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# Technological innovation strategies in substance use disorders

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STUDY

Science and Technology Options Assessment

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**Scientific Foresight Unit (STOA)**

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# Technological innovation strategies in substance use disorders

## Study

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### Abstract

Drug disorders are complex social and health problems that affect millions of people in the EU. In the last two decades, we have witnessed an extraordinary growth in computer and mobile technologies available to the general public. Researchers in the field of drug addiction have started to exploit the growth of the internet and new technologies, and an increasing number of interventions designed to promote changes in substance use disorders are now available.

The study includes an extensive critical literature review on the potential of new technologies for drug addiction management. A survey among European experts in the field of addiction was also carried out. New technologies have the potential to provide parallel/alternative instruments of information, prevention and treatment for substance use disorders. They have the capacity to reach populations that have not traditionally been in treatment.

Despite encouraging progress, new technologies need to be evaluated with caution. Across research studies, there are methodological difficulties, such as a lack of common definitions, selection biases and inappropriate research designs, which require further investigation. To date, new technologies have the potential to affect, and perhaps deeply transform, existing models of health care delivery in the field of addiction.

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## Executive summary

Drug disorders from licit and illicit drugs are complex social and health problems that affect millions of people in the EU and globally. In the last two decades we have witnessed extraordinary growth in computer and mobile technologies available to the general public, both in terms of accessibility as well as cost. In the EU-28 a majority of households (81%) had internet access in 2014. The proportion of the EU-28's population that had never used the internet was 18% in 2014, down from 30% in 2009. Researchers and clinicians in the field of drug addiction have started to exploit the exponential growth of the internet and new technologies, and over the past decade, an increasing number of interventions designed to promote changes in substance abuse disorders have been delivered. Technology-based interventions (TBIs) include the use of internet/PC (or telephone, smartphone, tablets, etc.) by e-mail, chat groups, video-conferencing, SMS, etc., for drug prevention and treatment programmes.

The study includes an extensive critical literature review on the potential of new technologies for drug addiction management: a survey among European experts in the field of addiction was also carried out. New technologies have the potential to provide parallel/alternative instruments of information, prevention and treatment for substance use disorders. They have the capacity to reach populations that have not traditionally been in treatment.

### 1. Drug use prevalence and trends in the EU

Some figures related to the prevalence are important for understanding the magnitude of drug use in Europe.

Alcohol: is one of the most important risk factors for morbidity and mortality in the EU with an estimated 23 million people affected by alcohol-related disorders.

Tobacco: 26% of people (aged 15 and older) are daily smokers (about 100 million).

Cannabis: is the illicit drug most used in the EU (51.5 million males and 32.4 million females); 13% of young adults (aged 15–34), used cannabis in the last year. Around 1% of adults (ages 15–64) use cannabis every day.

Cocaine: 2% of young adults (aged 15–34) used cocaine in the last year.

Heroin: the prevalence of high-risk opioid use among adults (aged 15–64) is 0.4%.

### 2. Drug related harms and treatments

The harms caused by a drug need to be considered in terms of its acute toxicity, as well as the probability of it causing long-term health problems. Drug use is a recognised cause of avoidable mortality among European adults. Alcohol is one of the most important risk factors for morbidity and mortality. In Europe, 6.5% of all deaths are attributable to alcohol. Alcohol use disorders are among the mental disorders with the lowest treatment rate - 10% or less of people fulfilling the diagnostic criteria receive treatment in Europe.

Tobacco consumption is the single largest avoidable health risk in the EU. It is the most significant cause of premature death in the EU, responsible for nearly 700 000 deaths every year. Around 50% of smokers die prematurely. The majority of European smokers have tried to quit (58%). However, only a minimal part of smokers receive adequate care and treatment in Europe.

Cannabis is the illicit drug most used in Europe. Overall, the number of first-time treatment entrants for cannabis problems increased from 45 000 in 2006 to 69 000 in 2014. However, existing cannabis treatment programmes reach only a very limited proportion of the population in need of treatment. Recent studies suggest that cannabis may increase cardiovascular disease risk in younger cannabis

smokers who are otherwise at relatively low risk. Cannabis use in adolescence can increase the risk of developing several mental disorders.

Heroin is the most commonly used illicit opioid in Europe. Chronic heroin use may have a direct and damaging effect on certain brain functions; these changes may be associated with impulsive and unhealthy decision making. Many complications associated with heroin abuse are associated with the intravenous use of the drug. Heroin users have a high mortality rate.

Cocaine is the most commonly used illicit stimulant drug in Europe. Many cocaine users consume the drug recreationally. Cocaine use has been associated with a variety of medical complications, which may involve all the major organs or systems. The most common adverse health consequences are psychiatric disorders, cardiovascular medical problems and neurological impairments.

### **3. E-Health in Europe**

ICT in healthcare plays a key role in expanding access to diagnostic services, improving their quality, increasing coordination between providers, improving patient management, and helping to overcome physical distances between patients and health professionals. TBIs for substance use disorders are a component of the application of information and communication technology (ICT) in healthcare.

There are several barriers that hamper the wider uptake of e-Health solutions in Europe. In brief, they are as follows: i) a lack of confidence in e-Health among patients and healthcare professionals; ii) limited interoperability between e-Health solutions; iii) limited evidence of the cost-effectiveness of e-Health tools and services; iv) a lack of legal clarity e.g. for mobile health applications; v) a lack of transparency regarding the utilisation of data collected by such applications; vi) a lack of reimbursement schemes for e-Health services; vii) high costs involved in setting up e-Health systems; and viii) EU national and regional differences in accessing ICT services.

### **4. Literature review on technology-based interventions**

The literature analysis provides a critical review of studies that have been published in recent years (2010-2016) on the efficacy and effectiveness of technology-based interventions (TBIs) on drug use disorders. The review considered the potential policy implications and perspectives for the decision-making process.

The review suggests that TBIs have the potential to enhance the effectiveness of substance use disorder treatment by providing parallel/alternative instruments of information, health education, prevention and treatment. TBIs for substance use problems appear to be efficacious, but effect sizes (that is, in statistics, a quantitative measure of the strength of a phenomenon, in this case treatment) are generally small to medium at best and treatment mechanisms remain largely unknown. The magnitude of success in behavioural change tends to be small to medium according to many meta-analytic studies. Nonetheless, these changes need to be favourably considered because, from a public health perspective, even small changes are meaningful at the population level.

Technology-supported treatment has the potential to play an important role in enhancing and expanding the availability of substance use disorder treatment. Given the substantial gap between the number of individuals seeking treatment for substance use disorders and the capacity to offer adequate and timely health support, TBIs appear to offer interesting opportunities for clinicians, health administrators and decision-makers to expand service availability and reduce health services barriers. TBIs are assumed to be cost-effective treatments. Although the initial development of these programmes can be costly, the cost of hosting and maintaining access to them thereafter is generally limited. Nevertheless, more economic evaluations are needed.

The portable and flexible nature of their use in a variety of settings need to be mentioned. These qualities give them potential to reach a far greater number of people who need treatment. TBIs can



reach certain populations not reached by traditional counselling or treatment facilities. TBIs can provide automated information with a high degree of standardisation, which is not always possible for face-to-face interventions. This standardisation could permit a detailed examination of different aspects from a clinical perspective, facilitating data collection and representing an added value also in the research perspective.

Despite encouraging progress, computer-based treatment for substance use disorders needs to be evaluated with caution. This field of medical science has suffered from a lack of clarity and consistency. Across research studies there are methodological difficulties such as a lack of common definitions, selection biases, inappropriate research designs, study attrition, difficulties in mounting randomised clinical trials and uncertain conclusions drawn from the findings. Some argue that the internet is not suitable for clinical work because it does not guarantee an adequate level of privacy. TBIs on substance use disorders may not be appropriate for all clients; for example participants with a substantial chronic abuse disorder and heavy psychiatric problems may not benefit from TBIs. Other disadvantages of technology-based treatments include: their inappropriateness in emergency situations, when an immediate intervention of the therapist is urgently necessary; and the impracticality of analysing biochemical outcomes (i.e. drug tests) with this type of intervention.

Ethical guidelines for standards of care and practice for online therapy are either absent or ambiguous in some instances. Although training courses on online counselling on drug abuse treatment have started to appear in Europe, few standards exist that elucidate the technical skills required to practice online therapy with this typology of subjects. In the near future, training for health personnel will become not only necessary but also multidisciplinary. Clinicians should develop expertise in different types of media and virtual reality interventions, developing collaboration with experts of other fields, such as cognitive psychology, ICTs and communications. TBIs in no way attempt to replace traditional therapy. Rather, they allow for the use of different methods of interventions, increasing the still limited number of therapeutic methods in drug dependence, approaching and reaching out to a different typology of subjects.

## 5. Survey and interviews

The aim of the survey was to highlight the current state and future trends of the clinical implementation of ICT-based interventions in the treatment of substance use disorders in Europe. In particular, we aim to identify: i) the extent to which these technologies are used among health professionals in the field of addiction; ii) their clinical effectiveness; iii) the main factors hampering their implementation; iv) the most effective strategies to promote their use in the treatment of substance use disorders. In addition to the survey, semi-structured interviews were carried out to collect qualitative data from a select group of experts in the field of addiction. The survey was carried out among more than 300 experts in the field of drug dependence. In addition, an in depth-analysis of the survey results was carried out through a series of interviews with experts in the field of drug addiction. To the best of our knowledge, this is the first survey of a large network of drug dependence and mental health professionals on the impact of TBIs on addiction care in Europe.

The great majority of experts recruited in this study operate in the public sector and have significant professional experience in the field of addiction, which strengthens the validity of their contributions. Although the complexity of the topic makes it hard to come up with generalisations about the usage of ICT-based interventions in the treatment of substance disorders, some key aspects emerged from this study. One of them is that the current level of knowledge is very low among the participants. Only half of the survey's respondents reported a level of knowledge from fair to very good and a marked difference exists between professionals from the public sector and those from private sector and academia who reported a significantly higher level of knowledge. Professionals from both academia and the private sector also use more ICT-based applications in their practice.

Participants believe that ICT-based interventions hold the promise of providing service to more people, to people in remote areas, and to people with limitations that prevent them from participating fully in the healthcare services as they are currently structured. In addition, in combination with face-to-face interventions, ICT-based interventions improve engagement and compliance to treatment, providing a more effective and always-available support for patients. Scarce infrastructure endowment is identified as the main barrier hampering the use of ICT-based interventions. Other major barriers involved the lack of digital literacy of health care professionals. A key to widespread adoption of ICT solutions is the promotion of these technologies among healthcare professionals and patients along with the improvement of education and training. In addition, a transformation of the regulatory and funding environment to support the integration of ICT-based interventions in the current health care services is required.

ICT-based interventions offer an opportunities to improve the treatment and management of substance use disorders. New technologies currently being developed hold great but unknown potential. More research is needed on the effectiveness and costs/benefits of ICTs as applied to the treatment.

## **6. Policy options**

Five policy options have been developed. They are discussed in light of the literature review and the taking into account of the results of the survey and interviews carried out with experts in the field of drug dependence.

### **Policy option 1: No action**

The 'no action' policy might be unsustainable because it may jeopardise the ability of the EU to take advantage of the opportunities that TBIs applied to drug addictions seem to offer.

### **Policy option 2: Supporting TBIs on drug addiction by investing in research**

Despite an increasing number of studies discussing internet-based interventions for the treatment of addictions, only a relatively small number represented suitable trials. There is a need to improve the methodological quality of studies undertaken by using rigorous study designs and selecting appropriate and sufficiently large samples. It is also important for standardised measures to be used to avoid inconsistency in definitions of treatment success and enable treatments to be compared in terms of outcomes. It emerged from both the literature review and the survey that supporting TBIs on drug addiction by investing in research is important for better understanding the potentiality and limits of these applications. Increasing the quality of research will enable effective clinical interventions to be implemented to assist those with addiction-related problems, but also can help to support the decision-makers in better understanding the potential of these technologies from a public health perspective.

### **Policy option 3: Technical support, training and sustaining digital literacy in new technologies among health professionals working on drug addiction**

Given the proliferation of data supporting efficacy of new technologies, it is surprising that few therapists use them in the clinical setting. A policy option that the EU can consider in order to foster the implementation of ICT-based interventions in the treatment of addictions is to provide funding and resources to increase technical support, provide adequate ICT infrastructure and foster digital literacy among healthcare professionals. In the near future, training for health personnel will become not only necessary but also multidisciplinary. Clinicians should develop expertise in different types of media and virtual reality interventions, developing collaboration with experts in other fields, such as cognitive psychology, ICTs and communication.

#### **Policy option 4: Supporting new technologies as tools for prevention, education and information on drug addiction**

As mentioned, a lot of research is needed to clarify impacts and different aspects of new technologies in the field of drug use. At present they can still be viewed as being immature and it could be argued that they are not sufficiently advanced to be applied for treatment. However, new technologies can be used as a tool for prevention, education and information on drug addiction. The increasing number of internet users and the use of the internet for health purposes show the relevance and potential of the medium in the field of health promotion and also for prevention of substance use disorders.

Several factors render the internet an attractive delivery platform for education, prevention and information programmes. Internet-based programmes can be made available around the clock. Interventions can be accomplished at the user's own pace, when and where they want. New technologies also have the potential to reach large populations of susceptible individuals and groups that may be difficult to access through more traditional approaches. Once developed, programmes need little maintenance effort and are widely accessible to a huge online population with almost no additional costs. Also, in terms of the per capita cost of prevention messages, they are relatively inexpensive.

An aspect that needs to be taken into account is that, although health promotion campaigns for the prevention of illicit drug use are common worldwide, few have been formally evaluated. The few that assessed outcomes in terms of behaviours of use often found weak effects. It should be noted that the likelihood of success is significantly increased by the application of parallel interventions. For example, concurrent facilitated access to treatment services is crucial to persuade people motivated by media messages to act on them. The creation of multiple public health policies that support opportunities to change provides additional motivation for change.

#### **Policy option 5: Supporting new technologies as treatment tools in the field of drug use**

A great number of people with substance use disorders do not seek treatment in EU. This means that existing treatment options are not suitable or sufficiently interesting for all subjects with addiction-related problems and new modes of therapy should be considered and explored.

In the EU, there is a significant target audience for internet-based programmes to deliver drug treatment programmes among young users and among people well socially integrated that refuse to be identified as 'traditional' drug users. Frequently these people do not accept being identified as drug users and they refuse to be treated in public centres for drug treatment, which are primarily targeted at people with heavy drug use disorders. It can be assumed that there will be further growth in internet-based interventions in the EU. Health centres for drug use mostly operate in specific local areas, while technologies-based interventions have the benefit of being able to offer a drug treatment service with full regional or even national coverage.

From an economic perspective, the cost-effectiveness, particularly of self-help programmes and their assumedly easy translation, may offer further arguments for a wider deployment of programmes which are particularly relevant for other EU Member States or a distinct target group, or for the treatment of a specific drug. New technologies can be used in association with other care tools (e.g. offered as an adjunct to substance pharmacological treatment), giving the clinician the opportunity to extend the therapeutic offer. In addition, clinicians may replace part of their typical interaction with users with a TBI, which may allow for the treatment of more clients by the same number of clinicians.

Given the deleterious effect of substance abuse and addiction, there is a need for effective and cost-efficient treatments to address these problems. In this respect, the therapeutic applicability of various forms of technology applied to the treatment of substance use disorders appears to be an interesting and promising solution. In addition, programmes applied with new technologies are offered free of charge, and therefore they could represent an instrument for overcoming inequalities in access to

treatment and other health services in the EU. Further potential may be seen in the integration of smartphones or other mobile technologies into the internet-based drug treatment interventions. The use of mobile phones to access the internet has increased greatly within the EU-28: 52% of the EU population accessed the internet from a mobile phone in 2015.

To fully realise the potential of technologies as tools for care, several areas of inquiry remain important. A first challenge will be to understand how to integrate these new treatment modalities into traditional face-to-face treatment, identifying where this is worth doing and where it is not. An organisational approach is crucial in the implementation of new treatments which involve the widespread use of new technologies. Several conditions are needed for an effective technology transfer, namely: i) the innovations need to be accessible to all health personnel; ii) evidence should show that the innovation is feasible and effective; and iii) available resources should be adequate.

## 1. Introduction

Drug disorders from licit and illicit drugs are complex social and health problems that affect millions of people in the European Union (EU) and globally. Drug addiction incurs costs in the areas of public health (related to drug prevention and treatment, health care and hospitals), public safety, the environment and labour productivity.

In the last two decades, we have witnessed extraordinary growth in computer and mobile technologies available to the general public, both in terms of accessibility as well as cost. In the EU-28 a majority (55%) of households had internet access in 2007. This proportion continued to increase and in 2014 reached 81% [Eurostat, 2016]. In 2014, 78% of all individuals in the EU-28 aged between 16-74 years had used the internet at least once within the previous three months when surveyed. The proportion of the EU-28's population that had never used the internet was 18% in 2014, down from 30% in 2009. Nearly two thirds (65%) of individuals accessed the internet on a daily basis in 2014 [Eurostat, 2016].

The importance of behaviour is increasingly recognised in many aspects of healthcare [Redding, 2000; Michie, 2004]. In addition, the rapidly escalating cost of healthcare contributes to the creation of a strong need for innovative interventions to promote health control and disease prevention. Given these trends, it is not surprising that, in Europe, there has also been significant recent interest devoted to the development of behavioural interventions delivered through computer and mobile technologies to people with substance use disorders [EMCDDA, 2009; EMCDDA, 2014]. Researchers and clinicians in the field of drug addiction have started to exploit the exponential growth of the internet and new technologies, and over the past decade, an increasing number of interventions designed to promote changes in substance abuse disorders have been delivered [Webb, 2010; Teesson, 2012; McClure, 2013; Kiluk, 2013; Marsch, 2014; Wood, 2014].

TBIs may include computer-assisted behaviour therapies, education, prevention and information interventions (e.g. drug-use prevention, infectious diseases prevention programmes, and cannabis prevention programmes), recovery support programmes and wellness monitoring. In this study, the definition of TBIs, computer-based technologies, new technology interventions and internet-based drug treatment interventions are used interchangeably. This study aims to provide insights into the state-of-the-art of developed TBIs in the EU, in order to provide decision-makers with a series of policy-options on the future use of these technologies in the field of addiction.

The evidence is currently far from sufficient to draw final conclusions on the effectiveness of TBIs on substance use disorders. Despite the need for further investigations and evaluation of existing TBIs on substance use disorders, the available data shows promising results for further research and development in the EU. TBIs can reach certain populations not reached by traditional treatment facilities [Postel, 2005; Lieberman, 2008]. They can be particularly useful in reaching people living in remote settings, where access to treatment may be limited and accompanied by stigma [Schopp, 2006; Baca, 2007; Young, 2012]. Other strengths of these new technologies are the relative ease of transfer and translation of programmes for other EU Member States and their attractiveness for first-time treatment seekers, in particular adolescents and young adults.

The study is structured as follows:

**Chapter 2** provides insight into the drug use prevalence and trends in the EU. The work includes definitions of substance use, abuse and dependence, as well as figures related to the prevalence of substance use for alcohol, tobacco, cannabis, heroin, cocaine, MDMA/ecstasy, amphetamine and synthetic opioids.

The harm caused by a drug needs to be considered in terms of its acute toxicity, as well as the probability of it causing long-term health problems. Drug use is a recognised cause of avoidable mortality among European adults. **Chapter 3** briefly describes the health consequences of drug use and

provide some notes on the treatment rate for people affected by drug addiction disorders in the European Union.

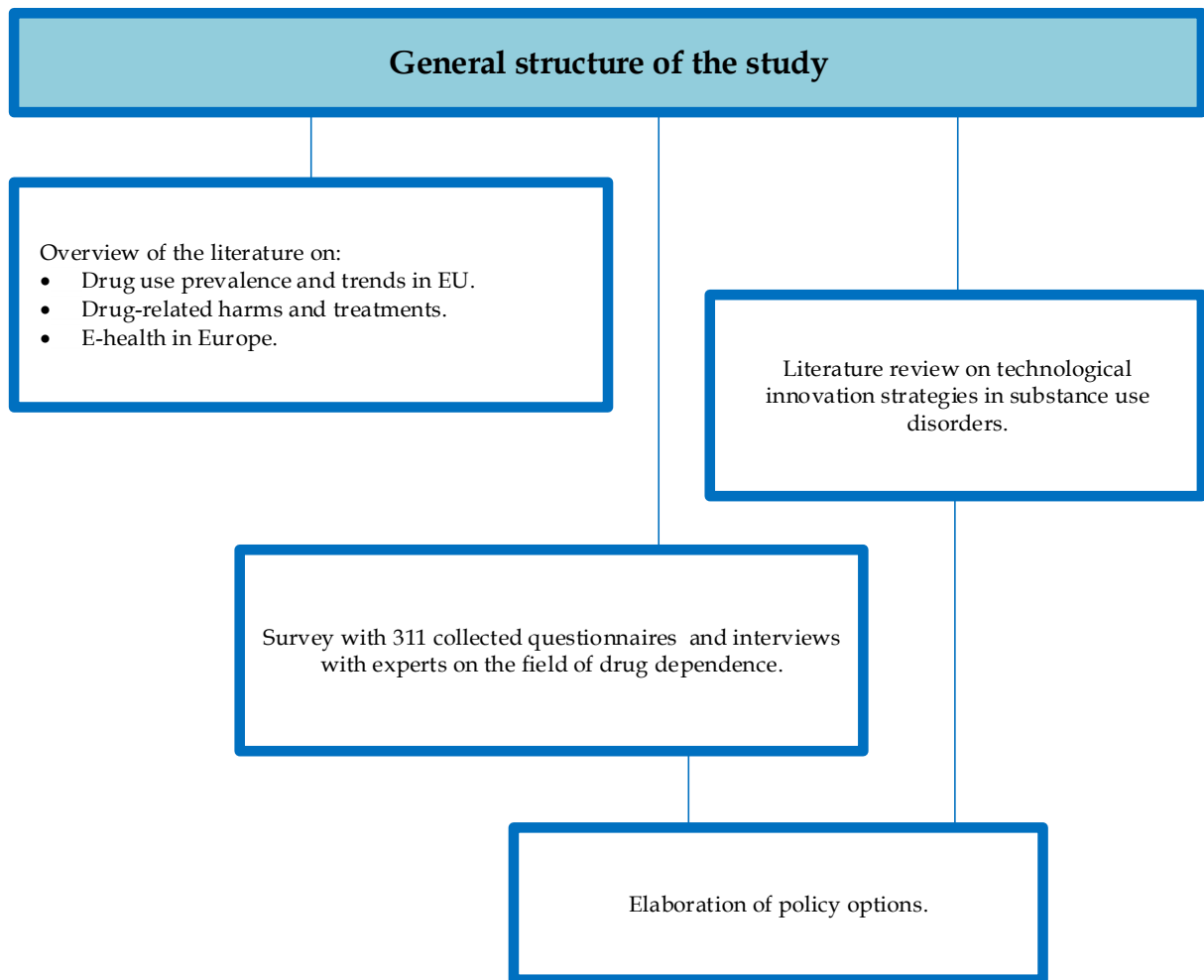
TBIs for substance use disorders are a component of the application of Information and Communication Technology (ICT) in healthcare. In **Chapter 4**, the key trends and challenges for the deployment of e-Health in the EU are briefly presented. It provides suitable elements for policy makers to understand the difficulties of implementation of the TBIs in the field of dependence at the EU level.

**Chapter 5** provides a critical review of studies that have been published in recent years (2010-2016) on the efficacy and effectiveness of TBIs on drug use disorders. The review considered the potential policy implications and perspectives for the decision-making process.

**Chapter 6** provides the results of a survey carried out among more than 300 experts in the field of drug dependence and mental health. Participants in the survey were asked to describe the current state-of-affairs with regards to TBIs on drug use in their countries. An in depth-analysis of the survey results was carried out through a series of interviews with European experts in the field of drug addiction. To the best of our knowledge, this is the first survey of a large network of drug dependence and mental health professionals on the impact of TBIs on addiction care in Europe.

**Chapter 7** presents different policy options, discussed in light of the literature review, the survey and the interviews. The following policy options have been discussed: i) no action; ii) supporting TBIs on drug addiction by investing in research; iii) technical support, training, and sustaining digital literacy in new technologies among health professionals working on drug addiction; iv) supporting new technologies as tools for prevention, education and information on drug addiction; v) supporting TBIs as treatment tools in the field of drug use in the EU.

The general structure of the study is schematised in Figure 1.



**Figure 1.** General structure of the study.

## 2. Drug use prevalence and trends in the European Union

### 2.1. Introduction

The majority of information presented in this chapter is related to publications of the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). This EU agency, based in Lisbon, was established to provide a technical reference point for collating and disseminating information on the European drug situation [Griffiths, 2012]. A central task for the agency is to produce an annual report on the latest data available on drug use in Europe. This reporting exercise is primarily based on a set of standardised reporting tools, which have been progressively refined during the 20 years in which the system has been operational [Mounteney, 2016].

### 2.2. Substance use, abuse and dependence: a necessary distinction

Not everyone who uses or abuses drugs becomes addicted to them. Although a possible continuum exists between the three behaviours, a distinction needs to be made between drug use, drug abuse and drug dependence. Abuse encompasses any inappropriate use of illicit or legal drugs (such as taking larger doses than were prescribed or using someone else's prescription). It includes the repeated use of drugs for pleasure, to alleviate stress, and/or to alter or avoid reality. Abuse always precedes dependence, and many people suffering from drug abuse progress to drug dependence [NIDA, 2014].

ICD-10 is the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD), a medical classification list by the World Health Organization (WHO). It contains codes for diseases, as well as signs and symptoms of injury or diseases [WHO, 2010]. The ICD-10 defines the dependence syndrome as a cluster of physiological, behavioural, and cognitive phenomena in which the use of a substance (or a class of substances) takes on a much higher priority for a given individual than other behaviours that once had greater value. A central characteristic of dependence is the strong overpowering desire to take the psychoactive drugs (which may or not have been medically prescribed) [WHO, 2016].

The WHO introduced the term 'dependence' in 1964. The term can be used generally with reference to the whole range of psychoactive drugs (drug dependence, substance use dependence), or with specific reference to a particular drug or class of drugs (e.g. alcohol dependence, cocaine dependence). There are differences in the characteristic dependence symptoms for different drugs [WHO, 2016].

The term dependence refers to both psychological and physical elements. Psychological dependence refers to the experience of impaired control over drug use, while physical dependence refers to tolerance and withdrawal symptoms. Although incorrect, dependence is often used in a narrower sense to refer only to physical dependence [WHO, 2016].

A definite diagnosis of dependence should usually be made only if three or more of the following signs or symptoms have been present together at some time during the previous year:

- A strong desire or sense of compulsion to take the substance;
- Difficulties in controlling substance-taking behaviour in terms of its onset, termination, or levels of use;
- A physiological withdrawal state when substance use has ceased or been reduced, as evidenced by the characteristic withdrawal syndrome for the substance or use of the same (or closely related) substance with the intention of relieving or avoiding withdrawal symptoms;
- Evidence of tolerance, such that increased doses of the psychoactive substance are required in order to achieve effects originally produced by lower doses;
- Progressive neglect of alternative pleasures or interests because of psychoactive substance use, or the increased amount of time necessary to obtain or take the substance or to recover from its effects;

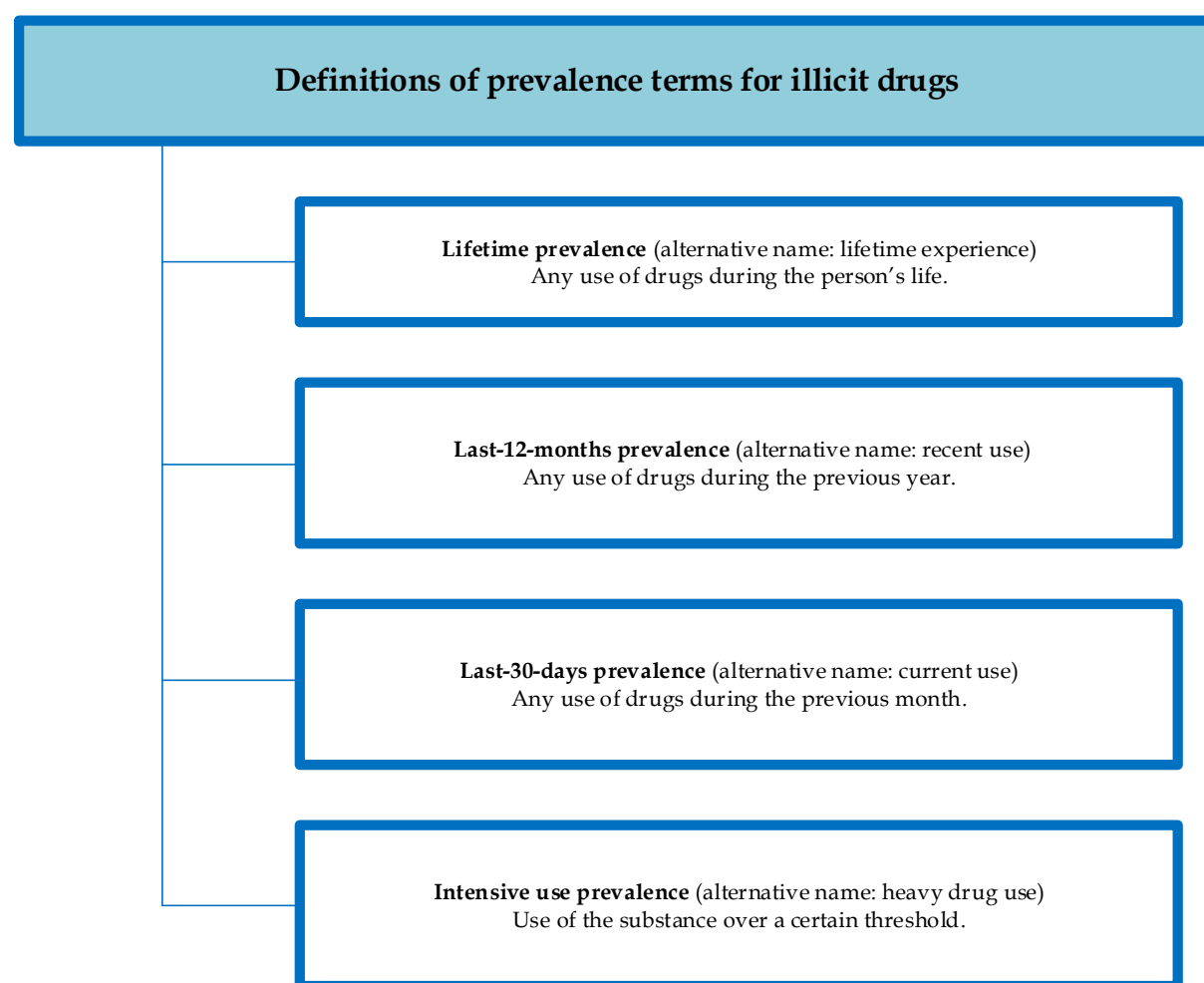


- Persisting with substance use despite clear evidence of overtly harmful consequences (such as harm to the liver through excessive drinking, depressive mood states consequent to periods of heavy substance use, or drug-related impairment of cognitive functioning) [WHO, 2016].

### 2.3. Definition of prevalence terms: how to read numbers

Drug use in the general population is estimated through population surveys. In interpreting the results, one needs to bear in mind the limitations of surveys in estimating the more marginalised forms of drug use (e.g. heroin injection) due to non-probabilistic errors (exclusion from the sampling frame, absence, non-response, etc.) [EMCDDA, 2012].

Prevalence estimates are based on standard periods of time. For illegal drugs, the usual measures are presented in Figure 2.



**Figure 2.** Definitions of prevalence terms for illicit drugs.

Lifetime prevalence always produces higher figures, but it alone will not capture the current drug situation (among adults) well, as it is a cumulative measure that also includes people that tried drugs a long time ago. However, lifetime prevalence gives a rough estimation of the extent of drug experience in the population. [EMCDDA, 2012]

Last-12-months prevalence better reflects the present situation, giving an indication of recent but probably occasional use in most cases. The combination of lifetime experience and last-12-months prevalence can give information on drug use patterns (e.g. 'continuation rates').

Last-30-days prevalence gives an indication of more regular use and will include the more intensive users, although in fact most current users will not be intensive users. [EMCDDA, 2012]

The concept of intensive use, or heavy drug use, is a broad term meaning use of the substance over a certain threshold of frequency or amount. It does not necessarily imply the existence of abuse/dependence, but it increases the risk of negative consequences. In general, intensive use is the use of drug in 20 days or more of the last 30 days [EMCDDA, 2012]. Estimates are available for three age bands: 15–64, 15–34 and 15–24 years old.

Finally, an important and increasing issue that needs to be mentioned is the polydrug use patterns. Polysubstance misuse encompasses wide variations in user populations and patterns of use both among licit and illicit drug users. Therefore, it is not possible to have a single definition of polydrug use (which would be necessary to develop standardised measures) [EMCDDA, 2009a]. Nevertheless, evidence shows that 75% of users entering treatment for problems related to drug use in Europe are recorded as using multiple substances [EMCDDA, 2016]. Polydrug consumption has become particularly apparent in recent years, where increasing prevalence of drug use has translated into additional populations of drug users, and an increasing range of available substances has resulted in additional drug combinations [Leri, 2003; EMCDDA, 2009a]. There are many examples of polydrug consumption patterns: heroin and cocaine, alcohol and cocaine, heroin, alcohol, or benzodiazepines and cocaine, MDMA and alcohol, cannabis and alcohol, etc. Alcohol is often the major component of polydrug use.

Alcohol and tobacco use are also frequently associated. People who drink alcohol are more likely to smoke and vice versa; in addition, people who drink larger amounts of alcohol tend to smoke more. Furthermore, patients diagnosed with dependence on one of the drugs also are commonly diagnosed with dependence on the other drug [Drobes, 2002]. Among people with alcohol disorders, 50–92% also smoke tobacco [Falk, 2006; De Leon, 2007], resulting in alcohol and tobacco abusers as the largest group of poly-substance abusers [Van Skike, 2016]. Similarly, smokers are far more likely to consume alcohol than are non-smokers and are 10–14 times more likely to have an alcohol use disorders than non-smokers [Di Franza, 1990; McKee, 2013; Van Skike, 2016]. Although the smoking rate in the general population has gradually declined over the past two decades in the EU, this is not the case among alcoholics.

