



Substance use and addictive disorders in *DSM-5* and *ICD 10* and the draft *ICD 11*

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Purpose of review

The present review compares and contrasts the diagnostic entities and taxonomy of substance use and addictive disorders in the beta draft of the Eleventh Revision of the International Classification of Diseases (ICD 11), which was released in November 2016, and the Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), which was published in mid-2013. Recently published papers relevant to these two classification systems are examined. New initiatives in diagnosis and assessment including the addictions neuroclinical assessment are noted.

Recent findings

The draft ICD 11 retains substance dependence as the 'master diagnosis' in contrast to the broader and heterogeneous concept of substance use disorder in DSM-5 and there is empirical support for the coherence of substance dependence for alcohol, cannabis, and prescribed opioids. Both systems now include gambling disorder in the addictive disorders section, with it being transferred from the impulse control disorders section. The new diagnosis of internet gaming disorder is included in DSM-5 as a condition for further study, and gaming disorder is grouped with the substance and gambling disorders in the draft ICD 11. Initiatives from the U.S. National Institutes of Health (NIH) are highlighting the importance of capturing the neurobiological phases of the addictive cycle in clinical diagnosis and assessment.

Summary

Although most of the changes in the draft ICD 11 and DSM-5 are incremental, the contrast between DSM-5 substance use disorder and substance dependence in the draft ICD 11, and the inclusion of gambling disorder and gaming disorder will generate much discussion and research.

Keywords

classification, diagnosis, gambling disorder, gaming disorder, substance dependence, substance use disorder, taxonomy

INTRODUCTION

Diagnostic systems are essential for communicating accurately our clinical findings to colleagues and patients, for epidemiological data gathering, and for providing a basis for precision in research. In the field of mental health and addictive disorders, the world is subdivided into countries which largely adhere to the diagnostic and statistical manual of mental disorders (DSM) classification and those which adopt the international classification of diseases (ICD) system, which is under the auspices of the WHO. For diagnostic coding and epidemiological reporting, all WHO member countries are under treaty obligation to employ the ICD system. Diagnostic and classification systems take many years to revise and update. The latest version of DSM is the Fifth Edition, DSM-5 [1], which was published in

mid-2013, nearly 20 years from the time of publication of the fourth edition, DSM-IV [2]. The publication of DSM-5 has generated much research into the comparative performance of its substance disorder diagnoses compared with DSM-IV and the ICD system. In November 2016, the beta draft of the eleventh revision of the ICD, ICD 11, was released for public comment [3^{***}]. Publication is expected in

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Curr Opin Psychiatry 2017, 30:000–000

DOI:10.1097/YCO.0000000000000332

KEY POINTS

- Many changes have occurred to the definitions and diagnostic criteria of substance use disorders in DSM-5 and the draft ICD 11 since their forerunners were published over 20 years ago.
- The draft ICD 11 retains substance dependence as the central diagnosis and defines it as a clinical syndrome or cluster of cognitive, behavioral, and physiological features reflecting an 'internal driving force' to use the substance; by contrast DSM-5 includes a heterogeneous disorder termed substance use disorder.
- Gambling disorder and (online or internet) gaming disorder are increasingly accepted as addictive disorders.
- The essential features of substance-induced mental disorders are little changed compared with previous versions of DSM and ICD.
- Neurobiological findings are now influencing the development of clinical instruments and diagnoses.

2018, some 25 years after the tenth revision, ICD 10, appeared [4,5]. The present review study compares and contrasts the descriptions and diagnostic criteria in DSM-5 and the definitions and diagnostic guidelines proposed for ICD 11, with briefer comparison with the earlier ICD 10 and DSM-IV. Relevant studies are presented and the potential contributions to diagnosis of the emerging data from neurobiological studies are highlighted.

OVERALL COVERAGE OF ADDICTIVE DISORDERS

Both DSM-5 and the draft ICD 11 have extended their scope to include new disorders and both have repositioned existing disorders. The completely new entity is termed 'internet gaming disorder' in DSM-5 and 'gaming disorder' in the draft ICD 11, which is subdivided into 'predominantly offline' and 'predominantly online', the latter being roughly equivalent to the DSM-5 entity. Internet gaming disorder is not yet included in the main section of DSM-5 but is in a separate chapter titled 'conditions for further study.' The features of these disorders are discussed further below. 'Gambling disorder' is a new entity in the 'Substance-Related and Addictive Disorders' section of DSM-5, being a reconceptualization of what was termed 'pathological gambling' listed within impulse control disorders in DSM-IV. Gambling disorder is now included in the Substance Use and Related Disorders chapter in the draft ICD 11 and like gaming disorder

is subdivided onto predominantly offline and predominantly online types.

