Adolescent Health 4

Interventions to reduce harm associated with adolescent substance use

J W Toumbourou, T Stockwell, C Neighbors, G A Marlatt, J Sturge, J Rehm

Summary
A major proportion of the disease burden and deaths for young people in developed nations is attributable to misuse of alcohol and illicit drugs. Patterns of substance use established in adolescence are quite stable and predict chronic patterns of use, mortality, and morbidity later in life. We integrated findings of systematic reviews to summarise evidence for interventions aimed at prevention and reduction of harms related to adolescent substance use. Evidence of efficacy was available for developmental prevention interventions that aim to prevent onset of harmful patterns in settings such as vulnerable families, schools, and communities, and universal strategies to reduce attractiveness of substance use. Regulatory interventions aim to increase perceived costs and reduce availability and accessibility of substances. Increasing price, restricting settings of use, and raising legal purchase age are effective in reducing use of alcohol and tobacco and related harms. Screening and brief intervention are efficacious, but efficacy of a range of treatment approaches has not been reliably established. Harm-reduction interventions are effective in young people involved in risky and injecting substance use.

In many countries, overdoses of alcohol and other drugs compete with road crashes as leading causes of death in young people.1 The substantial contribution of alcohol and other drugs to suicide, homicide, a range of injuries, poisoning, and the spread of infectious disease is also now well established.2,3 Hazardous alcohol use alone has been estimated to cause 31-5% of all deaths in 15–29-year-old men in the developed world and 86% of the 3·6 million substance-related deaths of 15–29-year-old men and women worldwide (table 1). Psychoactive substance use occurs in all known societies, with heavy episodic or binge use being especially common among young people,4,5 so that the risk of these adverse acute consequences can be seen as a function of societal context as well as individual susceptibility. In 2000, the use of alcohol and illicit drugs was estimated to contribute 9·8% of the total global burden of disease for people aged 15–29 years (table 2). This burden fell disproportionately on male individuals and people living in developed countries. In economically developed countries, 23·3% of the global burden of disease is contributed to by alcohol (18·5%) and illicit drugs (4·9%). No evidence exists of significant health benefits from moderate alcohol consumption for young adults to offset these adverse effects.2,6 There are several social and legal consequences of substance use for young people, including work and travel restrictions as a consequence of a

Search strategy
We aimed to complete an integrative summary of current knowledge of the effectiveness of interventions designed to prevent and reduce the major harms associated with adolescent substance use. The co-authors, selected because of their expertise in specific areas of work in this area, supplemented recently completed comprehensive systematic reviews5,6 using the PubMed, Psychlit, and Google scholar electronic databases, and keyword and text searches relevant to (adolescen*) and (alcohol or drug or substance and use or abuse) and (review) to locate additional systematic review papers published in the past 2 years. The conclusions of review papers were included where they met quality standards for systematic selection and methodological evaluation.5,6 Authors were asked to integrate review findings citing key evidence from well-done and influential empirical studies and noting implications for research and practice. A judgment of intervention efficacy required overall positive evidence from well-controlled outcome evaluations. Interventions were judged as effective where outcomes were maintained outside controlled research contexts in real-world service delivery conditions.6,9

We used a broad definition of substance use, which included adolescent use of alcohol (ethanol) and tobacco, and non-medical use of prescription medications (including analgesics and sedatives) and illicit drugs including cannabis, heroin, cocaine, amphetamine-type substances, and hallucinogens. As relevant to substance use, adolescence was defined broadly to refer to the period before puberty (around age 10 years) through to the achievement of financial independence in emerging adulthood (around late 20s).10 Literature relevant to harms, current substance use trends, and influences was overviewed to provide a context for intervention. We summarise current understanding of intervention opportunities and the conclusions of evaluation studies that have examined effects in modification of behaviour, reduction of harm, and savings in costs.
Table 1: Substance-attributable deaths in developed countries, countries with emerging economies, and developing countries for people aged 15–29 years in 2000 (thousands)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Developed countries</td>
<td>Emerging economies</td>
<td>Developing countries</td>
</tr>
<tr>
<td>Alcohol</td>
<td>72 (31.5%)</td>
<td>10 (12.5%)</td>
<td>82 (26.7%)</td>
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<tr>
<td>Illegal drugs</td>
<td>9 (3.9%)</td>
<td>3 (4.1%)</td>
<td>12 (3.9%)</td>
</tr>
<tr>
<td>Alcohol and illegal drugs</td>
<td>81 (35.3%)</td>
<td>13 (16.6%)</td>
<td>94 (30.6%)</td>
</tr>
</tbody>
</table>