## **2.4. Substance use prevalence of major licit and illicit drugs: some figures**

### **2.4.1. Alcohol**

The EU is the region with the highest alcohol consumption in the world: in 2009, average adult (aged 15+ years) alcohol consumption in the EU was 12.5 litres of pure alcohol (27 g of pure alcohol or nearly three drinks a day), more than double the world average [WHO, 2012]. Although there are differences among EU Member States, alcohol consumption in the EU as a whole has continued at a stable level over the past decade. In the EU it is estimated that 23 million people were affected by alcohol-related disorders in 2010 (4.5% of people aged 15+ years) [Shield, 2013; Wittchen, 2010; Rehm, 2015]. Overall, alcohol use disorders have the second highest burden of disease of all mental disorders after depression [Wittchen, 2010].

### **2.4.2. Tobacco**

Despite considerable progress made in recent years, the number of smokers in the EU is still high: 24% of the population aged 15 or over smoke, with 19.2% smoking on a daily basis [Eurostat, 2016b; EC,

2017]. The share of current smokers differs between genders, with a higher proportion of men (29%) smoking than women (19.5%) in the EU. In addition, slightly more than a fifth (21.6%) of the EU population aged 15 or over was exposed, on a daily basis, to tobacco smoke indoors.

Among the EU Member States for which data are available, the lowest shares of current smokers in 2014 among the population aged 15 or over were recorded in Sweden and the United Kingdom (17%), ahead of Finland (19%) and Portugal (20%). At the opposite end of the scale, about 1 in 3 persons aged 15 or over was a smoker in Bulgaria (35%) and Greece (33%), followed by Austria (30%), Slovakia and Latvia (29%) [Eurostat, 2016b].

### 2.4.3. Cannabis

Cannabis is the illicit drug most used in the EU. It is estimated that around 1% of European adults (ages 15–64 years) are daily or almost daily cannabis users. Around 60% of these are aged between 15 and 34 years. Levels of lifetime use of cannabis differ considerably between EU Member States, ranging from around 40% of adults in France, and 30% in Denmark and Italy, to less than 10% in some Eastern European countries (Bulgaria, Hungary and Romania) [EMCDDA, 2016].

An estimated 16.6 million young Europeans (aged 15–34, 13% of this age group), had used cannabis in the last year when surveyed [EMCDDA, 2016]. Only a limited number of EU Member States have survey data of medium and long-term trends in last year cannabis use among young adults (15–34 years). Surveys for relatively high-prevalence countries, such as Germany, Spain and the United Kingdom, all show decreasing or stable cannabis prevalence over the past decade, while France shows increases in prevalence after 2010 [EMCDDA, 2016].

Adolescents use the drug for a variety of reasons, including experimentation, mood enhancement, social enhancement and peer conformity [Lee, 2007]. The main purpose of the European School Survey Project on Alcohol and Other Drugs (ESPAD) is to collect comparable data on substance use among 15- to 16-year-old European students in order to monitor trends within as well as between countries. The last round of ESPAD reported that cannabis accounted for the majority of illicit drug use among 15- to 16-year-old school students [Hibell, 2012].

### 2.4.4. Heroin

Heroin is the most commonly used illicit opioid in the EU. The average prevalence of high-risk opioid use among adults (aged 15–64) is estimated at 0.4%, the equivalent of 1.3 million high-risk opioid users in Europe in 2014. At the national level, prevalence estimates of high-risk opioid use range from less than 1 to around 8 cases per 1 000 people (aged 15–64). Around 75% of the estimated high-risk opioid users in the EU are reported in the United Kingdom, France, Italy, Germany and Spain [EMCDDA, 2016]. From 2010–2011, indicators in many European countries highlighted a decline in the rate at which new people become heroin users and the existence of an ageing cohort of high-risk opioid users, many of whom were receiving substitution treatment [EMCDDA, 2016].

### 2.4.5. Cocaine

It is estimated that about 2.4 million young adults aged 15 to 34 (1.9% of this age group) used cocaine in the last year. Only Spain, the Netherlands and the United Kingdom report last year prevalence of cocaine use among young adults of 3% or more. Spain, Italy and the United Kingdom account for 74% of all reported treatment entries related to cocaine in Europe [EMCDDA, 2016]. Figures of problematic patterns of cocaine use in Europe are reported by few EU Member States. For 2011/2012, the United Kingdom estimated crack cocaine use among the adult population in England at 0.48%. Germany estimated cocaine-dependency among the adult population at 0.20% in 2012. This percentage was estimated at 0.29% in Spain (2013), at 0.64% in Italy (2014) and at 0.62% in Portugal (2015) [EMCDDA, 2016].

### **2.4.6. MDMA/ecstasy**

MDMA (3,4-methylenedioxy-methamphetamine) is commonly used in the form of ecstasy tablets (but is also increasingly available as crystals and powders). It is estimated that 2.1 million young adults (15–34 years) had used MDMA in the last year when surveyed (1.7% of this age group), with national estimates ranging from 0.3% to 5.5%. Until recently, in many countries MDMA prevalence has been on the decline from peak levels in the early to mid-2000s. This now appears to be changing, with an overall increasing trend in Europe. MDMA use is rarely cited as a reason for entering drug treatment centres [EMCDDA, 2016].

### **2.4.7. Amphetamine**

An estimated 1.3 million (1.0%) young adults (15–34 years) had used amphetamines during the last year when surveyed. In the last decade, most European countries have experienced a relatively stable situation in respect to trends in amphetamine use. Analysis of municipal wastewater carried out in 2015 found amphetamines at appreciable levels in cities across Europe, with the highest levels reported in northern European cities [EMCDDA, 2016a].

### **2.4.8. Synthetic opioids**

Synthetic opioids (methadone, buprenorphine, fentanyl, codeine, morphine, tramadol and oxycodone) are increasingly being misused in Europe. In 2014, 18 European countries reported that more than 10% of all opioid clients entering treatment services presented for problems primarily related to opioids other than heroin. In some European countries, non-heroin opioids now represent the most common form of opioid use among treatment entrants [EMCDDA, 2016].

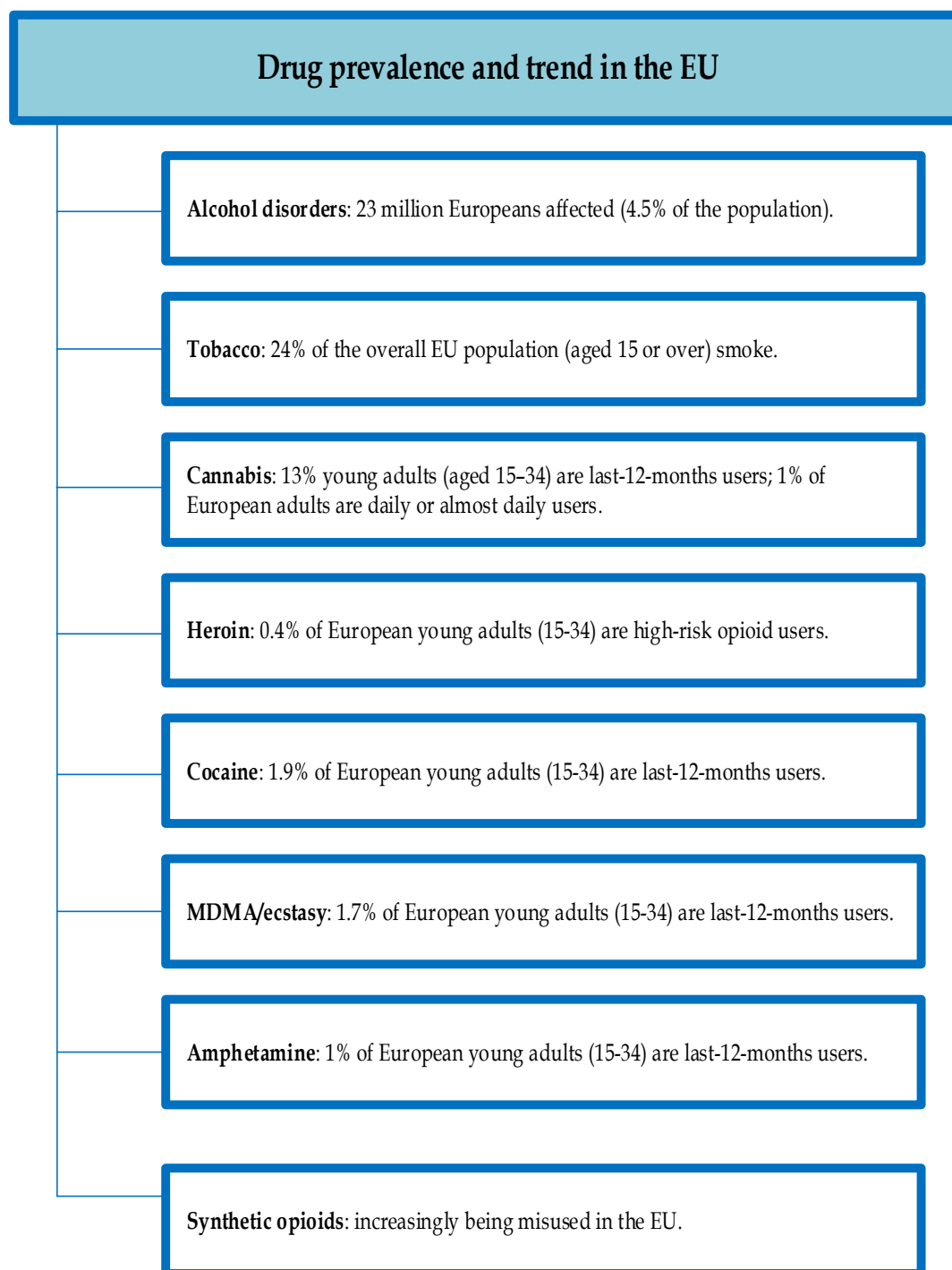
## **2.5. Conclusions**

Not everyone who uses or abuses drugs becomes addicted to them. A distinction needs to be made between drug use, drug abuse and drug dependence. Abuse encompasses any inappropriate use of illicit or legal drugs. It includes the repeated use of drugs for pleasure, to alleviate stress, and/or to alter or avoid reality. Abuse always precedes dependence, and many people suffering from drug abuse progress to drug dependence. The term dependence refers to both psychological and physical elements. Psychological dependence refers to the experience of impaired control over drug use, while physical dependence refers to tolerance and withdrawal symptoms. Rates of drug use, both for licit and illicit drugs, are notably higher among males than females. Drug use in the general population is estimated through population surveys. In interpreting the results, one needs to bear in mind the limitations of surveys in estimating the more marginalised forms of drug use due to non-probabilistic errors (exclusion from the sampling frame, absence, non-response etc.). Prevalence estimates are based on standard periods of time.

Polysubstance misuse encompasses wide variations in user populations and patterns of use among both licit and illicit drug users. About 75% of users entering treatment for problems related to drug use in Europe are recorded as using multiple substances. Polydrug consumption has become particularly apparent in recent years, where increasing prevalence levels of drug use have translated into additional populations of drug users, and an increasing range of available substances has resulted in additional drug combinations. Alcohol and tobacco use are frequently associated: patients diagnosed with dependence on one of the drugs are also commonly diagnosed with dependence on the other drug.

Despite progress made in recent years, the number of smokers is still high in the EU: 24% of the population aged 15 or over smoke. The EU is the region with the highest alcohol consumption in the world. In the EU it is estimated that 23 million people are affected by alcohol-related disorders. About

90 million adults (15 to 64 year-olds), are estimated to have tried illicit drugs at some point in their lives in the EU. The illicit drug most commonly-used is cannabis, with much lower estimates reported for the lifetime use of cocaine, MDMA and amphetamines. Some figures of drug prevalence and trends in the EU are reported in Figure 3.



**Figure 3.** Some figures of drug prevalence and trends in the EU.

### 3. Drug related harms and treatments

#### 3.1. Introduction

The physical and psychological harms caused by a drug needs to be considered in terms of its acute toxicity, as well as its probability to produce long-term health problems [Fox, 2013]. The acute effects experienced by user are dependent upon several factors: dose, method of administration, prior experience, concurrent drug use, personal expectations, mood state and the social environment in which the drug is used, among others. Cocaine, for example, at low doses produces euphoria, reduced fatigue and a perception of increased mental acuity. Higher doses may result in several undesirable side effects including paranoia, panic, repetitive stereotyped behaviour, tachyarrhythmias, stroke, and seizure [Pavarin, 2011; De Millas, 2013]. Effects of cannabis at low doses include a euphoric state of consciousness, and a relaxed, sociable and uninhibited condition. At higher doses (for someone also at first time use) effects can be negative, such as anxiousness, panic and paranoid thoughts.

As well as acute harm, many drugs when used repeatedly over time have chronic health consequences. The long-term health problem can be either directly related to the effect of the drug or due to the method of drug administration [Fox, 2013]. Drugs taken intravenously can lead to complications related to this route of delivery. These include thrombosed veins and blood-borne infections such as hepatitis B, hepatitis C and the human immunodeficiency virus (HIV). Viral hepatitis, particularly infection caused by the hepatitis C virus, is highly prevalent among injecting drug users across Europe. Substance dependence (particularly from alcohol and tobacco) is associated with a reduced life expectancy, with an increased prevalence of cancer and cardiovascular diseases [Jané-Llopis, 2006].

Long-term health problems also result from the psychoneurobiological impact of chronic use. Chronic cannabis use has been shown to result in depression, anxiety, and, in some individuals with a predisposing vulnerability, schizophrenia and other mental disorders [Agrawal, 2011]. MDMA, amphetamine and cocaine can result in impulsiveness, irritability, sleep disturbance, anxiety, and addiction [[Devlin, 2008; De Millas, 2010; Fox, 2013]. Many drugs also increase susceptibility and risk of suffering other conditions. Cocaine, either inhaled or taken intravenously, increases the risks of strokes and myocardial infarction [Devlin, 2008; McCord, 2008; Pavarin 2011].

Drug use is a recognised cause of avoidable mortality among European adults [Mezzelani, 1998; Quaglio, 2001]. For example, opioid users in Europe are 5 to 10 times more likely to die than their peers of the same age and gender. Increased mortality among opioid users is primarily related to overdose, but other causes of death indirectly related to drug use, such as infections, accidents, violence and suicide, are also relevant [EMCDDA, 2016].

An overarching aspect of drug use that needs to be mentioned is the comorbidity with mental health. Comorbidity of substance use and psychiatric disorders refers to the co-occurrence of the two clinical conditions in the same individual. In the EU, the most frequently identified mental health comorbidities among users of substances were major depression, anxiety disorders and personality disorders [Torrens, 2015]. Depression is the most common, with prevalence ranging from 12% to 80%. Rates as high as 35% have been reported for anxiety disorders (mainly panic and post-traumatic stress disorders). Comorbid substance-use disorders are more common in people with psychosis, in particular schizophrenia and bipolar disorder, than in the general population. Illicit substance use is often associated with a personality disorder (mainly antisocial and borderline). Subjects with a personality disorder and a substance use disorder are more likely to participate in risky behaviours [Torres, 2015]. Treating people with dual diagnosis is particularly challenging.

It is not the aim of this study, but it is worth mentioning the immense cost of drug use to the community and society. Drug abuse has a significant impact on healthcare services, public services and the criminal justice system. The damaging effects of drug use are not limited to the drug users,



but also to the family and the society at large. The abuse of alcohol and other substances is an important contributor to global rates of violence, traffic accidents and self-inflicted injuries [WHO, 2011]. This chapter briefly describes the health consequences of the drugs most frequently used in the EU and gives some short notes related to treatment.

### 3.2. Alcohol

Alcohol is one of the most important risk factors for morbidity and mortality, in Europe and worldwide. It is responsible for 3.8% of global mortality and 4.6% of disability-adjusted life-years (DALYs) lost due to premature death [Rehm, 2009]. The attributable burden in Europe, with 6.5% of all deaths and 11.6% of DALYs attributable to alcohol, is the highest proportion of total ill health and premature deaths due to alcohol of all WHO regions [Rehm, 2009; WHO, 2010a; Roerecke, 2013]. The young account for a disproportionate amount of this disease burden, with an alcohol-associated mortality over 10% and 25% of female and male youth respectively [Anderson, 2006; EASL, 2012].

Severe alcohol abuse and dependence are characterised by physical and mental comorbidity [Jane-Llopis, 2006; Samokhvalov, 2010; Rehm, 2015], and social disability [Rehm, 2015]. Alcohol-correlated disorders account for significant shares of disease burden in the EU [Rehm, 2013; Samokhvalov, 2010]. In Europe, alcohol is the third leading risk factor for disease and mortality after tobacco and high blood pressure [WHO, 2012]. Alcohol is a cause of noncommunicable diseases, including cancers (nasopharyngeal, oesophageal, laryngeal, liver, colon/rectal, and female breast), cardiovascular diseases (hypertensive diseases, ischaemic heart disease, ischaemic stroke, hemorrhagic stroke, and cardiac arrhythmias), liver diseases, pancreatitis [EASL, 2012], and neuropsychiatric diseases [WHO, 2012]. Chronic alcohol consumption significantly increases the possibility of developing alcohol withdrawal syndromes, which include withdrawal seizures, hallucinosis and delirium tremens. Withdrawal syndromes can be life threatening and occur in about 20% of alcoholics who stop drinking abruptly [Metha, 2016].

Alcohol use disorder, independently of other patient and illness characteristics, leaves individuals vulnerable to infection, which occur with greater severity and more complications compared to those who do not abuse alcohol. Alcoholism is an important risk factor for the development of both typical pneumonias as well as more severe respiratory infections [de Roux, 2006; Chalmers, 2009]. In addition, alcohol increases the risks of HIV/AIDS and tuberculosis infections. Sepsis is a systemic inflammatory syndrome that occurs as a result of a severe infection. The role of alcoholism in increasing the risk and severity of sepsis has been well established [O'Brien, 2007].

Alcohol is a cause of all types of intentional (self-inflicted injuries, interpersonal violence, assault, suicide, and homicide) and unintentional injury (traffic injuries, falls etc.) [Fabbri, 2001; Cunningham 2002; WHO, 2012]. Alcoholics are not only at an increased risk for suffering from critical illness, but they also experience a greater likelihood of complications, poorer outcomes, and increased healthcare utilisation compared to those patients who do not have alcohol use disorders [WHO, 2012; Mehta, 2016].

Alcohol use disorders are among the mental disorders with the lowest treatment rate. 10% or less of the people fulfilling the diagnostic criteria receive treatment in Europe [Alonso, 2004; Rehm, 2012; Rehm, 2013]. Different explanations for this phenomenon have been brought forward. The first is stigma that has been shown to reduce the probability of using healthcare services for treatment [Keyes, 2010; Finn, 2014; Mojtabai, 2014; Wallhed, 2014]. Subjects categorised as 'alcoholics' are many times more likely to be considered responsible for their condition [Schomerus, 2011; Probst, 2015]. They experience stigmatisation by the public more severely than people with other mental disorders [Schomerus, 2011].

### 3.3. Tobacco

Tobacco consumption is the single largest avoidable health risk in the EU. It is the most significant cause of premature death in the EU, responsible for nearly 700 000 deaths every year. Around 50% of smokers die prematurely (on average 14 years earlier) [Bertollini, 2016; WHO, 2016b; EC, 2017]. In addition, smokers have more life years in poor health. Many forms of cancer, cardiovascular and respiratory diseases are linked to tobacco use, which causes more problems than alcohol, drugs, high blood pressure or obesity.

Cigarette smoking harms nearly every organ of the body, causes many diseases, and reduces the health of smokers in general. Smoking causes about 90% of all lung cancer deaths. About 80% of all deaths from chronic obstructive pulmonary disease (COPD) are caused by smoking. Smoking is estimated to increase the risk for coronary heart disease by 2 to 4 times, for stroke by 2 to 4 times, and for developing lung cancer by 25 times [US Department of Health, 2014; CDC, 2017].

The role of nicotine in addiction has been extensively reviewed and reported. All forms of tobacco have the potential to be addictive because they all contain nicotine, but cigarettes are the most efficient for delivering nicotine into the body. The majority of European smokers have tried to quit (59%), with 19% having tried in the past 12 months when surveyed [EC, 2015b]. Similar figures are reported from the US, where approximately two out of three smokers want to quit, and 52.4% of current adult smokers having tried to quit within the past year when surveyed [MMWR, 2011]. Getting help, for example through counselling or pharmacological support, can double or triple the chances of quitting [MMWR, 2011]. Unfortunately, only a minimal proportion of smokers receive adequate care and treatment in Europe.

### 3.4. Cannabis

Across all age groups, cannabis is the illicit drug most likely to be used in Europe. The drug is generally smoked and commonly mixed with tobacco. Patterns of cannabis use can range from the occasional to the regular and dependent. Data on those entering treatment for cannabis problems can inform understanding of the nature and scale of high-risk cannabis use in Europe. Overall, the number of first-time treatment entrants for cannabis problems increased from 45 000 in 2006 to 69 000 in 2014. Among this group, those reporting daily use of the substance rose from 46% in 2006 to 54% in 2014. However, existing cannabis treatment programmes reach only a very limited proportion of the population in need of treatment [EMCDDA, 2015a]. The causes of the increase in the number of treatment entrants are unclear, but may be linked to changes in the prevalence of cannabis use and the availability of higher-potency cannabis products, with a higher concentration of the active chemical [EMCDDA, 2015a].

The most frequent short-term health effect of cannabis is intoxication marked by disturbances in the level of consciousness, cognition and perception [Crane, 2013]. A minority of first-time cannabis users become very anxious, have panic attacks, experience hallucinations and vomit [WHO, 2016a]. These symptoms may be sufficiently distressing to prompt affected users to seek medical care. Acute use impairs driving [Crean, 2011; Asbridge, 2012; Hartman, 2013]. There is some evidence that cannabis use can trigger coronary events [Casier, 2013; Benson-Leung, 2014]. Recent case reports and case series suggest that cannabis smoking may increase cardiovascular disease risk in younger cannabis smokers who are otherwise at relatively low risk [WHO, 2016a]. Withdrawal syndrome is well documented in cannabis dependence [Budney, 2006]. Regular cannabis users can develop drug dependence [van der Pol, 2013]. It is estimated that the risk is around 1 in 10 among those who have ever used cannabis, 1 in 6 among adolescent users, and 1 in 3 among daily users [WHO, 2016a].

Growing evidence shows that regular, heavy cannabis use during adolescence is associated with more severe and persistent negative outcomes than use during adulthood [Hall, 2014]. In a number of



prospective studies, there is a consistent dose–response relationship between cannabis use in adolescence and the risk of developing psychotic symptoms, schizophrenia and other mental disorders [Agrawal, 2011; Borges, 2016; Solowij, 2008]. Nevertheless, this is a topic that requires further research because pre-existing mental health conditions and other confounding factors certainly play a role [Haney, 2016; WHO, 2016a; EMCDDA, 2016].

Long-term cannabis smoking produces symptoms of chronic and acute bronchitis; however, it does not appear to produce chronic obstructive pulmonary disease [Tashkin, 2012]. Long-term heavy cannabis smoking can potentially trigger myocardial infarctions and strokes in young cannabis users [Jouanous, 2014]. Smoking a mix of cannabis and tobacco may increase the risk of cancer and other respiratory diseases, but it has been difficult to establish whether cannabis smokers have a higher risk than tobacco smokers [Tashkin, 2015; WHO, 2016a].

A small number of problematic cannabis users are treated in the public centres for addiction treatment [EMCDDA, 2009; EMCDDA, 2015a; Gates, 2012; Hoch, 2016]. Possible reasons of this situation include the feeling among cannabis users that treatment is not necessary, a lack of motivation to quit and a lack of treatment option awareness. Another important reason is that, in many cases, cannabis users prefer not to go to public centres for addiction treatment because they do not want to be labelled as drug addicts [Gates, 2012].

### 3.5. Heroin

In Europe, the most commonly used illicit opioid is heroin, which may be smoked, snorted or injected. It is estimated that 1.2 million people received treatment for illicit drug use in the EU during 2014. Opioid users represent the largest group undergoing specialised treatment (followed by cannabis and cocaine users) [EMCDDA, 2016]. An estimated 644 000 opioid users received substitution treatment in the EU in 2014. The numbers have fallen by around 50 000 since 2010. Estimates of opioid users would suggest that, overall, 50% receive substitution treatment. Methadone is the most commonly prescribed opioid substitution drug (61%) followed by buprenorphine (37%) [EMCDDA, 2016].

Chronic heroin use changes the physical structure and physiology of the brain, creating long-term imbalances in neuronal and hormonal systems that are not easily reversed [Wang, 2012]. There is evidence that heroin use may have a direct and damaging effect on certain brain functions; these changes may be associated with impulsive and unhealthy decision making. Chronic heroin use may be associated with more damaging effects on brain functions. These brain changes could last long after abstinence, which may increase the risk of relapse to heroin use. Heroin also produces profound degrees of tolerance and physical dependence [NIDA, 2014].

In addition to the direct untoward effects of heroin on the central nervous system, many complications associated with heroin abuse are associated with the intravenous use of the drug. For example, intravenous drug abusers are particularly likely to develop medical problems of the skin and soft tissues, endocarditis, pulmonary diseases, hepatitis B and C, sexually transmitted diseases, and renal diseases [Stein, 1999; McCann, 2000; Theodorou, 2005].

Heroin users have a higher rate of mortality than their age and sex-matched controls. Whilst the rates vary, all studies have shown a significant increase in mortality [Quaglio, 2001; Theodorou, 2005]. Overdose is one of the major causes of mortality in heroin users. Heroin users are 14 times more likely to commit suicide than nondrug-users [Darke, 2002; Darke, 2003].

### 3.6. Cocaine

Cocaine is the most commonly used illicit stimulant drug in Europe. Cocaine powder (cocaine hydrochloride) is primarily sniffed (nasal insufflation), but is also sometimes injected, whereas crack cocaine (cocaine base) is usually smoked. Many cocaine users consume the drug recreationally, with

use highest during weekends and holidays. Among regular users, a broad distinction can be made between more socially integrated consumers, who often sniff cocaine powder, and marginalised users, who inject cocaine or smoke crack frequently in a context of polydrug use [EMCDDA, 2016].

Cocaine use has been associated with a variety of medical complications, which may involve all of the major organs or systems. The most common adverse health consequences are psychiatric disorders [Devlin, 2008; De Millas, 2010], cardiovascular medical problems [Lange, 2001; Sanjurjo 2006; Devlin, 2008; McCord, 2008], and neurological impairments (headache, parenthesis, dizziness, syncope, and seizures) [Treadwell, 2007; Glauser, 2007; Pavarin, 2011]. Such complications can be associated with acute and chronic cocaine use and may differ according to the route of administration.

The most common complaints that lead cocaine users to the emergency room are related to its psychiatric symptoms and cardiovascular effects. Anxiety and psychomotor agitation are the most common psychiatric manifestations of cocaine intoxication. Panic attacks are also frequently noted [Devlin, 2008; Sanjurjo, 2006; Pavarin, 2011]. Cardiovascular problems (palpitations, chest pain, dyspnoea, ischemia and myocardial infarction) are among the most frequently discussed medical complications of cocaine. Cocaine accounts for up to 25% of acute myocardial infarctions in patients of 18–45 years of age [Qureshi, 2001]. Cocaine use is also associated with violence and risk-taking behaviour. Multiple epidemiological studies show associations between cocaine use and road accidents, homicide, suicide and accidental injury [Del Rio, 2000; Lowenstein, 2001; Giovanardi, 2005; Pavarin, 2001].

### 3.7. Conclusions

The harms caused by a drug need to be considered in terms of its acute toxicity, as well as the probability of it causing long-term health problems. Drug use is a recognised cause of avoidable mortality among European adults. Alcohol is one of the most important risk factors for morbidity and mortality. In Europe, alcohol is the third leading risk factor for disease and mortality after tobacco and high blood pressure: 6.5% of all deaths are attributable to alcohol. Alcohol is a cause of non-communicable diseases, including cancers, cardiovascular diseases and neuropsychiatric diseases. People affected by alcohol use disorder are more vulnerable to infection. Alcohol is a cause of all types of intentional and unintentional injury. Alcohol use disorders are among the mental disorders with the lowest treatment rate - 10% or less of people fulfilling the diagnostic criteria receive treatment in Europe.

Tobacco consumption is the single largest avoidable health risk in the EU. It is the most significant cause of premature death in the EU, responsible for nearly 700 000 deaths every year. Around 50% of smokers die prematurely (on average 14 years earlier). Many forms of cancer, cardiovascular and respiratory diseases are linked to tobacco use, which causes more problems than alcohol, illicit drugs, high blood pressure and obesity. The majority of European smokers have tried to quit (58%). However, only a minimal part of smokers receive adequate care and treatment in Europe.

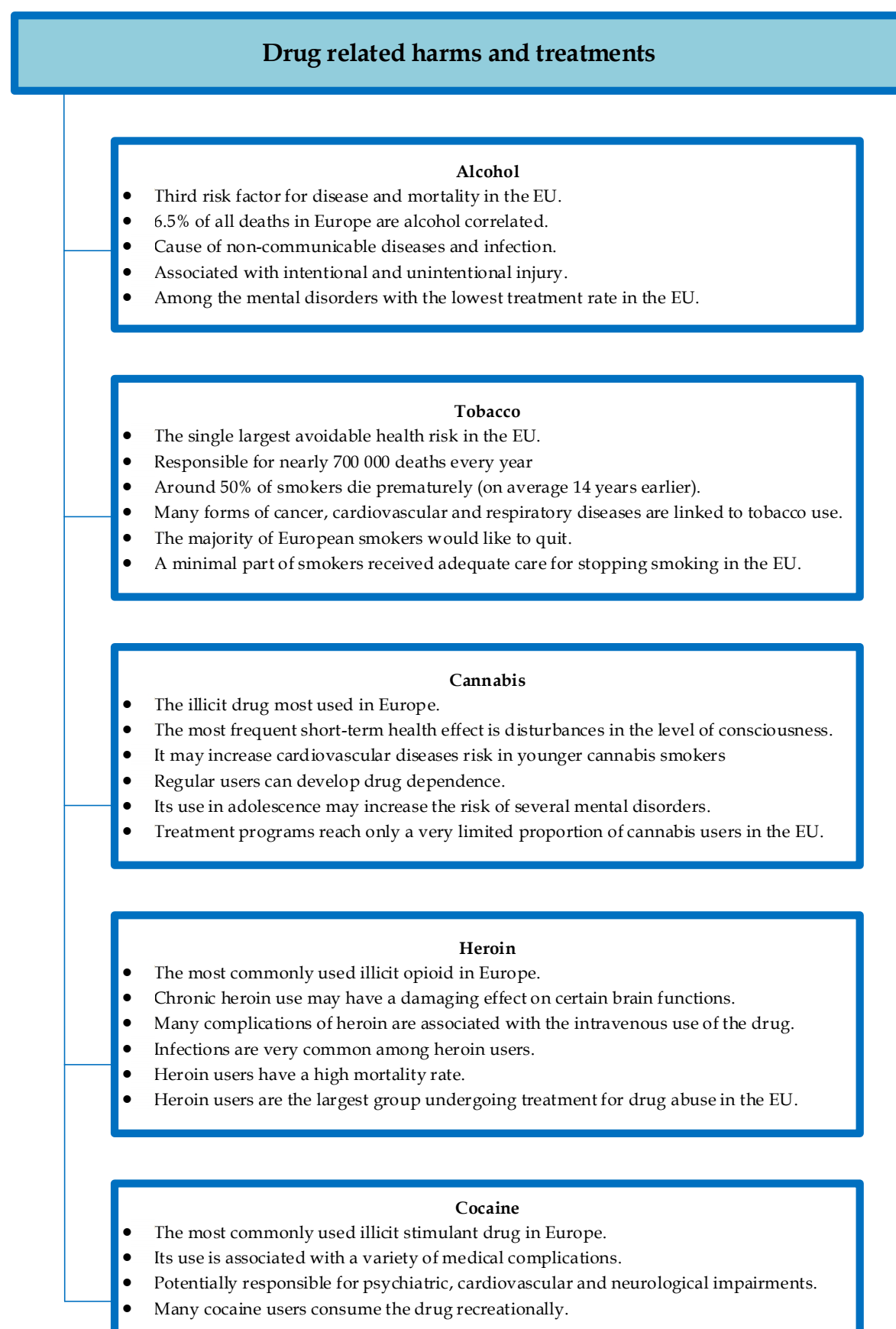
Cannabis is the illicit drug most used in Europe. Overall, the number of first-time treatment entrants for cannabis problems increased from 45 000 in 2006 to 69 000 in 2014. However, existing cannabis treatment programmes reach only a very limited proportion of the population in need of treatment. Recent studies suggest that cannabis may increase cardiovascular disease risk in younger cannabis smokers who are otherwise at relatively low risk. Regular cannabis users can develop drug dependence. There is a consistent dose–response relationship between cannabis use in adolescence and the risk of developing several mental disorders.

Heroin is the most commonly used illicit opioid in Europe. Chronic heroin use may have a direct and damaging effect on certain brain functions; these changes may be associated with impulsive and unhealthy decision making. Many complications associated with heroin abuse are associated with the intravenous use of the drug. Infection is a very common cause for clinical presentation of heroin users.

Heroin users have a high mortality rate: overdose and suicide are two major causes of mortality in heroin users.

Cocaine is the most commonly used illicit stimulant drug in Europe. Many cocaine users consume the drug recreationally. Cocaine use has been associated with a variety of medical complications, which may involve all the major organs or systems. The most common adverse health consequences are psychiatric disorders, cardiovascular medical problems and neurological impairments. Such complications can be associated with acute and chronic cocaine use. Cocaine use is also associated with violence and risk-taking behaviour.

The conclusions of this chapter are summarised in Figure 4.



**Figure 4.** Drug related harms and treatments.

## 4. E-health in Europe: a short overview

ICT in healthcare plays a key role in expanding access to diagnostic services, improving their quality, increasing coordination between providers, improving patient management, and helping to overcome physical distances between patients and healthcare professionals [Zanaboni, 2012]. TBIs for substance use disorders are a component of the application of information and communication technology (ICT) in healthcare. In this section, the key trends of e-Health in Europe and challenges for the deployment of e-Health in the EU are briefly presented. It provides suitable elements for policy makers to understand the difficulties in implementing the TBIs in the field of dependence at the EU level.

### 4.1. Key trends of e-Health in Europe

Many EU Member States have invested substantially in the development of ICT in healthcare. E-Health and m-Health are gaining wider acceptance and are being deployed more and more across the EU [Quaglio, 2016]. They are also becoming increasingly important in the delivery of top-quality care to European citizens, yet e-health and m-health still face barriers. For example, allowing patients access to online medical records was recommended a long time ago, as a key action contained in the Digital Agenda for Europe [EC, 2010]; yet it is still not realised in many EU MS. A report by the World Health Organization from 2016 indicates that 53% of the MS do not have legislation which supports patient access to their own electronic health data [WHO, 2016c].