In terms of substances and substance groups covered, DSM-5 has adopted a conservative approach. Ten separate classes of substance are included, namely alcohol, caffeine, cannabis, hallucinogens, inhalants, opioids, sedatives and anxiolytics, stimulants, tobacco, and 'other' substances, and this is essentially the same as in its forerunner (Table 1). The current ICD 10 classification subdivides psychostimulants into cocaine on the one hand, and other stimulants such as amphetamine-type compounds and caffeine on the other. This is further developed in the draft ICD 11 where there are four categories of psychostimulants. In contrast to the DSM system, the draft ICD 11 has incorporated various types of 'new psychoactive substances' into its coverage (Table 1). These include synthetic cannabinoids and synthetic cathinones, and there is a separate category for disorders because of methylene-dioxymethamphetamine (MDMA) and methylene-dioxyamphetamine (MDA). Thus, the draft ICD 11 is more specific as to the individual substances or subgroups compared with DSM, reflecting its role as an international system for monitoring trends in substance use globally as well as a clinical manual.

The DSM-IV and ICD 10 diagnoses of 'polysubstance dependence' (and similar entities) have been eliminated in DSM-5 and the draft ICD 11, respectively. It is recommended in both systems to make individual diagnoses corresponding to the substance responsible for the disorder. Sometimes substance use is so indiscriminate and opportunistic that no individual substance can be identified with confidence as the cause of the disorder. However, there is now no mechanism for describing this and if the substances used are not included in the main list, the categories of 'other or unknown substances' in DSM-5 or 'other specified substances' or 'unknown or unspecified substances' in the draft ICD 11 can be utilized.

THE RANGE OF SUBSTANCE USE DIAGNOSES

The range of disorders related to substance use can be subdivided conceptually into [1] those that represent the actual use of the substance, whether one-off or repeated, and its immediate effects, and [2] those which reflect the complications of substance use such as disease processes in the brain and the rest of the body.

Among the former are substance dependence (ICD 10, the draft ICD 11, and DSM-IV), which has at its core a psychobiological driving force to

Table 1. Coverage of psychoactive substance groups and addictive behaviors in DSM-IV and DSM-5, and ICD 10 and the draft ICD 11

Class	DSM-IV	DSM-5	ICD 10	Draft ICD 11	Comments
CNS depressants	Alcohol Cannabis	Alcohol Cannabis	Alcohol Cannabinoids	Alcohol Cannabis Synthetic cannabinoids	
	Inhalants Opioids Sedatives, hypnotics, or anxiolytics	Inhalants Opioids Sedatives, hypnotics, or anxiolytics	Volatile solvents Opioids Sedative hypnotics	Volatile inhalants Opioids Sedatives, hypnotics, or anxiolytics	
CNS stimulants	Nicotine Caffeine Amphetamines	Tobacco Caffeine Stimulants	Tobacco Other stimulants including caffeine	Nicotine Caffeine Stimulants including amphetamines, methamphetamine or methcathinone	The stimulants category in DSM-5 includes amphetamine-type substances, cocaine, and other or unspecified stimulants. For some diagnoses the type of substance can be specified.
Hallucinogens, empathogens and dissociative drugs	Cocaine Hallucinogens Phencyclidine	Hallucinogens	Cocaine Hallucinogens	Synthetic cathinones Cocaine Dissociative drugs including ketamine and phencyclidine Hallucinogens MDMA and related drugs including MDA	In DSM-5, there are separate descriptions for phencyclidine and for other hallucinogens. MDMA is classified under other hallucinogens.
Polysubstance use	Polysubstance		Multiple drug use and use of other psychoactive substances		The category Polysubstance use does not appear in DSM-5 or the draft ICD 11
Other and unknown substances	Other substances	Other or unknown substances		Other specified psychoactive substances Unknown or unspecified psychoactive substances	There is no category for unknown or unspecified substances in DSM-IV
Behavioral addictions	Pathological gambling	Gambling disorder Internet gaming disorder	Pathological gambling	Gambling disorder Gambling disorder	Pathological gambling was included in Impulse Control Disorders in DSM-IV and ICD 10. In ICD 11 gambling disorder is subdivided into predominantly offline and predominantly online Gaming disorders did not feature in DSM-IV or ICD 10. In the draft ICD 11 gambling disorder is subdivided into predominantly offline and predominantly online

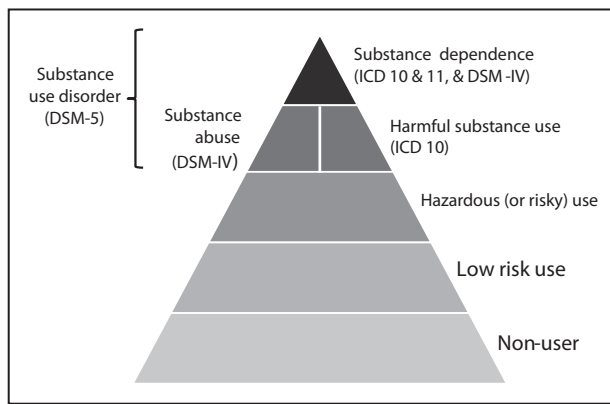


FIGURE 1. The hierarchy of substance use disorders in DSM-IV and DSM-5, and ICD 10 and the draft ICD 11.

consume the substance [6]. Substance use disorder (DSM-5) is a broader diagnostic entity which is essentially an amalgamation of DSM-IV substance dependence and substance abuse (described and discussed below). In addition, ‘hazardous substance use’, which describes a pattern of repeated substance use is included in the draft ICD 11 with other health risk factors and not in Chapter 6, the main section containing substance use and mental health diagnoses. There is a natural hierarchy of these disorders, which is schematically represented in Fig. 1.