Authors’ estimates derived from Ezzati and colleagues using their definitions of global regions. Overlap between harm caused by alcohol and by illegal drugs can result in small overestimation (<3%). Numbers may not add up due to rounding. *Percentage of total deaths in people aged 15–29 years for the relevant region in parentheses. †Substance-attributable deaths worldwide/total deaths worldwide for all conditions (% of total caused by alcohol and other drugs).

Table 2: Substance-attributable disability-adjusted life years (DALYS) in developed countries, countries with emerging economies, and developing countries for people aged 15–29 years in 2000 (thousands)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Developed countries</td>
<td>Emerging economies</td>
<td>Developing countries</td>
</tr>
<tr>
<td>Alcohol</td>
<td>5655 (26.6%)</td>
<td>1244 (7.7%)</td>
<td>6898 (18.5%)</td>
</tr>
<tr>
<td>Illegal drugs</td>
<td>1326 (6.2%)</td>
<td>487 (3.0%)</td>
<td>1814 (4.9%)</td>
</tr>
<tr>
<td>Alcohol and illegal drugs</td>
<td>6981 (32.9%)</td>
<td>1721 (10.7%)</td>
<td>8712 (23.3%)</td>
</tr>
</tbody>
</table>

Authors’ estimates derived from Ezzati and colleagues using their definitions of global regions. Overlap between harm caused by alcohol and by illegal drugs can result in small overestimation (<3%). Numbers may not add up due to rounding. *Percentage of total DALYS lost in people aged 15–29 years for the relevant global region in parentheses. †Substance-attributable DALYS lost/total DALYS lost worldwide for all conditions (% of total caused by alcohol and other drugs).

Patterns and trends

Data from clinical populations are clearly inadequate for monitoring population trends in adolescent substance use. Representative household surveys are done in several countries and offer the prospect of including young people who are not in school, but have weaknesses such as low response rates and failure to include homeless young people.

In developed nations, universal schooling provides quite comprehensive capture of student populations, offering the potential to monitor early use patterns in younger age groups. Monitoring The Future (MTF) is a well-done student survey done yearly in the USA with large, nationally representative samples. The survey was launched in 1975 and now spans more than 30 years. A European consortium (ESPAD) implemented an adaptation of the MTF survey on three occasions in 1995, 1999, and 2002, enabling comparison of international trends. The MTF has recorded a reduction in many forms of substance use in recent years. For example, the rate of US secondary school students in their final year who reported drinking alcohol in the past month fell from 69% in 1983 to 48% in 2004. The reduction in youth alcohol use in the USA began in the mid 1980s, encouraged by factors such as the 21-years age limit for legal drinking. Reductions have also been mirrored by lower rates of drinking in early high school. Use of tobacco, cannabis, and illicit drugs have also shown general reductions, although from the early 1990s...
younger cohorts began to show increases. This recent increase has been explained by so-called generational forgetting, in which younger generations tend to engage in more drug use when they have not directly witnessed the social upheaval of drug use in immediately older generations. The ESPAD surveys have revealed generally higher rates of alcohol and tobacco use for European youth but, in most countries, lower rates of use of cannabis and illicit drugs, compared with the USA. However, average European data mask considerable diversity, with young people in most northern European nations reporting high use of alcohol associated with alcohol-related problems, whereas those in several southern European nations report use of alcohol with few apparent problems, although rates of tobacco and inhalant use are often high in these nations. Patterns in young people in Australia and New Zealand tend to be similar to those in northern Europe. Post-school follow-up of the MTF samples in the USA has been regularly completed, mostly showing stability of patterns from high school into young adulthood, whereas alcohol use tends to increase after leaving school, especially for those entering college.