The first EU e-Health Action Plan was adopted in 2004 [EC, 2004]. Since then, the European Commission (EC) has developed several policy initiatives aimed at fostering the implementation of e-Health throughout the EU [EC, 2007]. The adoption in 2011 of the Directive on the Application of Patients' Rights in Cross-Border Healthcare, establishing the e-Health network, marked a further step towards formal cooperation on e-Health through interoperability and the implementation of e-Health systems [EC, 2008].

The new EC e-Health Action Plan describes the actions which will need to be implemented, regarding e-Health in Europe in the coming years, in order to address and remove well-known existing barriers. It focuses on the interoperability of e-Health services (semantic, legal and organisational) and e-Health deployment and uptake (funding, awareness, evidence, digital health literacy etc.). Finally, it also addresses the need to strengthen international cooperation among EU MS and to increase e-Health research and innovation [EC, 2012].

### 4.2. Challenges for the deployment of e-Health in the EU

Despite the proliferation of ICT in the EU, healthcare systems are still facing fundamental challenges in taking advantage of the full potential of e-Health solutions. Several European research projects have investigated the problems. These problems have been attributed to, amongst others things, the healthcare environment and also to the healthcare providers.

The Impact project was one of the first projects that systematically investigated critical success factors and published recommendations based on their findings. Amongst other things, these included the importance of multi-disciplinary teams in supporting the process of change [Stroetmann, 2006]. Another key study, the EHR Impact study, also recommended that policy-makers create an enabling organisational and a legal framework. It also highlighted that interoperability and engagement are central for the success of e-Health implementation [Dobrev, 2010].

Moen *et al.* identified a number of challenges attributed to e-Health in Europe belonging to four categories: policy, technology, organisation and professionals. According to this study, the most prominent challenges are: i) a missing legal framework and national strategy with sufficient funding; ii) the need to establish a sound e-Health platform (with an effort to harmonise standards, ensure

interoperability, optimise integration of new and existing ICT-solutions etc.); iii) the need to balance the interests between the private and the public sector; and iv) the complexity and variety of clinical practice across Europe [Moen, 2012]. A more comprehensive review carried out by Hoerbst *et al.* concerning the barriers and critical success factors for clinical information systems in integrated care settings, achieved similar results [Hoerbst, 2015].

From the United4Health project, it emerged that the resistance of healthcare providers to the use of e-Health is related to the lack of strong evidence supporting its clinical benefits. The increased time that clinicians spend on documentation due to new systems has been identified as a major barrier. Moreover, even when the clinicians are willing to get involved, they are not sufficiently supported by clear guidelines [United4Health, 2016]. The study suggested that, in order to convince the 'non-believers', a transparent reimbursement model, appropriate training, a clear legal and regulatory framework and carefully redesigned ICT-supported care pathways could be implemented.

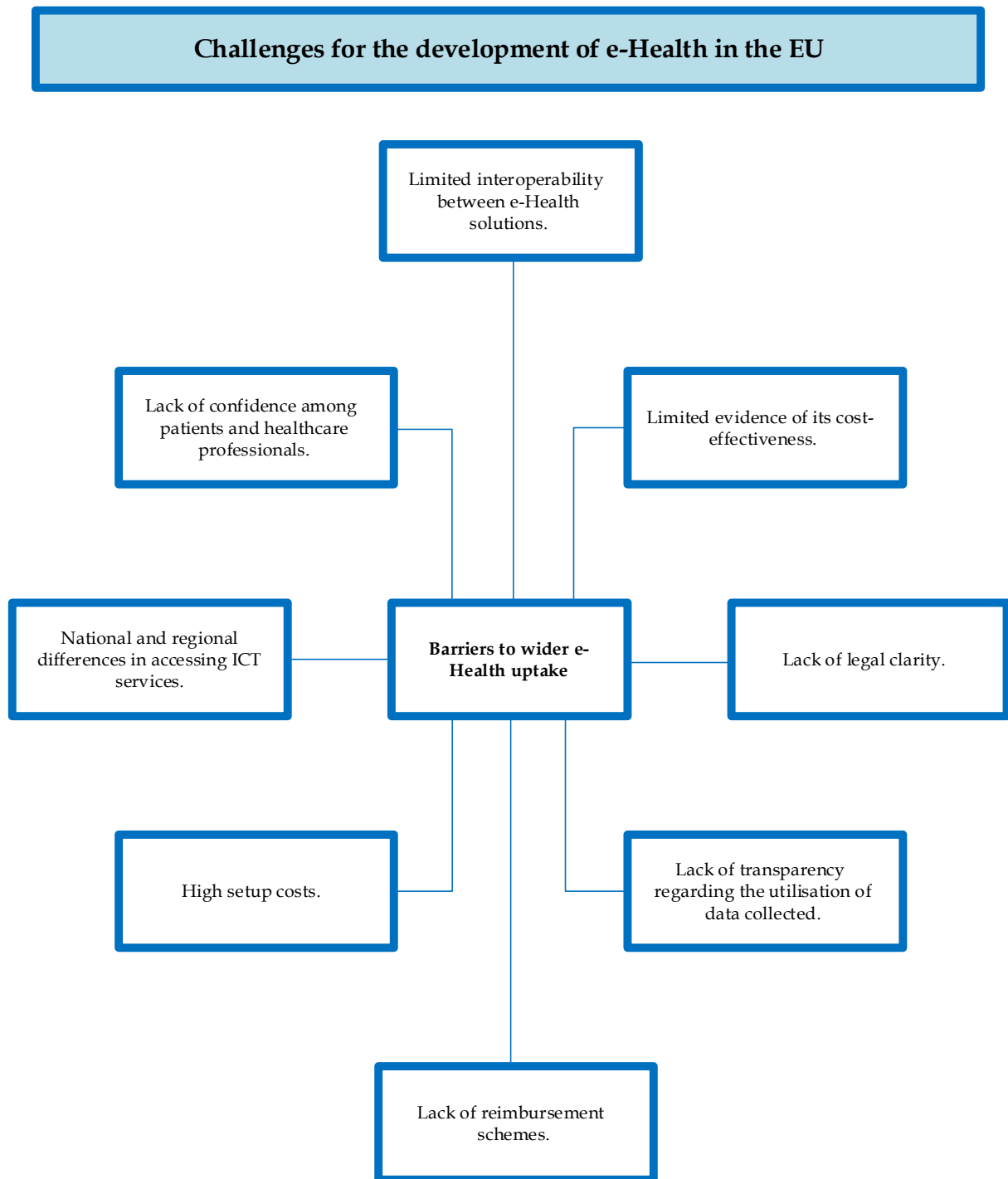
Within the EU, healthcare systems are highly differentiated by funding levels, access to healthcare services and quality of care. As EU MS aspire to improve their healthcare systems, the need for increased healthcare spending and ICT infrastructure/e-Health capacity in less developed countries will continue to pose a challenge. An important objective of the EU is to create a level playing field by extending access and availability of health services to all citizens. Policies to reduce health inequality include promoting cross-border healthcare [EC, 2015a], creating a digital single market [EC, 2015] and empowering patients [European Patient Forum, 2016]. The EU will not be able to afford the cost of illness unless it recruits citizens to be partners in the campaign to prevent disease and disability, to promote good physical and mental health and to manage their own diseases [Quaglio, 2016].

### **4.3. Conclusions**

ICT in healthcare plays a key role in expanding access to diagnostic services, improving their quality, increasing coordination between providers and helping to overcome physical distances between patients and health workers.

At present, several barriers hamper the wider uptake of e-Health solutions in Europe. They are as follows: i) a lack of confidence in e-Health among patients and healthcare professionals; ii) limited interoperability between e-Health solutions; iii) limited evidence of the cost-effectiveness of e-Health tools and services; iv) a lack of legal clarity e.g. for mobile health applications; v) a lack of transparency regarding the utilisation of data collected by such applications; vi) a lack of reimbursement schemes for e-Health services; vii) high costs involved in setting up e-Health systems; and viii) EU national and regional differences in accessing ICT services.

The major barriers hampering the uptake of e-Health solutions in Europe are summarised in Figure 5.



**Figure 5.** Some barriers that impede the uptake of e-Health in Europe.



## 5. Literature review on technology-based interventions

### 5.1. Introduction

In the last two decades, we have witnessed extraordinary growth in the range of computer and mobile technologies available to the general public, both in terms of accessibility and cost. In the EU-28, a majority (55%) of households had internet access in 2007. This proportion continued to increase and in 2014 reached 81% [Eurostat, 2016]. In 2014, 78% of all individuals in the EU-28 aged between 16-74 years had used the internet at least once within the previous three months when surveyed. The proportion of the EU-28's population that had never used the internet was 18% in 2014, down from 30% in 2009. Nearly two thirds (65%) of individuals accessed the internet on a daily basis in 2014 [Eurostat, 2016]. The use of mobile phones to access the internet has increased greatly within the EU-28: 52% of the EU population accessed the internet from a mobile phone in 2015 [Eurostat, 2016a]. Such high rates of technology use among the EU population have provided a strong rationale for the integration of technology into health services delivery and research.

In 2010, the EC adopted a strategy designed to encourage a flourishing digital economy by 2020. This outlines policies and actions aimed at maximising the benefit of the digital era to all sections of society and the economy. The agenda focuses on several priority areas for action, supporting the application of ICT to also address challenges facing society in the health sector [EC, 2010].

A recent report carried out for the EU on e-Health concluded that patients are playing a more active role in managing their health as well as their diseases [EC, 2012a]. A survey on digital health literacy was carried out in 2014 in the 28 EU MS and 26 566 respondents from different social and demographic groups were interviewed [EC, 2014]. The survey assessed the extent to which Europeans already use the internet and online resources to help manage their own health. Sixty percent of respondents had used the internet for searching for health-related information in the last 12 months and over half said they did so at least once a month. This percentage is highest in the 25-34 years age group and then decreases steadily with increasing age. General information on health-related topics, such as sports, diet and exercise, are the topics for which information is most often searched (55%), followed closely by information on specific diseases, injuries or symptoms (54%) [EC, 2014].

The importance of behaviour in many aspects of healthcare is increasingly being recognised [Redding, 2000; Michie, 2004]. In addition, the rapidly escalating cost of healthcare contributes to creating a strong need for innovative interventions to promote health control and disease prevention. European public health systems have difficulties addressing this need because (among other factors) of resource constraints [Quaglio, 2013; McDaid, 2013] and lack of health personnel [EC, 2004a; EP, 2015]. With ageing societies in Europe, the demand for products and services specific to the elderly will increase (e.g. health products and services), while demand for products and services directed at younger people will decline [EC, 2004a; EP, 2015]. These conditions have created the impetus for innovative approaches to health education, promotion, prevention and treatment [Portnoy, 2008].

Given these trends, it is not surprising that there has also been significant recent interest in Europe devoted to the development of behavioural interventions delivered through computer and mobile technologies to people with substance use disorders [EMCDDA, 2009]. Researchers and clinicians in the field of drug addiction have started to exploit the exponential growth of the internet and new technologies, and over the past decade an increasing number of interventions designed to promote changes in substance abuse disorders have been delivered [Webb, 2010; Teesson 2012; McClure 2013; Kiluk, 2013; Marsch, 2014; Wood, 2014].

Computer-based technologies now offer the potential to combine the efficacy of intensive treatments with the advantages of wide-reaching interventions through interactive responses and incorporating some of the features of face-to-face contact [Shahab, 2009]. In addition to drug use disorders, TBIs have



demonstrated positive results for a variety of other behavioural and psychiatric health conditions, such as physical activities [Vandelandotte, 2007], depression [Spek, 2007; van' t Hof, 2009; Vernmark, 2010], panic disorder [Pier, 2008; Klein, 2009; Ruwaard, 2010], anxiety [Christensen, 2010], social anxiety disorder [Titov, 2008 Cuijpers, 2009], posttraumatic stress disorder [Lange, 2010], eating disorders [Ljotsson, 2007, Little, 2016], insomnia [Ritterband, 2009], diabetes management [Blonde, 2006, Sarkar, 2008], HIV risk reduction [Holt, 2012, Blas 2013], and cancer support and counselling [Hesse, 2016; Kanera, 2016], among others.

In Europe, the demand for substance use disorder treatment in publicly funded systems far exceeds the available capacity [Kohn, 2004; EMCDDA, 2016]. As a result of this gap between treatment demand and capacity to provide support, a number of patients cannot receive the needed treatment. In substance abuse disorders, it is often crucial to be able to provide tailored support [Uchtenhagen, 2014]. Tailored health interventions have been shown to be effective in engaging individuals and improving their healthy behaviour, and new technologies appear to be able to provide tailored interventions to people with substance use disorders [Rimer, 2006]. Moreover, the motivation of users in need of substance use treatment often fluctuates, resulting in a lack of initiation of treatment and a high level of dropouts if the health system is not able to provide the right treatment at the right time [Prochaska 1992; Prochaska 1994; VanDeMark, 2010; Tober, 2014].

TBIs can reach certain populations not reached by traditional treatment facilities [Postel, 2005; Lieberman, 2008]. They can be particularly useful in reaching people living in remote settings, where access to treatment may be limited and accompanied by stigma [Schopp, 2006; Baca, 2007; Young, 2012], or for those with physical limitations [Portnoy, 2008]. They can also provide automated information with a high degree of standardisation, which could permit the examination of different clinical aspects, the facilitation of data collection in research [Moore, 2011; Litvin, 2013], and the inclusion of users previously excluded from research [Danaher, 2007].

## 5.2. Internet-based clinical work: criticisms and concerns

Online therapy has removed three basic elements of therapeutic interaction, namely a visible face-to-face contact, a talking contact and a synchronous interaction [Fenichel, 2002]. At the beginning of the ICT wave, concerns have been directed at the changes of the therapeutic environment resulting from the non-traditional medium of service. Many opponents claim that online therapy eliminates the nonverbal signals exchanged by therapist and patient, thus removing an important component of face-to-face interactions. The utilisation of TBIs with people with severe psychiatric disorders was considered to be unsuitable and inappropriate. Another common misconception was that new technologies (for example chat) were superficial tools in the therapeutic field [Jerome, 2000; Robson, 2000; Baur, 2000; Manhal-Baugus, 2001; Griffiths, 2001; Fenichel, 2002]. However, its increasing use showed that hostility was principally based on preconception rather than evidence.

Online clinicians often use creative approaches, mixing text, sound, and visuals (matching messaging, chat, video, phone calls and face-to-face meetings). They can also utilise virtual environments with the patient, in which patient and clinician create visual representations of themselves (avatars). For some users, particularly young ones, combining different and multiple modalities of interactions can give a therapeutic added value. In addition, a number of individuals are more uninhibited and expressive in writing than in face-to-face interactions. The internet, with a sort of disinhibition effect, can facilitate treatment [Suler, 2004].

Although further investigation is warranted to establish effectiveness and cost benefit in this population, there is growing evidence that online treatment for psychiatric conditions and drug use disorders are available and working [Titov, 2008; Ruwaard, 2010; Lange, 2010; Naslund, 2015]. With appropriate protections, such as assuring the patient's commitment to seeking local medication evaluation in case of acute situation, the online therapy can be useful also with subjects with severe

psychiatric conditions [Kasckow, 2013; Alvarez-Jimenez, 2014; van der Krieke, 2014; Naslund, 2015], and have the potential to improve clinical and social outcome [Alvarez-Jimenez, 2014; Blankers, 2016].

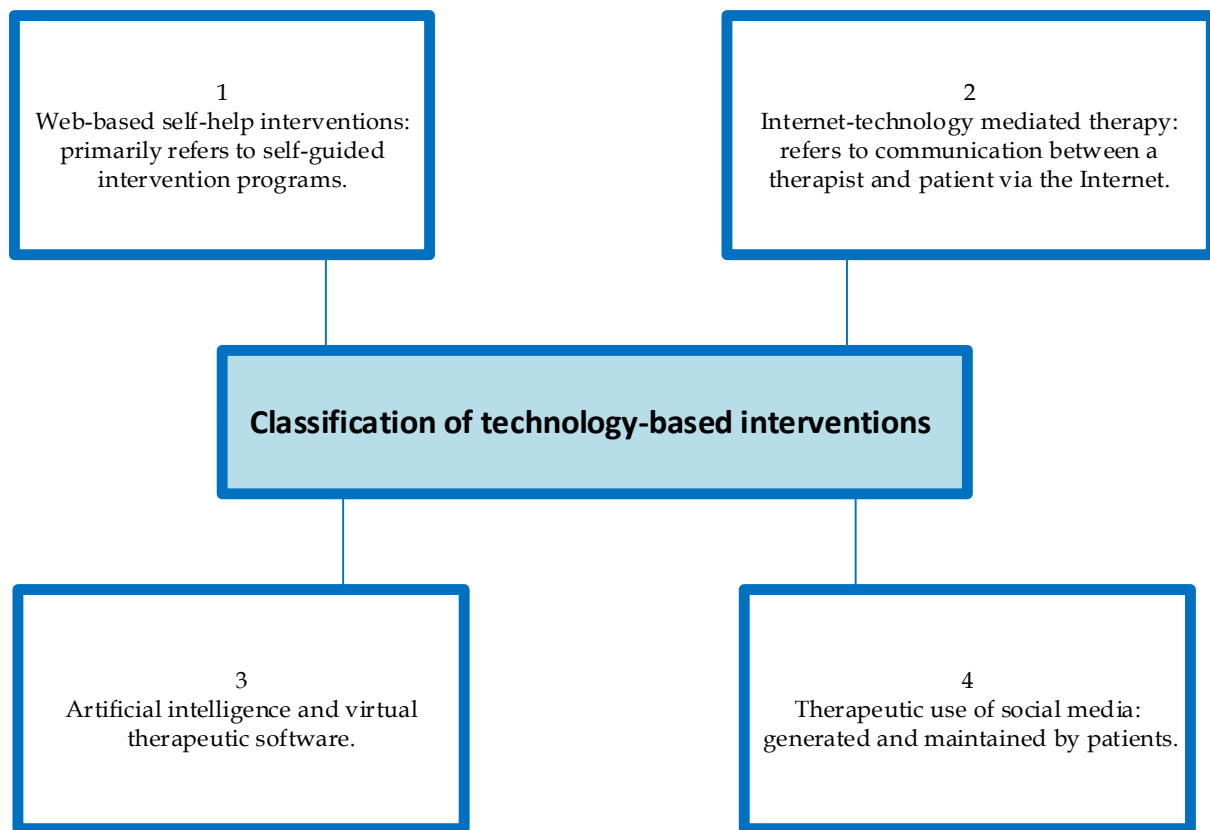
Therapeutic chat is a text-based, synchronous therapeutic encounter facilitated by a therapist who supports the subject to move toward a specific treatment goal (increasing motivation for behaviour change, handling cravings, developing coping strategies, improving relapse prevention approaches etc.). Usually the clinician is at the centre of the therapeutic process, helping subjects to navigate through a number of different therapeutic activities. Therapeutic chat is effective in drug abuse treatment [Barratt, 2012].

It has been observed that a clinician skilled in treating subjects with substance use disorders and with good knowledge of online technologies will not necessarily make an expert online therapist [Fisher, 2003; Lovejoy, 2009]. Although training courses on online counselling on drug abuse treatment have started to appear, few standards exist that elucidate the technical skills required to practice online therapy with this typology of subjects. Contrary to what is generally thought, especially for those who use the internet in a non-professional way, internet/technology-mediated therapy in drug abuse treatment (such as in other health behaviour treatments) is not an easy task. For example, in case of email communications between patient and therapist, written words are the only therapeutic tools and must be chosen with caution, avoiding hostility and a quarrelsome approach with the patient [Fenichel, 2002].

### **5.3. Classification of technology-based interventions for substance use disorders**

All TBIs for substance use disorders are based on a set of psychosocial interventions, geared towards changing participants' drug-use behaviour. These interventions, to varying degrees, focus on increasing participants' insight into their drug use, increasing their motivation for behaviour change, their ability to handle cravings, developing coping strategies, improving relapse prevention approaches, and improving control over behaviour [Goudriaan, 2011; EMCDDA, 2014]. Recent neurobiological theories comprise dysfunctions in cognitive and motivational neural circuitry as central components in substance dependence [Goldstein, 2002]. The cognitive functions related to this circuitry are distorted evaluation and appraisal of positive and negative consequences; these functions seems to play a role in decision making and diminished control over behaviour (diminished response inhibition) [Krawczyk, 2002; Goudriaan, 2011].

The classification of TBIs for substance use disorders used in this study (and in the survey presented in chapter 6) refers to that proposed by Barak *et al.* [Barak, 2009], which divided these interventions into four categories: i) web-based interventions, ii) online counselling and therapy, iii) artificial intelligence and virtual reality therapeutic software, and iv) other online activities. The field of TBIs for substance use is evolving quickly. For example, smartphone-based technology for substance use disorders are not contemplated in this classification. The authors of this taxonomy recognise that their classification has more a practical than a theoretical value. In addition, each category often includes aspects of other categories [Barak, 2009; Litvin, 2013]. This classification is schematised in Figure 6. The first two categories are more developed and have received more research attention than the other one.



**Figure 6.** Classification of technology-based interventions for substance use disorders (based on the classification of Barak, 2009).

1) Web-based self-help interventions primarily consist of self-guided intervention programmes that are executed by means of a prescriptive online programme through a website and used by clients. This definition includes three web-based intervention subtypes: i) web-based information and education interventions; ii) self-guided web-based therapeutic interventions; and iii) human-supported web-based therapeutic interventions.

Web-based education interventions are programmes designed to enable people to access information about a particular problem area (e.g. the meaning of specific symptoms, and diagnosis of a disorder/condition and its causes, effects, and how to treat it) [Barak, 2009]. They provide easily understandable pieces of information on a range of addiction disorders, self-help checklists and links to other helpful websites. These types of intervention do not have therapeutic objectives; however, some web-based education interventions contain some elements and information related to therapy [Griffiths, 2005]. On the contrary, self-guided and human-supported web-based therapeutic interventions are intended to create behavioural change. In the human-supported web-based therapeutic interventions, human support can be highly variable, limited in time (e.g. answering generic questions and providing reminders) or more substantial (e.g. providing ad-hoc therapeutic feedback) [Barak, 2009].

2) Internet/technology-mediated therapy (online counselling and therapy) is synchronous (i.e. real time) or asynchronous (i.e. not in real time, such as email) communication (text, audio or video-based) of process-oriented guidance from a non-therapist, or therapy-oriented guidance from a therapist via the internet. The use of the internet for therapeutic purposes is no different from any other online

interpersonal interaction, using email, chat, messages etc. With these methods, the traditional face-to-face therapist-patient appointment has become less relevant, and writing has become an important instrument of communication [Barak, 2009].

3) Artificial intelligence and virtual therapeutic software encompasses a variety of technologies such as artificial intelligence (e.g. robot simulation of therapists) and virtual reality environments [Bordnick, 2004; Squires, 2004; Saladin, 2006; Woodruff, 2007]. Virtual worlds are environments facilitated by computers that provide a “virtual” space where people interact and are represented by avatars [Molfenter, 2015]. Avatars are graphic representations of users that they build with tools supplied by the virtual environment. Users interact with others avatars within the virtual space; into this environment, different individuals or group services are accessible [Molfenter, 2015]. Although their efficacy is promising, the diffusion of these approaches is limited by the lack of technical expertise among health personnel and high costs of the technology [Barak, 2009].

4) Therapeutic use of social media (e.g. blogs, Twitter, email list correspondence, online support groups and networks) are generated and maintained by users rather than clinicians, but include services that are moderated by a health worker. Despite the fact that there is evidence of therapeutic benefits of expressing writing around emotional experiences [Gortner, 2006], research into the use and evaluation of blogging, online support groups and networks in health care is in its infancy [Minian, 2016]. These approaches seem to have potential health benefits, especially as adjuncts to other treatments (e.g. psychological treatment), as they encourage users to engage in knowledge-sharing and reflection [Nagel 2009; Graham, 2009].

#### **5.4. Smartphone technologies: new opportunities for treatment**

In the internet, there are a wide range of health tools on drug use support: informational and educational websites, assessment and psychotherapeutic software, comprehensive self-help programmes, social network therapeutic communities etc. The applications of these tools to smartphones and other mobile technologies (the so called m-Health) for treatment and research on drug use, has generated interest, curiosity, and expectations, but also concerns relating to the ethical aspects of their use [Mosa, 2012; Kuntsche, 2014; Meurk, 2014; Carrà, 2015; Capon, 2016; Carrà, 2016].

Remote monitoring devices are being developed to continuously monitor physiological responses or precursors to cravings or relapses in persons being treated for addiction [Boyer, 2010; Yu, 2012]. Physiological information (blood pressure, heart rate, substance concentration levels in blood etc.) can be measured using special sensors. Data collected by smartphones can be utilised by health personnel for elaborate messages and suggestion, helping the patient to control his/her cravings [Luxton, 2011; Tamony, 2015; Suffoletto, 2015; Whittaker, 2016].

Smartphone applications can prompt and record a patient's emotional, social, biological and behavioural states and activities in real time as they occur: this is commonly referred to as Ecological Momentary Assessment (EMA) [Shiffman, 2008; Shiffman, 2009; Serre, 2015]. The EMA approach offers the potential for examining the individual's exposure to the environment in a way not possible, or even imaginable, only few years ago. Smartphone technologies may passively record patterns of movement within the environment, e.g. via global positioning systems (GPS), which support the collection of location data in real time, and geographic information systems (GIS), which can be considered a type of spatial database software for acquiring location-based data [Epstein, 2009; Epstein 2010; Preston, 2011; Luxton, 2011; Stahler, 2013]. What is distinctive is the possibility to gather spatial and temporal information, i.e. where and when the behaviours of the subjects occur [Marsch, 2012; Gustafson, 2014].

The environmental impact on drug use and drug addiction has been termed the 'exposome' of addiction [Stahler, 2013]. The term has already been used in other areas of medical research, such as in cancer to refer to the environmental exposures throughout life as a way of understanding the environmental

influence of tumour diseases [Wild, 2013]. Thanks to the new technologies, a similar approach can be applied to drug addiction prevention and treatment.

## 5.5. Literature search methodology

The objective here is to provide a critical review [Grant, 2009] of the major reviews that have been published in recent years (2010-2016), particularly keeping in mind the potential policy implications and perspectives for the decision-making process. PubMed and Medline were searched for reviews of substance use-related TBIs using a combination of the following terms: electronic, computer, web, online, internet, virtual reality, e-health, m-health or mobile AND substance, drug, treatment, recovery management, smoke, nicotine, tobacco, alcohol, opioid, opiate, cannabis or cocaine AND review or meta-analysis. The reference sections of identified articles were also searched for additional reviews. An extensive web-based search was also carried out using Google and Google Scholar. The websites of other agencies and organisations working in the fields of public health and drug addiction (particularly the EMCDDA and WHO) were also consulted.

In the present study, we do not provide a meta-analysis or systematic review of TBIs for substance use disorders outcomes, because numerous such reviews have recently been published and are continuing to be published. In addition, a number of authors decided not to conduct a meta-analysis of TBIs studies. This is due to the degree of heterogeneity of interventions applied, and the variation in comparison groups, outcome measures and reporting time periods, which could make the meta-analytic approach inappropriate [Civljak, 2010; Hutton, 2011; Riley, 2011]. Because the field is evolving quickly, we have chosen not to limit our literature search procedure to a particular treatment approach or treatment of a specific drug. Each selected study is presented here in chronological order, providing general information (title, authors etc.) and the methods applied, results obtained, conclusions and perspectives.

<b>Title</b>	<b>Can stand-alone computer-based interventions reduce alcohol consumption? A systematic review.</b>
<b>Authors</b>	Zarnie Khadjesari, Elizabeth Murray, Catherine Hewitt, Suzanne Hartley, Christine Godfrey
<b>Journal</b>	Addiction
<b>Year of publication</b>	2010
<b>Objectives</b>	To determine the effects of computer-based interventions aimed at reducing alcohol consumption in adult populations.
<b>Methods</b>	<p>The review was undertaken following standard Cochrane and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidance for systematic reviews. The review included studies with the following characteristics:</p> <ol style="list-style-type: none"> <li>1) Randomised controlled trials.</li> <li>2) All-adult populations (aged 18 years and over) with any level of alcohol consumption.</li> <li>3) Application of computer-based interventions considered behavioural interventions which aimed at bringing about positive behavioural change (adapted for a computer-based format).</li> <li>4) Application of stand-alone (non-guided) computer-based interventions.</li> </ol> <p>Eligible studies compared computer-based interventions with either a minimally active (e.g. assessment-only, usual care, or generic non-tailored information) or an active comparator group (e.g. brief intervention). This review included studies that measured a change in alcohol consumption. A reduction in alcohol consumption was considered a positive behavioural change. The literature was searched with no restrictions on language.</p>
<b>Results</b>	24 studies were included in the review (19 combined in meta-analyses). Computer-based interventions were more effective than minimally active comparator groups at reducing alcohol consumed per week (in both student and non-student adult populations) and binge frequency (in student populations). A small number of studies found no difference between the amount of alcohol consumed per week in those receiving the intervention or an active comparator. However, most studies reported skewed data. A sensitivity analysis of those studies that presented suitable measures of central tendency for the distribution of the data found that in student populations, there was no difference between intervention and minimally active comparator groups in alcohol consumed per week. These findings should therefore be interpreted with caution.
<b>Major limitations</b>	<ol style="list-style-type: none"> <li>1) This review investigated the effectiveness of computer-based interventions with two specific measures of alcohol consumption: total consumption and binge frequency. It is possible that the selection of another consumption measure may have resulted in different findings.</li> <li>2) The studies included presented small sample sizes, short-term follow-up, insufficient information to judge potential sources of bias, and few comparisons with active comparator groups.</li> </ol>
<b>Conclusions and perspectives</b>	Computer-based interventions may reduce alcohol consumption. However, the conclusion remains tentative because of methodological weaknesses in many of the studies included in the review. The current literature was also limited by small sample size. Nevertheless, the volume of research in this field is encouraging and the potential benefit of technology-based interventions for reducing alcohol consumption needs to be further explored.



