELL.
```

Comparison of the clusters regarding predisposing, awareness and information factors/ Table 4

DATASET ACTIVATE DataSet1.

ONEWAY Age\_Rec AgeFinSco\_rec Agepremierdemandetout BY Lvl\_Drug\_Consumption

/STATISTICS DESCRIPTIVES HOMOGENEITY

/MISSING ANALYSIS

/CRITERIA=CILEVEL(0.95)

/POSTHOC=TUKEY BONFERRONI ALPHA(0.05).

CROSSTABS

/TABLES=Sco\_niveau\_rec JudSej\_rec\_YesNo JudRais1\_rec JudRais2\_rec

JudRais3\_rec JudRais4\_rec LieuVie\_rec Prof\_rec BY Lvl\_Drug\_Consumption

/FORMAT=AVALUE TABLES

/STATISTICS=CHISQ PHI GAMMA

/CELLS=COUNT ROW COLUMN

/COUNT ROUND CELL.