

Beyond the substances: a multi-criteria analysis of the spread of Drug Use in Europe

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Consiglio Nazionale delle Ricerche
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Background

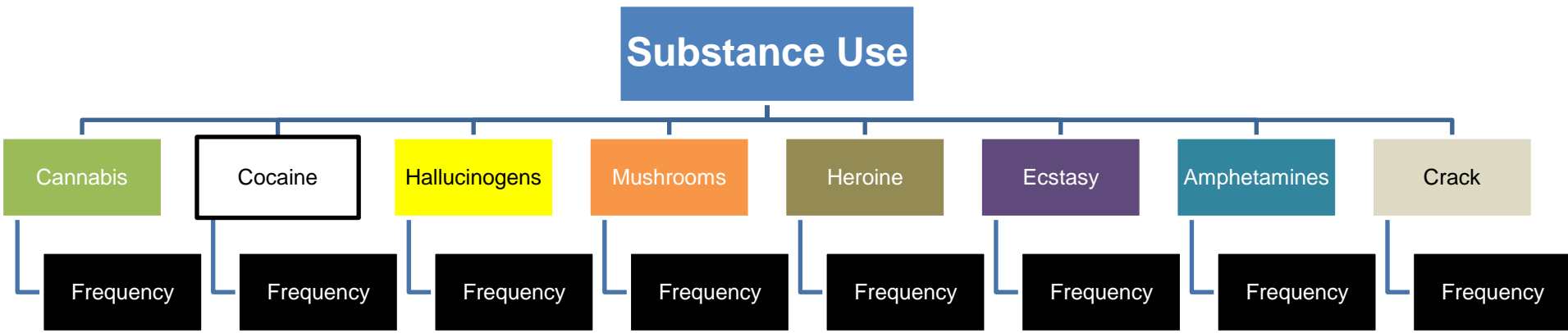
Statistics on drugs are mainly broadcasted as the prevalence of single substance users, only in few cases they are presented as the combined use of several substances.

From a policy perspective, the **inability to summarize such multidimensional information** has two main shortcomings:

1. **within single substances**, the prevalence of users is not informative about what the actual frequency of use is;
2. **between substances**, the multidimensional information does not allow ranking (i.e. we do not know how the prevalence of a specific substance can be compared with the prevalence of another substance).

What about the bigger picture?

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ESPAD Project

Welcome to ESPAD

This is the home page of ESPAD - the European School Survey Project on Alcohol and Other Drugs.

ESPAD is a collaborative effort of independent research teams in more than forty European countries and the largest cross-national research project on adolescent substance use in the world.

The overall aim with the project is to repeatedly collect comparable data on substance use among 15-16 year old students in as many European countries as possible.

[View the 2015 ESPAD Report](#)

**ESPAD Report
2015**
Results from the European
School Survey Project on
Alcohol and Other Drugs
The ESPAD Group

ESPAD data

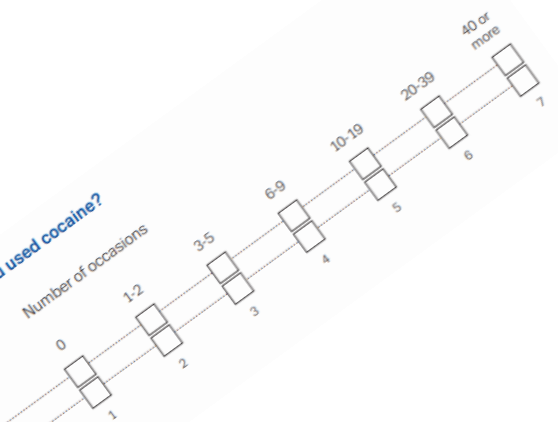


Countries

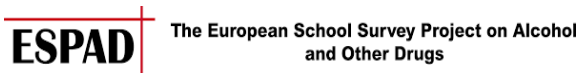
- Albania
- Armenia
- Austria
- Azerbaijan
- Belarus
- Belgium
- Bosnia and Herzegovina
- Bulgaria
- Canada
- Croatia
- Cyprus
- Czech Republic
- Denmark
- Estonia
- Faroe Islands
- Finland
- France
- Georgia
- Germany
- Greece
- Greenland
- Hungary
- Iceland
- Ireland
- Israel of Sam
- Italy
- Kosovo (under UNSCR 1244)
- Latvia
- Liechtenstein
- Lithuania
- Macaronesia, FYRE of
- Malta
- Moldova, Republic of
- Monaco
- Montenegro
- Netherlands
- Norway
- Poland
- Portugal
- Romania
- Russian Federation
- Serbia
- Slovak Republic
- Slovenia
- Spain
- Sweden
- Switzerland
- Turkey
- Ukraine
- United Kingdom

On how many occasions (if any) have you used cocaine?