<b>Title</b>	<b>Internet-based interventions for young people with problematic substance use: a systematic review.</b>
<b>Authors</b>	Robert J Tait, Helen Christensen
<b>Journal</b>	Medical Journal of Australia
<b>Year of publication</b>	2010
<b>Objectives</b>	To conduct a systematic review of randomised trials of web-based interventions for problematic substance use by adolescents and young adults.
<b>Methods</b>	Extensive search conducted in Medline, PsycINFO and Current Contents databases. The inclusion criterion was that studies had to use a randomised design to compare a web-based intervention with at least a no-treatment control. The eligible age groups were adolescents or young adults (i.e. specifically targeting tertiary students or other people aged 25 or less). Outcomes had to include a measure of consumption of the target substance, not just change in attitude.
<b>Results</b>	<p>Sixteen relevant studies were identified. The alcohol interventions had a small effect overall and for specific outcomes (level of alcohol consumption, binge or heavy drinking frequency, and alcohol-related social problems). The interventions were not effective in preventing subsequent development of alcohol-related problems among people who were initially non-drinkers.</p> <p>There is currently insufficient data to assess the utility of web-based interventions addressing smoking cessation in adolescents.</p>
<b>Major limitations</b>	<p>Limitations are related to the quality of the studies included:</p> <ol style="list-style-type: none"> <li>1) short-term outcomes (3 months or less);</li> <li>2) heterogeneity of the study samples (ranging from non-drinkers students at baseline to students who had been referred to counselling after alcohol abuse);</li> <li>3) although all the studies used randomised designs, there was considerable diversity in the intensity of the interventions delivered, ranging from an online course to a 15-minute assessment and feedback session; and</li> <li>4) not all studies provided a control group with an intervention of similar intensity as the experimental intervention.</li> </ol>
<b>Conclusions and perspectives</b>	<p>Adolescence and young adulthood are the key periods for initiation of substance use and the development of substance use disorders. The age of initiation has fallen in more recent birth cohorts, with a concomitant increase in the risk of developing disorders in later life. Therefore, there is a need to design and deliver interventions that address substance use by adolescents and young adults. Web-based interventions have the potential to provide interventions at the population level, with initial findings supporting their effectiveness in reducing problematic alcohol use in tertiary students and young adults.</p> <p>Web-based interventions targeting alcohol-related problems in young adults appear to have some effect for alcohol problems in current drinkers. Web-based interventions to prevent the development of alcohol-related problems in those who do not currently drink appear to have minimal impact. There is currently insufficient data to assess the effectiveness of web-based interventions for tobacco use by adolescents.</p>

<b>Title</b>	<b>A review of computer-based alcohol problem services designed for the general public.</b>
<b>Authors</b>	Michael L. Vernon
<b>Journal</b>	Journal of Substance Abuse Treatment
<b>Year of publication</b>	2010
<b>Objectives</b>	This review summarises the literature on computer-based drinking assessments and intervention programmes evaluated using members of the general public. The primary aim was to summarise the demand, usage, and effectiveness of these services. The study presents the behaviour of more than 41 000 internet service users.
<b>Methods</b>	A systematic search of the literature was carried out by querying literature search engines (PubMed, Science Direct, PsycInfo, Web of Science, and Google Scholar).
<b>Results</b>	A systematic search of the literature identified seven online drinking assessments and eight computerised interventions that were evaluated using members of the general public. Internet assessment users tend to be in their early 30s, are more often male, tend to be at risk of developing or are experiencing alcohol related problems, more fully explore assessment sites, and are more likely to enrol in interventions linked to these sites when their drinking problem is more severe.
<b>Major limitations</b>	<p>1) It was impossible to comment on the cost-effectiveness of the reviewed services because this information was lacking in the reviewed studies.</p> <p>2) None of the reviewed studies attempted to statistically control for the effects that additional help may have had on the intervention outcome. Confounds of this type very seriously threaten the validity of observed intervention effects when they are not controlled for.</p> <p>3) The number of studies reviewed was small and user characteristics varied considerably across these studies. Therefore, the conclusions should be interpreted with caution.</p>
<b>Conclusions and perspectives</b>	<p>The motivational readiness needed to quit drinking is often a temporary state, frequently resulting from a negative consequence or drinking-related change in lifestyle. Therefore, assessments, self-help materials and interventions should be readily available. Internet-based services answer this call by providing assistance that is typically free and available full time.</p> <p>The findings indicate that there is a demand for online assessment and intervention services among the general public. The users of these services are indeed consuming amounts that put them at risk of experiencing alcohol-related problems, and those with greater problems are also the ones who utilise these services most thoroughly. Although it continues to remain unclear what the most effective computer-based intervention is, it is encouraging to see that all the reviewed interventions were successful at reducing alcohol consumption regardless of how it was measured.</p> <p>A greater standardisation of intervention and assessment-related materials and information would further enhance researchers' ability to study and understand the differences in effectiveness that exist between intervention components.</p>



<b>Title</b>	<b>Online alcohol interventions: a systematic review.</b>
<b>Authors</b>	Angela White, David Kavanagh, Helen Stallman, Britt Klein, Frances Kay-Lambkin, Judy Proudfoot, Judy Drennan, Jason Connor, Amanda Baker, Emily Hines, Ross Young
<b>Journal</b>	Journal of Medical Internet Research
<b>Year of publication</b>	2010
<b>Objectives</b>	To review the efficacy of online interventions for alcohol misuse.
<b>Methods</b>	<p>Systematic searches of Medline, PsycINFO, Web of Science and Scopus databases were conducted.</p> <p>Articles were included if:</p> <ol style="list-style-type: none"> <li>1) the primary intervention was delivered and accessed via the internet;</li> <li>2) the intervention focused on moderating or stopping alcohol consumption; and</li> <li>3) the study was a randomised controlled trial</li> </ol>
<b>Results</b>	The literature search initially yielded 31 randomised controlled trials, 17 of which met inclusion criteria. Of these 17 studies, 12 were conducted with university students, and 11 specifically focused on at-risk, heavy, or binge drinkers. Studies predominantly involved brief personalised feedback interventions. Effect sizes could be extracted from 8 of the 17 studies. In relation to alcohol units per week or month, the median differential effect size to post treatment was 0.54. The median pre-post effect size for brief personalised feedback interventions was 0.3.
<b>Major limitations</b>	<p>Limitations are related to the quality of the studies included:</p> <ol style="list-style-type: none"> <li>1) short-term outcomes;</li> <li>2) heterogeneity of the study samples; and</li> <li>3) although all the studies used randomised designs, there was significant diversity in the intensity of the interventions delivered.</li> </ol>
<b>Conclusions and perspectives</b>	<p>Users can benefit from online alcohol interventions; this approach could be particularly useful for groups less likely to access traditional alcohol-related services, such as young people. However, more studies in community samples are required to better understand the efficacy of specific online alcohol approaches, types of programme, the additional effect of telephone or face-to-face interventions, and effective strategies for their dissemination and marketing.</p> <p>In addition, future research should incorporate economic analysis of online interventions. Internet-based interventions are likely to have greater reach if they are implemented in parallel with marketing campaigns or are embedded in routine primary care activities.</p>

<b>Title</b>	<b>Computer-based interventions for drug use disorders: A systematic review.</b>
<b>Authors</b>	Brent A. Moore, Tera Fazzino, Brian Garnet, Christopher J. Cutter, Declan T. Barry
<b>Journal</b>	Journal of Substance Abuse Treatment
<b>Year of publication</b>	2011
<b>Objectives</b>	The aim of the study was to conduct a systematic review of computer-based interventions for illicit drug use disorders.
<b>Methods</b>	<p>Electronic searches were conducted using Medline, Psychlit, and Embase databases.</p> <p>Studies were included if they:</p> <ol style="list-style-type: none"> <li>1) involved a computer-based intervention; and</li> <li>2) enrolled users with a substance-related disorder that was not alcohol or tobacco.</li> </ol> <p>Computer-based interventions were defined as those in which the primary treatment was provided by an automated, computer-based system rather than e-treatment in which a computer is used as the method of providing therapist-based treatment (e.g. video or audio conferencing or email contact).</p>
<b>Results</b>	<p>11 studies were pilot or full-scale trials compared to a control condition. Interventions showed high acceptability despite substantial variation in type and amount of treatment.</p> <p>Studies evaluated showed improved self-reported and urinalysis outcomes for computer-based interventions compared to control conditions.</p> <p>In addition, computer-based interventions were associated with high levels of client satisfaction, and participants exhibited similar levels of engagement and retention as those in therapist-provided treatments.</p>
<b>Major limitations</b>	<ol style="list-style-type: none"> <li>1) Most studies were primarily prototype testing, with heterogeneity of samples, methods and intervention types.</li> <li>2) Although a few randomised controlled trials with drug use outcomes and relevant controls have been published, these are still small-scale efficacy trials.</li> <li>3) Studies comparing content delivered via computer versus therapist are still inadequately powered to detect what may be clinically meaningful differences or to clearly establish that treatments are comparable.</li> </ol>
<b>Conclusions and perspectives</b>	<p>Despite these limitations, the positive findings call for larger efficacy trials. In designing these larger scale efficacy trials, standardisation is needed for outcome measures and control conditions. Such standardisation would facilitate comparison across efficacy trials.</p> <p>Research into computer-based treatments for drug use disorders is still clearly in its infancy, when publication bias may be stronger. Although a few randomised controlled trials with drug use outcomes and relevant controls have been published, these are still small-scale efficacy trials.</p> <p>Computer-based interventions for drug use disorders have the potential to increase the landscape of treatment for illicit drug use disorders. By expanding treatment options and availability, such systems may make treatment more attractive for the large percentage of abusing and dependent individuals who do not seek treatment.</p>

<b>Title</b>	<b>A systematic review of randomised controlled trials: web-based interventions for smoking cessation among adolescents, college students, and adults.</b>
<b>Authors</b>	Heidi E. Hutton, Lisa M. Wilson, Benjamin J. Apelberg, Erika Avila Tang, Olaide Odelola, Eric B. Bass, Geetanjali Chander
<b>Journal</b>	Nicotine & Tobacco Research
<b>Year of publication</b>	2011
<b>Objectives</b>	A systematic review of randomised controlled trials to evaluate the efficacy of web-based interventions in adults, college students, and adolescents was performed.
<b>Methods</b>	Medline, Embase, The Cochrane Library, Cinahl, and PsycInfo were searched for randomised controlled trials examining the efficacy of web-based smoking cessation programmes.
<b>Results</b>	<p>21 randomised controlled trials met eligibility criteria, with 15 conducted among adults.</p> <p>Among adults, two randomised controlled trials found that a multi-component intervention with web- and non-web-based elements was more efficacious than a self-help manual, and one of two randomised controlled trials found that web-based interventions may be more effective than no treatment. Three trials provided insufficient evidence to demonstrate whether web-based interventions were more efficacious than counselling. By contrast, tailored websites in two randomised controlled trials and greater website exposure in six of seven randomised controlled trials were associated with higher rates of abstinence.</p> <p>Among college students, evidence supporting the use of web-based interventions was insufficient because the one randomised controlled trial conducted was also a multicomponent intervention. Five randomised controlled trials among adolescents demonstrated mixed results, with insufficient evidence supporting their efficacy.</p>
<b>Major limitations</b>	<p>1) It is not clear what specific web-based treatments work. Only about half of the adult trials cited a particular theory used.</p> <p>2) Across all trials, behaviour change methods varied widely.</p> <p>3) Many adult studies combined web-based treatments with other treatments or other modes of delivering the intervention, thus confounding evaluation of the website's efficacy.</p> <p>4) A major limitation was the high loss to follow-up observed across all trials.</p>
<b>Conclusions and perspectives</b>	Web-based interventions can potentially provide a low-cost treatment for smoking cessation, which can be standardised and tailored as needed. However, at present, evidence supporting the use of web-based interventions for smoking cessation is insufficient to moderate in adults and insufficient in college students and adolescents. The randomised controlled trials collected in this review have, however, elucidated clinical, methodological, and statistical practices that are likely to improve future trial design and treatment delivery.

<b>Title</b>	<b>A systematic review of internet-based therapy for the treatment of addictions.</b>
<b>Authors</b>	Sally Gainsbury, Alex Blaszczynski
<b>Journal</b>	Clinical Psychology Review
<b>Year of publication</b>	2011
<b>Objectives</b>	The review attempts to summarise and evaluate the evidence of the effectiveness of internet therapy for addictions.
<b>Methods</b>	<p>A database search of Medline, PsychINFO, Web of Science, Scopus, PubMed, and Google Scholar was conducted. Studies were included if they met the following criteria:</p> <ol style="list-style-type: none"> <li>1) clients received a therapeutic intervention for a substance- or non-substance-related addiction including alcohol and gambling;</li> <li>2) the study included at least five subjects;</li> <li>3) the therapeutic intervention was delivered over the internet;</li> <li>4) the intervention involved at least minimal therapist contact over the course of the treatment programme (including telephone and face-to-face support); and</li> <li>5) the effectiveness of treatment was based on at least one assessed outcome.</li> </ol>
<b>Results</b>	Nine studies met criteria for inclusion with seven representing a randomised controlled trial. These included seven studies reporting on tobacco-cessation programmes, one on pathological gambling, and one treatment programme for substance abuse. Positive treatment effects were reported following completion of therapy and at longer-term follow-up.
<b>Major limitations</b>	<ol style="list-style-type: none"> <li>1) Only a small number of papers have been included.</li> <li>2) There was a lack of comparability across studies due to the wide range of outcomes measured and methodological differences.</li> <li>3) It was not possible to determine the effectiveness of various treatment components as internet-based therapies were evaluated as a whole. Therefore, it is difficult to determine whether the treatment effects were unique to the population studied, or whether they could be generalised to other forms of addiction.</li> </ol>
<b>Conclusions and perspectives</b>	<p>Internet-based therapies for addictions appear to be effective in achieving positive behavioural changes. However, more research is required to determine the comparative effectiveness of various internet-based therapies and evaluate the process variables that may mediate behavioural change. Important implication for future research that emerged from the study are:</p> <ol style="list-style-type: none"> <li>i) there is a need to conduct more intervention studies;</li> <li>ii) there is a need to improve the methodological quality of studies undertaken, by selecting rigorous study designs and dealing carefully with issues pertaining to recruitment of appropriate and sufficiently large samples, randomisation, and participant retention;</li> <li>iii) there is a need to use direct behavioural measures as opposed to non-validated self-report ratings to evaluate outcomes;</li> <li>iv) there is a need for collecting baseline data to assess the actual treatment impact and additional treatment-seeking behaviour in addition to the use of internet therapy to control for outside therapeutic assistance;</li> <li>v) it is important for standardised measures to be used to avoid inconsistency in definitions of treatment success and enable treatments to be compared in terms of outcomes.</li> </ol>

<b>Title</b>	<b>Effectiveness of E-self-help interventions for curbing adult problem drinking: a meta-analysis</b>
<b>Authors</b>	Heleen Riper, Viola Spek, Brigitte Boon, Barbara Conijn, Jeannet Kramer, Katherina Martin-Abello, Filip Smit
<b>Journal</b>	Journal of Medical Internet Research
<b>Year of publication</b>	2011
<b>Objectives</b>	To assess the overall effectiveness of e-self-help interventions without professional guidance, to curb adult problem drinking in the community, compared with control groups that receive no interventions.
<b>Methods</b>	<p>Medline, PsycInfo, Science Citation Index Expanded, Social Sciences Citation Index, Arts and Humanities Citation Index (1997 to present), Cinahl, Embase, the Cochrane Drug and Alcohol Group Specialized Register, the Cochrane Effective Practice and Organization of Care Group register, the Alcohol and Alcohol Problems Science Database, and ETOH databases were searched.</p> <p>The review included:</p> <ol style="list-style-type: none"> <li>1) only studies that examined e-self-help interventions for adult problem drinkers (aged 18 or older); and</li> <li>2) only randomised controlled trials that i) compared e-self-help intervention groups with control groups, and ii) assessed alcohol-drinking behaviour (e.g. frequency or quantity) as their primary outcome measure.</li> </ol>
<b>Results</b>	<p>Nine randomised controlled trials (for a total of 1553 participants), were identified. An overall medium effect size (<math>g = 0.44</math>) was found for the nine studies, all of which compared no-contact interventions to control conditions.</p> <p>A significant difference emerged between single-session, personalised, normative feedback interventions and more extended e-self-help, suggesting that the latter may be more effective.</p>
<b>Major limitations</b>	<ol style="list-style-type: none"> <li>1) The analysis is based by a limited number of studies, such that the results can be generalised only to self-referred adult problem drinkers.</li> <li>2) Some included studies had small samples.</li> <li>3) The loss of follow-up in some of the reviewed studies was substantial. The high attrition rate may have biased the overall results.</li> </ol>
<b>Conclusions and perspectives</b>	<p>e-Health interventions are subject to some constraints, as participants need computer and internet access and a reasonable degree of literacy. While the costs of disseminating and scaling up no-contact e-Health interventions are low, the costs of developing them can be substantial. From an economic point of view, no-contact e-self-help interventions could carry considerable promise as compared to other approaches like screening and brief face-to-face interventions in primary care, especially since the latter have relatively high implementation costs. Studies that rigorously assess this proposition are missing; however, economic evaluation studies on e-self-help for depression show favourable results in primary care and in the community.</p> <p>E-self-help interventions without professional contact appear to be effective in curbing adult problem drinking in high-income countries. The findings also highlight the need for more evaluations of the clinical outcomes and the cost-effectiveness of online screening instruments and interventions.</p>

<b>Title</b>	<b>A systematic review of school-based alcohol and other drug prevention programmes facilitated by computers or the internet.</b>
<b>Authors</b>	Katrina E. Champion, Nicola C. Newton, Emma L. Barrett, Maree Teesson
<b>Journal</b>	Drug and Alcohol Review
<b>Year of publication</b>	2013
<b>Objectives</b>	This paper identifies and describes school-based alcohol, cannabis and tobacco prevention programmes facilitated by computers or the internet.
<b>Methods</b>	The Cochrane Library, PsycINFO and PubMed databases were searched. Additional materials were obtained from reference lists of papers. Studies were included if they were an internet- or computer-based prevention programme for alcohol or other drugs, and if they were delivered at school. Programmes targeting school-aged students that were implemented in the home or community were excluded (as were those delivered in university or college). The primary outcome evaluated was alcohol and drug consumption, at immediate post-intervention and later follow-up occasions.
<b>Results</b>	12 trials of 10 programmes were identified. Seven trials evaluated internet-based programmes and five delivered an intervention via CD-ROM. Of the seven programmes with available data, six achieved reductions in alcohol, cannabis or tobacco use at post intervention and/or follow up. Two interventions were associated with decreased intentions to use tobacco, and two significantly increased alcohol and drug-related knowledge. Results from this review also compare favourably with traditional, non-computerised programmes. This suggests that computer- and internet-based interventions can be as effective as (if not more effective than) school-based programmes delivered without computers.
<b>Major limitations</b>	<ol style="list-style-type: none"> <li>1) Trials included in the review relied solely on student self-reporting.</li> <li>2) The number of studies included in the review is small and some studies presented differences in the assessed outcome measures.</li> <li>3) Of the 12 trials included in the review, only two analysed results separately for males and females. The importance of distinguishing between males and females is supported by the differential effect these interventions had by gender.</li> </ol>
<b>Conclusions and perspectives</b>	<p>Existing computer- and internet-based prevention programmes in schools have the potential to reduce alcohol and other drug use.</p> <p>Although the number of trials identified in this review is small, the results have implications for the delivery of alcohol and drug prevention in schools. The results of this review support the use of the internet as a potentially efficacious means of overcoming the obstacles associated with the implementation of traditional prevention programmes. Technology-based interventions offer increased accessibility and feasibility of use. They appear to be a promising framework for the provision of school-based education and prevention in the future.</p>



<b>Title</b>	<b>Internet-based interventions for smoking cessation.</b>
<b>Authors</b>	Civiljak M, Stead LF, Hartmann-Boyce J, Sheikh A, Car J.
<b>Journal</b>	Cochrane Database of Systematic Reviews
<b>Year of publication</b>	2013
<b>Objectives</b>	To determine the effectiveness of internet-based interventions for smoking cessation.
<b>Methods</b>	The Cochrane Tobacco Addiction Group Specialized Register was searched. Randomised and quasi-randomised trials were included. Participants were people who smoked. Any type of internet intervention was eligible. The comparison condition could be a no-intervention control, a different internet intervention, or a non-internet intervention.
<b>Results</b>	<p>The review includes 28 studies with over 45 000 participants. 15 trials compared an internet intervention to a non-internet-based smoking cessation intervention or to a no-intervention control.</p> <p>In a post hoc subgroup analysis, pooled results from three trials that compared interactive and individually tailored interventions to usual care or written self-help detected a statistically significant effect in favour of the intervention. However, all three trials were judged to be at high risk of bias in one domain and high statistical heterogeneity was detected. Pooled results from two studies of an interactive, tailored intervention involving the internet and automated phone contacts also detected a significant effect. Results from a sixth study, which compared an interactive but non-tailored intervention to control, did not detect a significant effect, nor did the seventh study, which compared a non-interactive, non-tailored intervention to control. Three trials comparing internet interventions to face-to-face or phone counselling also did not detect evidence of an effect, nor did two trials evaluating internet interventions as adjuncts to other behavioural interventions.</p> <p>14 trials, all in adult populations, compared different internet sites or programmes. Pooled estimates from three trials that compared tailored and/or interactive internet programmes with non-tailored, non-interactive internet programmes did not detect any evidence of an effect. One trial detected evidence of a benefit from a tailored email compared to a non-tailored one, whereas a second trial comparing tailored messages to non-tailored messages did not detect evidence of an effect. Three failed to detect a benefit of including a mood management component.</p>
<b>Major limitations</b>	<p>1) Biochemical validation of self-reported smoking cessation was attempted in few studies.</p> <p>2) Not all studies had a follow up six months later.</p> <p>2) Determining the contribution of a specific website presents a difficult challenge, since internet users appear to access different sites when searching for information or support.</p>
<b>Conclusions and perspectives</b>	Results suggest that some internet-based interventions can assist in smoking cessation, particularly those which are interactive and tailored to individuals. However, the trials that compared internet interventions with usual care or self-help did not show consistent effects. Future studies should carefully consider optimising the interventions which promise most effect, such as tailoring and interactivity. Future studies should aim to assess smoking status after a minimum of six months, so that the longer-term benefit of programmes can be determined.

<b>Title</b>	<b>Internet and computer based interventions for cannabis use: a meta-analysis.</b>
<b>Authors</b>	Robert J. Tait, Renske Spijkerman, Heleen Riper
<b>Journal and</b>	Drug and Alcohol Dependence
<b>Year of publication</b>	2013
<b>Objectives</b>	The aim of this review and meta-analysis was to collate evidence on the effectiveness of computer- and internet-based interventions in decreasing the frequency of cannabis use and to provide an estimate of the magnitude of this effect.
<b>Methods</b>	Medline, PubMed, PsychINFO, and Embase online databases were searched. Studies were included if they: 1) applied a randomised controlled design; 2) tested the effect of an internet- or computer-delivered intervention (either with or without additional therapeutic guidance) aiming at prevention or treatment; and 3) reported cannabis use as one of the outcome measures. The principal outcome measure was the frequency of cannabis use.
<b>Results</b>	Data was extracted from 10 studies and the meta-analysis involved 10 comparisons with 4 125 participants. Results found a small but significant overall effect size in favour of internet/computer-based interventions in reducing the use of cannabis.
<b>Major limitations</b>	<p>1) Four of the cannabis interventions specifically targeted only young women; this factor limits the extent to which generalisations can be made from the findings of this review.</p> <p>2) There was a small number of studies and little heterogeneity of target populations.</p> <p>3) Given the limited number of studies in the area, the review included both those with a prevention focus and those with a treatment orientation.</p> <p>4) The outcomes of the review relied on self-reported data.</p> <p>5) Not all of the studies specifically targeted cannabis, with some interventions assessing outcomes for illicit drugs or alcohol, or also addressing comorbid mental health problems.</p> <p>6) None of the studies included cannabis disorders as an entry criterion. Therefore, care should be taken in generalising the findings to those with cannabis disorders.</p>
<b>Conclusions and perspectives</b>	<p>Internet and computer interventions appear to be effective in reducing cannabis use in the short-term, albeit based on data from few studies and across diverse samples.</p> <p>The effect of internet/computer-based cannabis interventions was smaller than the effect found for in-person interventions (resulting from other meta-analysis). However, the potential extended reach of internet interventions means that, despite a small effect at the individual level, it could have a considerable public health impact.</p> <p>The review identified programmes that were effective as preventive interventions, suggesting the potential for widespread dissemination. Overall, low threshold internet-based interventions demonstrate promise for reducing the frequency of cannabis use and the potential to improve accessibility to users.</p>



<b>Title</b>	<b>Technology-based support via telephone or web: a systematic review of the effects on smoking, alcohol use and gambling.</b>
<b>Authors</b>	Anna-Karin Danielsson, Anna-Karin Eriksson, Peter Allebeck
<b>Journal</b>	Addictive Behaviors
<b>Year of publication</b>	2014
<b>Objectives</b>	The aim of this review and meta-analysis was to assemble evidence on telephone or internet-based support for smoking, alcohol use or gambling.
<b>Methods</b>	<p>PubMed and PsychInfo, Scopus, Web of Science, Cinahl and Cochrane Library databases were searched. Studies were included if they met the following criteria:</p> <ol style="list-style-type: none"> <li>1) being a randomised control trial, or at least having a control group;</li> <li>2) being focused on effects of telephone- or web-based interventions;</li> <li>3) being focused on pure telephone- or internet-based self-help (i.e. not including physical contact with a therapist, or other health care provider, or a prior established relationship with a health care provider);</li> <li>4) providing information on alcohol or tobacco consumption or gambling behaviour as an outcome;</li> <li>5) having a follow-up period of at least 3 months; and</li> <li>6) including a general population of adults (18 years or older).</li> </ol> <p>Articles describing specific populations (e.g. children or adolescents) or clinical populations (e.g. subjects in treatment for alcohol disorders, or people with mental disorders) were excluded.</p>
<b>Results</b>	<p>74 relevant studies were found. 36 addressed the effect of internet interventions on alcohol consumption, 21 on smoking and 1 on gambling; 12 on the effect of helplines on smoking, 2 on alcohol consumption, and 2 on gambling.</p> <p>The overall findings were that telephone helplines can have an effect on tobacco smoking, but that no conclusions can be drawn on whether telephone support, without an already established personal contact, has an effect on alcohol use or gambling. Also, the review provides inconsistent evidence on the effectiveness of internet-based support for smoking, alcohol use or gambling, making it difficult to state clear findings.</p>
<b>Major limitations</b>	<ol style="list-style-type: none"> <li>1) The results should be interpreted with caution, in light of the numerous methodological flaws that the studies collected for this review suffer from: lack of control groups, lack of demographic characteristics of participants, lack of information on possible dose-response relationships, lack of information on possible complementary care, short follow-up periods and high response attrition rates.</li> <li>2) Because 61% of the included studies on alcohol and internet included college students, the extent to which the conclusions can be generalised is questionable.</li> </ol>
<b>Conclusions and perspectives</b>	<p>Telephone helplines can have an effect on tobacco smoking, but there is no evidence of the effects for alcohol use or gambling.</p> <p>There are some positive findings regarding internet-based support for heavy alcohol use among US college students. However, evidence on the effects of internet-based support for smoking, alcohol use or gambling are to a large extent inconsistent. More research is needed to investigate which populations are more or less likely to benefit from technology-based intervention.</p>

<b>Title</b>	<b>Computer-based programmes for the prevention and management of illicit recreational drug use: a systematic review.</b>
<b>Authors</b>	Sara K. Wood, Lindsay Eckley, Karen Hughes, Katherine A. Hardcastle, Mark A. Bellis, Jochen Schrooten, Zsolt Demetrovics, Lotte Voorham
<b>Journal</b>	Addictive Behaviors
<b>Year of publication</b>	2014
<b>Objectives</b>	To establish whether computer-based interventions are effective in reducing illicit recreational drug use. The outcome measure was drug use behaviour (e.g. recent drug use or frequency of use).
<b>Methods</b>	<p>Eight electronic databases (Medline, ERIC, PsycINFO, Cochrane, ASSIA, Social Sciences Citation Index, CINAHL and IBSS) were searched.</p> <p>In this review, illicit recreational drug use was classed as use of any illegal drug such as cannabis, ecstasy, cocaine and gamma-hydroxybutyrate (GHB), with the exception of heroin, and non-medical use of prescription drugs.</p>
<b>Results</b>	<p>Universal drug prevention programmes were effective in reducing the frequency of recreational drug use in the mid-term (&lt;12 months), but not immediately post-intervention.</p> <p>Programmes targeting recreational drug users showed more inconsistent results but were generally effective in reducing the use of drugs, both immediately and in the mid-term.</p>
<b>Major limitations</b>	<p>1) Findings were limited by a lack of detailed data reported in a small number of papers.</p> <p>2) The review explores delivery type rather than intervention content. Although it was not possible to analyse the varying types of content separately, it is likely that the effectiveness of programmes will vary by the type of material provided.</p>
<b>Conclusions and perspectives</b>	<p>Computer-based programmes have the potential for use in addressing illicit recreational drug use when targeted at both universal populations and illicit drug users. However, more research is needed to establish long term (&gt;12 months) effectiveness.</p> <p>There is not currently much understanding of the value of human contact in health interventions. Five of the studies included in this review utilised at least some degree of professional input in addition to the computer-based programme. Although it was not possible to compare the effectiveness of these interventions with others that contained no professional input, previous research assessing programmes for drug, alcohol and tobacco use suggest that programmes containing some degree of therapist contact may see larger reductions in substance use. Greater understanding of the value of human contact within health interventions is essential and will help inform whether, and how much, professional contact should be involved in computer-based programmes. More research is needed to better understand the value of human contact in health interventions and to determine optimal levels of professional input.</p>

<b>Title</b>	<b>Technology-based interventions for tobacco and other drug use in university and college students: a systematic review and meta-analysis.</b>
<b>Authors</b>	Amelia Gulliver, Louise Farrer, Jade KY Chan, Robert J Tait, Kylie Bennett, Alison L Cleave, Kathleen M Griffiths
<b>Journal</b>	Addiction Science & Clinical Practice
<b>Year of publication</b>	2015
<b>Objectives</b>	The paper comprises an analysis of published randomised trials of technology-based interventions evaluated in a tertiary institution (university/college) for tobacco and other drug use (excluding alcohol). It extends previous reviews by using a broader definition of technology.
<b>Methods</b>	Three databases, namely PubMed, PsycInfo, and the Cochrane, were searched. The following criteria were chosen for the inclusion of studies: 1) the study was a randomised trial or a randomised control trial; 2) the sample was composed of students attending a tertiary institution; 3) the intervention was either delivered by or accessed using a technological device or process (e.g. computer/internet, telephone, or mobile short message services); 4) the mean age of the sample was between 18-25 years; and 5) the intervention was designed to alter a drug use outcomes relating to tobacco or other drugs (excluding alcohol).
<b>Results</b>	12 studies met the inclusion criteria. Nine included papers examined tobacco use, two studies targeted marijuana use, and one targeted marijuana, alcohol, and tobacco use. A quantitative meta-analysis was conducted on the tobacco-use studies using an abstinence outcome measure, demonstrating that the interventions increased the rate of abstinence by 1.5 times that of controls. Across all 12 studies, a total of 20 technology-based interventions were reviewed. Overall, three-quarters of the interventions were delivered using computers or the internet, with a minority using telephone or SMS technology.
<b>Major limitations</b>	1) The analysed studies displayed some methodological problems. All randomised control trials failed to report sufficient information about randomisation concealment, and randomisation methods. 2) Given that the review evaluated the interventions in tertiary student populations (age 18-25 years), the results cannot be applicable to the general population. 3) The sample sizes of studies included in the meta-analysis were small.
<b>Conclusions and perspectives</b>	Although technological interventions have the potential to reduce drug use in tertiary students, few trials have been conducted, particularly for substances other than tobacco. The improvement shown in abstinence from tobacco use has the potential to impact substantially on morbidity and mortality. The majority of interventions for tobacco use in the meta-analysis were compared with usual care control conditions, indicating that additional, tailored content may increase abstinence.

<b>Title</b>	<b>Computer-based interventions for problematic alcohol use: a review of systematic reviews.</b>
<b>Authors</b>	Christopher Sundström, Matthijs Blankers, Zarnie Khadjesari
<b>Journal</b>	International Journal of Behavioral Medicine
<b>Year of publication</b>	2016
<b>Objectives</b>	To provide an overview of knowledge and knowledge gaps in the field of computer-based alcohol interventions by: i) collating evidence on the effectiveness of computer-based alcohol interventions in different populations; and ii) exploring the impact of four specified moderators of effectiveness: therapeutic orientation, length of intervention, guidance and trial engagement.
<b>Methods</b>	A review of systematic reviews of randomised trials reporting on effectiveness of computer-based alcohol interventions published between 2005 and 2015. Systematic reviews were included if they: i) investigated the effectiveness of computer-based or internet-based interventions to reduce alcohol use; ii) included studies that compared the intervention to a control group; iii) included alcohol consumption or alcohol-related harm as the principal outcome; and iv) only or mostly included randomised trials. Reviews that included a combination of intervention modalities were excluded. Reviews that focused on computer-based interventions for a range of health behaviours were included only if findings from the studies on alcohol interventions were synthesised separately.
<b>Results</b>	14 reviews met the inclusion criteria. Across the included reviews, it was generally reported that computer-based alcohol interventions were effective in reducing alcohol consumption, with mostly small effect sizes. There were indications that longer, multi-session interventions are more effective than shorter or single session interventions. Evidence on the association between therapeutic approach of an intervention and reductions in alcohol consumption is limited, as the number of reviews addressing these themes is low.
<b>Major limitations</b>	1) Whilst the study had minimum quality criteria for the inclusion of systematic reviews in the review, it did not undertake a quality assessment of the reviews. Furthermore, the discussion of the moderators was not based on experimental data but was limited to meta-regression (i.e. observational data) in the included reviews. There is a growing literature that uses experimental design to explore the impact of some of these moderators. 3) Some individual, randomised controlled trials are included in several reviews; the results of the reviews are thus not fully independent of one other.
<b>Conclusions and perspectives</b>	This review highlights the mostly positive evidence supporting computer-based alcohol interventions. It followed a robust methodology and answered two specific questions. The study provides themes worth considering in future research: i) there is a lack of studies with long-term follow-ups; ii) given that guidance has been shown to improve effects in studies on internet interventions in other problem areas, more research on the impact of guidance in computer-based alcohol interventions is needed to clarify what amount leads to optimal effect; iii) even though there is a steady evidence base for computer-based alcohol interventions in adult and student populations, there is lack of evidence in other populations such as patients, employees and ethnic minority groups; and iv) many reviews mention the potential negative impact of trial drop-out on the quality and validity of the available literature.

<b>Title</b>	<b>Digital interventions for problematic cannabis users in non-clinical settings: findings from a systematic review and meta-analysis.</b>
<b>Authors</b>	Eva Hoch, Ulrich W. Preuss, Marica Ferri, Roland Simon
<b>Journal</b>	European Addiction Research
<b>Year of publication</b>	2016
<b>Objectives</b>	To assess the effectiveness of digital interventions (i.e. internet- and computer-based interventions) in the treatment of late adolescent and adult cannabis users recruited from non-clinical settings.
<b>Methods</b>	<p>The review searched the Cochrane Central Register of Controlled Trials, PubMed, Medline, Google Scholar and article reference lists for potentially eligible studies. Randomised controlled trials examining the effects of internet- or computer-based interventions were assessed.</p> <p>The primary outcome assessed was self-reported cannabis use as measured by a questionnaire. Participants were recruited from the general population through internet-based advertisements and via other channels (advertisements distributed by post, email, in print media etc.).</p>
<b>Results</b>	52 studies were identified and four studies (including 1 928 participants) met inclusion criteria. They combined brief motivational interventions and cognitive behavioural therapy delivered online. The study gives evidence of small effects at a three-month follow-up in favour of digital interventions.
<b>Major limitations</b>	<ol style="list-style-type: none"> <li>1) In all of the trials reviewed, cannabis use was measured only on the basis of self-reported data.</li> <li>2) The selected studies were only brief interventions for older adolescents and adults, with variability in intensity, duration, and intervention.</li> <li>3) The selected studies measured cannabis use as 'consumption in the past 30 days'. However, this variable was operationalised in different ways.</li> <li>4) Information on the long-term stability of treatment effects was not provided.</li> <li>5) The number of included trials was small.</li> </ol>
<b>Conclusions and perspectives</b>	<p>A small number of problematic cannabis users are being treated at the public centres for addiction treatment. Possible reasons for this situation include the feeling among cannabis users that treatment is not necessary, a lack of motivation to quit and lack of treatment option awareness. Another important reason is that, in many cases, cannabis users prefer not to go to public centres for addiction treatment because they do not want to be labelled as drug addicts. Given the high level of internet use in Europe, digital interventions have the potential to reach adolescents and young adults everywhere.</p> <p>Digital interventions can help in successfully reducing problematic cannabis use outside clinical settings. They have some potential for overcoming treatment barriers and increasing accessibility for at-risk cannabis users. However, studies collected in this review provided evidence only of minor levels of effectiveness of digital interventions in relation to regular or at-risk cannabis users. The effects of digital interventions in heavier cannabis users, poly-drug users and/or people with comorbid mental disorders were not explored.</p>

## 5.6. Discussion

### 5.6.1. Efficacy and advantages offered by technology-based interventions

Despite significant variation in inclusion criteria and methodology, as a whole the reviews summarised above reach a common conclusion: TBIs for substance use problems are efficacious, but effect sizes (that is, in statistics, a quantitative measure of the strength of a phenomenon, in this case treatment) are generally small to medium at best and treatment mechanisms remain largely unknown. The magnitude of success in behavioural change tends to be small to medium according to many meta-analytic studies. Nonetheless, these changes need to be favourably considered, because from a public health perspective, even small changes are meaningful at the population level [Portoy, 2008; Rose, 1992].

Further potential may additionally be seen in the integration of smartphones or other mobile technologies into internet-based drug treatment interventions. The use of mobile phones to access the internet has increased greatly within the EU-28 [Eurostat, 2016a]. Innovative work is exploring utilisation of smartphones in real-time (either via sensors, individual input, or both), monitoring a given individual's behaviour, and providing tailored feedback or intervention content that is related to that behaviour [Marsch, 2012].

It is important to point out that TBIs in no way attempt to replace traditional therapy. Rather, they allow for the use of different methods of interventions, increasing the still limited number of therapeutic methods in drug dependence, approaching and reaching out to a different typology of subjects [Lovejoy, 2009]. TBIs represent an alternative, or complementing instrument to the traditional face-to-face therapeutic approaches. Traditional face-to-face interventions and interaction with a therapist remain fundamental in the treatment of substance use disorders. However, the capability to develop feasible and effective alternatives by exploiting TBIs for clinical intervention should be regarded positively, because it allows for the expansion of the therapeutic toolkit [Barak, 2009].

