



ALICE RAP WP4: Deliverable 4.1

Classification of addictions: a report examining the various classifications of addictions and extracting common elements of addiction classifications

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This work was carried out as part of the European Commission-funded research project 'Addictions and Lifestyles in Contemporary Europe- Reframing Addictions Project' (ALICE-RAP), which aims to provide interdisciplinary scientific evidence to inform and reframe the public dialogue and to stimulate a broad debate on current and alternative scientific and policy approaches to addictions. The larger project examines substance use, gambling and online gaming as addictive behaviours and explores many facets of these behaviours including the prevalence, history, business and governance of addiction across Europe today. Its overall aim is to reframe addiction and encourage a new approach to addictive substances and behaviours which moves away from the idea of addiction itself as a central tenet and move towards a focus on a broader range of behaviours, harms and interventions and how understanding of these may contribute to improving well-being in Europe.

Countries: The work was undertaken in all countries participating in ALICE RAP, but is not country-specific.

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Participant organisations in ALICE RAP can be seen at <http://www.alicerap.eu/about-alice-rap/partner-institutions.html>



1 Abstract

A long tradition of research tried to understand the essence and mechanisms of addiction and worked on useful concepts for the clinical practice and other purposes. Currently, in medical classification systems substance use disorders are defined by a number of criteria, where no criterion is necessary or sufficient. While until recently, both diagnostic systems used for classifying mental disorders (ICD-10 and DSM-IV) were compatible in terms of defining dependence, the DSM-5 moved away from this, and the new ICD-11 is expected to widen the gap even further. The DSM-5 gave up the concept of splitting abuse and dependence, moving towards a more continuous classification defining different levels of severity by the number of criteria met.

The work in this project showed, that heavy use over time explains or is very closely linked to the main aspects of current conceptions of addiction. Heavy use over time as a conception of addiction has several advantages compared to current conceptions: It is easy to operationalize, it promises to better align treatment with standard medical treatments and could play a role in reducing stigma, placing all people on the same continuum. It could also be used likewise in health care and in the judicial system.

However, treatment systems need thresholds, if only for defining and reimbursing interventions. Looking at the International Classification of Diseases of the World Health Organization, it is not uncommon to define diseases from a threshold of a continuous dimension (as e.g. hypertension). The new concept of heavy use over time strengthens a low-threshold and urgently needed prevention: regular exploration of current use level at each visit to the general health care system, encouragement to keep track of and reduce consumption levels, and exploration of different ways to reduce use levels are core aspects of such preventive measures.



2 INTRODUCTION

2.1 Objectives

The objective of this work package was a deepened analysis of current as well as past concepts of addiction, differentiating common and different elements in the overarching frame of context and consequences. More specifically the objectives were:

1. To examine the various classifications of addiction and to extract common elements of addiction classifications
2. To identify potential differences between addictions by type of substance abused or type of addiction (e.g. are addictions in late adolescence/early adulthood different from addictions from addictions in later life), and by culture
3. To determine the harm consequences of addiction
4. To empirically analyse the question of categorical vs. continuous concepts of addiction and to quantify potential thresholds
5. To empirically compare risk for overall mortality of different addictions using a modified margin of exposure approach (EFSA, 2005)
6. To derive implications for research and policy

2.2 A bit of selective history

“Dependence is a rather useless term.....the term is often used in such a way that one assumes, on the basis of consequences, that dependence is at hand, which means that we generally have no indications on dependence which by definition are separate from the consequences. Therefore I will from here on principally disregard the concept of dependence” (Bruun, 1973)

Without attempting any systematic history of addiction (for a discussion of terminology of and concepts underlying the term see (Room, Hellman, & Stenius, accepted)), we would like to highlight some of the diversity of what has been understood in the last two centuries under this term. From its inception to originally characterize heavy drinking behaviour, it comprised additional elements attempting an “explanation” of such behaviour in terms of an underlying compulsion (Room, 1987), and such elements have continued until today, when Saunders speaks about an “internal driving force” underlying the continuation of heavy substance use (Saunders, 2013). From its first use, addiction was also very much associated with the notion of a moral weakness, and many of the later concepts tried to distinguish themselves from any kind of this moral underpinning. One of these concepts was the disease concept (Jellinek, 1952), which perceived alcohol dependence and later all



addictions as a medical disease with symptoms. From a psychological perspective, addictions were often described as being to a large degree determined by reinforcement of positively evaluated situations, and consequently interventions were conceptualized preventing heavy drinking occasions (“relapses” of prior forms of use; (Marlatt & Gordon, 1985)). The experiences of US veterans of the Vietnam conflict, where a sizable number of US soldiers became addicted to heroin, but the vast majority stopped using after returning home (Robins, 1993), led to some re-thinking about the importance of the social environment in shaping addictions, and some conceptualizations used an entirely social determination framework.

Our discussion so far has been in terms of the more “pure” and monothematic conceptualizations, but in fact many conceptualizations had been multidimensional, such as substance dependence being defined as a disease in the International Classification of Diseases (ICD; see below for ICD 10), with referral to biological, psychological and behavioral elements.¹ The Edwards and Gross (Edwards & Gross, 1976) definition of a syndrome has been influential for current definitions, at least for the medical classification systems. What has been added to the mix of conceptualizations in recent years was the notion of a brain disease, more specifically addiction as a “chronic and relapsing brain disease” (Leshner, 1997; McLellan, Lewis, O'Brien, & Kleber, 2000; Volkow, Fowler, & Wang, 2003).

Concepts and definitions of disease change over time. This is especially true for substance use disorders or for the wider term of “addiction”, which have received as variable conceptualizations as moral weakness, medical disease, entirely socially determined behaviour or brain disease.

¹ Some argue that inability to control can be seen as a “weakness” left over from the moral weakness definitions.



3 METHODS

3.1 Step 1: qualitative interviews

Forty eight qualitative interviews with experts from various disciplines and stakeholder areas were carried out using a semi-structured questionnaire between the program start and December 2012. Sampling was done to include a maximum of different disciplines. The results of these interviews were used to construct an internet questionnaire as described in the Technical Report 1.

3.2 Step 2: internet survey to all of ALICE RAP participants

In January 2013, an internet survey was open to all ALICE RAP participants. We received 72 responses and analyzed the data quantitatively and qualitatively. The main result of these analyses was the high variability of answers on almost all dimensions.