ICD 10 regards harmful substance use and substance dependence as having a hierarchical relationship, the former being diagnosed when there is harm but no dependence. Other central disorders of substance use include (acute) substance intoxication (all systems, although considered substance-induced in DSM), and substance withdrawal state (all systems, again substance-induced in DSM). Separate to the main section of substance and addictive disorders in the ICD system are disorders because of nonpsychoactive substances. These substances include laxatives, diuretics, erythropoietin, anabolic steroids (although not specifically listed in the draft ICD 11), and herbal and folk remedies.

The complications of substance use are generally termed ‘substance-induced disorders’ and there are several substance-induced mental disorders, including cognitive dysfunction, in both DSM and ICD and which are described below, and multiple substance-induced (or substance-related) physical disorders including trauma which are detailed extensively in the ICD system but do not feature in the DSM system.

SUBSTANCE DEPENDENCE OR SUBSTANCE USE DISORDER AS THE MASTER DIAGNOSIS

Arising largely from the work of Griffith Edwards at the Maudsley Hospital in London, the concept of a

‘substance dependence syndrome’ developed from the mid-1970s onwards [7]. It emphasized a central syndromal grouping of features such as craving, impaired control over substance use, stereotyping of use, and prioritizing of substance use, together with physiological features of tolerance and withdrawal. This central syndrome replaced the much broader notions of alcoholism and addiction which had typically incorporated some of the mental and social complications and externalizing behaviors and denial of the problem. The entity of substance dependence was highly influential and its existence was supported by numerous studies of its psychometric properties [6]. Applied first to alcohol it became accepted as applying to prescribed medications such as benzodiazepines and opioids and to a range of recreational and illicit drugs such as cannabis, heroin, and psychostimulants [6]. Substance dependence was incorporated into the WHO schema of substance disorders [8] and featured with some modifications in DSM-III-R (published in 1987), DSM-IV (published in 1994), and ICD 10 (published in 1992 and 1993). The criteria in DSM-IV, DSM-5, ICD 10, and the draft ICD 11 are presented in Fig. 2.

In DSM-5, substance use disorder is now the central diagnosis. It represents a combination of the diagnostic features of DSM-IV substance dependence and substance abuse, with some modifications. Craving is included as a diagnostic criterion in DSM-5 to increase the commonality with the ICD system. Legal problems, which were a criterion of DSM-IV substance abuse, has been omitted from the DSM-5 diagnosis. Decisions to include and exclude criteria and the fundamental step of having a single diagnostic entity covering patterns of substance use which cause harm were guided by sophisticated nontheoretical statistical techniques such as item response theory [9–11]. The analyses are well conducted, although it must be recognized that the original items for DSM-IV substance abuse were potential but ‘failed’ items for what became DSM-IV substance dependence.

DSM-5 offers a simplified diagnostic system and avoids what was considered a problem of ‘diagnostic orphans’, namely individuals who fulfilled two DSM-IV substance dependence criteria but no substance abuse criteria [12]. However, there are problems. Substance use disorder is defined as any two of eleven diagnostic criteria and rather than being syndromal in nature it is a very broad and heterogeneous condition. Indeed one can calculate that there are over 2000 combinations of the diagnostic criteria which fulfill the requirements for substance use disorder. Is it so broad and heterogeneous that it is a less useful entity than substance dependence in

clinical practice—in assessing risk (e.g. of a withdrawal state) and in determining treatment? Examples of the importance of clinical utility are that a dependence syndrome on an opioid such as heroin is necessary (and required in most countries) for an opioid agonist such as methadone or buprenorphine to be prescribed. In a similar vein, alcohol pharmacotherapies such as naltrexone and acamprosate have been trialed among people with alcohol dependence rather than the broader entity that is alcohol use disorder. Empirical studies published recently show that the DSM-5 criteria for alcohol and cannabis use disorders lead to a higher prevalence and capture different individuals compared with the DSM-IV (dependence and abuse), ICD 10, and draft ICD 11 diagnoses [13¹¹]. Diagnostic concordance is only moderate for the DSM-5 diagnoses compared with the other systems.

