



The global epidemiology and burden of psychostimulant dependence: Findings from the Global Burden of Disease Study 2010[☆]



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ABSTRACT

Aims: To estimate the global prevalence of cocaine and amphetamine dependence and the burden of disease attributable to these disorders.

Methods: An epidemiological model was developed using DisMod-MR, a Bayesian meta-regression tool, using epidemiological data (prevalence, incidence, remission and mortality) sourced from a multi-stage systematic review of data. Age, sex and region-specific prevalence was estimated for and multiplied by comorbidity-adjusted disability weightings to estimate years of life lost to disability (YLDs) from these disorders. Years of life lost (YLL) were estimated from cross-national vital registry data. Disability-adjusted life years (DALYs) were estimated by summing YLDs and YLLs in 21 regions, by sex and age, in 1990 and 2010.

Results: In 2010, there were an estimated 24.1 million psychostimulant dependent people: 6.9 million cocaine and 17.2 million amphetamines, equating to a point prevalence of 0.10% (0.09–0.11%) for cocaine, and 0.25% (0.22–0.28%) for amphetamines. There were 37.6 amphetamine dependence DALYs (21.3–59.3) per 100,000 population in 2010 and 15.9 per 100,000 (9.3–25.0) cocaine dependence DALYs. There were clear differences between amphetamines and cocaine in the geographic distribution of crude DALYs. Over half of amphetamine dependence DALYs were in Asian regions (52%), whereas almost half of cocaine dependence DALYs were in the Americas (44%, with 23% in North America High Income).

Conclusion: Dependence upon psychostimulants is a substantial contributor to global disease burden; the contribution of cocaine and amphetamines to this burden varies dramatically by geographic region. There is a need to scale up evidence-based interventions to reduce this burden.

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1. Introduction

Cocaine and amphetamines are the two major psychostimulants used for recreational purposes globally. In 2012, it was estimated that there were 34 million amphetamine users worldwide (range 14–53 million) and 17 million cocaine users (range 14–21; [The](#)

[United Nations Office on Drugs and Crime \(UNODC, 2013\)](#). The [UNODC \(2012\)](#) has estimated that amphetamines were the second most commonly used illicit drug type worldwide, after cannabis. Amphetamine users outnumbered opioid users in all regions except Europe and South Asia. Cocaine was less commonly used globally, but was the second most commonly used illicit drug in Southern Africa, North America, South America, the Caribbean and West and Central Europe ([UNODC, 2009](#)).

Cocaine is produced from the *Erthroxylon coca* plant, which is native to the Andes Mountains in South America. It is a central nervous system (CNS) stimulant that has a short half-life. It increases levels of dopamine, serotonin and norepinephrine in synapses in brain areas implicated in reward by blocking the reuptake of

[☆] Supplementary material can be found by accessing the online version of this paper. Please see [Appendix A](#) for more information.

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these monoamines (Kuhar et al., 1991; World Health Organization (WHO), 2004). Cocaine comes in many forms (paste, cocaine hydrochloride (HCL), crack cocaine, paco, basuco) but cocaine HCL and crack are the most commonly used forms (WHO/United Nations Interregional Crime and Justice Research Institute, 1995). They may be snorted, injected and smoked (American Psychiatric Association, 1994; WHO/United Nations Interregional Crime and Justice Research Institute, 1995; UNODC, 2009).

Many people use cocaine occasionally, but a minority develop a pattern of heavy and frequent use that produces cocaine dependence (WHO/United Nations Interregional Crime and Justice Research Institute, 1995). According to the American Psychiatric Association's Diagnostic Statistical Manual (DSM), a cocaine dependent person develops a tolerance to cocaine and reduces their social, recreational and occupational activities as a result of their drug use (American Psychiatric Association, 1994). A withdrawal syndrome has been identified that includes physiological symptoms such as agitation, fatigue, increased appetite and unpleasant or vivid dreams, disturbances in functioning and psychological distress with an onset a few hours to a few days after last use (American Psychiatric Association, 1994).

Amphetamines are central nervous system (CNS) stimulants that were first synthesised more than a century ago for medical use. Multiple forms of amphetamines exist, including diverted pharmaceutical amphetamines. Methamphetamine and amphetamine are thought to be the most commonly used types (UNODC, 2007, 2009). They can come in pill, powder or crystalline forms that vary in purity. They can be taken via different routes: pills are most typically swallowed, powder is often taken intranasally or via injection, whereas the crystalline form can be smoked, injected, or heated and its vapours inhaled. There is a meth/amphetamine dependence syndrome (Topp and Darke, 1997; Topp and Mattick, 1997a,b) that is increasingly recognised by international and national organisations as a significant public health and public order issue (UNODC, 2008a,b, 2009).