3.3 Step 3: Consensus meeting

A small consensus meeting was held in Barcelona at the time of the ALICE RAP meeting (23rd – 25th April 2013, Barcelona, Spain). In addition, in the plenary the conclusions of the analyses were presented. After some discussion it was concluded that heavy use over time was the only criterion, where all participants could agree.

3.4 Step 4: Further elaboration and dissemination of the concept

We created a working group including

- Basic scientists
- Epidemiologists
- Clinicians and
- Social scientists

.. to better and further describe and operationalize the concept:

Rehm, J, Anderson, P., Gual, A., Gmel, G., Kraus, L.; Marmet, S., Nutt, D.J., Room, R., Samokhvalov, A.V., Scafato, E., Trapencieris, M., Wiers, R.W. All of these members were part of ALICE RAP except for AV Samokhvalov, who had made the most comments in the qualitative interviews.

The position paper was submitted to a journal in June 2013, and accepted (Rehm et al., 2013). It received a lot of attention (see comments in Alcohol and Alcoholism, 2014; and our rejoinder).



3.5 Step 5: Other WP4 objectives

The comparison of different addictions using the margin of exposure approach is currently in preparation and will be presented by Dr. Dirk Lachenmeier at the May 2014 ALICE RAP plenary meeting. Once this has been discussed in plenary with the ALICE RAP scientists, all relevant feedback will be used to maximize the quality and impact of this analysis, as well as to elaborate final recommendations for future research and policy, producing an addendum to this deliverable which will be delivered in June 2014.

The objective on harm consequences of addiction were done in combination with WP 5 and have been listed in detail in the deliverable of this work package. The main results can be found in the Appendix of this report as well.



4 Results

4.1 How is “addiction” defined in medical classification systems?

Different conceptualizations of substance use disorders² could be seen in the major classification systems for diseases (for an overview see (Room, 1998)). In the last 60 years addiction was not always seen as one phenomenon which occurred more or less independently of the underlying psychoactive substance. Most prominent among the distinctions based on substances is the now infamous split in the late 1950s by the World Health Organization (WHO) between “drug addiction” and “drug habituation”, with alcohol and tobacco being classified into the latter category ((World Health Organization, 1957); (http://whqlibdoc.who.int/trs/WHO_TRS_116.pdf). At that time, in accordance with political orthodoxy, the WHO Expert Committee on Addiction-Producing Drugs distinguished between the addiction-producing illegal drugs with the characteristics of compulsion, tolerance, psychological and physical dependence and detrimental effects on the individual and on society, in contrast to the habit-forming legal drugs of alcohol and tobacco, with the characteristics of a desire to take the drug for individual wellbeing, little or no tendency to increase the dose, some degree of psychological but no physical dependence, and little or no detrimental effects (World Health Organization, 1957, pp. 9–10; see also Rehm and colleagues (Rehm, Marmet, et al., 2013) for further elaborations). These distinctions were basically made to justify international control for illegal drugs, whereas no international control measures were deemed necessary for alcohol and tobacco. Current definitions of substance use disorders are listed in detail below (from (World Health Organization, 1993); and from (American Psychiatric Association, 2013)). While until recently, both diagnostic systems used for classifying mental disorders (ICD-10 and DSM-IV) were compatible in terms of defining dependence (Üstün et al., 1997)³, the DSM-5 moved away from this, and the new ICD-11 is expected to widen the gap even further.

Currently, in medical classification systems substance use disorders are defined by a number of criteria which are associated with heavy use, where no criterion is necessary or sufficient. The two major classification systems differ in their definitions.

² We will use the term “substance use disorders” for the current view of what is described in DSM-IV, DSM-5 and ICD-10. As will be elaborated later, it is suggested that these definitions could and should be replaced by “heavy use over time”.

³ “Abuse” and “harmful use” were clearly conceptualized as different concepts. Moreover, there was a problem in reliably and validly measuring these concepts (Üstün et al., 1997) While dependence can be measured reliably and validly, measurement seems to be impacted by slight variations of instruments (e.g. CIDI version), as the wide variability of prevalence within the same country shows (e.g., (Rehm, Room, Van den Brink, & Jacobi, 2005)).



4.1.1 Diagnostic criteria for research (DCR) ICD-10 for alcohol dependence and harmful use

F1x.1 Harmful use

A pattern of psychoactive substance use that is causing damage to health. The damage may be physical (as in cases of hepatitis from the self-administration of injected psychoactive substances) or mental (e.g. episodes of depressive disorder secondary to heavy consumption of alcohol).

Psychoactive substance abuse DCR-10:

- A. There must be clear evidence that the substance use was responsible for (or substantially contributed to) physical or psychological harm, including impaired judgement or dysfunctional behaviour.
- B. The nature of the harm should be clearly identifiable (and specified).
- C. The pattern of use has persisted for at least 1 month or has occurred repeatedly within a 12-month period.
- D. The disorder does not meet the criteria for any other mental or behavioural disorder related to the same drug in the same time period (except for acute intoxication F1x.0).

F1x.2 Dependence syndrome

A cluster of behavioural, cognitive and physiological phenomena that develop after repeated substance use and that typically include a strong desire to take the drug, difficulties in controlling its use, persisting in its use despite harmful consequences, a higher priority given to drug use than to other activities and obligations, increased tolerance, and sometimes a physical withdrawal state. The dependence syndrome may be present for a specific psychoactive substance (e.g. tobacco, alcohol or diazepam), for a class of substances (e.g. opioid drugs), or for a wider range of pharmacologically different psychoactive substances.

DCR-10

A. Three or more of the following manifestations should have occurred together for at least 1 month or, if persisting for periods of less than 1 month, should have occurred together repeatedly within a 12-month period:

- 1) a strong desire or sense of compulsion to take the substance;
- 2) impaired capacity to control substance-taking behaviour in terms of its onset, termination, or levels of use, as evidenced by the substance being often taken in larger amounts or over a longer period than intended, or by a persistent desire or unsuccessful efforts to reduce or control substance use;
- 3) a physiological withdrawal state (see F1x.3 and F1x.4) when substance use is reduced or ceased, as evidenced by the characteristic withdrawal syndrome for the substance, or by use



of the same (or closely related) substance with the intention of relieving or avoiding withdrawal symptoms;

- 4) evidence of tolerance to the effects of the substance, such that there is a need for significantly increased amounts of the substance to achieve intoxication or the desired effect, or a markedly diminished effect with continued use of the same amount of the substance;
- 5) preoccupation with substance use, as manifested by important alternative pleasures or interests being given up or reduced because of substance use; or a great deal of time being spent in activities necessary to obtain, take or recover from the effects of the substance;
- 6) persistent substance use despite clear evidence of harmful consequences (see F1x.1), as evidenced by continued use when the individual is actually aware, or may be expected to be aware, of the nature and extent of harm.