The prevalence and correlates of DSM-5 substance use disorder have been examined (without diagnostic comparison) in some large-scale epidemiological studies. The U.S. National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) is a particularly valuable resource. Using this data set, Hasin *et al.* found 2.5% fulfilled the criteria for DSM-5 Cannabis Use Disorder in the past 12 months and 6.3% during the person's lifetime [14¹²]. Cannabis Use Disorder was significantly associated with anxiety, affective disorders, personality disorders, and other substance use disorders, with greater severity of the cannabis disorder correlated with the severity of the comorbid disorders. The public health implications of these findings are highlighted in a commentary by Compton and Bale [15¹³].

Substance dependence has been retained in the draft ICD 11. The description in it is that substance dependence is 'a disorder of regulation of use of a psychoactive substance arising from repeated or continuous use of the substance. Its central feature is a strong internal drive to use the substance, manifested by impaired ability to control use, increasing priority given to use of the substance over other activities, and persistence of use despite harm and adverse consequences. Individuals with substance dependence often develop tolerance and withdrawal symptoms. The constellation of behaviors suggesting dependence is evident over a period of at least 12 months if use is episodic, or over a period of at least one month if use is continuous (daily or almost daily)' [3¹⁴]. Opportunity has been taken to simplify the diagnostic guidelines so that in contrast to the six of ICD 10, substance dependence in the draft ICD 11 (Fig. 2) requires the presence of two or more of three composite guidelines [16,17]:

- (1) Impaired control over substance use – in terms of the onset, level, circumstances, or termination of use, often but not necessarily accompanied by a subjective sensation of urge or craving to use the substance.
- (2) Substance use becomes an increasing priority in life such that its use takes precedence over other interests or enjoyments, daily activities, responsibilities, or health or personal care. Substance use takes an increasingly central role in the person's life and relegates other areas of life to the periphery. Substance use often continues despite the occurrence of problems.
- (3) Physiological features (indicative of neuroadaptation to the substance) as manifested by (i) tolerance, (ii) withdrawal symptoms following cessation or reduction in use of that substance, or (iii) repeated use of the substance (or pharmacologically similar substance) to prevent or alleviate withdrawal symptoms. Withdrawal symptoms must be characteristic for the withdrawal syndrome for that substance and must not simply reflect a hangover effect.

The reasons for retaining substance dependence as a diagnostic entity have been alluded to above. They include the excellent psychometric performance of ICD 10 substance dependence for all substance groups (see 6), guidance to clinicians on prescribing pharmacotherapies (including agonist maintenance), and warning of the likelihood of a withdrawal state developing. How the simplified diagnostic guidelines compare with those in ICD 10 will be the subject of further research and field testing. They were described as being 'in almost perfect agreement' with the ICD 10 and DSM-IV substance dependence diagnoses [13¹⁵]. Further data on prescribed medication dependence are presented below.

DIAGNOSES AS APPLIED TO PRESCRIBED MEDICATION USE

Certain groups of prescribed medications are well recognized as inducing tolerance and physiological dependence. They can also lead to behaviors such as 'doctor shopping' and life becomes progressively focused on obtaining and maintaining the supply of prescribed medications. The two most common classes of drugs involved are the sedative–hypnotic–anxiolytic group (most particularly the benzodiazepines) and opioid analgesics, which range from (i) relatively low potency ones such as codeine, (ii) mid-potency agents such as oxycodone and tramadol, (iii) full potency agonists such as morphine and methadone, and (iv) super-agonists such as fentanyl.