- (a) In your lifetime
- (b) During the last 12 months



ESPAD data



Type: Multinational cross-sectional survey on psychoactive substance use

Target population: 16-year-old students

Collection: every 4 years since 1995 (6 waves)

Coverage: nationally representative samples from 40 European countries (600,000 students since 1995)

ESPAD average			
Lifetime use of illicit drugs (%) ^a			
reset order x	Average	Min.	Max.
Any illicit drug	18	6	37
Cannabis	16	4	37
Ecstasy	2	0	5
Amphetamine	2	0	6
Methamphetamine	1	0	5
Cocaine	2	0	5
Crack	1	0	3
LSD or other hallucinogens	2	0	5
Heroin	1	0	3
GHB	1	0	3

Purpose: Composite Index



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In the case of ordinal criteria as expressed in ESPAD data:

n participants

$$[f_k(a_i) = '40 \text{ or more}'] > [f_k(a_i) = '20 - 39'], k = 1, \dots, s, i = 1, \dots, n$$

s drugs

$$[f_k(a_i) = '20 - 39'] > [f_k(a_i) = '10 - 19'], k = 1, \dots, s, i = 1, \dots, n$$

$P_k(a_i, a_j)$ preference function

$$[f_k(a_i) = '10 - 19'] > [f_k(a_i) = '6 - 9'], k = 1, \dots, s, i = 1, \dots, n$$

$$[f_k(a_i) = '6 - 9'] > [f_k(a_i) = '3 - 5'], k = 1, \dots, s, i = 1, \dots, n$$

$$[f_k(a_i) = '3 - 5'] > [f_k(a_i) = '1 - 2'], k = 1, \dots, s, i = 1, \dots, n$$

$$[f_k(a_i) = '1 - 2'] > [f_k(a_i) = '0'], k = 1, \dots, s, i = 1, \dots, n$$

(1)

the following level preference function can be adopted:

$$P_k(a_i, a_j) = \begin{cases} 1 & \text{if } f_k(a_i) > f_k(a_j) \\ 0 & \text{if } f_k(a_i) \leq f_k(a_j) \end{cases} \quad (2)$$

For each criterion (f_k) and for each alternative (a_i) the PROMETHEE unicriterion net flows can be estimated as follows:

$$\phi_k(a_i) = \frac{1}{n-1} \sum_{j=1}^n [P_k(a_i, a_j) - P_k(a_j, a_i)], k = 1, \dots, s \quad (3)$$

On the base of unicriterion net flows in (3), the global net flows can be estimated as follows:

$$\phi(a_i) = \sum_{k=1}^s \phi_k(a_i) w_k, i = 1, \dots, n \quad (4)$$

Frequency of use and unicriteria net flows

	Cannabis		Cocaine	
	N. Observations	Unicriteria net flow	N. Observations	Unicriteria net flow
40 or more	1763	0.973	131	0.998
Between 20 – 39	825	0.934	49	0.995
Between 10 – 19	1247	0.902	86	0.993
Between 6 – 9	1360	0.862	116	0.990
Between 3 – 5	2293	0.807	238	0.985
Between 1 – 2	5139	0.693	959	0.966
Never	52968	-0.193	64016	-0.024
Total	65595		65595	

Where the weights $w_k: \{\sum_{k=1}^s w_k = 1\}$ represent the relative importance of each criterion in the decision. To this regard in this study we use the algorithm proposed in Caravaggio et al. (2019) and we estimate the weights by means of a DEA optimization on the unicriterion net flows (Equation 5). More specifically, for each alternative we estimate the global score ($\phi(a_i)$) by using the following linear program:

$$\begin{aligned} \phi(a_i) &= \max_{w_k} \sum_{k=1}^m \phi_k(a_i) w_k \\ \sum_{k=1}^m w_k &= 1 \\ w_k &\geq 0, k = 1, \dots, m \end{aligned} \tag{5}$$