4.1.2 Diagnostic criteria for alcohol use disorder as an example of substance use disorders in DSM-5:

A problematic pattern of alcohol use leading to clinically significant impairment or distress, as manifested by at least two of the following, occurring within a 12-month period:

- 1) Alcohol is often taken in larger amounts or over a longer period than was intended.
- 2) There is a persistent desire or unsuccessful efforts to cut down or control alcohol use.
- 3) A great deal of time is spent in activities necessary to obtain alcohol, use alcohol, or recover from its effects.
- 4) Craving, or a strong desire or urge to use alcohol.
- 5) Recurrent alcohol use resulting in a failure to fulfill major role obligations at work, school, or home.
- 6) Continued alcohol use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of alcohol.
- 7) Important social, occupational, or recreational activities are given up or reduced because of alcohol use.
- 8) Recurrent alcohol use in situations in which it is physically hazardous.
- 9) Alcohol use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by alcohol.
- 10) Tolerance, as defined by either of the following:
 - a) A need for markedly increased amounts of alcohol to achieve intoxication or desired effect.
 - b) A markedly diminished effect with continued use of the same amount of alcohol.



11) Withdrawal, as manifested by either of the following:

- a) The characteristic withdrawal syndrome for alcohol
- b) Alcohol (or a closely related substance, such as a benzodiazepine) is taken to relieve or avoid withdrawal symptoms.

The DSM-5 presents criteria for substance use disorders for ten classes of substances (here displayed for alcohol) (American Psychiatric Association, 2013). The criteria themselves did not change much from DSM-IV criteria for abuse and dependence (American Psychiatric Association, 2000), but the two diagnoses were put together forming one single diagnosis: 'Substance Use Disorder' (Hasin et al., 2013). The former concepts of abuse and dependence were meant to capture two different dimensions with abuse reflecting impaired social and everyday functioning and dependence representing more physiological aspects as tolerance and withdrawal and insinuating that abuse was a lighter form, prodromal to dependence. In DSM-5 both diagnoses were integrated into a one dimensional concept of substance use disorders as similarly suggested by Rounsaville, Spitzer, and Williams (Rounsaville, Spitzer, & Williams, 1986) more than two decades ago. Hasin and colleagues (Hasin et al., 2013) extensively reviewed evidence for that fusion and brought forth the following arguments:

The hierarchy of abuse and dependence does not conform to the empirical evidence with respect to severity of symptoms and it limits the reliability of the abuse diagnosis.

- The new concept overcomes the problem of 'diagnostic orphans'.
- Factor analyses of abuse and dependence criteria led to either two highly correlated or one single factor.
- Item response theory analysis confirmed unidimensionality as well as overlap in severity of symptoms.

Reviewing single symptoms led to the exclusion of the abuse criterion of recurrent substance-related legal problems due to its poor fit with other criteria and its little explanatory value. Craving or a strong urge to use the substance was added to the criteria. A threshold of at least two fulfilled criteria was applied to the overall eleven criteria, complemented by a measure of severity: two or three criteria lead to a diagnosis of a mild, four or five to a moderate and six or more to a severe substance use disorder (American Psychiatric Association, 2013). The new diagnosis moved towards a more dimensional perspective on substance use disorders, a perspective that has been linked to the hope of reduced stigmatization (Rehm, Marmet, et al., 2013; Rehm & Roerecke, 2013), but may add the difficulty of properly identifying the group of individuals (formerly diagnosed as "dependent") which may be in need of treatment. DSM-5 tried to address this by noting that for



many substances, four or more criteria in DSM-5 are highly associated with the old DSM-IV diagnosis of "dependence" (Hasin et al., 2013).

The diagnosis for nicotine use disorder was aligned with the criteria for other substance use disorders and gambling disorder was added into the chapter. The latter led to the new name 'Substance-Related and Addictive Disorders' for the chapter, which was discussed extensively (Hasin et al., 2013). Some changes that were discussed among experts as the inclusion of biomarkers (Goldstein & Volkow, 2011; Kranzler & Edenberg, 2010; Martinez, Kim, Krystal, & Abi-Dargham, 2007), or the inclusion of other excessive behavioral patterns such as 'exercise addiction' (Berczik et al., 2012), 'sex addiction' (hypersexual disorder) (Kafka, 2010) and 'internet gaming disorder' (Ko et al., 2013) were not included due to a lack of evidence (Hasin et al., 2013). The latter was included in section III of the DSM-5 ("a condition warranting more clinical research and experience before it might be considered for inclusion as a formal disorder").

4.2 Heavy use over time as the key definitory criterion

While none of symptoms or diagnostic criteria listed above is a necessary or sufficient condition for substance abuse categories as defined above, and while criteria changed considerably over the past half century, there is one constant which can be seen as underlying all definitions: heavy use over time (Rehm, Anderson, et al., 2014; Rehm, Marmet, et al., 2013). A closer analysis of the definitions reveals several communalities, which could be summarized as consequences of heavy use over time:

- Some criteria are physiological consequences of heavy use of psychoactive substances over time (tolerance, withdrawal).
- Some criteria are linked to psychological consequences of heavy use over time (e.g., craving).
- Some criteria are linked to social and behavioural consequences of heavy use over time, such as "giving up important social, occupational, or recreational activities" because of the heavy use over time.
- Some criteria are linked to health or physical consequences arising from heavy use or heavy use over time (diseases such as liver cirrhosis for alcohol (Rehm, Taylor, et al., 2010) or risk for death from driving under the influence of substances⁴ (Popova, Rehm, Patra, Baliunas, & Taylor, 2007)– for an overview see (Lim et al., 2012)).

⁴ The association between heavy use over time and a traffic injury is less pronounced than the association between heavy use over time and chronic disease categories such as liver cirrhosis. While the majority of all alcohol-attributable mortality and burden of disease is due to heavy drinking (Rehm, Shield, Rehm, Gmel, & Frick, 2013), the same is not always true for injury and the prevention paradox may apply ((Rossow, Bogstrand, Ekeberg, & Normann, 2013); generally (Rossow & Romelsjö, 2006)).