	DSM-IV Dependence	DSM-5 Substance Use Disorder	ICD 10 Substance Dependence	ICD 11 Substance Dependence
Stem	A maladaptive pattern of substance use, leading to clinically significant impairment or distress, as manifested by three or more of the following occurring at any time in the same 12-month period.	A problematic pattern of substance use leading to clinically significant impairment or distress, as manifested by at least two of the following occurring within a 12 month period	Three or more of the following [six] manifestations should have occurred together for at least one month, or occurred together repeatedly within a 12-month period.	The diagnosis requires two or more of the three central features to be present in the individual at the same time and to occur repeatedly over a period of at least 12 months or continuously over a period of at least one month.
1	No equivalent criterion – mentioned in text	Craving or a strong desire or urge to use the substance	A strong desire or sense of compulsion to take the psychoactive substance (craving or compulsion)	1. Impaired control over substance use – in terms of the onset, level, circumstances or termination of use, and often, but not necessarily, accompanied by a subjective sensation of urge or craving to use the substance.
2	There is persistent desire or unsuccessful attempts to cut down or control substance use	There is persistent desire or unsuccessful efforts to cut down or control substance use	No equivalent criterion but text states that the subjective awareness of compulsion is most commonly seen during attempts to stop or control substance use.	
3	The substance is often taken in larger amounts or over a longer period of time than was intended	The substance is often taken in larger amounts or over a longer period than was intended	Difficulties in controlling substance-taking behaviour in terms of its onset, termination, or levels of use (<i>loss of control</i>)	
4	Important social, occupational or recreational activities are given up or reduced because of drinking or psychoactive substance use.	Recurrent substance use resulting in a failure to fulfil major role obligations at work, school or home	Progressive neglect of alternative pleasures and responsibilities because of psychoactive substance use, or increased amount of time necessary to obtain or take the substance or to recover from its effects.	2. Substance use becomes an increasing priority in life such that its use takes precedence over other interests or enjoyments, daily activities, responsibilities, or health or personal care. It takes an increasingly central role in the person's life and relegates other areas of life to the periphery. Substance use often continues despite the occurrence of problems.
5	A great deal of time is spent in activities necessary to obtain the substance, use the substance or recover from its effects.	A great deal of time is spent in activities necessary to obtain the substance, use the substance or recover from its effects	Subsumed in the above criterion.	
6.	The substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance	Continued substance use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance.	Persisting with substance use despite clear evidence of overtly harmful consequences.	3. Physiological features (indicative of neuroadaptation to the substance) as manifested by (i) tolerance, (ii) withdrawal symptoms following cessation or reduction in use of that substance, or (iii) repeated use of the substance (or pharmacologically similar substance) to prevent or alleviate withdrawal symptoms. Withdrawal symptoms must be characteristic for the withdrawal syndrome for that substance and must not simply reflect a hangover effect.
6.	Tolerance: as defined by either (a) a need for markedly increased amounts of the substance to achieve the desired effects or (b) markedly diminished effect with continued use of the same amount of the substance.	Tolerance is defined by either of the following: a) a need for markedly increased amounts of the substance to achieve intoxication or desired effect b) a markedly diminished effect with continued use of the same amount of the substance	Tolerance: such that increased doses of the psychoactive substances are required in order to achieve effects originally produced by lower doses.	
7.	Withdrawal as manifested by either (a) the characteristic withdrawal syndrome for the substance or (b) the same (or a	Withdrawal is manifested by either of the following: a)the characteristic withdrawal syndrome for the substance, or	A physiological withdrawal state when substance use has ceased or been reduced, as evidenced by the characteristic withdrawal	must not simply reflect a hangover effect.
	closely related) substance is taken to relieve or avoid withdrawal symptoms.	b) the substance (or a closely related substance) is taken to relieve , or avoid withdrawal symptoms	syndrome for the substance; or use of the same (or a closely related substance) with the intention of relieving or avoiding withdrawal symptoms.	
9. Former DSM-IV abuse	Continued substance use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance (e.g. arguments with spouse about consequences of intoxication, physical fights)	Substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by that substance	To some extent subsumed in criterion no. 4.	To some extent subsumed in criterion no. 2.
10. Former DSM-IV abuse	Recurrent substance use in situations in which it is typically hazardous (drink driving)	Recurrent use in situations in which it is physically hazardous	No equivalent criterion	No equivalent criterion
11. Former DSM-IV abuse	Recurrent substance use which results in failure to fulfil major obligations at work, school or home	Important social, occupational or recreational activities are given up or reduced because of substance use	To some extent subsumed in criterion no. 4.	To some extent subsumed in criterion no. 2.
Former DSM-IV abuse, now omitted	Recurrent substance-related legal problems (e.g. driving an automobile or operating a machine when impaired by substance use)			

FIGURE 2. Diagnostic criteria for substance dependence and substance use disorder in DSM-IV and DSM-5, and ICD 10 and ICD 11. In DSM-5, the diagnosis of substance use disorder is further classified according to severity: presence of two to three symptoms: mild; presence of four to five symptoms: moderate; presence of six or more symptoms: severe.

In many countries, low-dose combination opioid analgesics (such as paracetamol-codeine and ibuprofen-codeine) are available for purchase through pharmacies. Cottler *et al.* [18¹¹] have demonstrated significant morbidity and (long term) mortality associated with use of such analgesics for nonmedical reasons.

The tolerance- and physiological dependence-inducing properties of these agents pose difficulties in determining whether a substance disorder has developed. Tolerance is a predictable consequence of being placed on an opioid analgesic. Should this be regarded as a diagnostic criterion for an addiction? If a person experiences withdrawal symptoms when a medically prescribed opioid analgesic is suddenly ceased or reduced in dose, should this too be regarded as an indicator of an addiction? These issues also raise concerns about the legal liability of medical practitioner for their occurrence, of particular concern in litigious medical environments such as the United States.