Method

Averandex & Inequality

In order to give an estimation of the country-level drug usage, we take the average $\phi(a_i)$ of students in the country (to this aim we used weights provided by ESPAD to obtain representative estimates):

$$\text{Drug Use Index in Average} = \text{Average} (\phi(a_i)) \quad (6)$$

In order to get the drug use distribution, we decide to measure Between Country Inequality (BCI) and Within Countries Inequality (WCI) in the drug use using the Standard Deviation (SD) observed in individual $\phi(a_i)$:

$$\text{Drug Use Index Inequality} = \text{Standard deviation} (\phi(a_i)) \quad (7)$$

2015 ESPAD database used

(Male = 32 043, Female = 33 552)

23 of the 35 countries that participated in the 2015 data collection.

2003 ESPAD database used

(Male = 31 143, Female = 33 796).

the same countries (n=23)

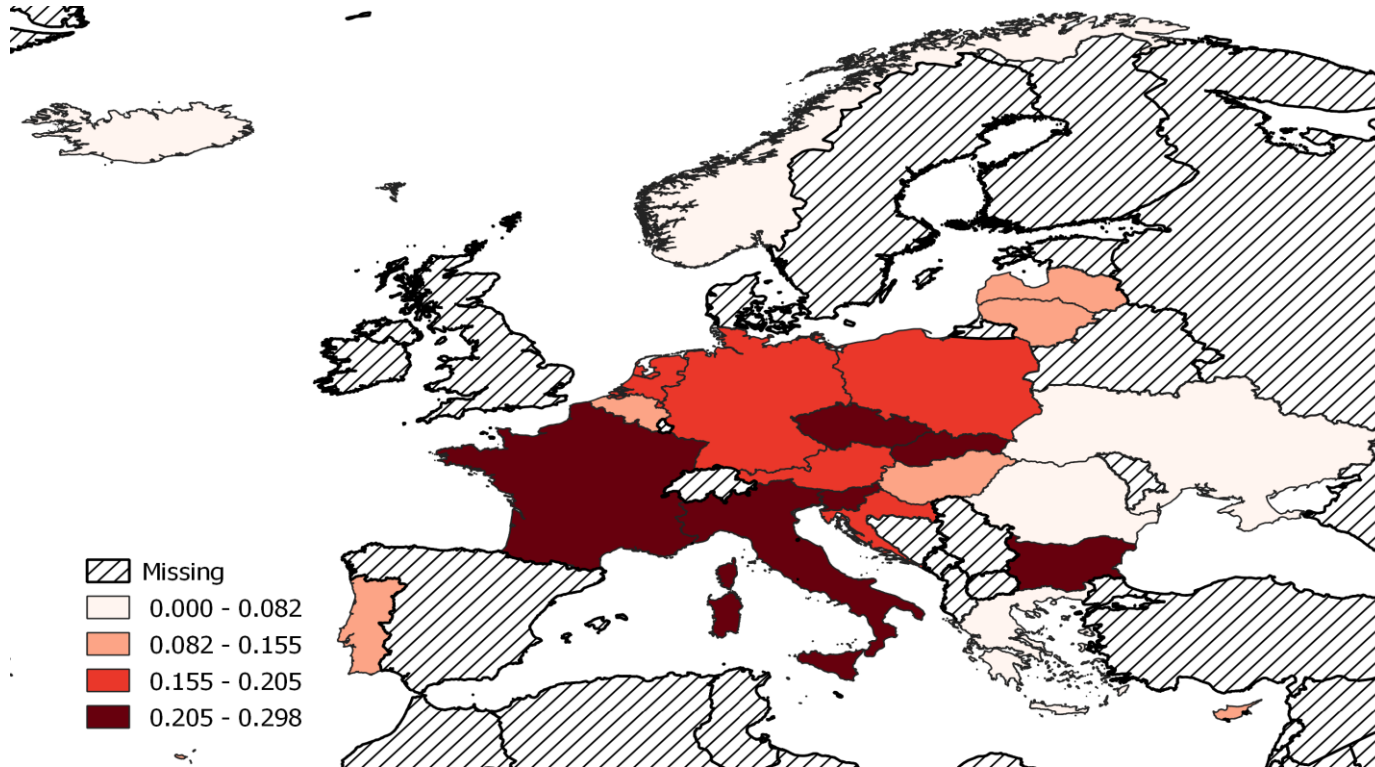
Countries are grouped into five regions: Northern (NE), Southern (SE), Western (WE), Eastern Europe (EE) and Balkan States (BS).