**Intervention conceptual models and frameworks**

In 1998 the UN called for a balanced approach to drug policies aimed at reducing both supply and demand. Efforts to reduce supply, primarily through law enforcement punishment for possession and distribution (ie, the War on Drugs), have remained the primary focus in many countries including the USA and UK. Other countries, such as Australia, have achieved better balance, implementing supply-reduction strategies designed to disrupt production and supply of illicit drugs, demand-reduction strategies to prevent the initiation of drug use, and harm-reduction strategies to reduce drug-related harm for individuals and communities.

In adolescents and young adults, prevention is a central demand-reduction strategy. Traditional classification of prevention approaches includes primary, secondary, and tertiary strategies. Primary prevention aims to reduce risks and prevent new cases, secondary prevention seeks to limit harm in the early stages of a disorder, and tertiary prevention treats the long-term sequelae and consequences of the disorder. An alternative conceptualisation categorises approaches on the basis of level of risk of a disorder in various groups targeted. Universal interventions are directed at whole populations at average risk; selective interventions target groups at increased average risk, and indicated interventions target individuals with early emerging problems. Across prevention and treatment approaches, the specification of abstinence as the only acceptable outcome is a key controversy. Among adolescents, zero-tolerance approaches to drug and alcohol prevention are ineffective and in some cases contraindicated. With respect to treatment, abstinence-only approaches functionally deny services to those unwilling to completely eliminate use. Consequently, harm-reduction approaches have emerged in recent years to offer alternatives to zero-tolerance. Such approaches acknowledge that many adolescents will at least experiment with substance use, and offer strategies designed to reduce potential consequences of use. Reductions in pre-birth maternal use of drugs, environmental tobacco smoke, and substance-impaired parenting have been associated with reduced risk of adolescent substance misuse and mental health problems. Unsurprisingly, developmental perspectives have been widely incorporated in attempts to understand and reduce adolescent substance use. Common early social developmental pathways predict a range of psychosocial problems, including problematic involvement with both legal and illegal drugs. Social developmental risk and protective factors originate not only during the early years but also in a range of environments, such as education systems and local communities, and are affected by cultural factors.

Emerging strategies focus on objectives relevant to positive youth development, such as social participation and wellbeing. The developmental perspective also emphasises individual and contextual factors that

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**Figure:** Protection and risk model for distal and proximal determinants of risky substance use and related harms

Adapted from Loxley and colleagues.
current situations as well as the importance of situational factors, particularly in adolescence (eg, peer interactions). Loxley and colleagues proposed a synthesis between the developmental pathways approach and efforts to reduce drug-related harm at the population level (figure). In this integrated model, risk factors that predispose young people towards harmful drug use range from distal (eg, early developmental, social, and behavioural) to proximal (patterns and places of drug use). The concept of protection was also expanded to incorporate more proximal factors such as harm-reduction programmes, reduced drug availability, and low risk patterns of use (including abstinence).