The classification systems have adopted different approaches to avoid predictable physiological consequences being termed pathological. Indeed, it was a reason why the diagnostic term 'substance dependence' was deleted from DSM-5 [19]. In DSM-5, there is a specific exclusion for making the diagnosis of substance use disorder if the use of that substance has occurred solely as a consequence of medical prescription. In the draft ICD 11, a different approach has been adopted. Only two of three central guidelines will be required for the diagnosis of substance dependence and the presence of tolerance and withdrawal (as markers of physiological dependence) will not be sufficient in themselves for the diagnosis. A recent Australian study showed excellent agreement between the draft ICD 11 guidelines and the corresponding criteria in ICD 10 and DSM-IV; agreement and psychometric properties were worst for DSM-5 [20¹¹]. Thus, in the draft ICD 11 at least one other guideline will need to be fulfilled (other than tolerance and withdrawal) for substance dependence to be diagnosed. If a withdrawal syndrome occurs when a medically prescribed sedative or opioid has been ceased or reduced, a diagnosis of substance withdrawal can be made according to the draft ICD 11 guidelines.

SUBSTANCE-INDUCED MENTAL AND OTHER DISORDERS

Substance-induced mental disorders are treated differently in DSM-5 compared with its predecessor. DSM-IV listed a range of substance-induced mental disorders within the main chapter of substance use disorders. These include substance-induced mood

disorder, substance-induced anxiety disorder, substance-induced bipolar disorder and substance-induced psychotic disorder. DSM-5 has adopted a different approach to these disorders in that they are now incorporated into the sections dealing with, for example, 'neurocognitive disorders', 'depressive disorders', and 'anxiety disorders' and are labeled as 'substance/medication-induced' conditions within these sections. A diagnosis of a substance/medication-induced mental disorder is made when there is a history of use of a substance which is capable of producing the relevant symptoms and when the condition is not better explained by a nonsubstance-induced disorder. Important pointers to the role of the substance are that significant substance or medication use was present prior to the onset of symptoms and that the symptoms usually persist for between 1 and 6 months after the effects of the substance (specifically intoxication or withdrawal) have abated. There is no difference in the diagnostic criteria or thresholds for substance-induced and independent mental disorders. There is little detail on individual disorders. It is surprising given the focus on comorbidity ('dual diagnosis') nowadays that so little attention has been paid to empirical studies aimed at delineating substance/medication-induced disorders from independent ones.

In ICD 10, the neuropsychiatric complications of substance use are included in the psychoactive substance use chapter and embrace (1) Withdrawal State with Delirium, (2) Psychotic Disorder, (3) Amnestic Syndrome, and (4) Residual and Late Onset Psychotic Disorder. Two further sections cover other and unspecified mental and behavioral complications. Residual and late onset psychotic disorder covers a range of sequelae, including (i) persisting flashbacks, (ii) personality or behavior disorder, (iii) residual affective disorder, (iv) dementia, (v) other persisting cognitive impairment, and (vi) late-onset psychotic disorder. There are specific descriptions too of substance-induced mood disorder, anxiety disorder, and other psychiatric consequences.

The structure of the draft ICD 11 is quite different to ICD 10. Many psychiatric sequelae are listed under each substance (or substance group). Substance-induced delirium replaces withdrawal state with delirium and encompasses both withdrawal-related and intoxication-related states of delirium. Psychotic disorder is much the same as in ICD 10. There are also descriptions for substance-induced mood disorder, anxiety disorder, sexual dysfunction, and sleep disorder. However, neurocognitive sequelae such as amnestic syndrome are listed separately. The collection of disorders subsumed within residual and late onset psychotic disorder in ICD 10 also feature elsewhere in the draft ICD 11.

DSM-5 eschews mention of the physical diseases consequent on substance use. Given the worldwide morbidity and mortality from them, this seems extraordinary. One would not expect detailed descriptions or diagnostic criteria in a psychiatric manual but they have faded into oblivion, together with the 'general medical conditions', which formed Axis III of the previous DSM multiaxial system. The ICD system, by contrast, covers all known human disorders together with health risk factors and external causes of disease and injury. For medical and traumatic sequelae of substance use, ICD 10 already has detailed descriptions and diagnostic guidelines for the array of physical, neurological, and traumatic sequelae. No substantial change in these descriptions is anticipated for ICD 11, although more attention is being paid to blood-borne viral, bacterial, and other infections.

HAZARDOUS AND RISKY SUBSTANCE USE

As well as there being a range of substance use disorders, substance use is a risk factor for many physical and psychiatric ailments and social consequences. For example, it is known that the level of a person's alcohol consumption is related to the subsequent likelihood of their developing cirrhosis of the liver, chronic pancreatitis, peptic ulcer disease, carcinoma of the colon, breast cancer, and many other disorders [21]. Recently, this morbidity has also been analyzed in relation to specified alcohol use disorders [22]. Mostly, this reflects the tissue toxic effects of alcohol but they may be due to nutritional deficiency, the mode of administration, and interactions with other agents. Likewise, many physical disorders are related to the number of cigarettes a person smokes. Caffeine-containing energy drinks are increasingly popular in many countries [23] and there appears to be a dose—response relationship. The pattern of substance use is also important, with some of the acute physical sequelae arising from periodic heavy use – trauma being an example – compared with regular daily consumption of essentially the same amount.