All these consequences have “heavy use over time” as the major risk factor, but as usually for risk factors, these are probabilistic relationships (maybe with the exception of tolerance, which seems an inevitable outcome of heavy use over time), i.e., not all occasions of heavy drinking over time lead to a certain consequence (for definitions and operationalization of risk factors, see (Rothman, Greenland, & Lash, 2008)).

The questions arising here are the following:

- 1) Are the consequences listed as criteria in current definitions inevitably linked to heavy use over time? Is there heavy use over time without consequences?
- 2) Can or should there be substance use disorders without heavy use over time?
- 3) How close is the link between heavy use over time and the current definitions of substance use disorders?

Heavy use is clearly linked to consequences in the human brain, most of which will happen independently of circumstances (see (D. Nutt, 2012)). There are differences by substance on neurobiology (World Health Organization, 2004), but overall, there are enough communalities to subsume the consequences of heavy use of psychoactive substances under one unifying label of “addictive brain disorders” (Baler & Volkow, 2006; Leshner, 1997; McLellan et al., 2000; Volkow et al., 2003). Summarizing the neurocognitive effects of substance use disorders (dependence, abuse) vs. heavy use for the Dutch Medical Research Council, a group of Dutch researchers ended up concluding that based on the current literature any such distinction is impossible to make, because there are no studies on neural effects of substance dependence without prolonged heavy use (Wiers et al., 2012). Thus, the effect of prolonged heavy use on the brain appears to be at least largely overlapping if not identical with what is called ‘substance use disorders’.

How close is the link between current criteria and amount consumed? Rehm and colleagues listed a very close relationship for alcohol from the US National Epidemiologic Survey on Alcohol and Related Conditions (Rehm, Anderson, et al., 2014). Based on ALICE RAP, we will list the relationship for different substances based on the German Epidemiological Survey of Substance Abuse (Kraus, Piontek, Pabst, & Gomes de Matos, 2013). There are substantial correlations between average use and number of DSM-IV criteria (see Table 1), which increase for people who had sought treatment within the last 12 months: for alcohol from 0.24/0.25 explained variation to 0.46/0.51 for dependence/dependence and abuse combined; for cannabis from 0.46/0.51 to 0.69/0.68; for cocaine and tobacco numbers in treatment were too small to allow meaningful correlations. All correlations were above 0.5 with some reaching 0.9, and separated by sex, they were even higher. Thus, level of heavy use over time and number of DSM-IV criteria correlate substantially (for even higher correlations see (Rehm, Anderson, et al., 2014)).



Table 1 Number of persons observed (n) and average consumption (mean and standard deviation (SD)) for cigarettes, alcohol, cannabis, and cocaine by number of DSM-IV criteria fulfilled for alcohol dependence (last year) and abuse and dependence combined - German Epidemiological Survey of Substance Abuse (ESA) (Kraus et al., 2013)

	Tobacco			Alcohol			Cannabis			Cocaine		
Number of Symptoms	Number of cigarettes/day			Pure alcohol in gram/day			Frequency of use/12 month			Frequency of use/12 month		
	N	Mean	(SD)	N	mean	(SD)	N	mean	(SD)	n	mean	(SD)
Dependence												
0	592	5.06	(8.76)	5890	8.01	(12.35)	337	17.32	(47.22)	31	4.50	(9.00)
1	493	11.06	(10.25)	1106	16.74	(18.53)	78	68.10	(79.84)	7	9.23	(12.79)
2	405	13.40	(9.55)	405	25.67	(29.49)	26	96.82	(85.32)	1	3.50	
3	300	14.90	(10.83)	149	28.98	(28.31)	18	140.13	(105.91)	3	4.37	(1.32)
4	198	16.37	(10.05)	58	54.20	(48.82)	11	153.30	(75.15)	-		
5	118	18.71	(7.53)	62	35.38	(43.65)	8	190.66	(77.39)	3	156.74	(70.87)
6	58	17.47	(9.04)	14	150.65	(178.88)	6	128.23	(95.25)	2	223.13	(66.13)
7	6	26.70	(7.35)	3	164.67	(77.01)	9	189.59	(68.89)	2	12.58	(10.76)
R ²	0.2369			0.2434			0.4596			0.8337		
Abuse/Dependence combined												
0				5833	7.88	(12.18)	319	12.11	(34.60)	31	4.50	(9.00)
1				1093	16.76	(18.62)	88	56.94	(71.31)	7	9.23	(12.79)
2				414	22.87	(21.16)	30	137.01	(96.74)	1	3.50	
3				166	28.45	(30.11)	15	113.42	(103.13)	2	3.50	(0.00)
4				82	44.43	(44.91)	12	140.58	(95.19)	1	7.50	



5				63	43.40	(53.72)	7	140.45	(64.13)	-		
6				22	60.66	(51.47)	5	149.98	(80.52)	1	7.50	
7				6	53.81	(49.04)	10	206.29	(66.30)	3	97.00	(102.88)
8				5	65.64	(64.29)	5	205.21	(62.64)	2	136.16	(33.54)
9				2	480.24	(188.85)	2	130.88	(89.57)	1	249.50	
10				1	240.05		-			-		
11				-			-			-		
R ²				0.2521			0.5148			0.8338		