The relatively small number of included studies and variable methodological quality limits the extent to which the reported findings can be generalised. As with many behaviour change interventions, most studies provided inadequate detail on treatment characteristics and more needs to be done to improve reporting. Study design, subject characteristics, length of follow-up, insufficient reporting of the interventions, and outcome measures were highly variable among published studies, as synthesised by reviews. This heterogeneity makes it difficult to determine consistent predictors of efficacy. The majority of evidence tends to be substance-specific [Sundström, 2016; Hoch, 2016]. The majority of publications are related to tobacco [Hutton, 2011; Newman, 2011; Civljak, 2013; Gulliver, 2015] and alcohol [Vernon, 2010; White, 2010; Khadjesari, 2010; Riper, 2011; Newman, 2011; Champion, 2013; Sundström, 2016] treatment. Although some evidence involving illicit drugs is already available [Alemi, 1996; Alemi, 2007; Tait, 2013; Christensen, 2014], much more work is needed [Danielrsoon, 2014].

In addition, there remains a lack of clarity about what types of computer-based applications are most effective. While the number of TBIs for substance use programmes is growing, it is still unclear how, why and under what conditions such interventions work and which factors influence their effectiveness [Etter, 2006; Shahab, 2009]. To improve the effectiveness of TBIs for substance use, it will be important for future research to develop computer-based programmes with clearer theoretical foundations, and more rigorous evaluation methods to determine their effectiveness [Walters, 2006].

This literature review has also revealed some advantages of new technologies, which can be particularly relevant from a public health perspective for clinicians, health administrators and decision-makers. They are summarised in Table 1.



Issue	Comment
TBIs can expand the availability of substance use disorder treatment	TBIs appear to offer interesting opportunities to reduce health service barriers
TBIs are flexibility for use in a variety of settings, especially as devices have got smaller and more portable	TBIs can reach certain populations not reached by traditional counselling or treatment facilities
Tailored health interventions have been shown to be effective in engaging individuals and changing their harmful behaviour	New technologies appear to be able to provide tailored interventions to people with substance use disorders
TBIs can provide automated information with a high degree of standardisation and in real time	These factors can facilitate clinical and research activities
TBIs are assumed to be cost-effective treatments	Nevertheless, more economic evaluations are needed
TBIs can improve privacy	This can simplify the treatment entry of a number of users, reducing stigma
TBIs are available all day, every day	There is opportunity for more frequent and/or longer therapeutic contact

**Table 1.** Advantages of technology-based interventions for substance use disorders.

Technology-supported treatment has the potential to play an important role in enhancing and expanding the availability of substance use disorder treatment. Given the substantial gap between the number of individuals seeking treatment for substance use disorders and the capacity to offer adequate and timely health support, TBIs appear to offer interesting opportunities to expand service availability and reduce health service barriers [VanDeMark, 2010].

The portable and flexible nature of TBIs in a variety of settings needs to be mentioned. These qualities give them potential to reach a far greater number of people who need treatment [Litvin, 2013]. TBIs can reach certain populations not reached by traditional counselling or treatment facilities [Postel, 2005; Lieberman, 2008]. They can be particularly useful in reaching people living in rural or remote settings, where access to treatment for substance use disorders may be limited and accompanied by increased stigma [Schopp, 2006; Baca, 2007; Young, 2012], those with physical limitations [Portnoy, 2008], people that travel a lot for work reasons, or people who are shy and introverted. The lack of geographic limitations allows the patient to select a therapist who appears to have the expertise needed for his/her specific health condition. TBIs can be particularly useful for people to whom privacy and anonymity represent barriers to treatment entry [Wood, 2014].

Tailored health interventions have been shown to be effective in engaging individuals and changing their harmful behaviour. New technologies appear to be able to provide tailored interventions to people with substance use disorders. Rimer *et al.* defined tailored health communication as 'any combination of information and behavior change strategies intended to reach one specific person based on information unique to that person, related to the outcome of interest, and derived from an individual assessment. Tailored health communication have been studied as a means to facilitate behavioural change by influencing some key intermediate steps that precede the behavioral outcome. These include the extent to which people attend to communications, think about them, find them relevant and salient, and intend to take action' [Rimer, 2006].

TBIs can provide automated information with a high degree of standardisation, which is not always possible for face-to-face interventions. This standardisation could permit a detailed examination of different aspects from a clinical perspective, facilitating data collection and representing added value also in the research perspective [Moore, 2011; Litvin, 2013]. In addition, TBIs may allow for data about



individual's substance use and triggers for use to be obtained from people in real-time (e.g. via mobile devices) outside the setting of centre treatment where they are traditionally collected [Marsch, 2012]. They also have been shown to have potential to involve users previously excluded from research [Danaher, 2007].

Cost-effectiveness analysis is a tool for investigating the net gains in relation to the incremental costs of a given treatment compared to an alternative [Saha, 2001]. TBIs are assumed to be cost-effective treatments [Portoy, 2008; Murray, 2008; Olmstead, 2010; Litvin, 2013]. Although the initial development of these programmes can be costly, the cost of hosting and maintaining access to them thereafter is generally limited [Marsch, 2012]. Nevertheless, more economic evaluations are needed.

### 5.6.2. Disadvantages of technology-based interventions for substance use

Progress in the field of computer-based therapies on substance use disorders needs to be evaluated with caution, since they provide a number of methodological challenges that need to be acknowledged [Glasgow, 2007; Strecher, 2007] (Table 2).

Issue	Comment
Lack of adequate level of privacy	Nowadays, a satisfactory level of security seems guaranteed
TBIs on substance use disorders may not be appropriate for all clients	Chronic users and people with heavy psychiatric problems may not benefit from internet-based technologies
The use of the internet as a medium for delivering interventions may bias against people with low computer literacy	In the last two decades, we have witnessed extraordinary growth in computer and mobile technologies available to the general public
New technologies may expose people to the risk of drug use	Increased availability and accessibility of licit and illicit drugs through websites, as well as enhanced contacts through mobile phone and social networks, can facilitate the distribution of drugs
Impracticality of analysing biochemical outcomes	Due to anonymity and the physical distance between patient and clinician, drug tests cannot be conducted - therapists have to rely completely on information self-reported by clients
Relative inappropriateness in emergency situation	When an immediate intervention of the therapist is urgently necessary
Increased use of text communication	The communication needs to be bound by clear rules in order to avoid deviations from what is expected from a therapeutic communication

**Table 2.** Major disadvantages of technology-based interventions for substance use disorders.

Although tools such as secure chat rooms, digital signatures, encrypted email, and other measures provide a satisfactory level of security, some argue that the internet is not suitable for clinical work because it does not guarantee an adequate level of privacy.

TBIs on substance use disorders may not be appropriate to all clients; for example, some may prefer and respond better to a face-to-face interaction. The great majority of internet-based communication for therapeutic purposes is conducted in textual, not verbal, relationships. For a number of individuals, this could represent a limitation. Non-verbal communication may disappear with the new technologies. Participants with a substantial chronic abuse and heavy psychiatric problems may not benefit from internet-based technologies.

The use of the internet as a medium for delivering interventions may bias against people with low computer literacy, i.e. introduce a 'digital divide' [Bickel, 2011; Shahab, 2009]. The digital divide refers broadly to the unequal access to technology across various groups of the population. People who are older, poorer, or are less educated are less likely to use the internet [Lopez, 2011]. These findings are particularly important among subjects with substance use disorders, the frequently-unemployed, and those with limited economic resources or low educational level [McClure, 2013]. However, in the last two decades we have witnessed extraordinary growth in computer and mobile technologies available to the general public, both in terms of accessibility as well as cost.

A paradoxical aspect that needs to be taken into account is that, although new technologies may lead to innovative solutions to address the problem of drug dependence, they may also expose people to the risk of drug use. In fact, increased availability and accessibility of licit and illicit drugs through websites, as well as enhanced contacts through mobile phone and social networks, can facilitate the availability of drugs and the ease of contact between drug suppliers and drug consumers [King, 2012; Stahler, 2013; Mounteney, 2016]. The internet as a source of drugs recently gained public attention, with concern about the difficulties in regulating this method of international supply [Nielsen, 2009].

Finally, other disadvantages of TBIs include: their inappropriateness in emergency situations, when an immediate intervention of the therapist is urgently necessary; and the impracticality of analysing biochemical outcomes (i.e. drug tests) with this type of intervention [Shahab, 2009].

### 5.6.3. Ethical considerations

Finally, ethical considerations need to be mentioned. Ethical guidelines for standards of care and practice for online therapy are either absent or ambiguous in some instances [Capon, 2016]. For example: should clients be allowed to retain text interactions between patient and therapist generated through email or chat rooms? If not, what could be the measure to prevent them from doing so? Could these transcripts be used in a court of law [Lovejoy, 2009]? M-Health raises novel ethical issues, for both research and treatment that is particularly noticeable in the field of drug use [Carter, 2015; Meurk, 2014]. Ensuring privacy of research data collected through smartphone technologies appears to be a difficult task. There is great potential for m-Health technology to be applied to drug addiction. Therefore, it is crucial that ethical considerations related to their use are properly evaluated [Capon, 2016].

For the use of TBIs, patient confidentiality and safety concerns are barriers that are well documented in the literature. If left unaddressed, these issues may render the implementation of online therapy for substance use disorders incompatible with the sense of ethical duty of a number of health professionals to protect their clients' privacy.

## 5.7. Conclusions

This review documents the rapidly growing body of literature suggesting that TBIs have the potential to enhance the effectiveness of substance use disorder management by providing parallel/alternative instruments of information, health education, prevention and treatment. They have the potential to reach populations that have not traditionally been in treatment, helping populations with significant barriers in accessing treatment. TBIs can provide some subjects with the opportunity to establish first contact with treatment services. This initial contact may then lead to a more structured and regular support with a therapist, who might use these new tools to extend and augment treatment [EMCDDA, 2014].

Despite an increasing number of studies discussing internet-based interventions for the treatment of addictions, only a relatively small number represent suitable trials. There is a need to improve the methodological quality of studies undertaken by using rigorous study designs and selecting appropriate and sufficiently large samples. The novelty of this field has precluded the establishment of a gold standard treatment evaluation method and this limits the extent to which trials and treatments

can be compared. Furthermore, it is not possible to determine whether the treatment effects are unique to the population studied, or whether they could be generalised to other forms of addiction and other subgroups of patients. Few studies included any follow-up assessments, thereby limiting our knowledge about the long-term effects of these treatments. Most of the studies failed to document the specific amount of therapist-contact time and failed to examine clients' satisfaction with technology-based treatment.

Despite encouraging progress, computer-based treatments for substance use disorders need to be evaluated with caution. Barak *et al.* correctly pointed out that despite its development, this field of medical science “has suffered from a lack of clarity and consistency. Scientists and professionals have operated mostly independently with little intercommunication or accepted standards, which has brought about the use of numerous rival terms and applications alike – all of this typical of a pioneering area” [Barak, 2009]. Across research studies, there are methodological difficulties such as a lack of common definitions, selection biases, inappropriate research designs, study attrition, difficulties in mounting randomised clinical trials and uncertain conclusions drawn from findings [Harris, 2006; Proudfoot, 2009; Danaher, 2009].

A clinician skilled in treating subjects with substance use disorders and with good knowledge of online technologies is not necessarily an expert online therapist [Fisher, 2003; Lovejoy, 2009]. Although training courses on online counselling on drug abuse treatment have started to appear in Europe, few standards exist that elucidate the technical skills required to practice online therapy with this typology of subjects. In the near future, training for health personnel will become not only necessary but also multidisciplinary. Clinicians should develop expertise in different types of media and virtual reality interventions, developing collaboration with experts of other fields, such as cognitive psychology, ICTs and communications. As the amount of internet usage continues to grow in the EU, and it becomes integrated into many people's daily lives, it is foreseeable also that therapists will increase their ability to develop online practices in their work in drug abuse disorders treatment, encouraging further deployment of internet-based drug treatment interventions within the European Union.

A great number of people with substance use disorders do not seek treatment; in addition, there are high attrition rates among those that do. This means that existing treatment options are not suitable or sufficiently interesting for all subjects with addiction-related problems, and new modes of therapy should be considered and explored. The widespread and growing availability of TBIs presents an opportunity for broad dissemination and increased access to treatment [Gainsbury, 2011].

The number of TBIs applied to substance use disorders has been increasing greatly in Europe for the past decade. With the development of new internet-based treatments worldwide, knowledge in this specific field is growing steadily. In conclusion, there is sufficient evidence to continue to investigate the benefits (but also the limits) of TBIs for substance use disorders. To date, the evidence emphasises the potential of this approach to affect (and perhaps, in the near future, to deeply transform) existing models of health care delivery in the field of addiction.

Figure 7 summarises the efficacy, advantages and disadvantages of TBIs described in this chapter.

## Literature review: key messages

### Efficacy and effectiveness

- TBIs for substance use problems are efficacious, but the magnitude of success in behavioural change tends to be small to medium by many meta-analytic studies.
- Nonetheless, these changes need to be favourably considered, because from a public health perspective, even small changes are meaningful at the population level
- More research is needed: study design, subject characteristics, length of follow-up and outcome measures are highly variable among studies. This heterogeneity makes it difficult to determine consistent predictors of efficacy.

### Advantages

- TBIs can expand the availability of substance use disorder treatment.
- Flexibility and portability for use in a variety of settings.
- 24-hour availability.
- Tailored health interventions.
- They provide information with a high degree of standardisation and in real time.
- TBIs are assumed to be cost-effective treatments.
- TBIs can improve privacy.

### Disadvantages

- TBIs may not be appropriate to all clients.
- Their use may bias against people with low computer literacy.
- New technologies may expose people to the risk of drug use.
- Impracticality of analysing biochemical outcomes.
- Relative inappropriateness in emergency situation.
- Lack of face-to-face interaction.

**Figure 7.** A summary of the efficacy, advantages and disadvantages of TBIs.

## 6. Survey

### 6.1. Introduction

The European Brain Council (EBC) is the representative organisation bringing together patient groups, scientific and professional organisations, as well as industry partners with an interest in brain disorders. Through its network, the EBC was able to pull together experts in the field addressed by this survey. The aim of the present survey is to highlight the current state and future trends of the clinical implementation of ICT-based interventions in the treatment of substance use disorders in Europe. In particular, we aim to identify: i) the extent to which these technologies are used among health professionals in the field of addiction; ii) their clinical effectiveness; iii) the main factors hampering their implementation; iv) the most effective strategies to promote their use in the treatment of substance use disorders.

### 6.2. Methodology

The questions of the survey (closed form) and their answer choices were drafted based on the relevant issues in the field and according to the objectives of the study. As a pilot test, the questionnaire was sent to 10 selected specialists in the field of addictions in April 2015. The list of possible answers, as well as the formulation of some questions, was modified as deemed necessary further to the comments gathered in this test phase. The master version of the survey was in English and was translated into 4 European languages: Italian, French, Polish and German. A survey for each language was created and made available online on the platform SurveyMonkey [SurveyMonkey, 2016]. The validated survey was launched on 18 June 2015 and was open until 31 January 2016. During this time, several reminders were sent either via email or via phone when possible in order to maximise the number of responses.

The target respondents of the survey were European experts in the field of substance use disorders. Respondents were selected using the approaches of convenience sampling and respondent-driven sampling. In particular, the following strategies were used: i) circulate the survey among members of relevant professional organisations in the area of addictions within the network of the European Brain Council (EBC); ii) contacts collected from public lists and online databases; iii) contacts provided directly by respondents; iv) formal requests sent to other relevant organisations and associations.

The target respondents were searched for both at European and at national level, among experts operating in the following selected European countries: France, Germany, Italy, the Netherlands, Poland and the UK. Table 3 summarises the European and national organisations through which the survey was disseminated.

The survey questionnaire was structured in three sections (see the questionnaire in Annex I):

Section A – Personal information consists of 9 questions aimed to gather profile information about the respondents: i) name; ii) gender; iii) age; iv) affiliation; v) job title; vi) specialisation (if medical doctor); vii) years of experience in the field of substance use disorders; viii) major area of competence/interest in the field of substance use disorders; ix) European country of activity.

Section B – Role of ICT applications in substance use disorders was designed to assess: i) the level of knowledge of ICT-based interventions among participants and, ii) the benefits and limitations of these technologies in the treatment of substance use disorders.

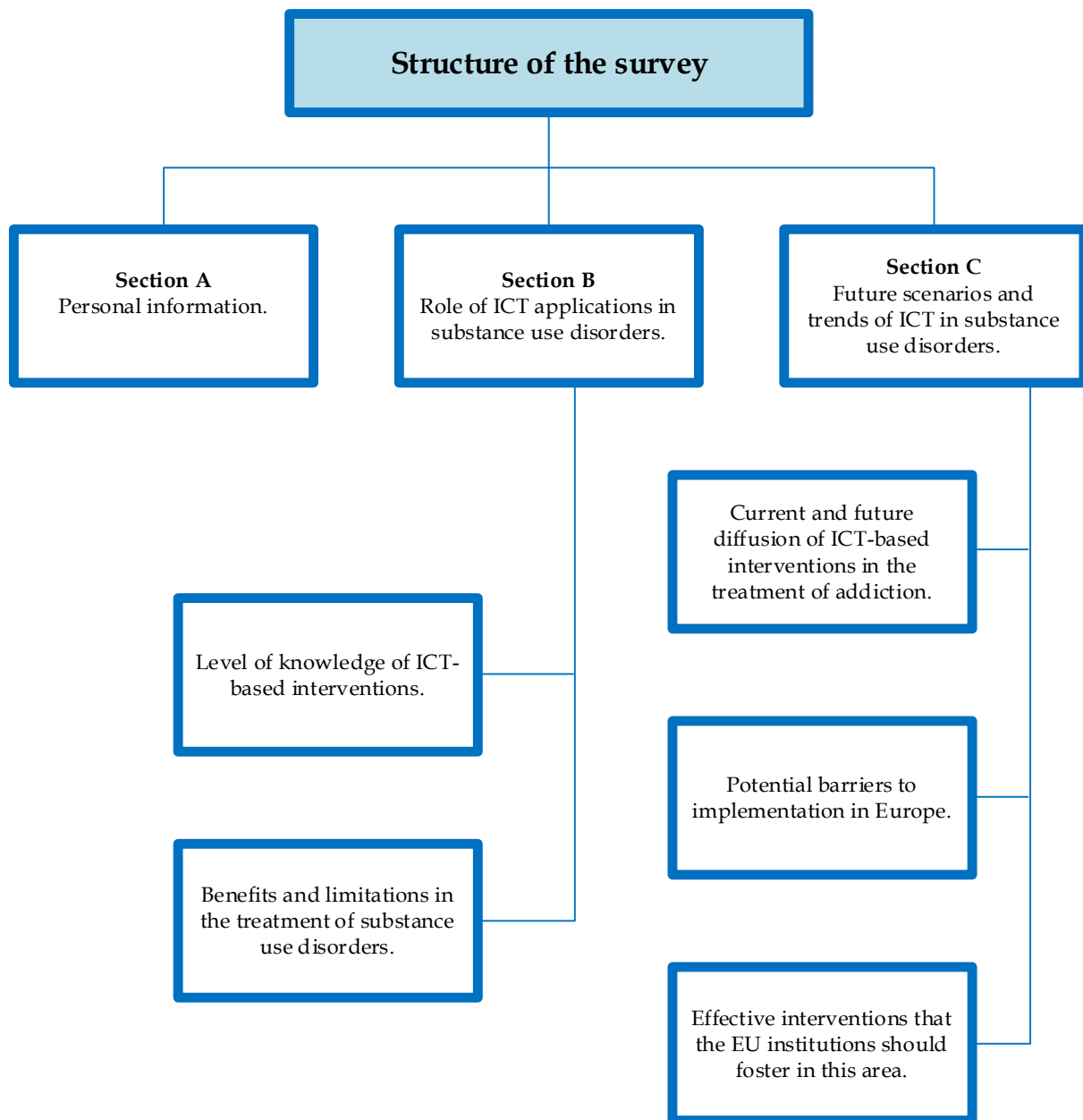
Name of association	Geographic Area
European Federation of Addiction Societies (EUFAS)	EU
European Psychiatric Association (EPA) and subsection of Addictive Behaviours	EU
European Federation of Psychiatric Trainee (EFPT)	EU
European Academy of Neurology (EAN) and Sub - Specialty Panel of Neurotoxicology	EU
Polskie towarzystwo badan naduzalezniensiami (Polish Society for Addiction Research)	Poland
Société Française d'Alcoologie (French Alcoholology Society)	France
Nederlandse Vereniging voor Psychiatrie (Dutch Psychiatric Association - NVvP)	Netherlands
Tactus	Netherlands
Vereniging voor Verslavingsgeneeskunde Nederland (Society for Addiction Medicine Netherlands - Vvgn)	Netherlands
Federazione Italiana degli Operatori dei Dipartimenti e dei Servizi delle Dipendenze (Italian Association of Addiction Societies - FeDerSerD)	Italy
Società Italiana Alcolologia (Italian Alcoholology Society - SIA)	Italy
Società Italiana Pschiatra (Italian Psychiatric Society - SIP)	Italy
Deutsche Gesellschaft für Suchtforschung und Suchttherapie (German Society for addiction research and treatment - DG-sucht)	Germany
Deutsche Gesellschaft für Suchtmedizin (German Society of Addiction Medicine - DGS)	Germany
Deutsche Gesellschaft für Suchtpsychologie (German Society of addiction psychology - DGSPS)	Germany
Society for the Study of Addiction	UK
Specialist Clinical Addiction Network	UK
Royal College of Psychiatrists	UK
Faculty of Addictions	UK

**Table 3.** List of professional organisations involved in the dissemination of the survey.

Section C - Future scenarios and trends of ICTs in substance use disorders in Europe investigated on: i) the current and future diffusion of ICT-based interventions in the treatment of addictions; ii) the potential barriers to their implementation in Europe and iii) effective interventions or approaches that EU institutions should foster in this area.

Section B and C ended with open questions, inviting respondents to leave general comments. Comments were screened and selected on the basis of the added value to the information provided, in order to avoid the repetition of ideas that had already emerged from the closed-form responses. For the majority of questions, participants were asked to evaluate between 3 and 7 proposed answers using the same set of ordered scale options (e.g. not important, important, very important). For each proposed answer, the choice was limited to only one option in the ordered scale. For all of the questions, the proportion of respondents who selected each option in the ordered scale was calculated for each proposed answer. This measure synthesises the participant's opinion on selected proposed answers. Raw data were collected in an Excel file and analysed and summarised in graphs using Excel 2013. The structure of the survey is schematised in Figure 8.





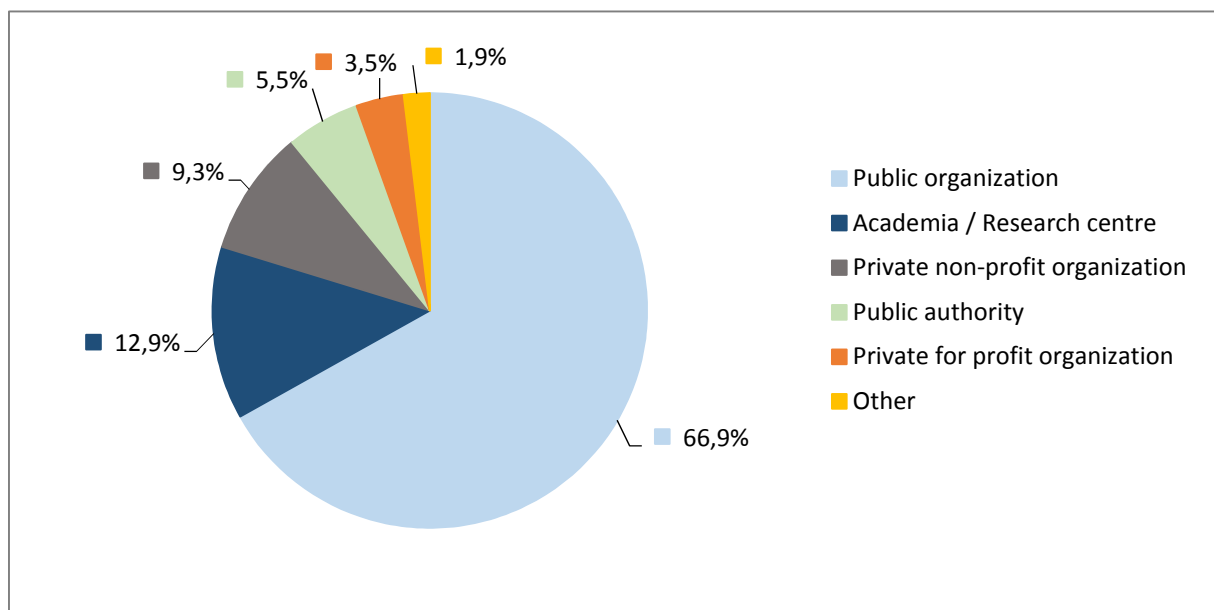
**Figure 8.** Structure of the survey.

## 6.3. Results

### 6.3.1. Section A - Respondents' information

#### 6.3.1.1. Type of affiliation

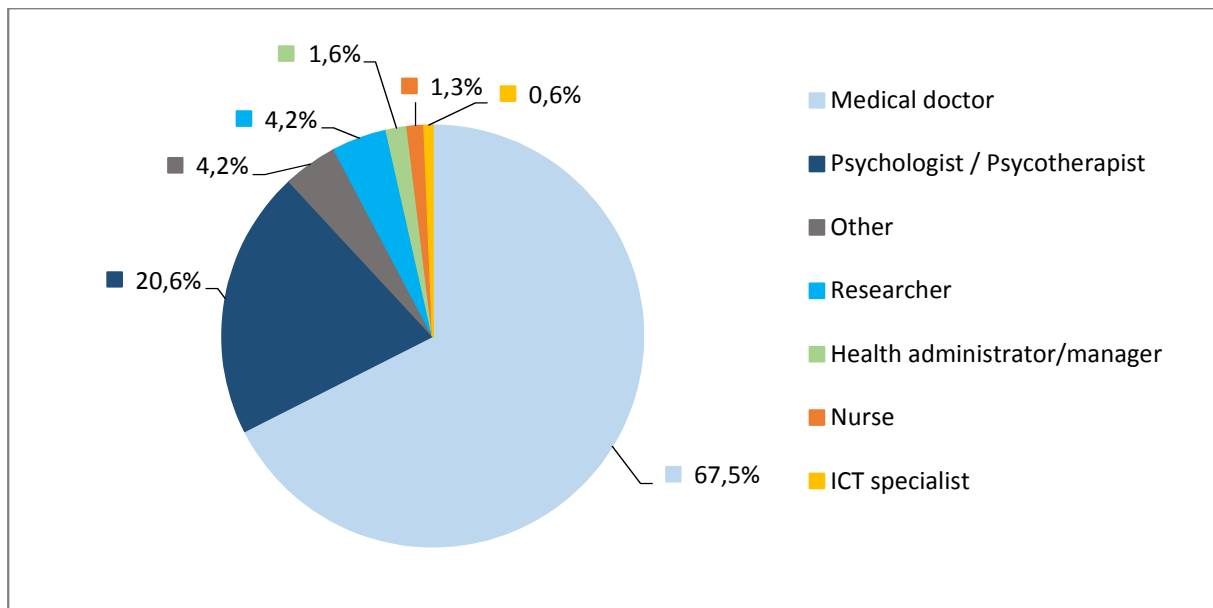
Overall the invitation was sent to about 1200 experts. Three hundred and fifty answers have been collected. Thirty-nine experts (11%) left the survey after having replied to Section A (i.e. providing personal information). These respondents have been excluded from the analysis, as their contribution is null. Out of 311 valid answers, 305 (98% of respondents) replied to all of the sections of the survey while six (2% of respondents) replied to Section A and Section B only. The sample survey respondents are characterised by the overarching presence (66.9%) of experts working in public organisations (i.e. public hospitals, public addiction centre treatment, etc.). The second most represented typology of affiliation is academia/research centres (12.9%). Other typologies of affiliation are private non-profit organisations (9.3%), public authorities (5.5%), private for profit organisations (3.5%) and private for profit organisations (3.5%) (Fig. 9).



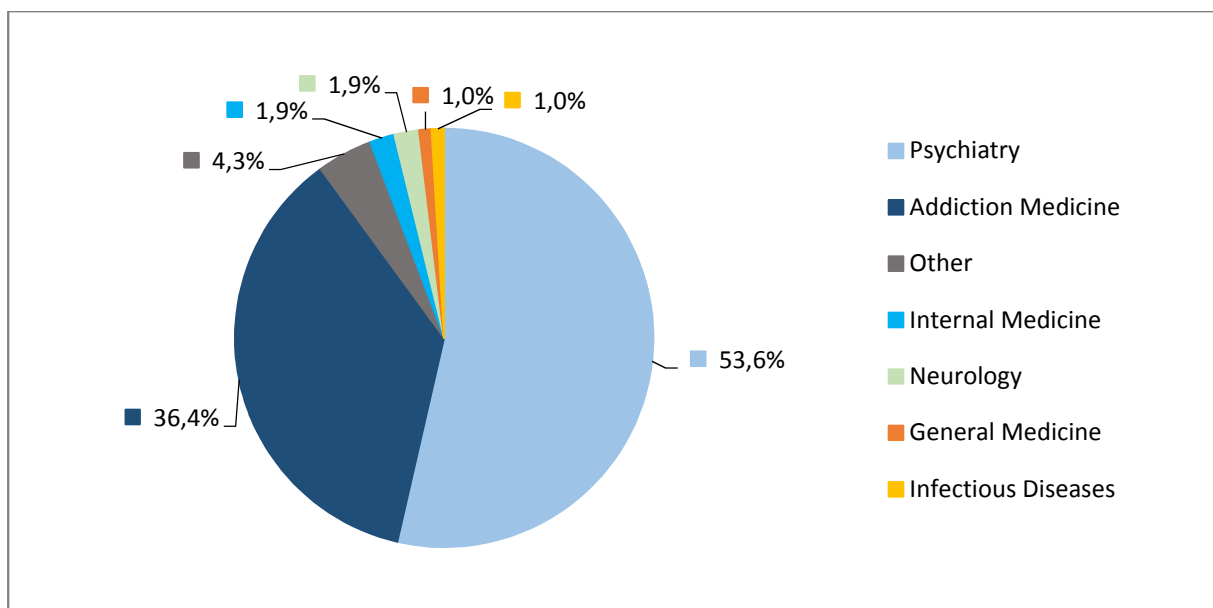
**Figure 9.** Participants stratified by type of affiliation. Percentage of respondents, sample size 311.

### 6.3.1.2. Respondents' job title

The majority of participants are medical doctors (67.5%). Psychologists and psychotherapists are also well-represented (20.6%). Other professions include researchers (4.2%), health administrators (1.6%), nurses (1.3%) and ICT specialists (0.6%), which account all together for about 8% of respondents (Fig. 10). Amongst medical doctors, specialists in psychiatry and addiction medicine account for 53.6% and 36.4% respectively (90% together), whereas the remaining 10% is divided among neurologists, general practitioners, internal medicine and infectious disease specialists (Fig. 11).



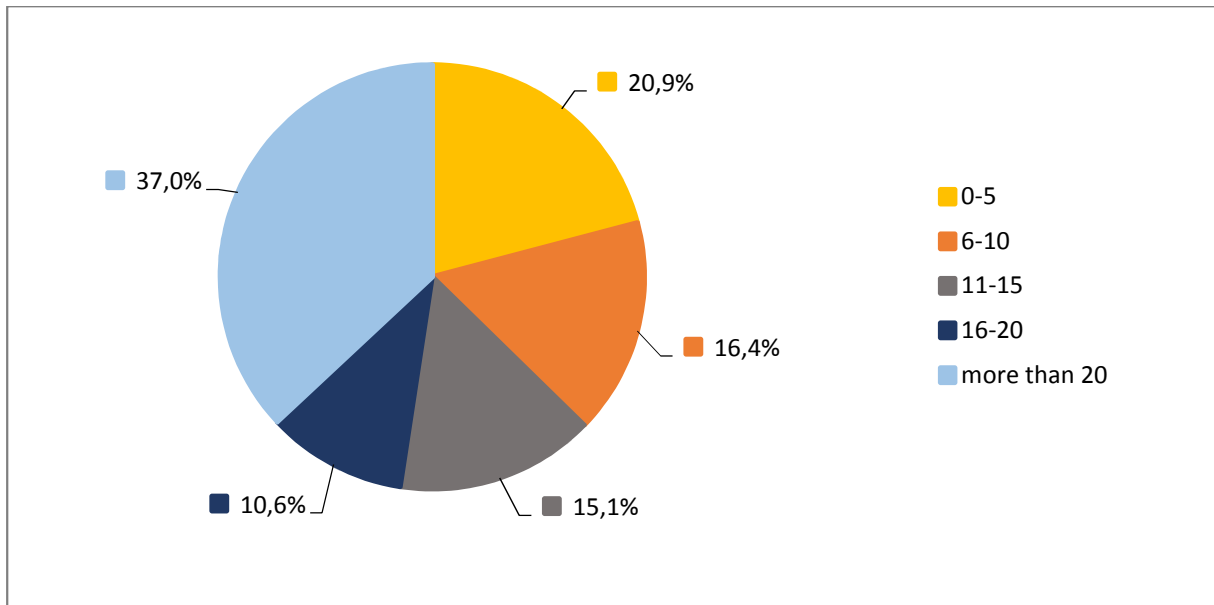
**Figure 10.** Survey participants stratified by job title. Percentage of respondents. Sample size 311.



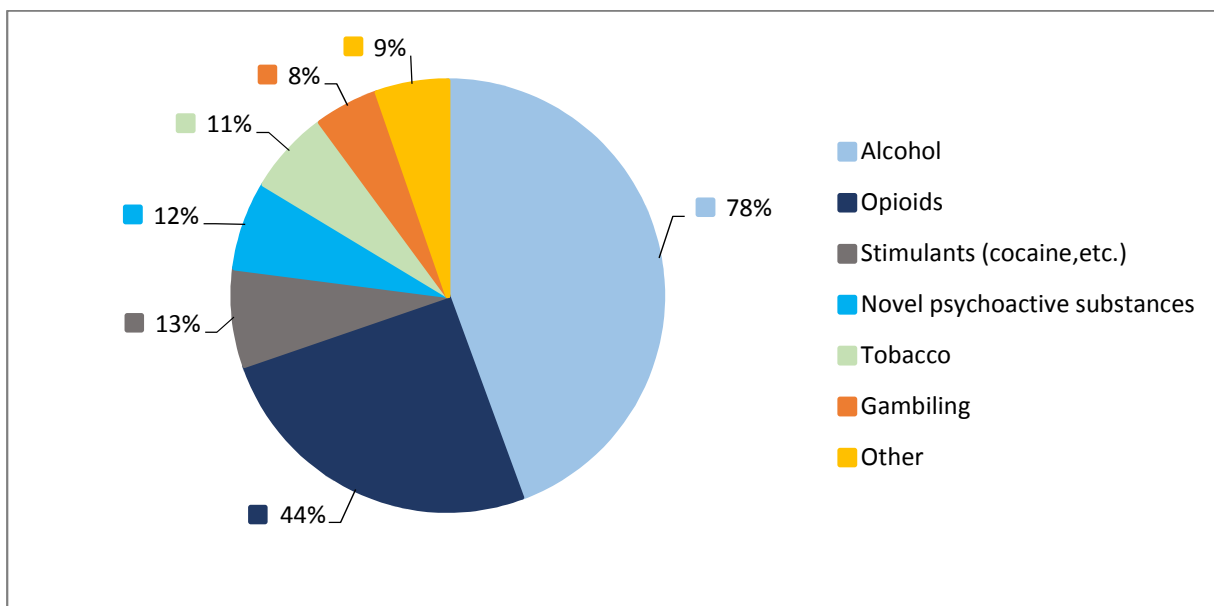
**Figure 11.** Medical doctors stratified by specialisation. Percentage of respondents. Sample size 209.