Various labels are attached to the use of a substance which confers the risk of subsequent harm in this way. In many countries, there are criteria for hazardous or risky alcohol consumption [24] and the WHO has long used the term 'hazardous' to apply to a level of substance use which confers the risk of harmful consequences [8]. In DSM-IV and DSM-5, this understanding of hazardous substance use does not feature even though the contribution of American epidemiologists to our understanding of alcohol and cigarette use as major

health risk factors has been vast. The use of the term 'hazardous' is limited to use in physically hazardous situations in DSM-IV and DSM-5.

'Hazardous' or 'risky' substance use is an important concept for public health and prevention. There has been a long-standing debate about whether notions of risky substance use should be incorporated into the ICD system. For example in ICD 10, the term 'hazardous substance use' is not a diagnostic entity in the main chapter of mental health and substance use disorders, having been deleted at the final draft stage. It is possible to note the presence of risky consumption using other sections of the classification such as the Y90 and Y91 codes. In the draft ICD 11, hazardous alcohol consumption has been included in a separate chapter as a health risk factor (not in the main section of substance use disorders). It is defined as 'a pattern of alcohol use that appreciably increases the risk of harmful physical or mental health consequences to the user or to others to an extent that warrants attention and advice from health professionals'. The increased risk may be from the frequency of alcohol use, from the amount used on a given occasion, or from risky behaviors associated with alcohol use or the context of use, or from a combination of these. The risk may be related to short-term effects of alcohol or to longer-term cumulative effects on physical or mental health or functioning. Hazardous alcohol use has not yet reached the level of having caused harm to physical or mental health of the user or others around the user. The pattern of alcohol use often persists in spite of awareness of increased risk of harm to the user or to others [3**].

GAMBLING AND GAMING AS ADDICTIVE DISORDERS

Excessive gambling and gaming are increasingly accepted as addictive disorders. On the basis of the evidence review in the DSM-5 developmental process, it was decided that there were sufficient grounds for regarding what was termed pathological gambling in DSM-IV as an addiction, with the new diagnostic label of 'gambling disorder' [1]. Certain criteria are common to those for substance use disorder, including persistent thoughts about gambling, making repeated unsuccessful efforts to control or cease gambling, and a criterion akin to tolerance, of needing to gamble with increasing amounts of money to achieve the desired effect. These criteria reflect the internal driving force of an addictive disorder and the priority given to gambling over other activities and responsibilities. Gambling may be episodic or very regular, when the addictive progression which sees gambling occupy

center-stage in that person's life is very evident. Other criteria are, unsurprisingly, different and they emphasize certain characteristic features such as gambling specifically to recover losses ('chasing' losses) and relying on money from others to relive desperate financial situations. In addition to sharing many core features of addiction, gambling disorder shares with the other addictions common associations such as comorbid disorders, antecedent factors, and there is considerable similarity in the neurobiological mechanisms which lead to that internal drive [25[¶]].

'Internet gaming disorder' is not included in the main text of DSM-5 but in a separate chapter under 'conditions for further study' [1]. There are draft diagnostic criteria which are very similar – surprisingly so—to those which apply to substance use disorders. Internet gaming disorder is defined as the persistent and recurrent use of the internet to engage in games and leading to clinically significant impairment or distress. This maladaptive involvement with on-line games leads to preoccupation with them and loss of interest in other hobbies and activities, and neglect of educational and career opportunities. They progressively dominate a person's life. The relevant DSM-5 Committee considered, however, that there was not yet sufficient evidence available for internet gaming disorder to be accepted as a diagnostic entity definitively. This is a fair expression of the available data in the 2007–2013 period. Petry and *et al.* [26] have developed guidelines for assessing internet gaming disorder using the DSM-5 approach and describe the intended meaning for each criterion.

More specific features of a gaming addiction have been identified since then and include the concept of 'immersion' in the virtual world. In addition there is more information about the common antecedents and comorbidities of internet gaming disorder, which are different in some respects from substance use disorders. For example internet gaming disorder is associated with autistic spectrum disorder (which does not apply for substance disorders or gambling). In the draft ICD 11 gaming disorder is included in the addictions chapter. It is subdivided into predominantly on-line gaming and off-line gaming, with the former being the most common type and the greatest cause for concern. The draft ICD 11 guidelines emphasize persistent or recurrent gaming behavior with impaired control over gaming and increasing priority given to gaming over other activities. Tolerance and withdrawal do not feature in these guidelines, but playing increasingly complex games to obtain the desired effect and acts of violence when access to the internet is interrupted may well

correspond to the typical features of substance dependence. The features [27], prevalence [28], health impacts, and neuroimaging features are the subject of several recent publications (see, e.g. [29]).