How should we interpret the cases where the application of the concept "heavy use over time" results in other conclusions than using number of criteria? From a public health point of view, there are good reasons to rely on heavy use over time, as most consequences of substance use are linked to heavy use (see Appendix). Consider the following examples: somebody who has been smoking 20 cigarettes a day over the last year, but does not qualify for nicotine dependence in DSM-IV over that period. This case seems to be relatively frequent (Rehm, Marmet, et al., 2013), and based on risk for mortality and hospitalization which follows a dose-response relationship (e.g., (Baliunas, Patra, Rehm, Popova, Kaiserman, et al., 2007; Baliunas, Patra, Rehm, Popova, & Taylor, 2007)), one would clearly see 20 cigarettes as more important for starting interventions to quit or reduce smoking. Now consider some smokers, who did not smoke daily over the past year with on average less than 5 cigarettes per occasion, but qualifying for nicotine dependence. While this pattern may still incur risks, the risks are certainly considerably lower than the risks of somebody who smokes 20 cigarettes but does not qualify for dependence. One may argue here, that smoking and nicotine dependence (DSM-IV) or tobacco use disorders (DSM-5) are a special case, not always included in substance use disorders (e.g., the above example of (World Health Organization, 1957), or earlier versions of DSM). So let us consider alcohol use disorders and average level of alcohol consumption in grams. Heavy drinking has been shown to be responsible for the vast majority of alcohol-attributable harm in Europe (Rehm, Shield, et al., 2013). The dose-response curves are mostly exponential (Rehm, Baliunas, et al., 2010; Rehm & Roerecke, 2013; Rehm, Zatonski, Taylor, & Anderson, 2011), leading to the following implication: the same reduction in level of consumption (e.g., 40 grams per day) leads to considerably more pronounced reductions in mortality and hospitalizations if it is taken off from a higher level of consumption than from a lower level of consumption (Nutt & Rehm, 2014; Rehm & Roerecke, 2013). For public health, it is vital to reduce consumption, especially at high levels of consumption, even if these people do not qualify for alcohol dependence or alcohol use disorders. Similarly, it is important to reduce high levels of consumption, if the people who reduce do not change their status as having an alcohol dependence or alcohol use disorder, or if they do not lower their severity on the scale based on criteria (American Psychiatric Association, 2013). Heavy drinking over time clearly is the more meaningful criterion with respect to health consequences compared to a diagnosis of alcohol dependence or alcohol use disorders. Similar arguments could be made for cannabis, but the underlying literature is much weaker and more scarce (Fischer et al., 2011).



Heavy use over time causes the changes in the brain we currently associate with substance use disorders. It is also very closely linked to all criteria used to define such disorders in medical classification systems. Heavy use over time is easy to operationalize and has been shown to associate with mortality and morbidity outcomes of dependence or other substance use disorders better than current diagnostic criteria.

From a clinical perspective, especially in academic centres, it should be noted that though number of criteria of substance use disorders in DSM-5 designate severity, substance use per se is commonly used as an indicator of the course of the disorder (e.g., number of standard drinks per day, number of heavy drinking days, etc.) (Hasin et al., 2013). Accordingly, there is duplication between two different clinical formats: the diagnostic criteria to establish diagnosis and amounts of consumption to establish course of the disorder. Given the high correlation between heavy use and diagnosis of substance use disorders, this raises the question of the necessity of both formats.

Overall, we conclude that there is a close correlation between “heavy use over time” and the number of criteria in current classification systems, but in cases where the two concepts do not agree with each other, heavy use over time seems to be the more relevant for mortality and morbidity, and thus for public health. Individuals may value other dimensions such as social outcomes, but heavy use over time has been shown to be strongly associated with these outcomes as well (Rehm, Marmet, et al., 2013). Heavy use over time would also be feasible from a clinical perspective, as patterns of use (doses, frequency) are measurable and can be properly followed for most substances (e.g., alcohol with AUDIT C, (Reinert & Allen, 2007)). It should be noted, however, that we may have to develop standardized measures for some substances, which should be a priority in future research. Currently, for many substances heavy use is entirely defined via frequency.

4.2.1 What about gambling

With respect to gambling similar changes in the concept as described above for substance use disorders were observable. In DSM-III pathological gambling was introduced as a disorder of impulse control (American Psychiatric Association, 1980), suggesting an intrapersonal difficulty to control one’s actions. In the last years similarities to the phenomenon of substance use disorders were discussed (Petry, 2006): similarities in the neurological activation of the reward system (Reuter et al., 2005), genetic similarities (Slutske et al., 2000) as well as similarities of specific symptoms such as craving and tolerance (Potenza, Kosten, & Rounsaville, 2001). These arguments finally led to the inclusion of gambling disorder into the category of substance-related and addictive disorders in DSM-5 as described above (Hasin et al., 2013). Furthermore, as for substance use disorders, a clear



relationship between frequency of gambling and the number of symptoms is observable (Sassen et al., 2011). In sum, even though further research has to be done, we would suggest to include gambling under the category of “addictive disorders”, which can also be well defined by heavy use over time.

What is currently defined as addictive gambling disorder in DSM-5 can be captured by heavy gambling over time.

4.2.2 What is addiction?

What is currently labelled as “substance use disorder” seems to be well described by the concept of heavy use over time. So far, we have not defined the thresholds for heavy use over time for different purposes. This section will discuss setting thresholds and implications for different sectors.

As indicated, the level of heavy use over time has a dose-response relationship to relevant public health outcomes such as mortality or morbidity. As the relationship is exponentially dose-dependent, it is not necessary to define thresholds, and we can work with continuous concepts. For individuals, in principle, the same applies and it has been suggested that people should “know their number” with respect to alcohol consumption (i.e., grams consumed per day) as an important individual-level strategy to reduce risks (D. J. Nutt & Rehm, in press).

However, treatment systems need thresholds, if only for defining and reimbursing interventions. Looking at the International Classification of Diseases of the World Health Organization, it is not uncommon to define diseases from a threshold of a continuous dimension. Hypertension is a prime example of a disease defined by an arbitrary threshold of blood pressure (World Health Organization, 1992). Several similarities exist with respect to level of use over time: blood pressure level is a continuum, it is related to human behavior (physical activity, alcohol consumption, salt intake) and it can vary from day to day. Categorical classifications based on continuous variables have the advantage that people with values above the thresholds are harder to stigmatize, as all people can be placed on the same continuum (Schomerus, Matschinger, & Angermeyer, 2013). The underlying continuum of the definitory variable is one of the reasons why people with hypertension are not as stigmatized as people with alcohol or drug dependence (Schomerus et al., 2011), even though their disease is clearly linked to behaviors which could be characterised as being based on personal traits. Other characteristics of how the health care system treats high blood pressure are repeated measures (for blood pressure often at the same visit, but also over different visits to primary and specialized care), encouragement of the client to measure blood pressure regularly outside of visits to the health care system, and exploration of different behaviors in the interview at the primary care physician with subsequent advice about behavior change. Basically, the same strategy could be



applied to alcohol or tobacco consumption. Regular exploration of current use level (if possible with the exploration of biomarkers) at each visit to the general health care system, encouragement to keep track of and reduce consumption levels, and exploration of different ways to reduce use levels (e.g., by motivational interviewing (Rollnick & Miller, 1995) or brief advice (Heather, 2004)). If such interventions fail, pharmacotherapy could be explored or patients could be referred to the specialized treatment system. Many of the current pharmacotherapies for heavy use over time have been shown to be successfully applied at the primary care level, from abstinence-oriented therapies to interventions aiming to reduce consumption levels, to substitution therapies (e.g., for heroin dependence). Aligning the definitions of heavy use with those used in other fields of medicine and aligning the treatment services provided for individuals suffering from these disorders with those provided in other fields of medicine is an important step in finalizing the move towards integrating these disorders into routine medical practice.