### 6.3.1.3. Years of experience in the field of substance use disorders

The majority of participants (195, 62.7%) reported to work in the field of substance use disorders for more than 10 years, of which 37% reported more than 20 years of medical experience (Fig. 12). The survey also included a question asking the participants for their major area(s) of competence in the field of addictions (two choices were allowed for this question). Alcohol and opioids are the most-represented areas of competence, with 78% and 45% respectively (Fig. 13). Stimulants, novel psychoactive substances and tobacco are equally represented accounting for the 36% all together, while gambling and cannabis are less represented with 8% and 2% respectively.



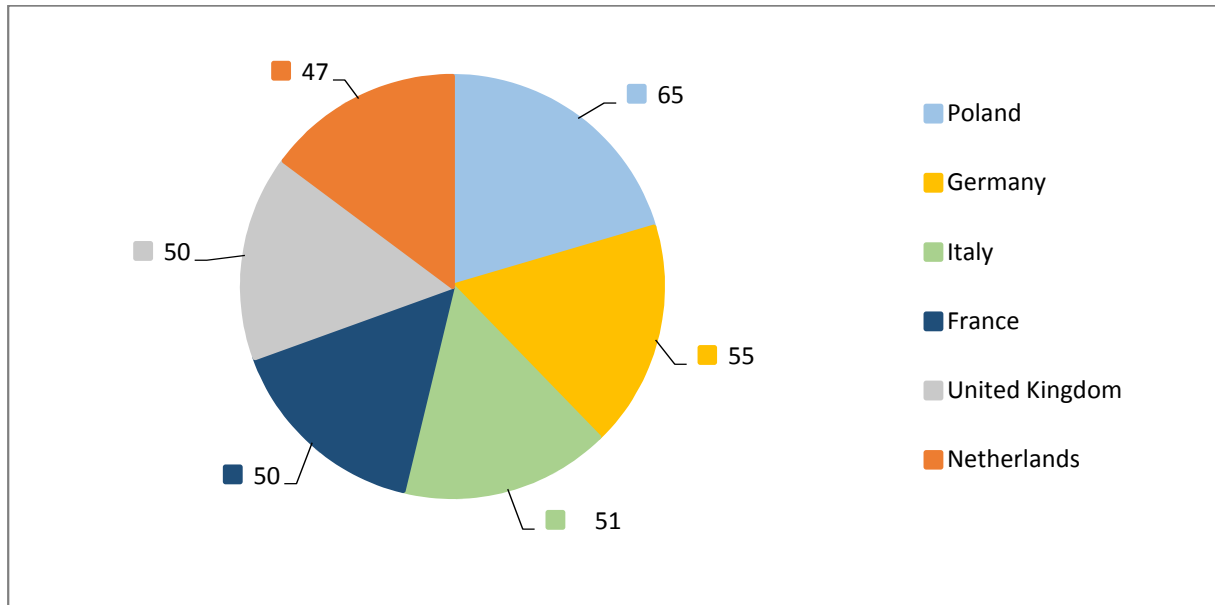
**Figure 12.** Survey participants stratified by years of experience in the field of addictions. Percentage of respondents, sample size 311.



**Figure 13.** Survey participants stratified by area(s) of competence. Percentage of respondents, sample size 311.

#### 6.3.1.4. Geographical distribution of survey participants

The survey also included a question that aimed to identify the countries where respondents work and two choices were allowed for this question. Survey respondents were selected from the following representative European countries: France, Germany, Italy, the Netherlands, Poland and the UK. The majority of participants (304, i.e. 97.7%) selected only one country. A special effort was made to maintain a homogenous country coverage of about 50 respondents per country (Fig. 14).

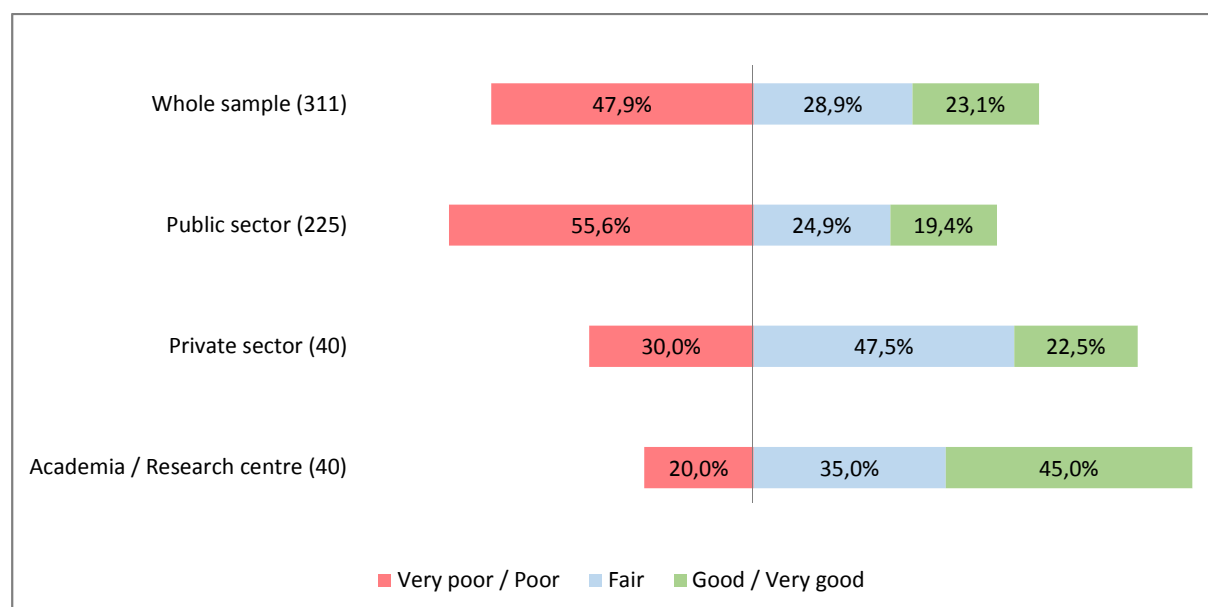


**Figure 14.** Number of survey respondents working in each of the selected European countries, sample size 311.

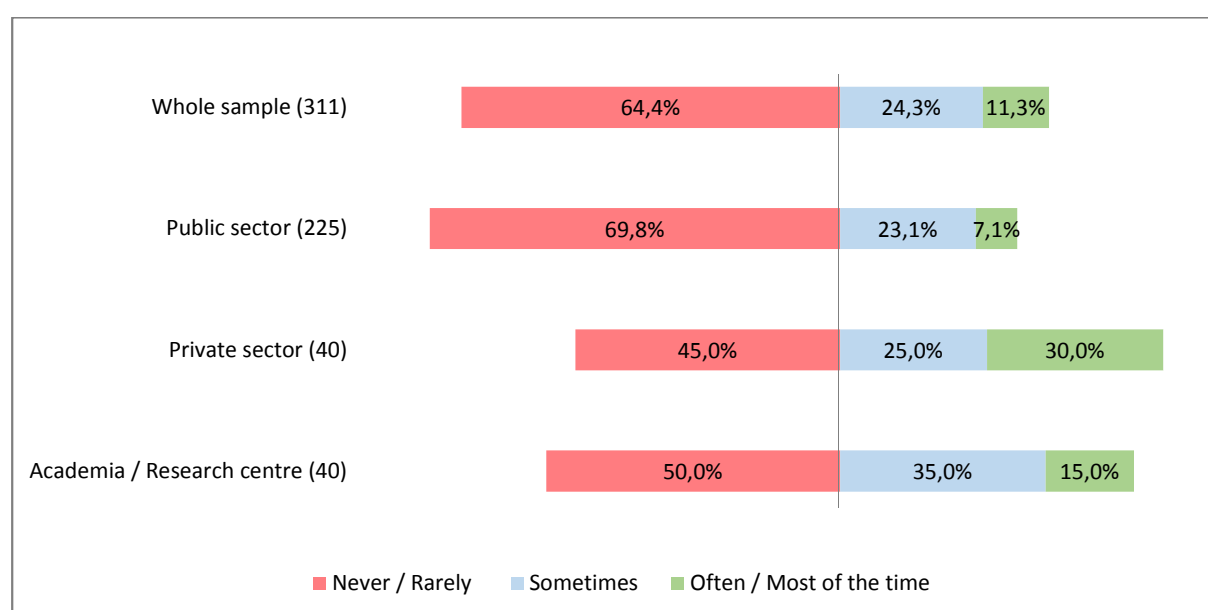
### 6.3.2. Section B - Role of ICT applications in the treatment of substance use disorders

#### 6.3.2.1. Level of knowledge and frequency of use of ICT-based interventions in the treatment of addictions among health professionals

The first two questions of this section aimed to assess the level of knowledge and the frequency of use of ICT-based interventions among the survey's respondents.



**Figure 15.** Please judge your level of knowledge of ICT applications in the treatment of substance use disorders (Question 10) Whole sample and subgroup analysis by affiliation type. Percentage of respondents, sample size indicated within the brackets.

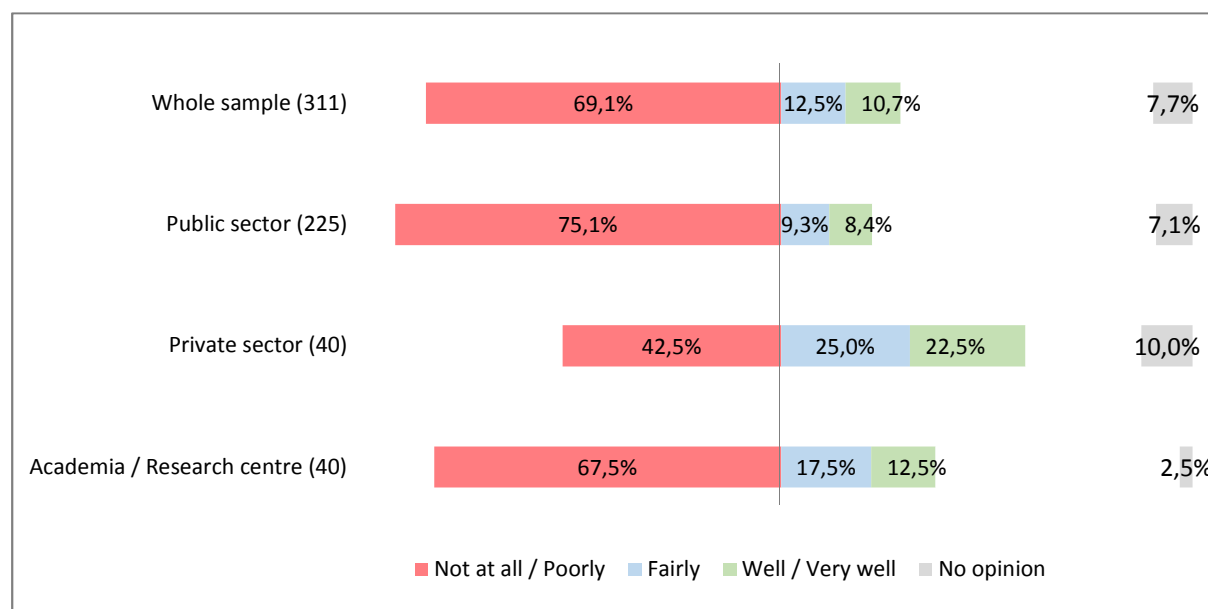


**Figure 16.** How often do you use ICT applications in your practice to treat substance use disorders? (Question 11) Whole sample and subgroup analysis by affiliation type. Percentage of respondents, sample size indicated within the brackets.

About half of the respondents (47.9%) reported their level of knowledge as very poor/poor (Fig. 15) and likewise more than half of participants (64.4%) reported that they rarely/never use these tools in their clinical practice (Fig. 16). Subgroup analysis reveals a clear shift towards higher level of knowledge and frequency of use of ICT-based interventions across different types of affiliation. In particular, respondents from academia/research centres, as well as from the private sector (both profit and non-profit), reported a higher level of knowledge together with a higher frequency of use of ICT-based interventions (Fig. 15 and 16). Other factors including age, area of competence and years of experience seem not to correlate with the level of knowledge and the frequency of use of ICT-based interventions.

### 6.3.2.2. Integration of ICT applications in different health care settings for addiction treatments

The large majority of survey respondents (69.1%) reported that ICT applications are not at all/poorly integrated in the health care setting where they work. Subgroup analysis reveals a correlation between this data and the type of affiliation, where in the private sector (both profit and non-profit) ICT applications seem to be better integrated (Fig. 17). Other factors including age, area of competence and years of experience do not seem to correlate with the level of integration of ICT-based interventions in the health care setting.

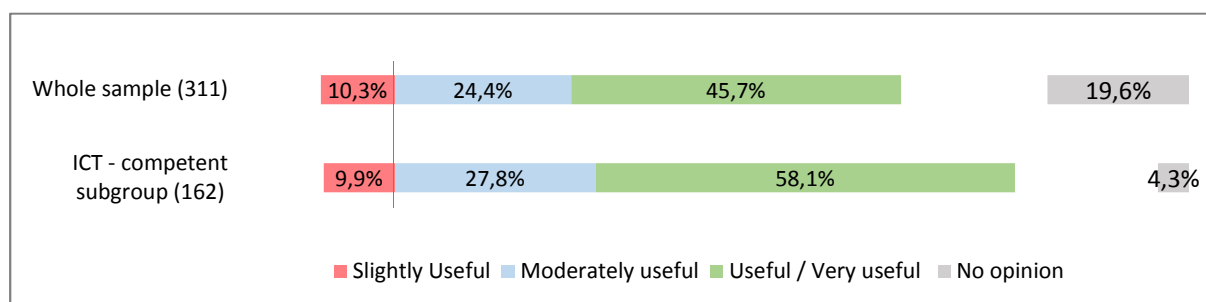


**Figure 17.** How well are ICT applications integrated in your healthcare setting of substance use disorders treatment? (Question 12) Whole sample and subgroup analysis by affiliation type. Percentage of respondents, sample size indicated within the brackets.

### 6.3.2.3. Clinical importance of ICT applications in the treatment of addiction

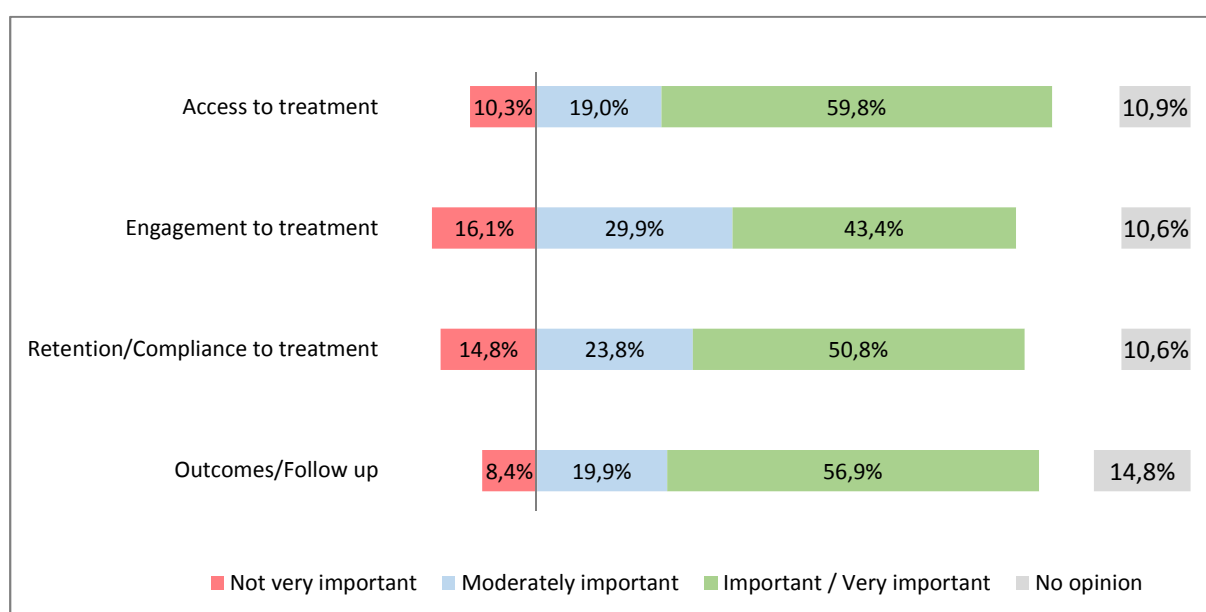
In this set of questions, survey participants were asked to give an opinion on the effectiveness of ICT applications in the treatment of addiction. About 46% of respondents consider ICT applications useful/very useful in the treatment of substance use disorders (Fig. 10). The relative large proportion (20%) of respondents expressing 'no opinion' is likely due to the poor/very poor level of knowledge of ICTs within the whole sample (47.9%, Fig. 7). In fact, the proportion of 'no opinion' falls to 4% among participants who have fair/good/very good level of knowledge of ICT (ICT- competent subgroup) (Fig. 18).





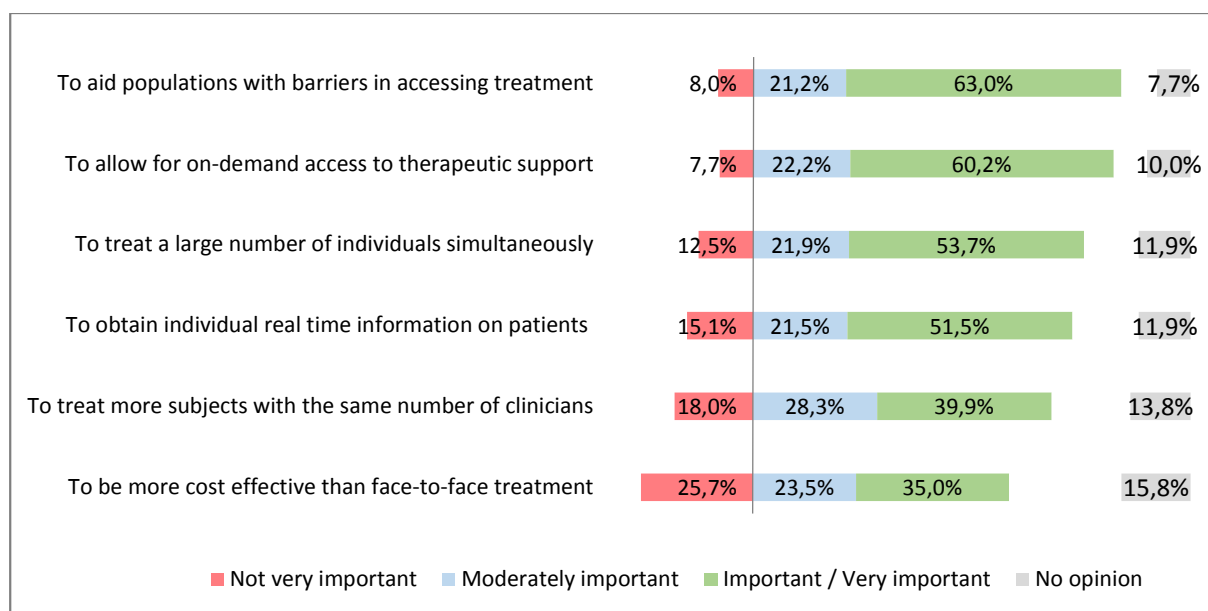
**Figure 18.** How useful are ICT applications in the treatment of substance use disorders? (Question 13) Percentage of respondents, sample size is indicated within the brackets.

In general, respondents consider ICT applications important or very important to improve access to treatment and outcome/follow up (Fig. 19).



**Figure 19.** How important are ICT applications to improve each of the following phases of the treatment of substance use disorder? (Question 14) Percentage of respondents, sample size 311.

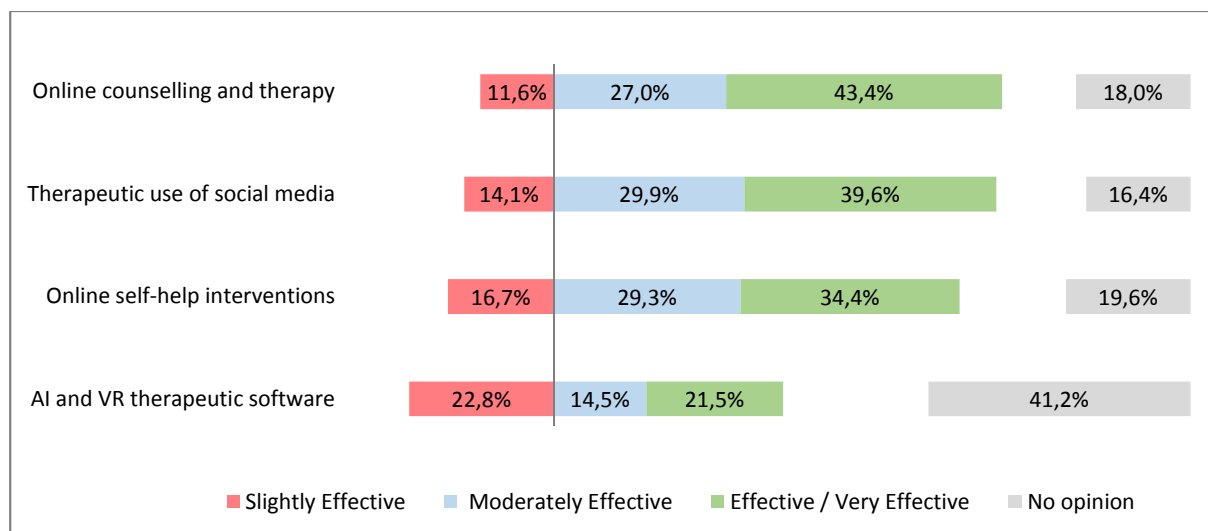
When it came to more specific aspects of the treatment, survey participants considered ICT applications particularly important 1) to aid populations with significant barriers in accessing treatment and 2) to allow for on-demand access to therapeutic support outside of formal care settings. Whereas respondents do not clearly consider ICT applications to be more cost-effective than the face-to-face treatment (Fig. 20).



**Figure 20.** How important are ICT applications to improve each of the following aspects of substance use disorders treatment? (Question 15) Percentage of respondents, sample size 311.

#### 6.3.2.4. Effective ICT-based applications for the treatment of substance use disorders

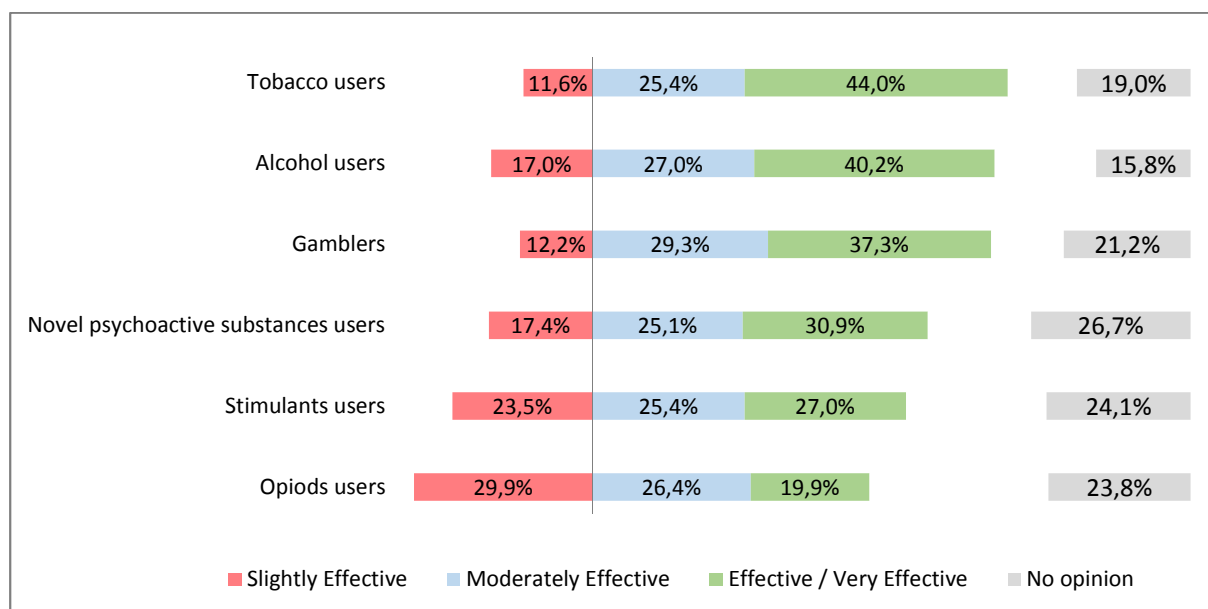
In general, online counselling and therapy are the ICT-based interventions considered most effective in the treatment of substance use disorders (Fig. 21). These experts' opinions do not vary across different sample subgroups (selected for type of affiliation, area of competence and country where they work).



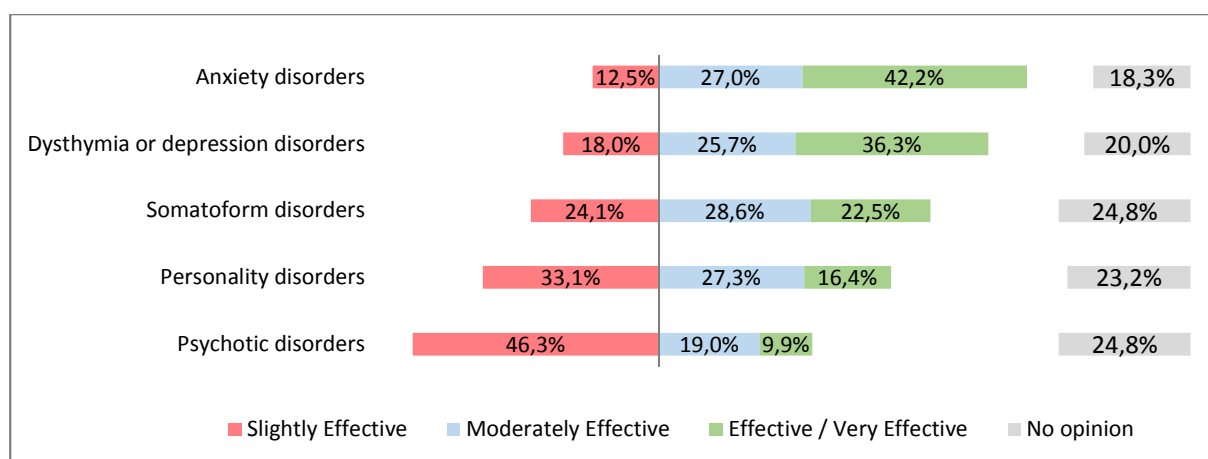
**Figure 21.** How effective are the following ICT applications, in your opinion, in the treatment of substance use disorders? (Question 16) Percentage of respondents, sample size 311. AI = Artificial Intelligence; VR = Virtual Reality

### 6.3.2.5. Effectiveness of ICT-based interventions in different substance user groups

Survey participants reported that ICT-based interventions are particularly effective in the treatment of tobacco and alcohol users and gamblers, and less effective in the treatment of opioid users (Fig. 22). Moreover, in the case of substance users living with psychiatric disorders, ICT-based intervention would be particularly effective in the treatment of users with anxiety disorders and dysthymia or depression, while they would be only slightly effective for patients with psychotic and personality disorders (Fig. 23).



**Figure 22.** Although nowadays drug users are often poly-drug users, in your opinion, how effective are ICT applications in the treatment of the following substance users? (Question 17) Percentage of respondents, sample size 311.

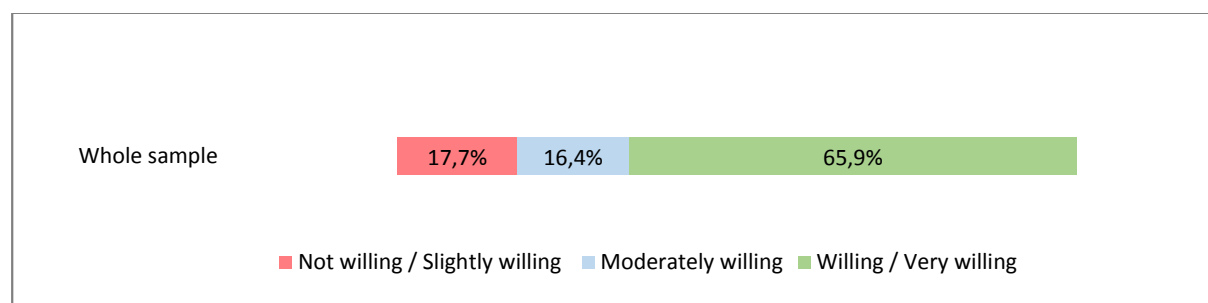


**Figure 23.** Substance users are often also affected from psychiatric disorders. In your opinion, how effective are ICT applications in the treatment of the following psychiatric disorders? (Question 18) Percentage of respondents, sample size 311.

### 6.3.3. Section C - Future scenarios and trends of ICT applications

#### 6.3.3.1. Willing to attend training courses on the use of ICT applications

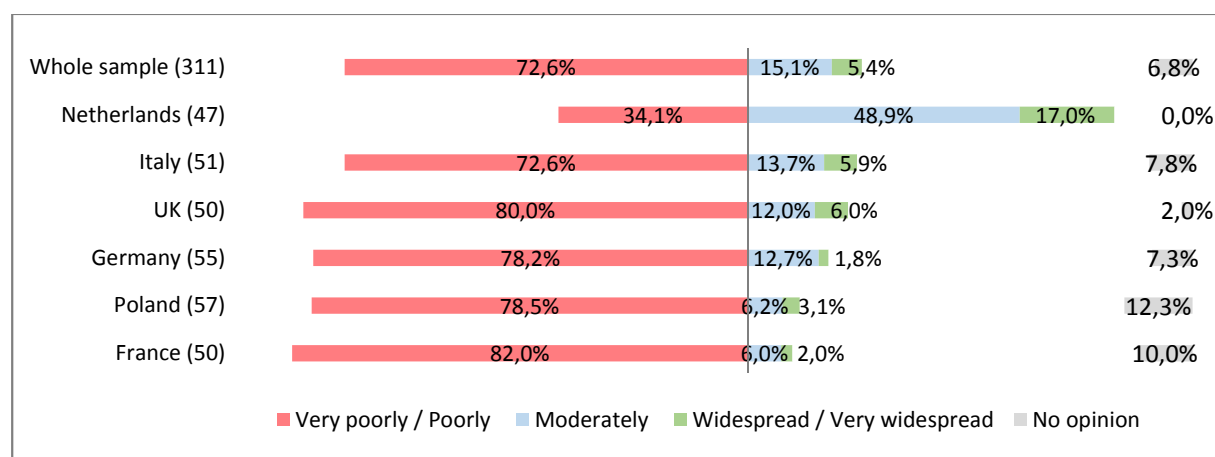
Regardless of their current level of knowledge of ICT based interventions, the majority of participants are willing or very willing to attend training courses on the use of these technologies in the treatment of substance use disorders (Fig. 24).



**Figure 24.** How willing are you to attend training courses on the use of ICT applications in the treatment of substance use disorders? (Question 19) Percentage of respondents, sample size 311.

#### 6.3.3.2. Current diffusion of ICT-based interventions in the European countries under study

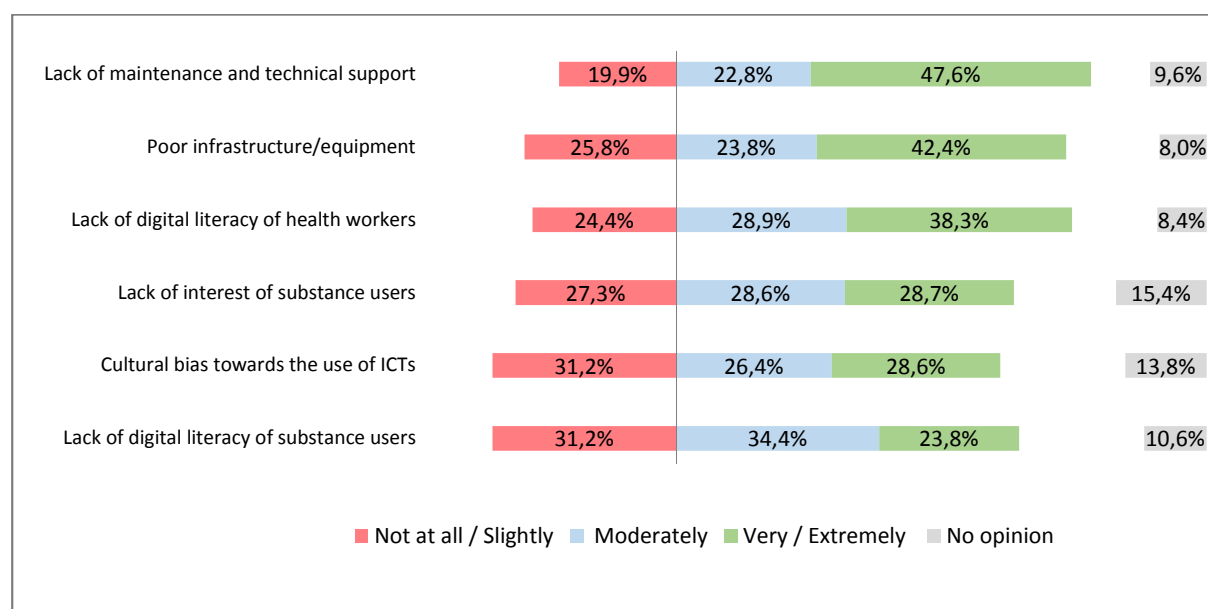
The large majority of experts reported that the use of ICT-based interventions for the treatment of addiction is very poorly or poorly widespread in the country they work in (Fig. 26). This situation does not vary significantly across countries, with only the exception of the Netherlands where the proportion of experts reporting a moderate to very widespread usage of these technologies is almost three times larger than the average of the whole sample (Fig. 25).



**Figure 25.** How widespread do you believe the use of ICT applications is in the treatment of substance use disorders in your country? (Question 20) Percentage of respondents, sample size is indicated within the brackets.