CONCLUSION: POINTERS TO THE FUTURE

A considerable literature has been generated leading up to and subsequent to the publication of DSM-5 and in the development of the draft ICD 11 examining the psychometric properties and diagnostic yield of key diagnostic entities, some of which has been noted above. More sophisticated survey designs and more precise mathematical tools have been employed. However, all this work is essentially of a confirmatory nature. The diagnostic criteria used in DSM-IV and DSM-5 seem to have attained a divine status of which Moses would have been proud. The ways of thinking about diagnoses and the type of information gathered from people with problems due to substance use have remained unchanged for more than a generation. The lists of symptoms and experiences of people with substance use problems often date back to the 1930s to 1960s. The evidence base is patchy. The original description of the alcohol dependence syndrome was based on data gathered from 100 patients [8]. The application of this syndrome to other substances was based on a confirmatory approach, rather than gathering fresh data from the experiences of people with, say, benzodiazepines or psychostimulant problems. The features of several of these disorders have been studied, for example by Ashton [30] but typically they have not informed diagnostic descriptions and criteria. No attention has been paid to the burgeoning literature on the neurobiology of these disorders or clinical trials of treatment. The current diagnostic systems are built on limited foundations.

With regard to the ICD 11 developmental process, field testing is underway and is assessing the draft ICD 11 definitions and guidelines for clinical utility, value for epidemiological studies and monitoring, and comparability with ICD 10 (and DSM-IV and DSM-5). It comprises a web-based key informant study, focus groups of health professionals, and a consensus conference, to be held after the results of field testing are available and with the objective of generating an overall consensus on the overall taxonomy and the Clinical Descriptions and Diagnostic Guidelines. Hence, there is scope for change in the definitions and guidelines based on results from field testing and data analysis.

In a welcome development, Volkow *et al.* [31^{¶¶}] have challenged the research community to pay attention to the wealth of research findings on the neurobiology of addictive disorders. From both

laboratory animal research and human imaging studies, three phases of addictive disorders have been identified, namely, intoxication, withdrawal and negative affect, and preoccupation with substance use and what they term 'anticipation' which equates to craving for the substance. Each of these stages is characterized by activation of specific neurocircuits [32]. Intoxication reflects activation of the dopamine-based reward system (other neurotransmitters have a subsidiary role) in the nucleus accumbens, with projections to the dorsal striatum. Withdrawal and negative affect involve corticotrophin releasing factor (CRF), glutamate and dynorphin within the amygdala, bed nucleus of the stria terminalis and nucleus accumbens. At the stage of preoccupation and craving, the ventral striatum is activated, together with the orbitofrontal and anterior cingulate cortex. Dysfunction of the prefrontal cortex negates the brake on these feelings and behaviors that might otherwise occur. These phases correspond well with the features of substance use disorders, although the time frame for their development may not directly match the insidious onset of substance disorders in humans.

Is it now time to reconfigure substance use disorders to a neurobiological framework? A group from the U.S. National Institute on Alcohol Abuse and Alcoholism has proposed an 'addictions neuro-clinical assessment' [33], which is based on the phases of addiction described above, combined with recognized clinical substance use disorder domains. To generate the data needed to test the value of this approach, the authors propose a detailed assessment (approximately 10 h per patient), the like of which has not been attempted for a generation. Along similar lines, Ghitza [34] from the National Institute on Drug Abuse has developed the ASPIRE model of assessment. This is also based on a neuroscience framework. The possibility of biological markers of the various stages of addiction is addressed in a related paper [35]. These initiatives complement the National Institute of Mental Health's Research Domain Criteria Initiative [36,37]. The stage should now be set for the identification of clinically-relevant diagnostic features, biological markers, and potentially neuroimaging findings that accurately define these phases. The challenge here will be to synthesize these disparate sciences to achieve common goals of diagnosis and classification.

Acknowledgements

None.

Financial support and sponsorship

The author has received travel support and meeting fees from the American Psychiatric Association and the

World Health Organization respectively to attend meetings of DSM-IV, DSM-5, ICD 10 and ICD 11 working groups. He has not received any remuneration from commercial, educational or other organizations in relation to this work.

Conflicts of interest

The author was a member of the Advisory Panel for the development of DSM-IV (from 1988 to 1994), and was Co-Chair of the Research Advisory Committee for DSM-5 from 2003 to 2008; he was not a member of the Editorial Group for DSM-5. He was a member of the Psychoactive Substance Use Disorders Workgroup for the development of ICD 10 from 1987 to 1994. He was involved in developing and revising the ICD 10 Clinical Descriptions and Diagnostic Guidelines and was subsequently responsible for developing the corresponding ICD 10 Diagnostic Criteria for Research. He is currently a member of the Substance Use and Related Disorders Work Group for ICD 11. The opinions stated in this paper are those of the author and do not represent endorsement from the American Psychiatric Association and the World Health Organization.

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