Defining substance use disorders as heavy use over time promises to better align treatment with standard medical treatments and could play a role in reducing stigma.

Finally, in the legal system, 'substance use disorders' are not main concept used. In this system, for legal substances, heavy use over time is irrelevant, and only in special situations (traffic, working heavy machinery) use is restricted or forbidden. For illegal substances, use is often categorically forbidden, and even if not, there is no distinction between people who used heavily over time and others. Such a distinction would help, however, to create more appropriate interventions such as therapeutic interventions instead of punishment (Belenko, 1998; Hora, Schuma, & Rosenthal, 1999). In sum, in various fields where substance used disorders play a role, the new definition via heavy use over time seems applicable and in many cases promises to improve identification of cases relevant for intervention.

5 Discussion and conclusion

Overall, we believe that there are good reasons for using a concept of heavy use over time as the main concept to operationalize addiction in Europe for the years to come. Summarizing these reasons again would lead to the followings statements:

- Heavy use over time correlates highly with the current operationalization of DSM-5 and ICD 10, but is simpler (less assumptions and easier to operationalize); it is in line with common medical ways to define disease based on the threshold of a continuous risk factor (e.g. hypertension as threshold for blood pressure);

- Heavy use over time could be used in the legal system as well, and actually is better in line with definitions used there compared to the current medical definitions;
- As a continuous system it promises to evoke less stigmatization;
- Heavy use over time is better for future research, with clear and unambiguous operationalizations (see also the final report of WP 5).

The group will thus try to push implementation of this concept in the future.

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6 Appendix: Harmful health consequences from substance use

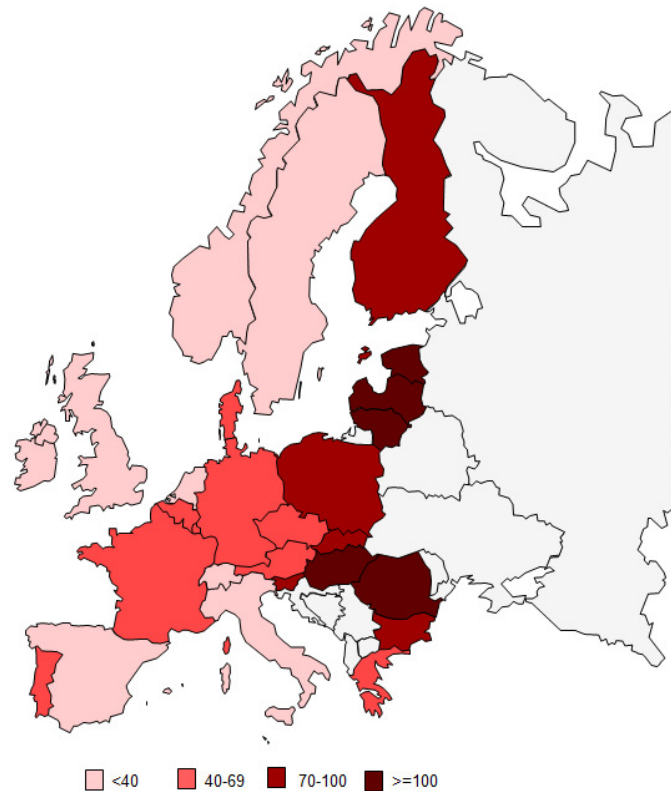
6.1 Harm caused by alcohol consumption

Table 6.1 *Alcohol attributable deaths, years of life lost (YLL), disability adjusted life years lost (DALY), 15+ years old*

	Absolute numbers (net burden)			Rates per 100000		
	Attributable deaths	Attributable YLLs	Attributable YLDs	Attributable deaths	Attributable YLLs	Attributable YLDs
Austria	3021	87926	177069	42	1233	2483
Belgium	4939	135315	211109	55	1502	2344
Bulgaria	5351	156441	224911	83	2427	3489
Cyprus	133	4655	11666	20	686	1720
Czech Republic	6168	196987	276205	69	2197	3080
Denmark	2569	76625	108394	57	1690	2391
Estonia	3161	69177	91461	279	6113	8082
Finland	3240	99235	147000	73	2223	3294
France	29524	830316	1248574	56	1577	2371
Germany	38366	1064208	1607808	54	1504	2272
Greece	4351	114298	186642	46	1197	1955
Hungary	8617	271444	478422	101	3179	5604
Iceland	43	1233	2549	17	491	1015
Ireland	1352	42143	78373	38	1199	2230
Israel	458	11821	48444	8	219	897
Italy	8969	221655	278488	18	436	548
Latvia	7128	143583	175557	392	7888	9645
Lithuania	10792	251522	304649	404	9413	11402
Luxembourg	175	5046	8354	42	1222	2023
Malta	88	2387	4019	25	681	1146
Netherlands	3751	99087	123989	27	725	908
Norway	886	25625	82782	22	650	2101
Poland	26087	859136	1277381	81	2653	3944
Portugal	5579	150927	233819	62	1685	2611
Romania	22542	695930	802695	131	4046	4666
Slovakia	3918	132128	205022	86	2901	4501
Slovenia	1453	42418	71583	83	2411	4068
Spain	14472	371516	476522	37	939	1205
Sweden	3013	77389	174448	39	993	2239
Switzerland	2225	61104	131872	34	925	1997
United Kingdom	18852	586815	1372740	37	1140	2666
Central-East and Eastern Europe	95217	2818766	3907886	111	3281	4555
Nordic Countries	9751	280107	515173	46	1334	2454
Central-West and Western Europe	102205	2911960	4959888	47	1349	2303
Southern Europe	34050	877259	1239600	30	763	1081
EU27	237611	6788309	10356900	57	1626	2481
ALICE-RAP	241223	6888092	10622547	55	1587	2448