Differing demand-reduction frameworks and aspects of supply reduction can be related to alternative explanatory models of substance use in young people. A recent integrative review of published work identified four major motivational processes that affect adolescent substance use: conforming to norms, individuating identity, escaping distress, and self-management and regulation. Conforming to norms includes processes of social influence and legal sanctions. Conformity influences are the most prevalent motivational process affecting adolescent drug use, explaining the common occurrence in most nations of young people conforming to prevalent societal patterns of substance use. In the context of prevalent peer drug use, puberty can trigger drug use motivated by the desire to be popular with peers. Individuating identity describes a less common situation of novel classes of drug use (eg, ecstasy in the 1990s) emerging almost exclusively within youth culture. Liberalisation of female gender roles has been associated with an increase in substance use and harm. The historical emergence of wide-scale recreational use of illicit drugs in the 1960s has been linked to social freedoms stemming from technological mastery and the related pattern of a large proportion of young people delaying adult responsibility to pursue education. The most severe and harmful substance use problems are prevalent in an important minority motivated by escaping distress associated with developmental difficulties occurring from before birth (eg, exposure to alcohol and drug use during pregnancy) and throughout childhood (eg, child abuse and neglect). Longitudinal research suggests that developmental problems are more likely where several risk factors are present, and persist over longer periods of time. Finally, a complex range of diverse substance use problems can be traced to pharmacological advances in drug development and the maladaptive replacement of traditional methods of achieving functional benefits such as self-management and regulation (eg, overuse of antibiotics, using tobacco to regulate mood, abuse of analgesics, diet and body-building drugs). Favourable attributions and expectations for the effects of substance use predict intentions to use drugs, which in turn predicts initiation of substance use.

Evidence for different interventions

In the following sections, we present the major interventions that have evidence for successful reduction of adolescent substance use and related harm. These interventions address different developmental stages and motives for substance use. We assess evidence for supply-reduction (regulatory) interventions, the demand-reduction strategies of developmental prevention intervention, early screening and brief intervention, and treatment and harm-reduction interventions. Table 3 summarises the main conclusions relevant to the level of evidence for each of the interventions described below.

Regulatory interventions

Regulatory interventions to limit drug-related harms can address reduction of supply and motivations for conformity, and range from unfettered access to prohibition with criminal sanctions. Laws controlling substances categorised as narcotics in UN conventions, such as cocaine, heroin, and amphetamine, may receive stringent enforcement with criminal sanctions—even the death penalty in some countries. In some jurisdictions, however, civil penalties (fines) and cautions for first time offenders apply. Regulatory frameworks for legal substances increase the options for influencing health outcomes—eg, controls over who is permitted to supply substances, the user’s age or level of intoxication, the hours of sale, quantity permitted, and price.

Controls on price, usually through taxation, are among the interventions with the highest evidence for effectiveness in reducing levels of harm in the population, especially for young people. Taxes on the alcohol or tobacco content of products (eg, favouring drinks with a lower alcohol content) and indexed for consumer pricing movements are the most effective.

Other strategies with evidence of effectiveness include: ignition interlocks for individuals who repeatedly drive when drunk, enforcement of laws that prohibit service to intoxicated patrons, limits on outlet density, and rationing and restrictions on the hours and days of sale. Passive
smoking regulations and their enforcement have had a powerful effect on rates of smoking and related harms.\textsuperscript{13} Substantial evidence of effectiveness exists for enforcement of minimum age laws and increasing the age at which young people are permitted to purchase alcohol.\textsuperscript{12,13} The use of young people attempting to make illegal purchases to check compliance with minimum age regulations\textsuperscript{19} and enforcement of youth possession laws\textsuperscript{50} are procedures that contribute to efficacy. Regulatory strategies to minimise the availability of inhalants are worthy of evaluation to establish efficacy—eg, providing aviation fuel for cars in remote rural areas of Australia to prevent young Aboriginals from petrol sniffing.\textsuperscript{11}

The enforcement of laws on youth access, passive smoking, and licensing of alcohol can often be determined locally. In recent years, controlled trials in which communities were encouraged to enforce these laws have yielded evidence of effectiveness in reducing alcohol-related violence and road crashes,\textsuperscript{61} especially if supported by increased taxes.\textsuperscript{61}

Regulatory changes regarding illicit drugs and illicitly available prescription drugs that are worthy of evaluation to establish efficacy include: the prescription of heroin to severely dependent individuals, monitoring the use of multiple family doctors by the same individual to obtain psychotropic medication, and modification of legal sanctions from criminal toward civil penalties.\textsuperscript{11}