### 6.3.3.3. Barriers to ICT-based interventions for the treatment of substance use disorders

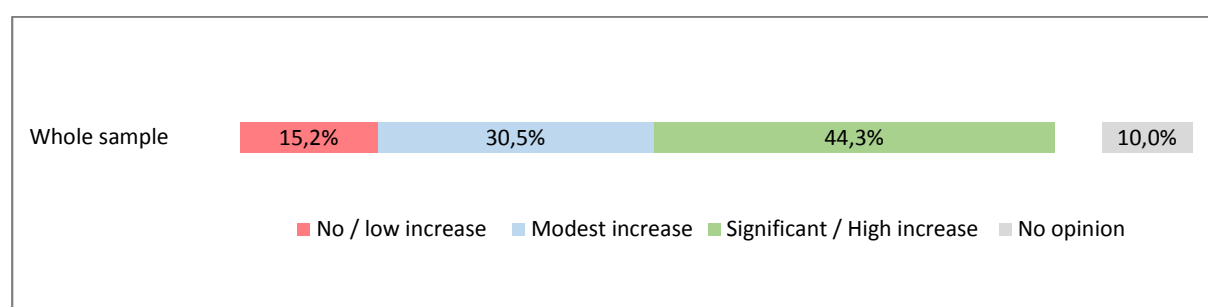
Concerning the underlying obstacles facing the poor diffusion of ICT-based interventions for addiction treatment, the survey's participants identified poor infrastructure, lack of maintenance and technical support endowment in these countries as major obstacles. Another slightly less important obstacle is the lack of digital literacy of health workers. Cultural bias and a lack of interest of substance users towards ICT-based interventions are not seen as major obstacles (Fig. 26).



**Figure 26.** In your opinion, how much do the following factors hinder the use of ICT applications in the treatment of substance use disorders in your country? (Question 21) Percentage of respondents, sample size 311.

### 6.3.3.4. Future trends in the use of ICT-based interventions in the treatment of addictions

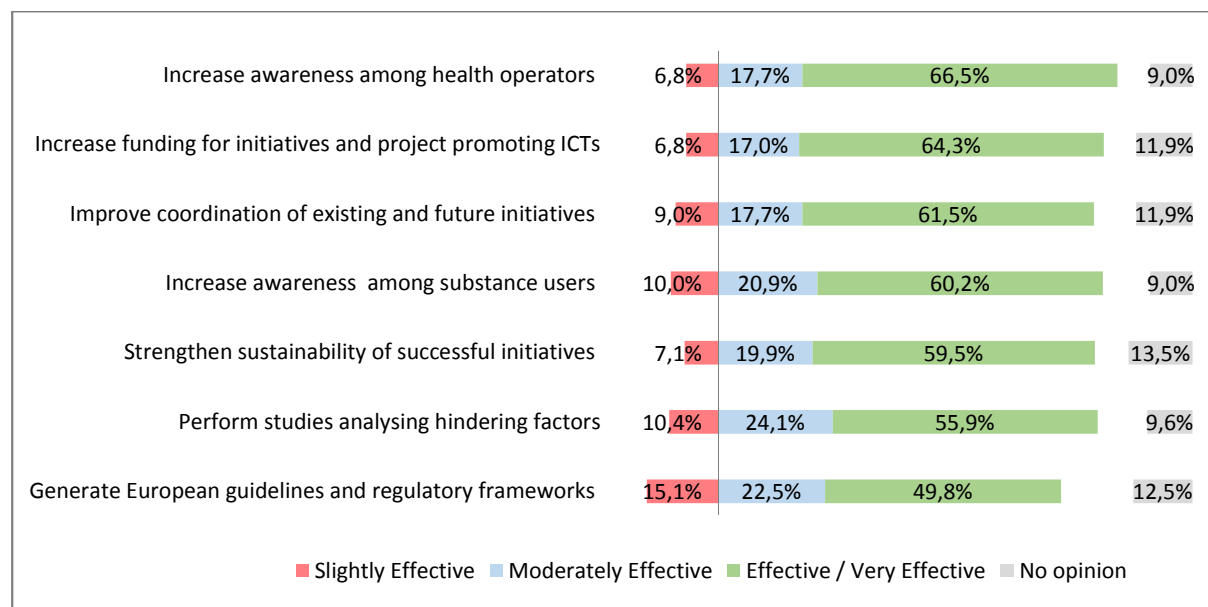
Half of the survey's participants foresee a significant/high increase in the use of ICT-based interventions in the treatment of addiction in the future (Fig. 27).



**Figure 27.** Which trend do you foresee in the future for the use of ICT applications in the treatment of substance use disorders in your country? (Question 22) Percentage of respondents, sample size 311.

### 6.3.3.5. Policies which can foster the use of ICT-based interventions in the treatment of addictions

Focusing on policy options that can contribute to fostering ICT-based interventions usage, the need for more funding and to increase awareness of ICTs benefit among health professionals are indicated as major issues followed by improving coordination and sustainability of ICT initiatives (Fig. 28).



**Figure 28.** In your opinion, how effective would the following policy options be in promoting the use of ICT applications to treat substance use disorders in your country? (Question 23) Percentage of respondents, sample size is 311.

## 6.4. Conclusions

New technologies may play an important role in assessing, preventing, treating and supporting the rehabilitation of people with substance use disorders. Nonetheless, the application of these technologies in the treatment of addictions is still at an early stage: establishing how these technologies can be implemented in the current and future health care systems requires further research. The present survey and associated interviews investigate the clinical efficacy of these technologies and potential hindering factors to their implementation in the context of the European Union public health system.

The great majority of experts recruited in this study operate in the public sector and have significant professional experience in the field of addiction, which strengthens the validity of their contributions. Although the complexity of the topic makes it hard to come up with generalisations about the usage of ICT-based interventions in the treatment of substance disorders, some key aspects emerged from this study. One of them is that the current level of knowledge is very low among participants. Only half of the survey's respondents reported a level of knowledge from fair to very good and a marked difference exists between professionals from the public sector and those from private sector and academia who reported a significantly higher level of knowledge. Professionals from both academia and the private sector also use more ICT-based applications in their practice.

Participants believe that ICT-based interventions hold the promise of providing service to more people, to people in remote areas, and to people with limitations that prevent them from participating fully in the healthcare services as they are currently structured. In addition, in combination with face-to-face interventions, ICT-based interventions improve engagement and compliance to treatment, providing a more effective and always-available support for patients.

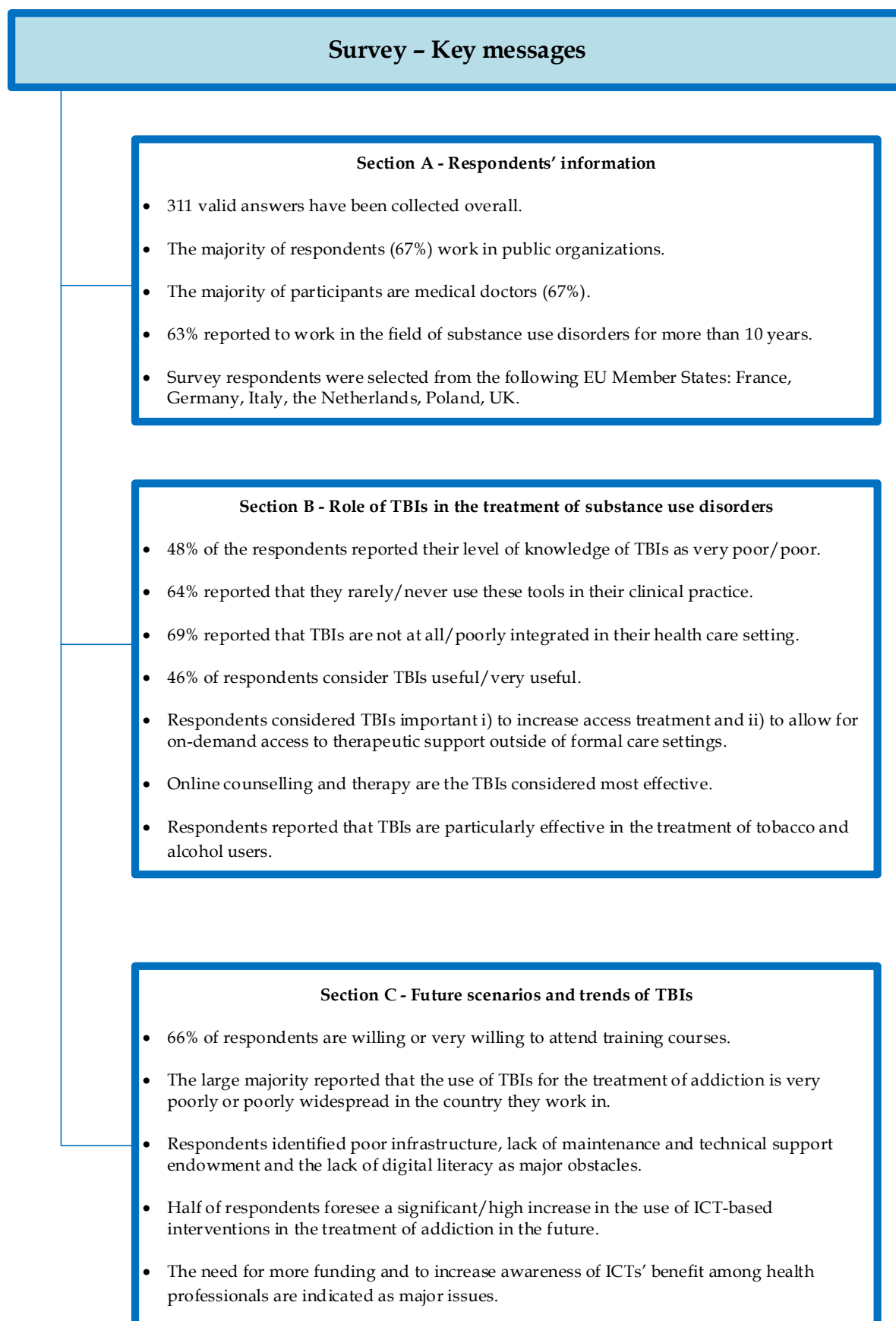
Scarce infrastructure endowment is identified as the main barrier hampering the use of ICT-based interventions. Other major barriers involved the lack of digital literacy of health care professionals. A key to widespread adoption of ICT solutions is the promotion of these technologies among healthcare professionals and patients alongside with the improvement of education and training. In addition, a transformation of the regulatory and funding environment to support the integration of ICT-based interventions in the current health care services is required.

One limitation of the survey is the potential participant bias. A convenience sample was used in this study because applying a statistical sampling technique was impractical. Although this undermines our ability to make generalisations from our sample to the population, the majority of survey participants selected are professionals with many years of experience in the field of addiction, confirming that most of the collected opinions are underpinned by a significant professional experience in the field this study examines.

Another limitation is the information bias that the questionnaire design may have conveyed and thus that respondents' opinions may have been distorted. That said, all questions in the survey were reviewed by a panel of researchers and participants in the pilot study, and thus, the questionnaire was less likely to include items that could mislead respondents' judgment.

ICT-based interventions offer an opportunities to improve the treatment and management of substance use disorders. New technologies currently being developed hold great but unknown potential. More research is needed on the effectiveness and costs/benefits of ICTs as applied to the treatment. ICTs represent an exciting and promising development in the treatment of substance use disorders but technological and non-technological factors must be addressed effectively in order to adopt these technologies widely.





**Figure 29.** Key messages of the survey.

## 7. Semi-structured interviews with leading experts

### 7.1. Introduction

The aim of semi-structured interviews was to expand and elaborate on the experts' view on the topic of ICT-based interventions in the treatment of substance use disorders. Interviewees were selected among experts who had participated in the survey based on their years of experience in the field of addiction and in such a way as to guarantee a balanced geographical coverage.

Interviews followed a semi-structured questionnaire with a predefined list of questions (available in Annex II). All of the questions were based on the results of the online survey. In particular, they focused on two main topics:

- 1) Clinical value of ICT-based interventions in the treatment of addictions, which elaborates on the results of Section B of the survey.
- 2) Policy implications for their implementation, which elaborates on the results of Section C of the survey.

Overall 18 experts were interviewed. The majority of the interviewees (76.5%) are medical doctors, specialised in psychiatry or addiction medicine. Those working in the public sector or in the academia and research represents 94% of the sample (47% respectively). Six per cent works in the private sector. One interviewee is the president of a patient's association. The interviews were carried out by phone or via a laptop through platforms such as Skype or GoToMeeting. Interviews lasted between 30-60 minutes. To prepare for the interview, interviewees received the questionnaire and a summary of the survey's data at least one week in advance.

### 7.2. Summary of findings

#### 7.2.1. Value of ICT-based interventions in the treatment of addictions

This section of interviews elaborates on the results of Section B of the survey assessing the importance of ICT applications in the treatment of substance use disorders. All of the interviewees confirmed ICT applications as valuable tools to improve the treatment of substance use disorders. Most interviewees agreed that a combination of face-to-face and ICT-based interventions (blended interventions) are the most effective.

However, some interviewees mentioned that the extent to which ICT should be included in a therapeutic programme should always be carefully considered. The right balance in each therapeutic programme between the face-to-face and ICT components depends heavily on several factors such as: age, stages and types of patients. As a general principle, blended interventions are seen as particularly effective for patients who are not willing or able to strictly follow the treatment (e.g. young patients or patients with severe psychiatric comorbidity). However, stand-alone ICT-based interventions would suit more self-motivated patients. In this context, the importance of an integrated and flexible system, which allows for choosing whether and the extent to which a particular therapeutic programme should adopt ICT tools, was highlighted.

Most interviewees agree that ICT-based interventions are valuable tools to overcome both physical and social barriers such as stigma, and hence significantly facilitate the access to treatment. Moreover, several interviewees mentioned that ICT applications played an important role in the screening and early detection of populations at risk. In this regard, it was noted that ICT applications (as first base line interventions) offer a platform where people can test themselves if they have a problem and where they can find further help. This is likely to allow a larger population of patients to access treatment and at an earlier stage in the disease progression, therefore maximising the success of the treatment. In this

particular context, some interviewees emphasised the crucial role that ICT applications could have in reducing the enormous treatment gap in addiction, with important long-term benefit for society, especially when applied to young people.

According to some interviewees, blended interventions could also improve the engagement and adherence to treatment through intensifying medical support provided to patients. Forums, social media and mobile apps linked to the treatment were specifically indicated regarding this. In particular, the effectiveness of patient-to-patient platforms controlled by physicians in facilitating access, engagement and compliance to treatment has been noted. These kinds of platform function as contact points where patients can share information about where to find treatments and treatment protocols as well as potential treatment side effects and their management. In this regard, such platforms provide an interesting perspective in serving as first pharmacovigilance units to monitor potential drugs' side effects.

Most of the interviewees agreed that ICT-based interventions could potentially be more cost-effective than traditional approaches. However, they warned that the cost-effectiveness of a particular ICT-based intervention (either blended intervention or stand-alone) relies on several factors and needs to be evaluated on a case-by-case basis. ICT-based interventions hold the promise to reduce costs by optimising resources and by delivering treatment to a larger group of patients while ensuring a similar or better level of clinical effectiveness as compared to the traditional treatment. Some ICT-based interventions - like brief screening interventions for substance use - may, as a result, be very cost effective due to their relatively low setup costs. On the contrary, others, like platforms for the treatment and management via Internet, require high setup and maintenance costs, which need to be amortised in the long term by maximising the number of patients receiving the treatment.

In line with the survey's data, poor infrastructure and the lack of digital literacy are largely recognised as major barriers to the diffusion of ICT-based interventions in the treatment of addiction. However, few interviewees working in countries where these two issues have been solved reported cultural bias towards ICT-based interventions as a major barrier to the implementation of these technologies.

Cultural bias lies in the belief of some professionals who consider that ICT-based interventions lacked the essential element of direct human-to-human communication. In the context of cultural bias, poor adherence to the therapeutic protocols by clinicians is considered as another important hindering factor. In addition, few interviewees considered the non-integration of ICT-based interventions in the formal national reimbursement system as another major hampering factor, which in turn does not stimulate either investments in this sector or the use of these technologies in the clinical practice.

## **7.2.2. Future actions for the implementation of ICT-based interventions**

This section of interviews elaborated on the results of Section C, investigating the major barriers to the implementation of ICTs in the treatment of substance use disorders and future actions to overcome them. With regard to the type of future actions that the EU should consider in order to foster the implementation of ICT-based interventions in the treatment of addictions, interviewees' answers essentially confirmed the survey's data. Increased awareness about the benefits of ICT-based interventions and fostering digital literacy among healthcare professionals and patients are widely recognised as important. In this context, promotional campaigns, the integration of training programmes on ICT applications in the training programmes for health care professionals of addiction, and establishing incentives promoting the development and the use of ICT applications in the clinical practice were considered to be valuable potential solutions. Two interviewees suggested that including ICT-based interventions in the formal reimbursement system would stimulate the investments in this area and the usage of these technologies in clinical practice.

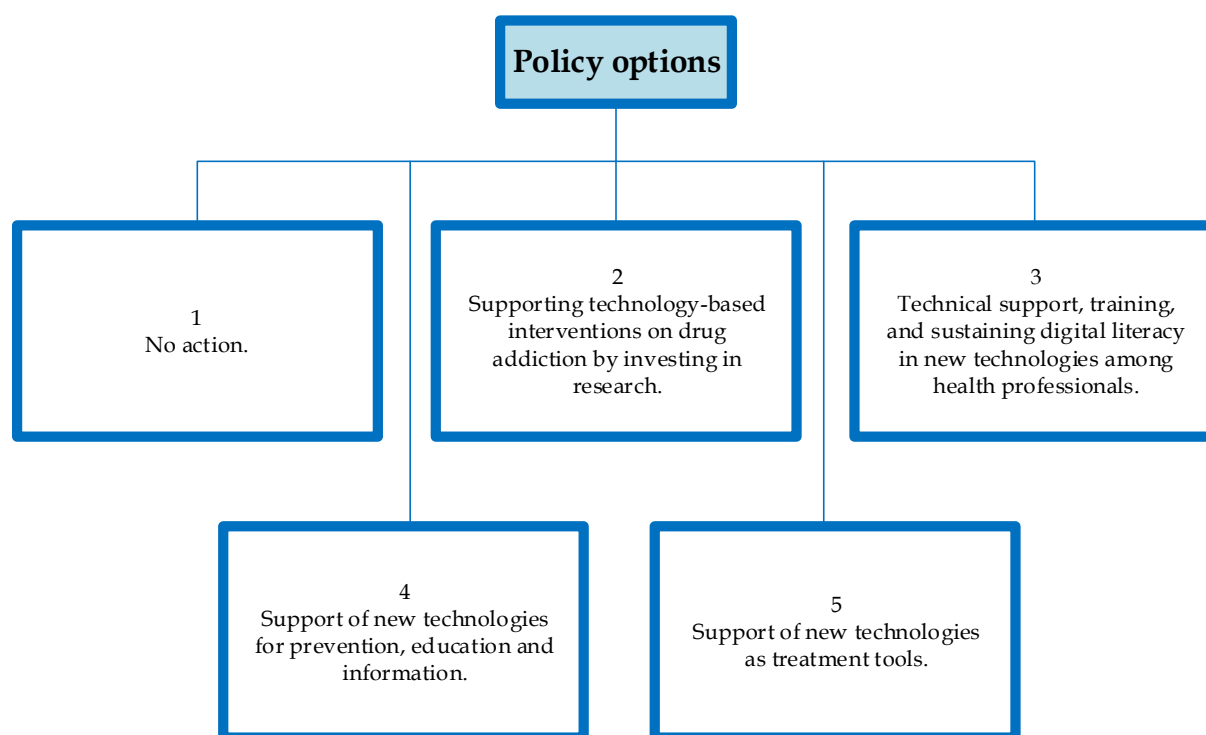
Other interviewees highlighted the need to increase funding and improve coordination of initiatives promoting ICT-based interventions in Europe. Collaboration between different actors including

professional and patient organisations as well as national health authorities and the private sector should be carried out in order to avoid duplicating and overlapping and to ensure the sustainability of such initiatives.

Finally, most interviewees highlighted the need for more robust research in this area in order to assess the effectiveness and cost-effectiveness of the ICT-based interventions. Moreover, it has been pointed out that more research should be carried out, targeting more specifically the performance of these interventions in the real life context. In this regard, it was noted that ICT-based interventions per se are powerful research tools, as the patient data from ICT-based programmes provides a valuable set of real-life data immediately available for research purposes, which would allow relatively rapid identification of best practices and treatments that are more effective.

## 8. Policy options

This chapter assesses different policy options (Figure 30). They are discussed in light of the literature review and the results of the survey and interviews carried out with experts in the field of drug dependence. In the formulation of the options, existing EU policies, when pertinent, have been taken into account. Within this framework, five policy options emerged. Each option has its own advantages and disadvantages. They are presented and discussed in the following sections.

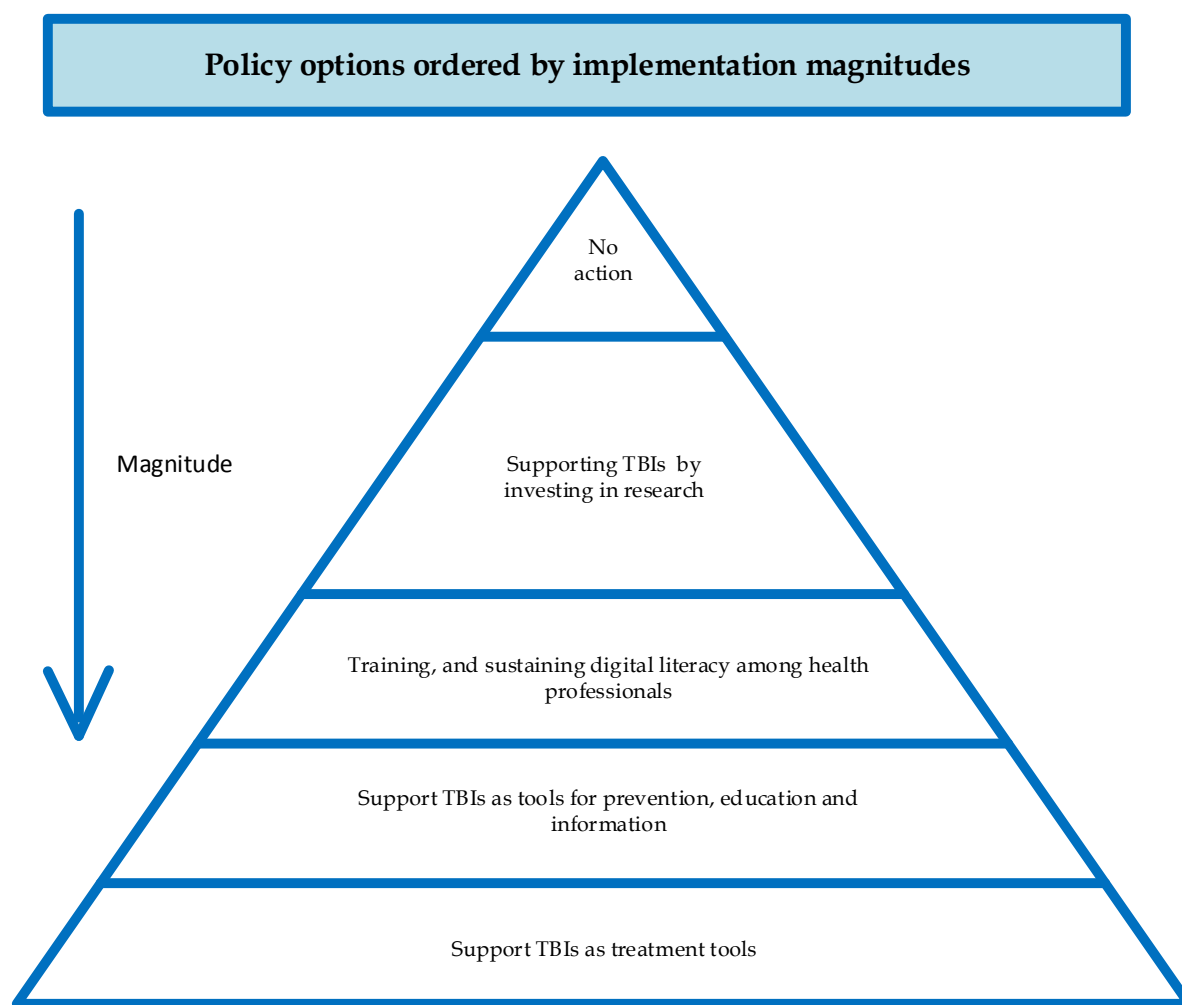


**Figure 30.** Policy options.

The policy options presented here can be seen as an in-depth involvement of TBIs in the field of addiction care, ranging from policy option 1 (which does not require any action) to policy option 5 (that suggests a full use of new technologies in the treatment of addictions), going through other options (policy option 2, 3 and 4) which suggest progressive and subsequent steps (Figure 31).

### 8.1. Policy option 1: No action

If no action is taken, an opportunity to address some important public health issues related to drug addiction prevention and treatment would be missed. In EU drug policy, an increasing focus has been placed on service quality in recent years. This culminated in the adoption of 'Minimum quality standards in drug demand reduction in the European Union' by the EU Council of Ministers in September 2015 [Council of the European Union, 2015]. The standards reinforce the need to base interventions on evidence, providing staff with appropriate training, sharing of best practices at a European level and promoting knowledge exchange. The 'no action' option does not include any of these activities.



**Figure 31.** Policy options ordered by implementation magnitudes.

In addition, it seems difficult to see an evolution in addiction care (including the realisation of the EC e-Health Action Plan 2012-2020 [EC, 2012]) without enhancing new technologies as a key part of a new model of care. The EC encourages cooperation between EU Member States on e-Health and supports them in developing and implementing cost-effective and interoperable e-Health solutions to improve health systems [EC, 2012; Official Journal of the European Union, 2011]. The EC also emphasises the benefits of e-Health services for citizens, patients and healthcare providers, and proposes specific actions to lower the barriers for deploying these services [EC, 2012]. European reference networks would represent an ideal opportunity to introduce and test new technologies for addiction disorders in the EU.

Therefore, the 'no action' policy might be unsustainable because it may jeopardise the ability of the EU to take advantages of the opportunities that the application of TBIs to drug addictions seems to offer. The policy option 'no action' also does not permit the exploitation of advantages and innovative solutions, or even properly address the criticalities, which have emerged from the use of new technologies on drug disorders.

## 8.2. Policy option 2: Supporting technology-based interventions on drug addiction by investing in research

Despite an increasing number of studies discussing internet-based interventions for the treatment of addictions, only a relatively small number represent suitable trials. There is a need to improve the methodology of studies undertaken by rigorously designing the studies and selecting appropriate and sufficiently large samples. The novelty of this field has precluded the establishment of a gold standard treatment evaluation method and this limits the extent to which trials and treatments can be compared [Gainsbury, 2011]. Furthermore, it is not possible to determine whether the treatment effects are unique to the population studied, or whether they could be generalised to other forms of addiction and others subgroups of patients. Few studies included any follow-up assessments, thereby limiting our knowledge about the long-term effects of these treatments. Most of the studies failed to document the specific amount of therapist-contact time and failed to examine clients' satisfaction with technology-based treatment.

Future research might address issues of study design, optimising the efficacy of computer technologies and understanding the mechanisms of delivery [Carrey, 2009]. From both the literature review and the survey, it emerged that supporting TBIs on drug addiction by investing in research is important for better understanding the potential and limits of these applications. Several features and limitations regarding the particularities of internet-based drug treatment interventions should be better elucidated. Some lines of research that this policy option could support are mentioned here below.

1. Systematic comparisons of computer technologies to alternatives that vary in type (e.g. education-only, brief and long face-to-face interventions, and single versus multiple computer-delivered modes) would be helpful: such data could provide a clearer picture of the added value of computer technologies over other treatments.
2. Additional research is needed investigating the differences between existing technology programmes. There may be a difference in efficacy because of the different communication methods used or the frequency and intensity of personal contact between clinician and participant. Furthermore, while cognitive behaviour therapy is the predominant approach for treatment using the internet, other methods and approaches have to be applied and evaluated.
3. Studies might be designed to better match characteristics of individuals (type of drug used, personality, potential associated psychiatric disorders, level of motivation, risk factors, polydrug use etc.) with intervention modalities [Cook, 2005; Moyers, 2006]. The final goal should be to produce a set of guidelines that could be used to match patients of a specific profile with the best available internet interventions available to them.
4. It would be informative to evaluate maintenance of gains and long-term impacts associated with computer technologies more systematically; studies should include more and longer follow-ups. Also, users who did not complete the therapy programme should be included in follow-up studies to determine the impact of partial programme completion, including whether they subsequently engaged in any other form of treatment. Self-reported data should be confirmed through biochemical testing or clinician interviews.
5. More research is necessary on how to make TBIs available to a wider European audience, attractive to subgroups of addiction populations (e.g. lower educated and older clients), as well as considering different techniques to increase treatment effectiveness among men and women.



6. Additional research is needed investigating how to address data security/privacy issues regarding internet interventions, and to assure that the content and technical architecture of internet interventions meets minimum quality demands.
7. It would be informative to evaluate how to make internet interventions scalable and maintainable endeavours for national and regional public health systems and treatment organisations. Few studies have examined the cost-effectiveness of technology-based treatments. Given the advanced hardware required for some forms of technology-based therapy (such as virtual reality therapy), it is important to determine whether these treatments are, in fact, cost-effective alternatives to face-to-face treatment.
8. At present, most drug treatment programmes are for cannabis, tobacco and alcohol: it is important to gain specific data about the efficacy of new technologies also for illicit drugs (cocaine, heroin, MDMA etc.).
9. Cost-effectiveness analysis is a tool for investigating the net gains in relation to the incremental costs of a given treatment compared to an alternative [Saha, 2001]. More economic valuations are needed, especially comparing technologies interventions and face-to-face interventions or the most cost-effective intervention currently available [Donker, 2015]. Evaluation of new technology interventions can improved by increasing comparability between the studies (e.g. by using standardised generic measures), clarifying which costs should be included in evaluations. As addiction disorders are chronic relapsing diseases associated with economic consequences, at both individual and social levels, the societal perspective would be the one of most value to policy makers [Donker, 2015].

Increasing the quality of research would enable effective clinical interventions to be implemented to assist those with addiction-related problems but also could help and support decision-makers in better understanding the potentiality of these technologies from a public health perspective.

### **8.3. Policy option 3: Technical support, training, and sustaining digital literacy in new technologies among health professionals working on drug addiction**

Given the proliferation of data supporting the efficacy of new technologies, it is surprising that few therapists use them in the clinical setting. 64% of participants in our survey reported that they rarely/never use these tools in their clinical practice. Another, less recent, study among psychotherapies in the UK found that only 2.4% were using computerised self-help with their clients and only 1% were using computerised self-help as an alternative to face-to-face contact [Whitfield, 2004]. However, the majority of the respondents to our survey believe that ICT applications could be important for improving access, compliance and follow up to treatment (60%, 51% and 57% respectively). In addition, 66% of the sample declared themselves to be willing/very willing to attend training courses on the use of new ICT in the treatment of substance use disorders. Finally, among factors hindering the use of ICT applications in the treatment of substance use disorders are lack of technical support (48%), poor infrastructure equipment (42%) and lack of digital literacy of health workers (38%).

It has been observed that a clinician skilled in treating subjects with substance use disorders and with good knowledge of online technologies will not necessarily make an expert online therapist [Fisher, 2003; Lovejoy, 2009]. Contrary to what is generally thought, especially for those who use the internet in a non-professional way, internet/technology-mediated therapy in drug abuse treatment is not an easy task.

Although training courses on online counselling on drug abuse treatment have started to appear in the European Union, they remain few in number. In addition, few standards exist that elucidate the technical skills required to practice online therapy with this typology of subjects. In this context, ICT could be included in the training programmes for health care professionals of addiction. A number of diploma degrees in this new biomedical field, or a number of open access literature repositories and educational activities on new technologies promoting the development and the use of ICT applications at the clinical level, could also be pursued.

A policy option that the EU could consider in order to foster the implementation of ICT-based interventions in the treatment of addictions is to provide funding and resources to increase technical support, providing adequate ICT infrastructure and fostering digital literacy among healthcare professionals. This policy option emerged as a priority from the interviewees. Several EU research studies which have investigated the major challenges of e-Health in Europe have emphasised the importance of training and technical support to health workers as a key factor for success [Moen, 2012; U4Health, 2016; Hoerbst, 2015].

With increasing access and demand for TBIs, health professionals will need to embrace this evolution and evolve along it [Marsch, 2013]. In the near future, training for health personnel will become not only necessary but also multidisciplinary. Clinicians should develop expertise in different types of media and virtual reality interventions, developing collaboration with experts of other fields, such as cognitive psychology, statistics, ICTs and communications [Marsch, 2013; Ramsey, 2016].

#### **8.4. Policy option 4: Support of new technologies as tools for prevention, education and information on drug addiction**

Drug prevention approaches aim to prevent drug use and related problems, while drug treatment represents the primary response to dependence. As mentioned in policy option 2, a lot of research is needed to clarify impacts and different aspects of new technologies on the field of drug use. At present, they can still be viewed as being immature and it could be argued that they are not sufficiently advanced to be applied for treatment. However, new technologies on drug addiction can already be used as tools for prevention, education and information. The increasing number of internet users and the use of the internet for health purposes show the relevance and potential of the medium in the field of health promotion and prevention.

A survey on e-Health was carried out in 2014 in the 28 EU MS by the European Commission [EC, 2014]. The survey assessed the extent to which Europeans already use the internet and online resources to help manage their own health. Sixty percent of respondents had used the internet for searching health-related information in the last 12 months and over half said they did so at least once a month. This percentage is highest in the 25-34 years age group and steadily decreases thereafter [EC, 2014]. Personally-tailored information compares favourably to standardised 'one-fits-all' brochures [Lilja, 2003; De Vries, 1999]. The internet, with its interactive character, is well-suited to such personalised methods of information and knowledge transfer.

Several factors render the internet an attractive delivery platform for education, prevention and information programmes. internet-based programmes can be made available around the clock. Users can mostly accomplish the intervention at their own pace, when and where they want. New technologies also have the potential to reach large populations of susceptible individuals and groups that may be difficult to access through more traditional approaches. Once developed, programmes need little maintenance effort and are widely accessible to a huge online population with almost no additional costs. In addition, in terms of the per capita cost of prevention messages, they are relatively inexpensive [Brinn, 2010].