We used the students' lifetime use of eight illegal psychoactive substances: Cannabis, Cocaine, Hallucinogens, Mushrooms, Heroine, Ecstasy, Amphetamines and Crack.

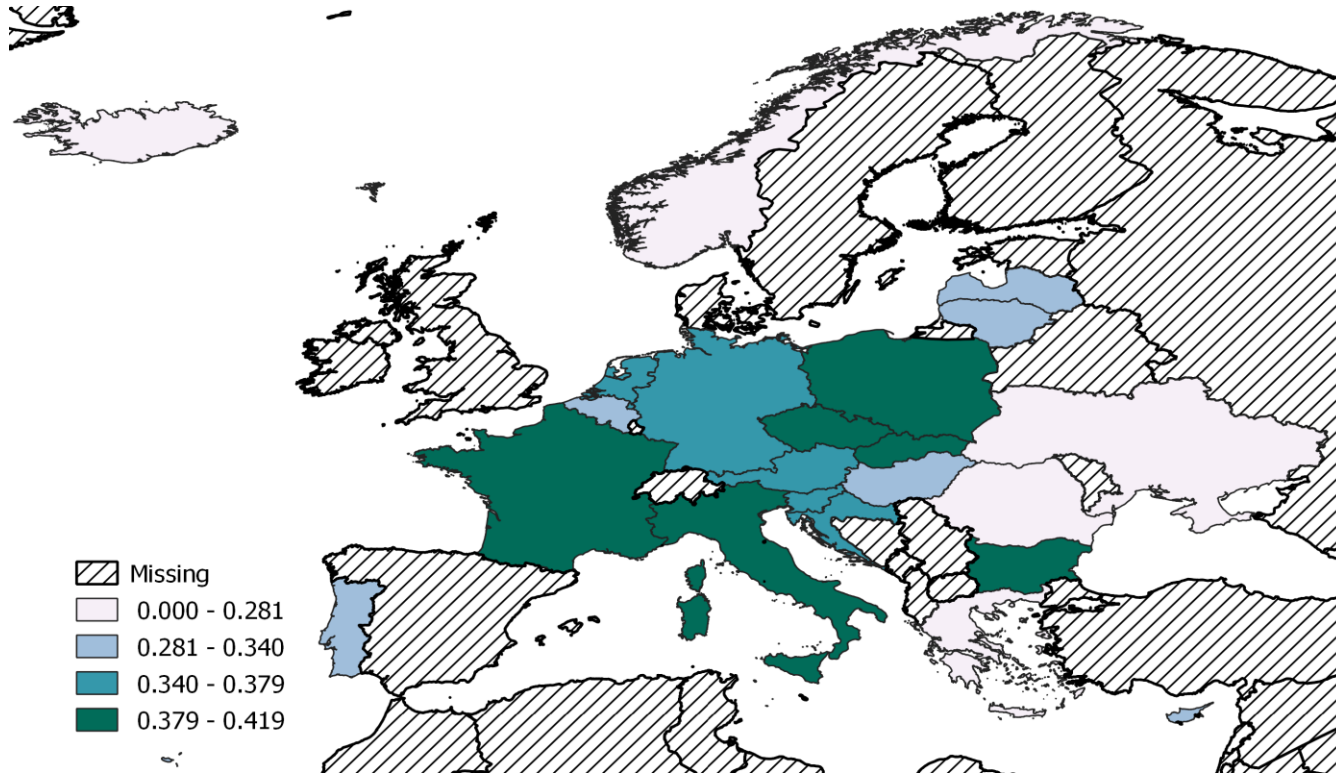
Results