**Developmental prevention interventions**

Developmental prevention interventions aim to reduce pathways to drug-related harm by improving conditions for healthy development in the earliest years through to adolescence. The interventions beginning before birth aim to reduce drug use motivated by escape from distress, by reducing risk factors such as use of tobacco, alcohol, or other drugs in pregnancy and exposure of children to environmental tobacco smoke. There is evidence of efficacy from small well-controlled trials that family home visitation is a feasible strategy for implementation with disadvantaged families and can reduce risk factors for early developmental deficits and thereby improve childhood development outcomes.\textsuperscript{14} Follow-up at age 15 years has associated such interventions with reduced rates of early initiated tobacco and alcohol use.\textsuperscript{15} In the USA, savings and returns to government have been estimated across a range of areas at around US$5 for every $1 spent on the programme over the first 15 years of the child’s life. This strategy might not demonstrate benefits where it is applied more universally to include mothers who have low rates of child development problems.\textsuperscript{16} The Perry Preschool programme has encouraged intensive early preschool experiences combined with home visits for families targeted because of high rates of child development problems.\textsuperscript{17} A small experimental trial of this programme followed up children until age 27 years and found developmental advantages, including lower rates of substance use,\textsuperscript{18} with aggregated benefits translating to a US$6 saving for every $1 invested.\textsuperscript{16} The effect of early developmental disadvantage on progression to harmful substance use is not inevitable but can be moderated by reducing its translation to social marginalisation. Some of the strongest evidence for efficacy in reducing developmental pathways to drug-related harm comes from interventions delivered through the early school years to improve educational environments and reduce social exclusion.\textsuperscript{62,63} A recent independent economic evaluation estimated that savings on overall social and health costs were large, at US$9837 per student through effective intervention in the early school years.\textsuperscript{64}

Many interventions targeting the high-school age period focus on reduction of motivations for drug use related to conformity, individuating, and self-management. Drug education in schools has been the most commonly evaluated strategy. Components of the curriculum that address social influences on drug use aim to develop young peoples’ competence to resist peer pressure.\textsuperscript{65} Drug education based on social competence training has shown efficacy in delaying drug use by about 1 year.\textsuperscript{66} These approaches address conformity and individuation pathways and can be combined with information to reduce perceived prevalence. Drug education programmes addressing emotional competence include stress management components to improve the individual’s ability to cope effectively in difficult situations. Reviews typically show that information is insufficient on its own to prevent initiation of substance use.\textsuperscript{67} More recent schemes have incorporated harm-reduction information, and evidence from an Australian trial shows reductions in alcohol use and misuse after 2 years.\textsuperscript{68} Encouraging efficacy evidence suggests that reductions in alcohol\textsuperscript{69} and tobacco use\textsuperscript{70} are achievable through interventions to alter norms and consequences for drug use within families through the early adolescent years. In general, prevention programmes seem more successful when they maintain intervention activities over several years and incorporate more than one strategy. Developmental prevention programmes are unlikely to be adequate as a stand-alone policy to reduce population harm related to substance use, particularly for substances such as tobacco where the burden of harm falls late in life.\textsuperscript{67} However, opportunities exist for communities to tailor a mixture of programmes that address the local conditions that give rise to substance-related harm, and developmental prevention schemes can be usefully coordinated with regulatory approaches and with treatment and harm-reduction programmes. Developmental prevention activities can be coordinated using funding from different jurisdictions—eg, crime prevention, health promotion, mental health, education, and substance abuse prevention.\textsuperscript{71}
Early screening and brief intervention

Findings of longitudinal cohort studies in different nations show that use of a specific substance early in life increases the risk of progression to more frequent and problematic use in later life. However, the trend for early substance use to predict later problems masks considerable variation, and programmes based on principles of harm reduction have demonstrated success in encouraging young alcohol users to adopt more moderate and less harmful patterns of use. One feasible intervention framework that has efficacy evidence combines early screening of adolescent substance use behaviour and brief interventions aimed at encouraging behaviour change. Brief motivational enhancement interventions using motivational interviewing principles have shown substantial promise and have been widely implemented to address use of alcohol, tobacco, and other drugs.