Health prevention and education campaigns are initiatives typically undertaken by national or regional health authorities which use communication media to disseminate health information or to persuade people to adopt behavioural changes. For example, an important reason for not seeking alcohol treatment is a lack of problem awareness. Several studies have showed that patients did not seek treatment because they did not perceive any need for treatment [Edlund 2006; Mojtabai, 2013; Probst, 2015]. The finding that the main reason for not seeking treatment was a lack of acknowledgment of the problem indicates a huge potential for prevention if the health care system were to address those patients with mild alcohol use disorders, who are already at increased risk, but do not (yet) perceive a need to seek treatment [Probst, 2015; Rehm, 2013a]. TBIs with a continuous monitoring of patients' alcohol use could be useful in prevention of alcohol use disorders.

The use of cannabis by young people is one of the focuses of prevention strategies on drug addiction in the European Union. The prevention of cannabis use and drug-related problems among young people encompasses different approaches. Universal strategies target entire populations, while selective strategies targets vulnerable young people who may be at greater risk of developing drug use problems [WHO, 2016a]. Many drug prevention activities take place in school settings, where a relatively robust evidence base exists for some approaches [EMCDDA, 2016]. Also, interventions in school settings have been showed to be effective [Faggiano, 2010]. In all of these approaches, the role of new technologies can be particularly relevant.

Prevention and information through new technologies can also be useful in harm reduction policy. For example, testing for and treatment of infectious diseases can help to reduce incidence and prevalence of infections among drug users. Testing can both increase individual awareness of infection status and support earlier treatment uptake. However, stigma and marginalisation, as well as limited knowledge about screening and treatment options, remain barriers to uptake [EMCDDA, 2016]. In Europe, drug overdose continues to be the main cause of death among drug users. Reducing fatal drug overdoses and other drug-related deaths is a major task. [EMCDDA, 2016]. In this respect, the use of new technologies with prevention and information functions could be particularly useful.

A critical aspect that needs to be taken into account is that, although health promotion campaigns for the prevention of illicit drug use are common worldwide, few have been formally evaluated. In addition, most of those evaluations assessed only the process (in terms of understanding, retention and appeal of the messages). The few that assessed outcomes in terms of behaviours of use often found weak effects [Ferri, 2013]. However, it needs to be remarked that the likelihood of success is significantly increased by the application of parallel interventions [Wakefield, 2010]. For example, concurrent facilitated access to treatment services is crucial to persuade people motivated by media messages to act on them. The creation of multiple public health policies that support opportunities to change provides additional motivation for change [Wallack, 1996; Randolph 2004].

## **8.5. Policy option 5: Support of new technologies as treatment tools in the field of drug use**

A proliferation of technology-based interventions for drug use can already be observed in the European Union. Their attractiveness shows that these technologies can be regarded as important for education and prevention, but also for treatment [EMCDDA, 2009]. A great number of people with substance use disorders do not seek treatment. This means that existing treatment options are not suitable or sufficiently interesting for all subjects with addiction-related problems and new modes of therapy should be considered and explored. Policy option 5 analyses the potential of new technologies as treatment tool.

The first European Plan to combat drugs dates back to 1990. Since then, a series of multi-annual action plans have followed. They attempt to articulate a common Europe-wide position on EU Member States, promoting a shared model with defined priorities, objectives, and actions [EMCDDA, 2015].

For the first time, the 2013–20 EU drug strategy incorporates the 'reduction of the health and social risks and harms caused by drugs' as a policy objective, alongside the two traditional drug policy aims of reducing supply and demand.

The EU Drug Action Plan 2013–20 encourages Member States to develop new research and integrated models of treatment [Council of the European Union, 2012; EMCDDA, 2015]. It provides arguments to support the use of new-technologies as tools for care. In particular, objective 19 of the EU Drug Action Plan 2013–20 includes the goals to: 'Expand the availability, accessibility and coverage of effective and diversified drug treatment across the EU to problem and dependent drug users including non-opioids users, so that all those who wish to enter drug treatment can do so, according to relevant needs' (objective 19.5); 'Develop and expand integrated models of care, covering needs related to mental and/or physical health-related problems, rehabilitation and social support in order to improve and increase the health and social situation, social reintegration and recovery of problem and dependent drug users, including those affected by co-morbidity' (objective 19.7); and 'Develop effective and differentiated drug demand reduction measures that aim to reduce and/or delay the onset of drug use and that are appropriate to the needs of specific groups, patterns of drug use and settings' (objective 19.8). These suggestions can encourage Member States to increasingly adopt innovative methods in drug treatment fields such as internet-based technologies in order to increase the access of care for a great proportion of the EU population.

A public consultation was conducted to inform the Mid-Term Assessment of the EU Drugs Strategy 2013–2020 and the final evaluation of the EU Action Plan on Drugs 2013–2016. The objective was to gather views from different stakeholders (individuals, non-profit organisations, industry, national/regional/local public administrations etc.). A plurality of respondents (page 5) believed that measures had not been sufficiently implemented in increasing the availability and accessibility of drug treatment services and introducing best practices in drug demand reduction. In addition, the most frequently indicated option for future areas of focus for the EU drugs policy (page 14) was risk and harm reduction, followed by treatment and rehabilitation [EC, 2016].

Europe is experiencing high prevalence of licit and illicit drug use, with a low percentage of people in treatment. For example, alcohol use disorders are among the mental disorders with the lowest treatment rate. 10% or less of the people fulfilling the diagnostic criteria receive treatment in Europe [Alonso, 2004; Rehm, 2012; Rehm, 2013]. Different explanations for this phenomenon have been brought forward. One of these is stigma, which has been shown to reduce the probability of using health care services for treatment [Keyes, 2010; Finn, 2014; Mojtabai, 2014; Wallhed, 2014]. Subjects categorised as 'alcoholics' are many times considered responsible for their condition [Schomerus, 2011; Probst, 2015]. They experience stigmatisation by the public more severely than people with other mental disorders [Schomerus, 2011]. TBIs can offer access to treatment which, in a traditional form, might not be available or easily accessible. They can potentially offer support, particularly for target groups not reached by traditional treatment facilities.

Current trends in health care delivery support the need for flexible care processes that extend care outside the boundaries of the clinic, and technology is gradually being seen as a powerful instrument for meeting expanded care demands [Ramsey, 2016]. The EC encourages methods to reduce health care costs and enhance treatment-related efficiencies that include health information technology and the use of technology-based treatment approaches to foster efficiencies in care delivery [EC, 2012; Official Journal of the European Union, 2011].

In the EU, there is a significant target audience for internet-based programmes to deliver drug treatment among young users and among people well socially integrated [Quaglio, 2006] that refuse to be identified as 'traditional' drug users. Frequently, these people do not accept being identified as drug users and they refuse to be treated in public centres for drug treatment, which are primarily targeted at people with heavy drug use disorders [EMCDDA, 2009]. It can be assumed that there will be further growth in internet-based interventions in the European Union. Health centres for drug use

mostly operate in specific local areas, while technology-based interventions have the benefit of being able to offer a drug treatment service with full regional or even national coverage [EMCDDA, 2009].

From an economic perspective, the cost-effectiveness, particularly of self-help programmes and their assumedly easy translation, may offer further arguments for a wider deployment of programmes [EMCDDA, 2009]. New technologies can be used in association with other care tools (e.g. offered as an adjunct to substance pharmacological treatment), giving the clinician the opportunity to extend the therapeutic offer. In addition, clinicians may replace a portion of their typical interaction with users with a TBI, which may allow for the treatment of more clients with the same number of clinicians [Marsch, 2012].

The lack of qualified health personnel is a well-recognised problem in the EU. With ageing societies in Europe, the demand for products and services specific to the elderly will increase (e.g. health products and services), while demand for products and services directed at younger people will decline [EC, 2004a; EP, 2015].

As already mentioned in policy option 3, the advantages inherent to new technologies (privacy, low threshold, flexibility, high degree of freedom for participants, 24-hour accessibility etc.) represent further arguments for supporting their use also in treatment programmes for drug use.

Addiction disorders are major public health concerns with considerable interpersonal, psychosocial, physical and societal consequences. Given the deleterious effect of substance abuse and addiction, there is a need for effective and cost-efficient treatments to address these problems. In this respect, the therapeutic applicability of various forms of technology applied to the treatment of substance use disorders appears to be an interesting and promising solution. In addition, programmes applied with new technologies could be offered free of charge, and therefore they could represent an instrument in order to overcome inequalities for access and treatment to health services in the European Union. As seen in chapter 5, the magnitude of success in behavioural change tends to be small to medium according to many meta-analytic studies. Nonetheless, these changes need to be considered favourably, because from a public health perspective even small changes are meaningful at the population level.

Further potential may additionally be seen in the integration of smartphones or other mobile technologies into the internet-based drug treatment interventions. The use of mobile phones to access the internet has increased greatly within the EU-28: 52% of the EU population accessed the internet from a mobile phone in 2015 [Eurostat, 2016a].

Innovative work is being carried out in exploring the utilisation of smartphones in real-time (either via sensors, individual input, or both) monitoring of a given individual's behaviour, providing tailored feedback or intervention content that relates to that behaviour [Marsch, 2012]. Specially-developed programmes for use with smartphones or other mobile technologies could be one of the future steps within the development of treatment interventions for drug use in the EU.

To fully realise the potential of technologies as tools for care, several areas of inquiry remain important. A first challenge will be to understand how to integrate these new treatment modalities into traditional face-to-face treatment, identifying where this is worth doing and where it is not. The integration of new technologies into traditional treatment facilities is probably a more feasible and effective exploitation of the technologies; this may enhance the provision and efficacy of the treatment approach as a whole, tailoring the treatment to the specific personality and modality of drugs used by the patient. There is longstanding recognition that it is important to develop a continuum of treatment opportunities for people with drug use problems. Emerging technologies are proving to be one interesting tool in this regard.

As discussed in more detail in chapter 4, it needs to be considered that before the benefits of applying technologies to the treatment of drug dependence are achieved, a computer-based treatment

programme needs to be implemented in a consistent number of EU Member States. This requires an effort at technological and human levels. An organisational approach is crucial in the implementation of new treatments which involve the widespread use of new technologies [Bickel, 2011]. Several conditions are needed for an effective technology transfer, namely: i) the innovations need to be accessible to all health personnel; ii) evidence should show that the innovation is feasible and effective; and iii) available resources should be adequate.

Finally, as mentioned in chapter 4, a pertinent concern for therapists working in drug dependence field is the lack of adequate reimbursement for TBIs services in many EU Member States. Payment and regulatory systems should be refined and adequately extended to go beyond electronic medical records and telehealth/distance care interventions, enhancing the quality, efficiency and cost-effectiveness of care [Marsch, 2012a; Marsch, 2013; Quaglio, 2016; Ramsey, 2016].

## 9. References

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## 10. Annexes

### 10.1. Survey questionnaire

This survey is conducted by the European Brain Council (EBC) on behalf of the Science and Technology Options Assessment (STOA) secretariat of the European Parliament and with the support of EUFAS, EPA and EAN. As a European expert in the field of addiction, you are kindly invited to this research survey and we want to thank you for your time and valuable collaboration. It should take only 10 minutes of your time. The purpose of the study is to gain insight into the impact of Information and Communication Technologies (ICTs) on improving the treatment of substance use disorders and which are the major obstacles to their implementation in Europe. This study will build up a useful evidence based information pool that will be provided directly to members of the European Parliament and other decision makers. We want to assure you that your responses will be processed anonymously and the results will be published in an aggregate form only. Your contact information will be not shared with any third party and will only be used by the European Parliament to assess your participation at the survey.

This survey is divided in 3 sections:

A - Personal information

B - Role of ICT applications in substance use disorders

C - Future scenarios and trends of ICT applications in substance use disorders in Europe

Please note that with 'ICT applications' in this survey, we refer to a set of technology based interventions for health behaviour change that are grouped according to the following practical classification:

- Online self-help interventions: primarily refers to self-guided intervention programs that are executed by means of a prescriptive online program through a website and used by patients.
- Internet/technology/digitally mediated therapy (online counselling and therapy): refers to synchronous (i.e. real time) or asynchronous (i.e. not in real time, such as email) communication (text, audio or video-based) between a therapist and patient via the internet.
- Therapeutic use of social media: e.g. blogs, support groups, generated and maintained by patients rather than clinicians, but including services that are moderated by a health worker.
- Artificial intelligence and virtual reality therapeutic software: encompasses a variety of technologies such as artificial intelligence (e.g. robot simulation of therapists) and virtual reality environments.

## Section A – Personal information

### 1. Name and Affiliation

Name

Affiliation

Email address

City

Country

### 2. What is your gender?

- ☐ Female
- ☐ Male

### 3. What is your age

- ☐ 18 to 24
- ☐ 25 to 34
- ☐ 35 to 44
- ☐ 45 to 54
- ☐ 55 to 64
- ☐ 65 to 74
- ☐ 75 or older

### 4. Who do you work for?

- ☐ Public authority (e.g. national/regional governmental agency, ministry of health, etc.)
- ☐ Public organisation (e.g. public hospital, public addiction centre treatment, etc.)
- ☐ Private for profit organisation (e.g. ICT providers)
- ☐ Private non-profit organisation (e.g. Non-Governmental Organisations)
- ☐ Academia
- ☐ Think tank / Research centre
- ☐ Other (please specify)

**5. What is your job title?**

- ☐ Medical doctor
- ☐ Nurse
- ☐ Psychologist
- ☐ General practitioner
- ☐ Health administrator/manager
- ☐ ICT specialist
- ☐ Researcher
- ☐ Other (please specify)

**6. If you are a medical doctor, please specify your specialization**

- ☐ Psychiatry
- ☐ Toxicology/Pharmacology
- ☐ Internal Medicine
- ☐ General Medicine
- ☐ Neurology
- ☐ Infectious Diseases
- ☐ Other (please specify)

**7. How many years of experience do you have in the field of substance use disorders?**

- ☐ 0-5
- ☐ 6-10
- ☐ 11-15
- ☐ 16-20
- ☐ 20 or more

**8. What is your major area of competence/interest in the field of substance use disorders?  
(Please choose up to 2)**

- ☐ Opioids
- ☐ Stimulants (cocaine, etc.)
- ☐ Alcohol
- ☐ Tobacco
- ☐ Novel psychoactive substances
- ☐ Gambling
- ☐ Other (please specify)

**9. Which European country do you mainly work in? (Please choose up to 2)**

- ☐ Austria
- ☐ Belgium
- ☐ Bulgaria
- ☐ Croatia
- ☐ Cyprus
- ☐ Czech Republic
- ☐ Denmark
- ☐ Estonia
- ☐ Finland
- ☐ France
- ☐ Germany
- ☐ Greece
- ☐ Hungary
- ☐ Ireland
- ☐ Italy
- ☐ Latvia
- ☐ Lithuania
- ☐ Luxembourg
- ☐ Malta
- ☐ Netherlands
- ☐ Norway
- ☐ Poland
- ☐ Portugal
- ☐ Romania
- ☐ Russia
- ☐ Serbia
- ☐ Slovakia
- ☐ Slovenia
- ☐ Spain
- ☐ Sweden
- ☐ Switzerland
- ☐ United Kingdom

## **Section B – Role of ICT applications in substance use disorders**

**10. Please judge your level of knowledge of ICT applications in the treatment of substance use disorders.**

- ☐ Very good
- ☐ Good
- ☐ Fair
- ☐ Poor
- ☐ Very poor

**11. How often do you use ICT applications in your practice to treat substance use disorders?**

- ☐ Most of the time
- ☐ Often
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

**12. How well are ICT applications integrated in your healthcare setting of substance use disorders treatment?**

- ☐ Very well
- ☐ Well
- ☐ Fairly
- ☐ Poorly
- ☐ Very poorly
- ☐ Not at all
- ☐ No opinion

**13. How useful do you believe ICT applications are in the treatment of substance use disorders?**

- ☐ Very useful
- ☐ Useful
- ☐ Moderately useful
- ☐ Slightly useful
- ☐ No opinion

**14. How important are ICT applications to improve each of the following phases of substance use disorders treatment?**

	Not very important	Moderately important	Important	Extremely important	No opinion
Access to treatment.					
Engagement to treatment.					
Retention/compliance to treatment.					
Outcomes/follow up.					

**15. How important are ICT applications to improve each of the following aspects of substance use disorders treatment?**

	Not very important	Moderately important	Important	Extremely important	No opinion
To obtain individual information in real time from patients (e.g. via mobile devices).					
To made simultaneously available the treatment to large numbers of individuals.					
To allow for on-demand access to therapeutic support outside of formal care settings.					
To aid populations with significant barriers in accessing treatment (e.g. people who are employed, parents).					
To allow to treat more subjects with the same number of clinicians.					
To be more cost effective than face-to-face treatment.					

**16. In your opinion, how effective are the following ICT applications in the treatment of substance use disorders?**

	Slightly effective	Moderately effective	Effective	Very effective	No opinion
Online self-help interventions: primarily refers to self-guided intervention programs that are executed by means of a prescriptive online program through a website and used by patients.					
Internet/technology/digitally mediated therapy (online counselling and therapy): refers to synchronous (i.e., real time) or asynchronous (i.e. not in real time, such as email) communication (text, audio or video-based) between a therapist and patient via the internet.					
Therapeutic use of social media: e.g. blogs, support groups, generated and maintained by patients rather than clinicians, but including services that are moderated by a health worker.					
Artificial intelligence and virtual reality therapeutic software: encompasses a variety of technologies such as artificial intelligence (e.g. robot simulation of therapists) and virtual reality environments.					

**17. Although at present drug users are often poly-drug users, in your opinion, how effective are ICT applications in the treatment of the following substance users?**

	Slightly effective	Moderately effective	Effective	Very effective	No opinion
Opioids substance users.					
Stimulants (cocaine, etc.) substance users.					
Alcohol users.					
Tobacco users.					
New substances (smart drugs, designer drugs etc.) users.					
People affected by gambling.					

**18. Substance users are often also affected by psychiatric disorders. In your opinion, how effective are ICT applications in the treatment of the following psychiatric disorders?**

	Slightly effective	Moderately effective	Effective	Very effective	No opinion
Anxiety disorders.					
Dysthymia or depression disorders.					
Somatoform disorders.					
Psychotic disorders.					
Personality disorders.					

**19. How willing are you to attend training courses on the use of ICT applications in the treatment of substance use disorders?**

- ☐ Very willing
- ☐ Willing
- ☐ Moderately willing
- ☐ Slightly willing
- ☐ Not at all willing

**Do you have any other comments on this section?**



## Section C – Future scenarios and trends of ICT in substance use disorders in Europe

**20. How widespread do you believe the use of ICT is in the treatment of substance use disorders in your country?**

- ☐ Very widespread
- ☐ Widespread
- ☐ Moderately widespread
- ☐ Poorly widespread
- ☐ Very poorly widespread

No opinion

**21. In your opinion, how much do the following factors hinder the use of ICT applications in the treatment of substance use disorders in your country?**

	Not at all	Slightly	Moderately	Very	Extremely	No opinion
Poor infrastructure/equipment (e.g. unreliable internet service) in the addiction unit.						
Cultural bias towards the use of ICTs in the addiction field.						
Lack of digital literacy of health workers in the addiction field.						
Lack of digital literacy of drug users.						
Lack of maintenance and technical support.						
Lack of interest of drug users to be treated with ICTs.						

**22. Which trends do you foresee in the future for the use of ICT applications in the treatment of substance use disorders in your country?**

- ☐ High increase in the use
- ☐ Significant increase in the use
- ☐ Modest increase in the use
- ☐ Low increase in the use
- ☐ No increase in the use
- ☐ No opinion

**23. In your opinion, how effective would the following policy options be in promoting the use of ICT applications in the treatment of substance use disorders?**

	Slightly effective	Moderately effective	Effective	Extremely effective	No opinion
Increase funding for initiatives and projects in promoting the use of ICT in the treatment of substance use disorders.					
Increase awareness of the benefits associated with ICT applications among health operators.					
Increase awareness of the benefits associated with ICT applications among drug users.					
Improve coordination of existing and future ICT promoting initiatives in Europe.					
Perform research studies to analyse the reasons that hinder the use of ICT applications in the treatment of substance use disorders in Europe.					
Generate European guidelines and regulatory frameworks of ICT applications in the treatment of drug users.					
Strengthen sustainability of successful initiatives.					

**Do you have any other comments on this section?**

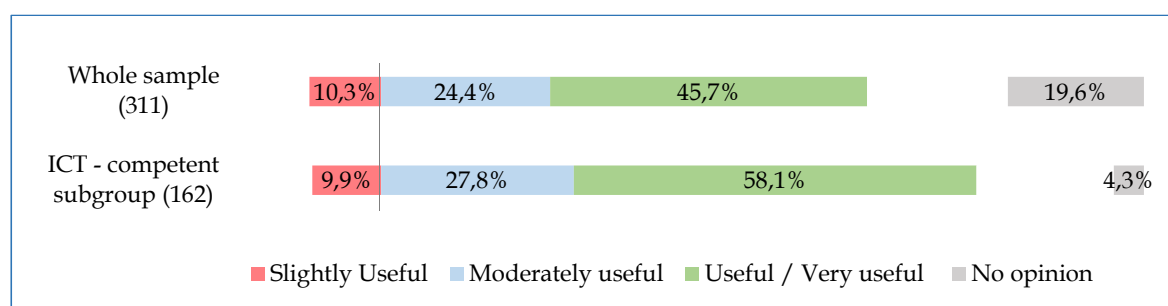
## 10.2. Interview questionnaire

The aim of these structured interviews is to expand and elaborate further the results of the survey. In particular, we will focus mainly on some survey results about the value of ICT based interventions in the treatment of addictions (Topic I) and the policy implications for their implementation (Topic II).

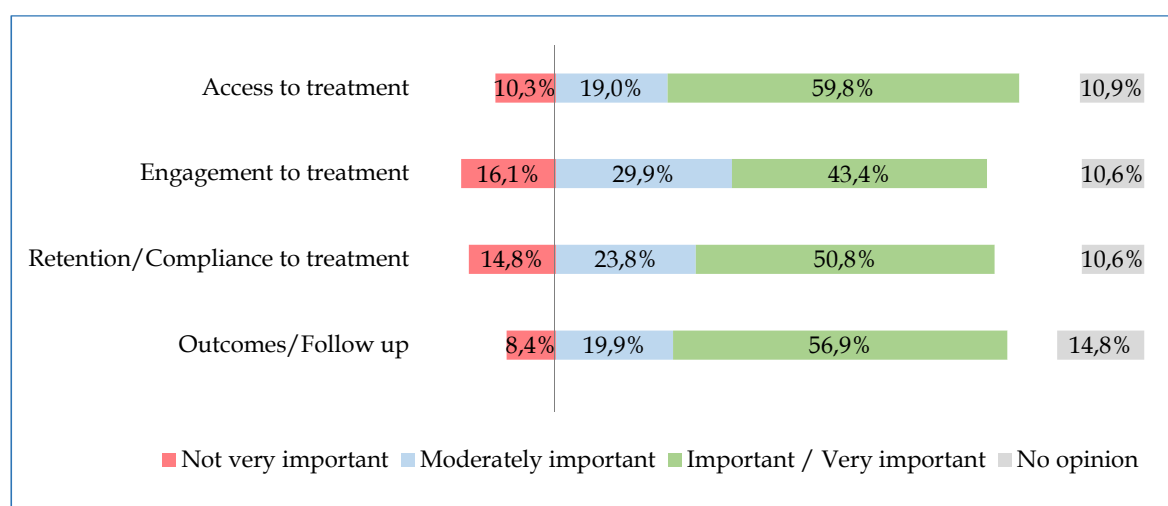
### Topic I. Value of ICT based interventions for substance use disorders

#### Question A [related to results of Q13 and Q14]

Q13. How useful are ICT applications in the treatment of substance use disorders?



Q14. How important are ICT applications to improve each of the following phases of substance use disorders treatment?



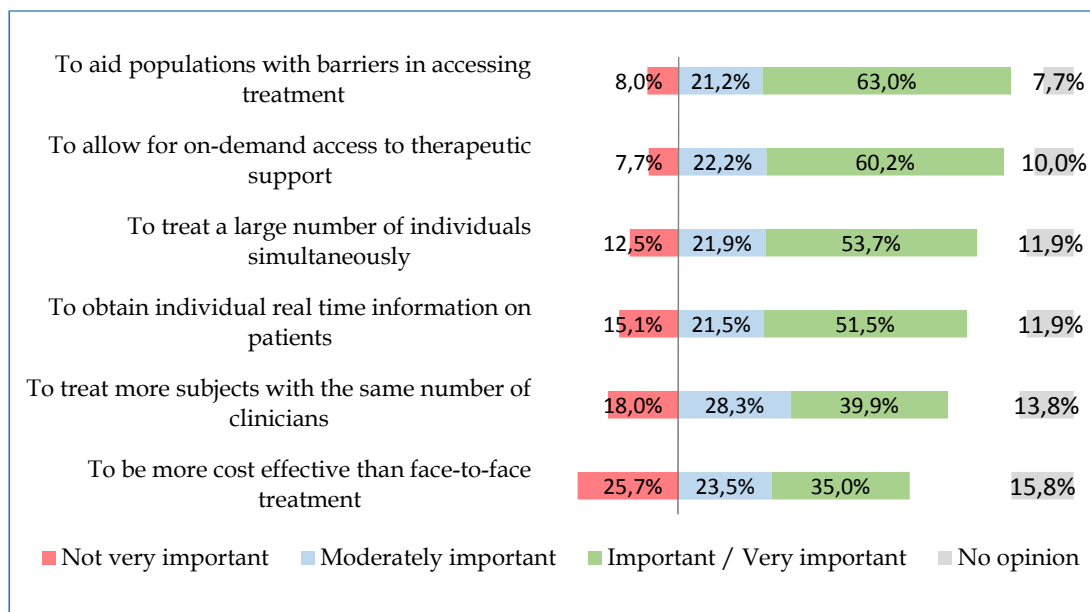
About the 46% of all survey's participants consider ICT- based interventions useful/very useful in the treatment of substance abuse disorders. This proportion increases to the 58% among those participants who have at least a fair knowledge of ICT - based interventions (ICT- competent group). Taken together,

these results indicate that overall survey's participants consider ICTs useful in the treatment of addictions. More specifically, participants consider ICTs particularly useful in improving access to treatment (60%) and outcomes/follow up (57%).

- a) Do you agree with this picture?
- b) Could you provide examples or evidence supporting this argument?

#### Question B [related to results of Q15]

*Q15. How important are ICT applications to improve each of the following aspects of substance use disorders treatment?*



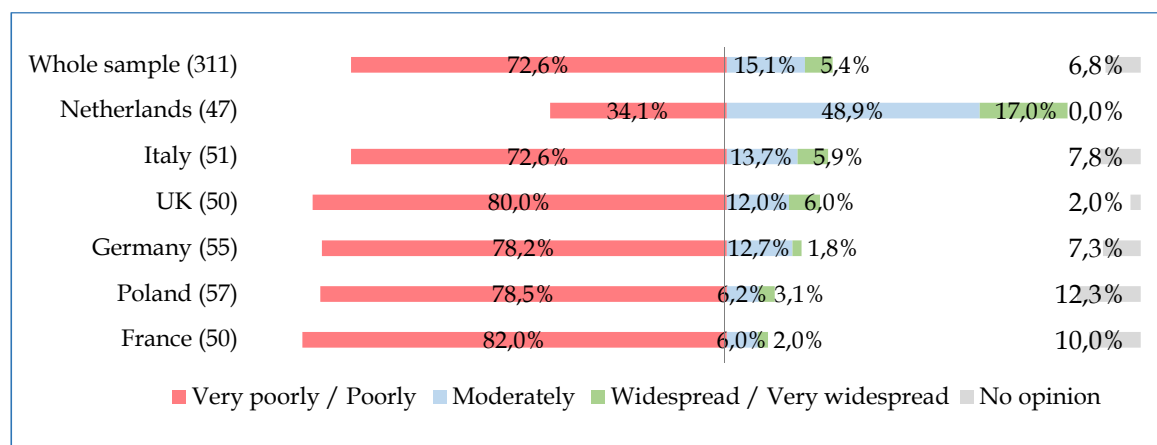
In contrast with widespread supposition that ICT-based interventions offer a better value for money and should be prioritized, a significant proportion (26%) of survey's participant consider ICT-based interventions for substance use disorders to be not more cost effective than face-to-face treatments.

- a) Do you agree with this view?
- b) Do you have any further comment on this topic?

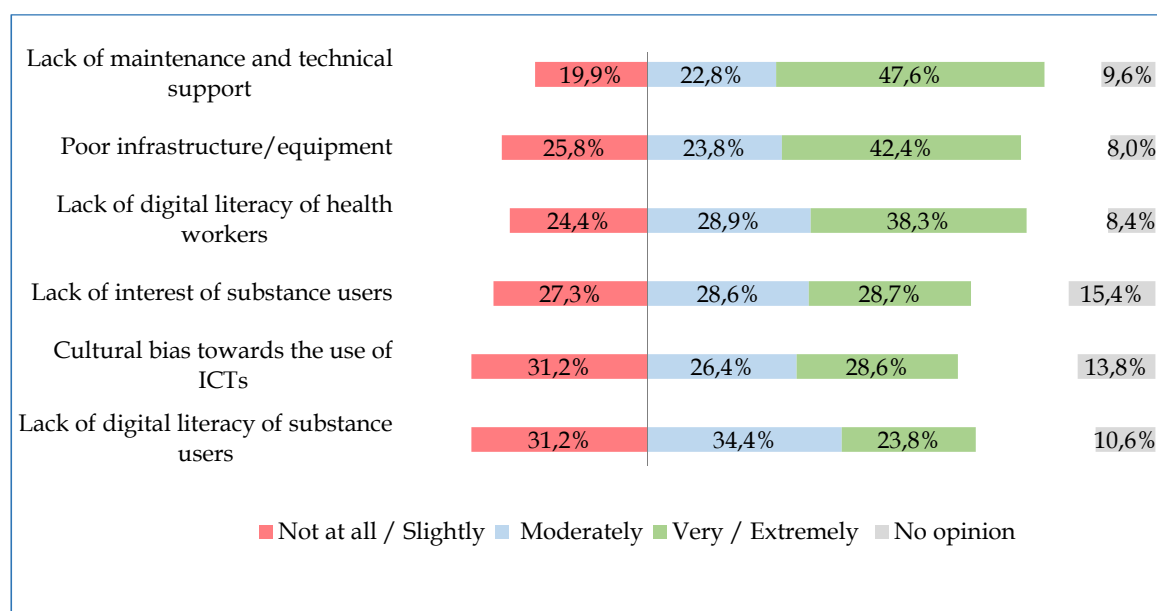
## Topic II. Policy Implications for ICTs diffusion in the treatment of substance use disorders

### Question C [related to results of Q20 and Q 21]

Q20. How widespread do you believe the use of ICT applications is in the treatment of substance use disorders in your country?



Q21. In your opinion, how much do the following factors hinder the use of ICT applications in the treatment of substance use disorders in your country?

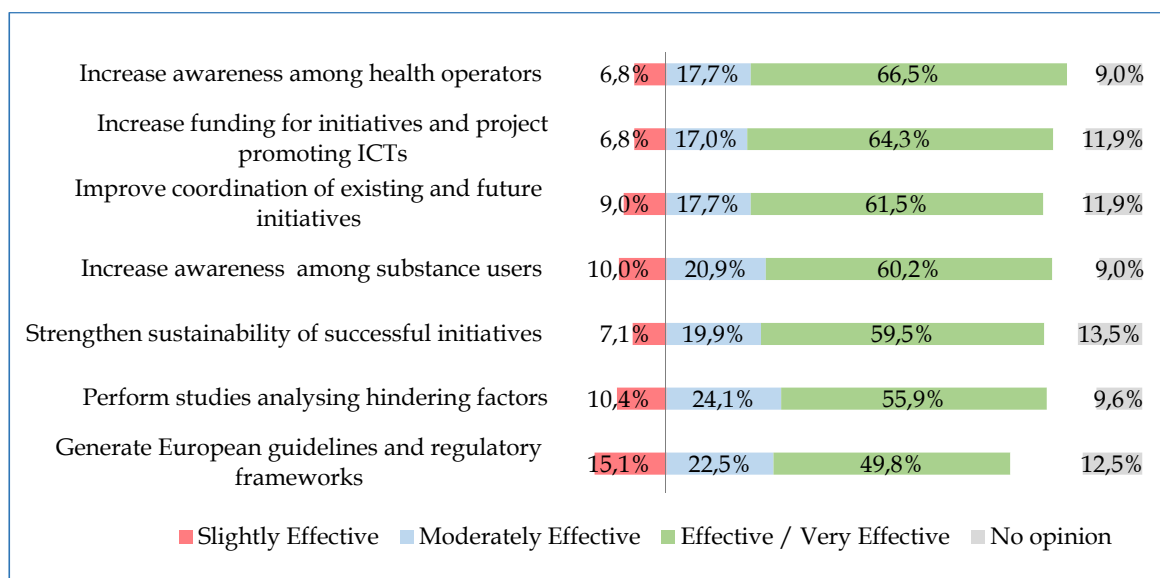


According to the survey, the use ICT-based interventions for substance use disorders are poorly or very poorly widespread in all the countries under study, with only the exception of the Netherlands where the proportion of experts reporting a moderate to very widespread usage of these technologies is almost three times larger than the average of the whole sample. The participants identified: 1) Lack of maintenance and technical support; 2) Poor infrastructure/equipment (e.g. unreliable internet service) in the addiction unit; and 3) Lack of digital literacy of health workers in the addiction field as major factors hindering the implementation of these interventions in their own country.

- Do you agree with this picture?
- Could you identify other hindering factors in your country?
- In your opinion, which strategies could be successful in overcoming these obstacles? Could you provide any relevant examples from your country?

#### QD [related to results of Q23]

Q23. In your opinion, how effective would the following policy options be in promoting the use of ICT applications to treat substance use disorders in your country?



When asked which policy options would be more effective in promoting the use of ICT-based interventions for substance use disorders, survey's participant expressed no clear consensus on one or few of the options proposed. A slight preference was given to "Increase funding for initiatives and project promoting the use of ICT applications in the treatment of substance use disorders" and "Increase awareness of the benefits associated with ICT applications among health operators.

- What is your interpretation of this result?
- Could you propose other policy options that, in your opinion, would be more effective than the ones proposed?
- If you were policy advisor, which would be your priority list of policy options.
- Do you have any further comment on this topic?



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Drug disorders are complex social and health problems that affect millions of people in the EU. In the last decades, we have witnessed an extraordinary growth in computer and mobile technologies. An increasing number of interventions designed to promote changes in substance use disorders are now available.

The present study includes a critical literature review on the efficacy of new technologies for drug addiction management. A survey among European experts in the field of addiction was also carried out.

To date, new technologies have the potential to affect existing models of health care delivery in the field of addiction. Despite encouraging progress, new technologies need to be evaluated with caution. Across research studies, there are methodological difficulties, such as a lack of common definitions, selection biases and inappropriate research designs, which require further investigation.

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