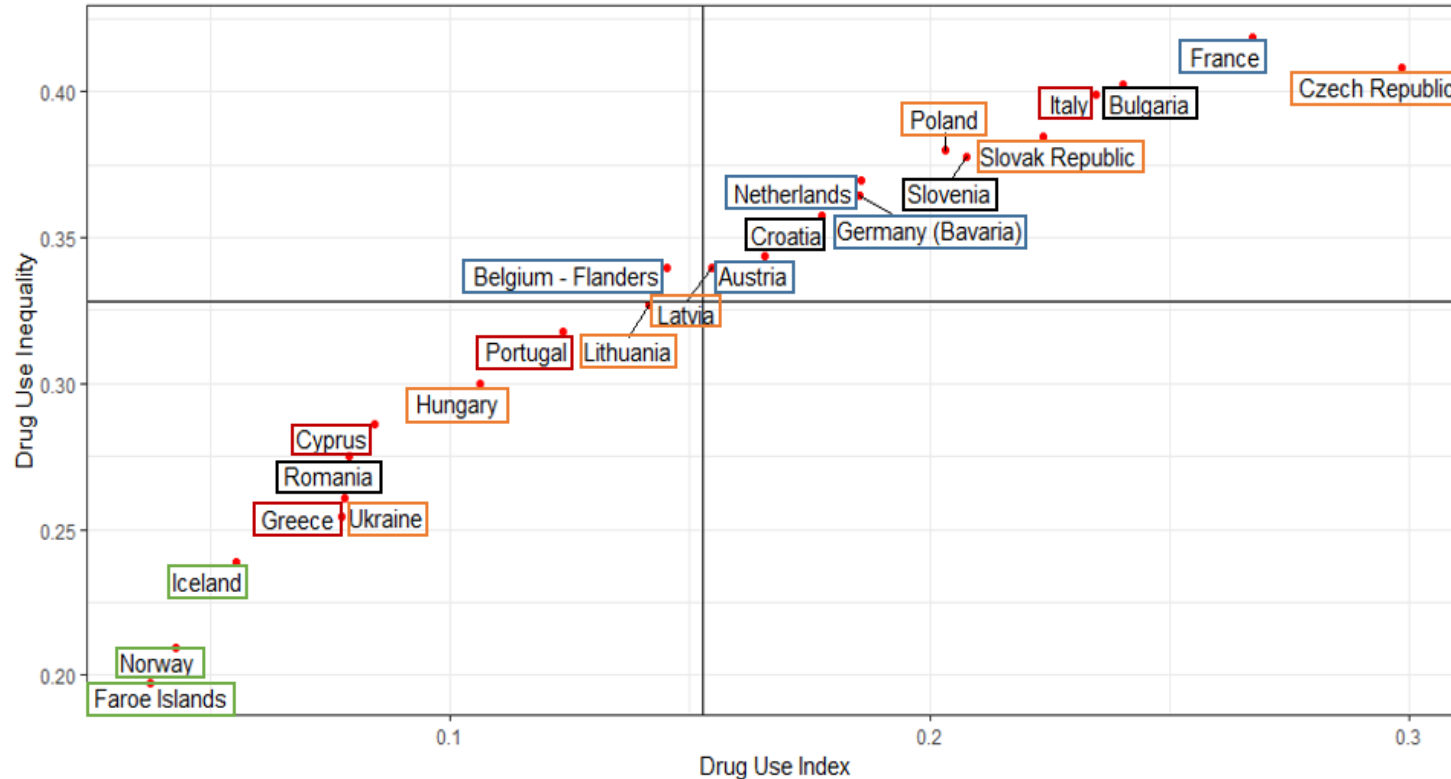
Cartogram of Drug Use Index in Average (4 classes) distribution. ESPAD 2015



Cartogram of Poly-Drug Use Index Standard Deviation (4 classes) distribution. ESPAD 2015