Source: WHO Global Status Report on Alcohol and Health 2014

Figure 6.1 Death rates per 100,000 due to alcohol, 15+ years old



Source: ALICE RAP Deliverable 5.1 Prevalence of substance use, dependence and problematic gambling in Europe, WP5

Table 6.1 and Figure 6.1 give an overview on mortality and burden of disease caused by alcohol. The burden of alcohol is high; alcohol continues to be a major risk factor for ill health in the European region. We find a clear West-East gradient in Europe, with the lowest risk of death and burden in the Southern parts of Europe. A closer inspection of the correlation between harm and use vs. dependence shows that heavy use is more correlated with harm than dependence. However, the harm due to AUD is associated with more measurement error. This harm can be measured in two ways:

- Via death certificates, i.e. doctors' coding of the cause of death; or coding for hospital stays): according to this measure alcohol use disorders would be responsible for 0.6% of the total deaths and 2.9% of the DALYs in the WHO European region. This would be lower for EU and ALICE RAP countries.
- Via modelling, such as by using alcohol attributable fractions. This would basically consider alcohol dependence or alcohol use disorders as a risk factor. Unfortunately, there are not the same depth of studies on causality between AUD and disease outcomes for as they exist for alcohol use and heavy drinking. But a rough estimate would suggest that 71% or all alcohol attributable net burden and 62% of the overall burden would be due to alcohol dependence (Rehm, Shield et al., 2013).

6.2 Harm from smoking

We have not found a possibility to calculate harm from dependent smoking (or more generally from Tobacco Use Disorders), Harm from smoking is reported based on the work for the Global Burden of Disease Study which uses an indirect approach based on lung cancer mortality.

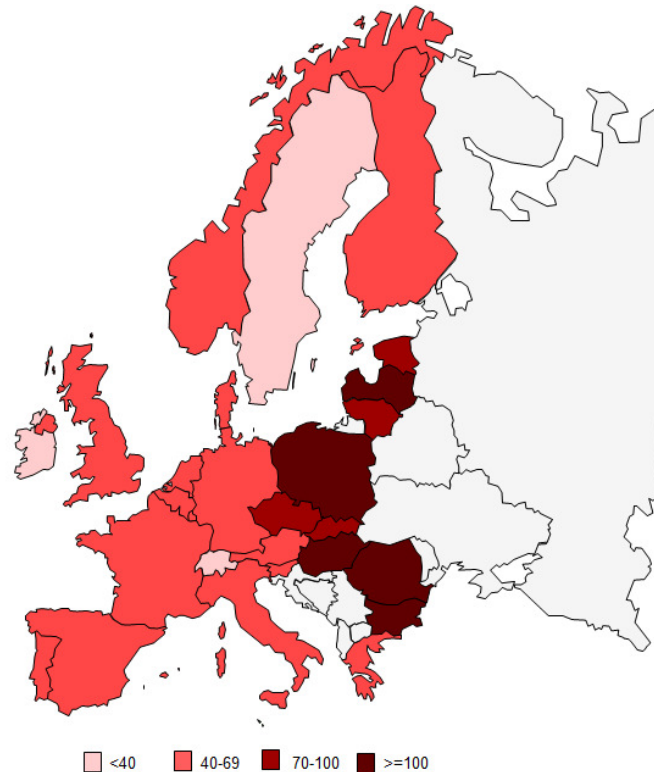
Table 6.2: *Deaths, years of life lost and disability adjusted years of life lost from smoking, Total and by sex, 15 to 64 years old*

	Attributable deaths			Years of life lost			DALY		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
Austria	2020	664	2684	62881	21037	83918	79290	33052	112343
Belgium	3638	1032	4670	111192	32901	144092	132431	47613	180045
Bulgaria	5948	1363	7310	187207	44227	231434	204229	54532	258760
Cyprus	160	23	183	5009	752	5761	6139	1203	7343
Czech Republic	4851	1185	6037	144643	35511	180154	163334	47384	210718
Denmark	1458	914	2372	43803	27501	71304	54128	37073	91201
Estonia	595	102	697	18192	3033	21225	20168	3873	24040
Finland	1262	313	1575	37649	9456	47105	44182	13205	57387
France	19856	3980	23836	623212	132864	756074	717253	197242	914495
Germany	22324	7446	29770	701513	238366	939878	823494	325928	1149423
Greece	4322	791	5113	136426	25718	162144	157000	37292	194292
Hungary	7457	2657	10114	234979	84546	319525	256831	101441	358272
Iceland	36	20	56	1115	595	1710	1436	872	2308
Ireland	776	350	1126	24206	10970	35176	30471	16089	46559
Israel	969	245	1214	30502	7598	38100	39734	13345	53079
Italy	12520	3207	15727	384723	102430	487153	473520	160139	633660
Latvia	1342	216	1557	41800	6584	48384	46172	8123	54296
Lithuania	1831	188	2018	58488	6147	64635	65025	8111	73136
Luxembourg	122	37	159	3772	1146	4919	4536	1664	6200
Malta	88	15	103	2668	439	3106	3293	706	3999
Netherlands	4094	2273	6367	123841	71083	194925	151938	95250	247188
Norway	850	445	1295	25527	13330	38857	32365	18741	51106
Poland	23157	5800	28956	719434	180358	899791	793581	227441	1021021
Portugal	2837	408	3245	92096	14162	106258	106955	20526	127482
Romania	14024	2670	16694	449774	86756	536529	493173	109536	602709
Slovakia	3024	567	3591	94279	17894	112174	105050	23519	128570
Slovenia	615	145	760	19162	4569	23731	22842	6900	29742
Spain	11981	1890	13872	382448	66288	448736	450504	100073	550578
Sweden	1039	720	1759	30587	21191	51778	39182	30249	69431
Switzerland	1374	497	1871	42190	15499	57689	58272	27917	86190
United Kingdom	13309	7101	20410	409063	216287	625349	501084	303240	804323
Central-East and Eastern Europe	62843	14891	77734	1967957	469625	2437582	2170406	590860	2761264
Nordic Countries	4645	2411	7056	138681	72073	210755	171293	100140	271433
Central-West and Western Europe	67513	23382	90895	2101870	740153	2842020	2498769	1047996	3546766
Southern Europe	32877	6579	39457	1033871	217386	1251257	1237146	333284	1570431