Both cocaine and amphetamine dependence have been associated with negative social, physical and psychological outcomes (Degenhardt and Hall, 2012). These include psychotic symptoms, cardiovascular disease, blood borne viral infections HIV, hepatitis C (HCV) and hepatitis B (HBV), and sexually transmitted infections (Cregler, 1989; Satel et al., 1991; Marzuk et al., 1992; Cornish and O'Brien, 1996; Roy, 2001; Falck et al., 2003; Darke and Kaye, 2004; Kaye and Darke, 2004; Degenhardt et al., 2005; Haasen et al., 2005; Mooney et al., 2006; Ribeiro et al., 2006; Conner et al., 2008; Mathers et al., 2008; Degenhardt and Hall, 2012).

There has never been a systematic review and estimate of global, regional and country-level patterns of amphetamine and cocaine dependence and associated health burden. Such information is crucial to inform policy and programming efforts to prevent and treat these disorders.

The global burden of disease (GBD) framework was initiated by the World Bank for its 1993 World Development Report (World Bank, 1993) and uses information on mortality and disability caused by a given disease or injury to estimate the years of life lost due to premature mortality (YLLs) and the years of life lived with disability (YLDs). YLLs and YLDs can be summed to give disability-adjusted life years (DALYs), an overall measure of disease burden. Previous GBD studies have not estimated the burden of disease due to cocaine and amphetamine dependence (Murray and Lopez, 1996; Prince et al., 2007; WHO, 2008).

GBD 2010 refined the methods used to estimate disease burden. It estimated the burden of 291 diseases and 67 risk factors, by age, sex, 187 countries, and 21 world regions, for 1990 and 2010 (Lim et al., 2012; Lozano et al., 2012; Murray et al., 2012; Salomon et al., 2012; Vos et al., 2012). GBD 2010 conducted systematic reviews of the literature to capture all the available epidemiological

data, from 1980 onwards, on the prevalence, incidence, remission and mortality from psychostimulant dependence. Other methodological improvements included using a Bayesian meta-regression approach to model epidemiological data. Among other things, this approach carried forward the effects of uncertainty in epidemiological parameters into the final burden estimates. Disability was quantified for a more comprehensive list of health states than in 2000, using more representative survey data. Burden estimates were also adjusted for the effects of comorbidity (Murray et al., 2012; Vos et al., 2012).

This study uses the systematic reviews of the epidemiology of cocaine and amphetamine dependence (Singleton et al., 2009; Calabria et al., 2010; Degenhardt et al., 2011a,b). In this study, we: (1) assemble these data into comprehensive disease models of cocaine and amphetamine dependence; (2) generate global and regional estimates of the prevalence of these forms of dependence; and (3) present global and regional estimates of YLDs, YLLs and DALYs attributable to cocaine and amphetamine dependence.

It is important to note that this paper focuses exclusively upon the direct burden of these disorders. It does not detail the attributable burden of other health outcomes for which cocaine and amphetamine dependence are risk factors. In GBD 2010, the only outcome of these disorders that met the criteria for being included in the comparative risk assessment component (Lim et al., 2012) was suicide (Degenhardt et al., 2013, 2014b). The attributable burden of amphetamine and cocaine dependence as risk factors for suicide has been detailed elsewhere (Ferrari et al., 2014). Although HIV, HBV and HCV are associated with cocaine and amphetamine dependence, we examined burden of injecting drug use overall due to these viruses, rather than specific types of injecting drug use (Degenhardt et al., 2013).

We did not explicitly estimate the prevalence and disease burden related to MDMA (ecstasy) dependence. Debate continues about a potential dependence syndrome (Degenhardt et al., 2010a); there was also no MDMA dependence syndrome included in the American Psychiatric Association's Diagnostic and Statistical Manual (DSM) or by the WHO in the International Classification of Diseases (ICD).

2. Method

2.1. Case definition

The case definition of cocaine dependence included cases meeting the Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychiatric Association, 2000) or International Classification of Diseases (ICD; WHO, 1993) diagnostic criteria for cocaine dependence (DSM:304.20; ICD:F14.2). Amphetamine dependence included cases meeting the DSM (American Psychiatric Association, 2000) or ICD (WHO, 1993) diagnostic criteria for amphetamine dependence (DSM:304.40; ICD:F15.2).

2.2. Epidemiological data and prevalence modelling

We drew on data collected through a series of systematic searches that were conducted for studies reporting prevalence, incidence, remission, case-fatality and excess all-cause mortality for cocaine dependence and amphetamine dependence. Results of these reviews have been reported in detail elsewhere (Singleton et al., 2009; Calabria et al., 2010; Degenhardt et al., 2010b, 2011a,b).

In brief, the reviews used multiple search strategies including: systematic searches of the peer-reviewed literature for studies published between 1990 and 2009; searches of the grey literature and specific online databases such as the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA); and consultation with experts in the field via email and attendance at conferences. An additional literature search was conducted to search for any indication that psychostimulant use occurred within regions that did not have any estimates of prevalence. Such evidence was based on derived estimates of use (UNODC, 2008a,b), sample estimates, drug-related treatments, drug seizures, drug-related arrests, or qualitative information related to use of illicit drugs. Search methods were consistent with those recommended by the Meta-analysis of Observational Studies in Epidemiology (MOOSE) group (Stroup et al., 2000) and reporting as per the accepted PRISMA guidelines (Moher et al., 2009).

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