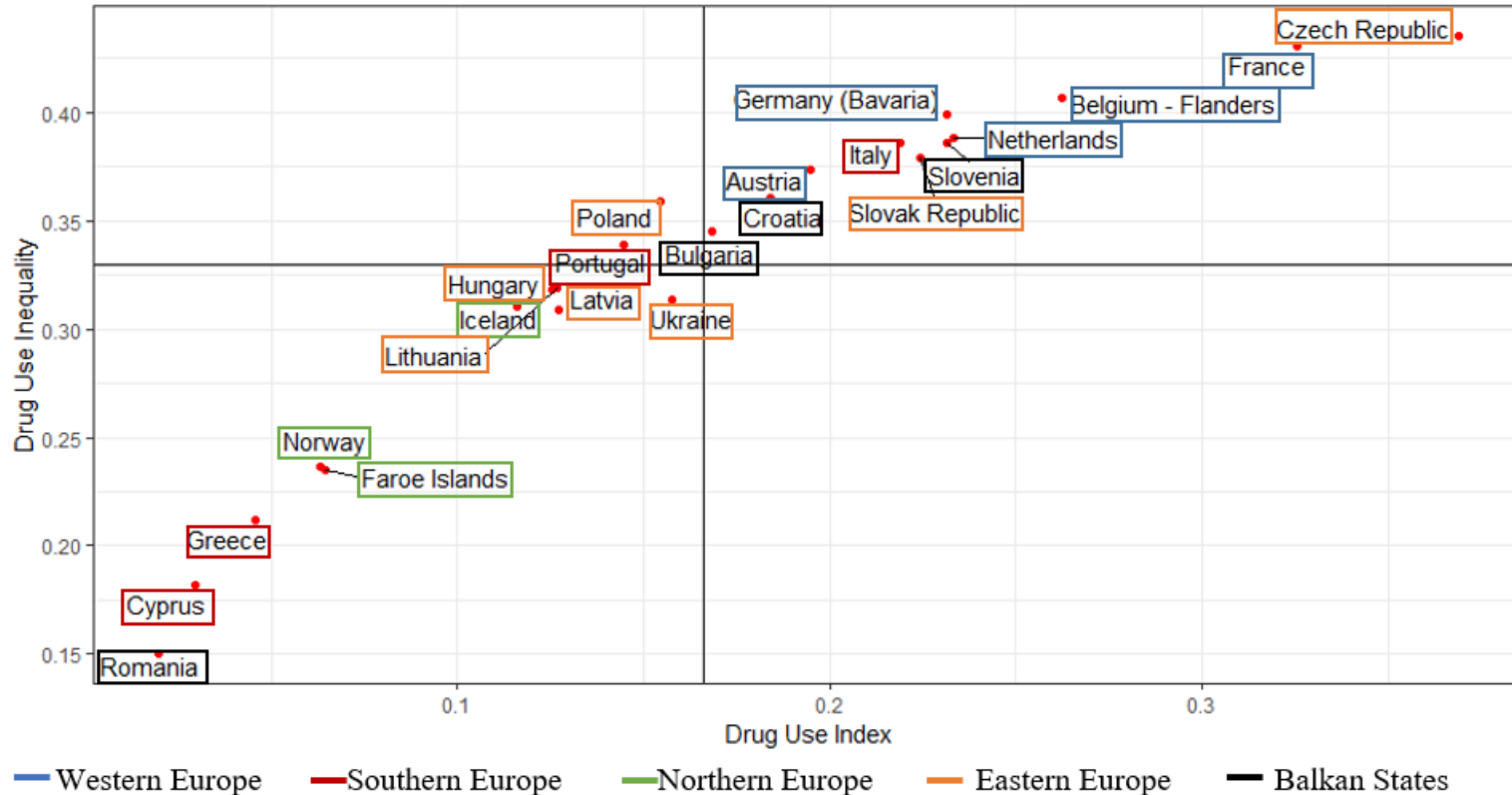


Four Quadrant Diagram Drug Use in Average and Poly-Drug Use Standard Deviation Indexes. ESPAD 2015



— Western Europe — Southern Europe — Northern Europe — Eastern Europe — Balkan States

Four Quadrant Diagram Drug Use in Average and Poly-Drug Use Standard Deviation Indexes. ESPAD 2003



Overall and Between Countries Standard Deviation in 2003 and 2015

	2003	2015
Overall Standard Deviation	0.346	0.352
Between Countries Standard Deviation	0.090	0.074
Autors' elaboration on ESPAD (2015; 2003) data		

Discussion & Conclusions

Multi-criteria decision analysis can help to exploit and summarize multidimensional information **on substance use**

The use of **ordinal** techniques can be an added value for surveys

The assignment of weights stems from a data-driven process: **individual weights** for each participant allow to consider **differentiation** in the **pattern of use**

We find significant **differences among** and **within countries** both in average and inequality drug use index

As other **socio-economic** features, also for substance use Inequality **between countries** is decreasing and **within** countries is increasing.

Further Development

It is a **work in progress**

Increase number of **Countries** and number of **Years**

Include other (legal) **substances**

Comments and **suggestions** are **welcome!**

**Sonia Cerrai
Elisa Benedetti
Alessio Ishizaka
Sabrina Molinaro**



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Thank you for your attention!

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