EU27	164649	46056	210705	5143046	1462215	6605258	5945806	2011405	7957212
ALICE-RAP	167878	47264	215142	5242380	1499238	6741614	6077613	2072280	8149894

Source: GBD 2010 (<http://www.healthmetricsandevaluation.org/gbd>)

Figure 6.2 *Death rates per 100'000 attributable to smoking*



Remark: for sources and exact values see table 6.2. Map adapted from clearlyandsimply.com

Overall, we see a similar West-East gradient as for alcohol, but Southern Europe is not the region with lowest burden from smoking. The majority of the deaths and burden of disease from smoking occurs in men, the difference between men and women is greatest in Central-East and Eastern Europe and Southern Europe, as was independently suggested from ALICE RAP estimates on prevalence of smoking and prevalence of dependence. It was estimated that in EU27 more than 210'000 people die before the age of 65 due to smoking. According to our estimates about one third of smokers are dependent smokers, this would give a lower bound (assuming a uniform distribution of deaths among all smokers) of 70'000 deaths due to dependent smoking annually in the EU27. This is certainly an underestimate as there is a dose-response relationship between number of cigarettes smoked in lifetime and mortality from smoking, and dependent smokers can be assumed having smoked more than non-dependent smokers. We think an upper bound would be closer to twice as many death under the assumption of uniform distribution, i.e. around 140'000 deaths before the age of 65 annually in Europe.

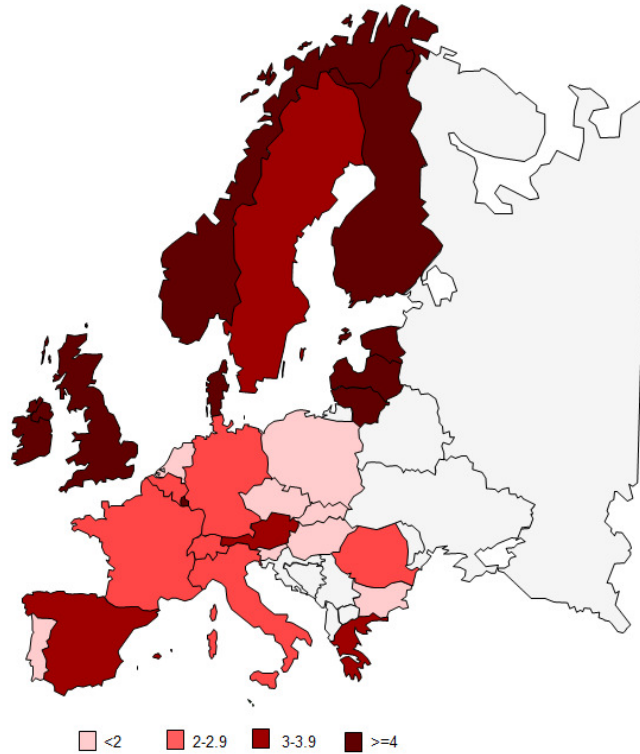
6.3 Harm from illegal drugs

Table 6.3: *Deaths, years of life lost and disability adjusted years of life lost from smoking, Total and by sex, 15 to 64 years old.*

	Attributable deaths			Years of life lost			DALY		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
Austria	168	48	216	8288	2357	10645	23210	9117	32328
Belgium	135	49	184	6305	2109	8414	23681	9875	33556
Bulgaria	53	14	67	2456	606	3062	9820	3982	13802
Cyprus	7	1	8	321	70	391	1232	484	1716
Czech Republic	69	21	90	3047	870	3917	13570	5886	19456
Denmark	170	47	218	7601	1918	9520	14080	4962	19042
Estonia	70	21	92	3488	923	4411	5370	1843	7213
Finland	155	52	207	7029	2130	9159	11544	4249	15794
France	648	213	861	27995	8328	36323	103712	40601	144313
Germany	1215	323	1538	55188	13513	68700	164177	62310	226487
Greece	197	31	228	10345	1554	11899	21866	6132	27999
Hungary	63	19	83	2882	823	3704	13633	6025	19658
Iceland	5	3	8	217	111	328	741	341	1083
Ireland	94	31	126	4692	1413	6106	12259	4646	16906
Israel	87	18	105	3994	802	4796	14950	5620	20570
Italy	752	186	938	33728	7525	41253	143677	53421	197099
Latvia	66	22	88	2922	881	3803	5868	2358	8226
Lithuania	103	25	128	4841	1031	5873	9123	3170	12293
Luxembourg	13	4	17	629	164	794	1498	529	2026
Malta	4	1	5	218	44	263	912	324	1237
Netherlands	115	32	147	5319	1405	6724	25676	10366	36042
Norway	195	56	251	9169	2531	11699	16318	5506	21824
Poland	428	112	539	19464	4396	23861	74265	31942	106206
Portugal	91	25	115	4051	1016	5067	17656	6717	24373
Romania	206	86	292	8235	3232	11467	32280	14553	46833
Slovakia	59	19	77	2421	705	3125	8125	3340	11464
Slovenia	22	6	28	1069	257	1326	2970	1063	4032
Spain	843	235	1078	36301	9467	45767	134553	49630	184183
Sweden	164	42	207	7330	1788	9118	18576	6294	24870
Switzerland	83	25	109	3833	1052	4885	14496	5760	20256
United Kingdom	1551	394	1945	77091	18555	95646	227396	86048	313443
Central-East and Eastern Europe	1140	345	1485	50826	13723	64549	175023	74160	249183
Nordic Countries	690	201	890	31345	8478	39823	61260	21352	82612
Central-West and Western Europe	4022	1120	5142	189340	48897	238237	596105	229251	825357
Southern Europe	1981	498	2479	88957	20477	109434	334848	122328	457176
EU27	7463	2061	9524	343257	87079	430336	1120730	429865	1550595
ALICE-RAP	7833	2163	9996	360469	91575	452043	1167236	447092	1614328

Source: GBD 2010 (<http://www.healthmetricsandevaluation.org/gbd>)

Figure 6.3 Death rates per 100'000 attributable to illicit drug use, 15-64 years old



Remark: for sources and exact values see table 6.3. Map adapted from clearlyandsimply.com

About 70% of the harm due to illicit drug use occurs in men. Overall in the EU-27 there were about 9'500 people aged 15-64 years dying from illicit drug use in 2010. With respect to regional trends the Northern part of Europe clear has higher mortality and burden rates (see Figure 6.3).