Many adolescents who drink heavily or use other drugs tend to grow out of their addictive behaviour pattern as they enter adulthood, opening opportunities for encouraging this process through assessment centred on health risks and consequences associated with current patterns of use. A useful screening assessment measure for alcohol problems is the Rutgers Alcohol Problem Index (RAPI), which includes questions designed to assess consequences of problems (such as hangovers, cognitive impairment, and interpersonal conflict).

The stages of change model has been used to guide brief intervention strategies. Initially developed to describe the stages people progress through in smoking cessation, this model has since proved influential in describing the stages people progress through in smoking brief intervention strategies. Initially developed to improving treatment outcomes. Motivational interviewing has also been successfully adapted and applied with a range of other health behaviours, including use of illicit substances, smoking, and HIV risk reduction.

The motivational interviewing approach, as used in the Brief Alcohol Screening in College Students (BASICS) programme, has been effective in reducing binge drinking and excessive drinking in college students. This brief intervention consists of two one-on-one interviews designed to promote reduced alcohol consumption or abstinence among high-risk drinkers. The format is guided by personalised feedback, including descriptive graphs presenting the patient’s own drinking patterns relative to normative trends, negative consequences of drinking, and related attitudes and beliefs. An attempt is made to resolve ambivalence about changing one’s drinking behaviour and a move toward a safer drinking plan. BASICS is efficacious in reduction of alcohol use and associated drinking problems in several long-term follow-up studies, and has been selected as a model programme in the USA.

Another setting in which brief interventions are effective is in primary and specialty medical care settings. Training doctors to communicate with adolescents has been shown to increase rapport and trust. A brief session (5–10 minutes) of advice from a doctor that is directed toward the risks of excessive consumption and strategies to avoid excessive drinking can significantly reduce alcohol use. In developing prevention programmes, the adolescent patient’s risk and protective profile is important to consider in planning topics to be covered. Brief interventions have also been shown to be effective in working with patients who are treated in emergency room settings or trauma centres where alcohol or other drug use may have been involved. Other evidence suggests that brief interventions can be feasible for young cannabis users and effective in reduction or elimination of tobacco use and other illicit drug use in adolescent patients.

The challenge remains as to how to provide the training and financial incentives to make screening and brief interventions for problem substance use routinely implemented across health-care systems.

Treatment

Systematic reviews show inconsistent outcomes after treatment for substance-use disorders in adolescence and current practice fails to implement the most promising approaches. Issues that complicate the treatment of adolescent substance abuse and dependence include inadequate screening, assessment, and access to care. Traditional evidence-based approaches for treatment include cognitive-behavioural therapy, contingency management, family-based therapy, and
12-step programmes. In general, psychosocial treatment is better than no treatment, but much more research is needed to evaluate which approaches work better for which individuals. There are potential risks of escalating problems where treatment programmes aggregate young people with antisocial behaviour.

Relative to psychosocial therapy, pharmacotherapies for adolescents have been less frequently evaluated. Few studies have evaluated pharmacotherapies specifically designed to treat substance use. Approved medications for treatment of addiction to alcohol (eg, disulfiram, naltrexone, acamprosate), opiates (eg, methadone and buprenorphine), and nicotine (bupropion, nicotine replacement) may or may not be appropriate for adolescents. In the absence of empirical evidence documenting efficacy of pharmacological treatments for adolescents, caution is warranted in use of treatments for which evidence supports use in adults. Some evidence supports the use of naltrexone in the treatment of adolescent alcohol dependence. Nicotine replacement and bupropion have shown modest effects in treating nicotine dependence but are not contraindicated in adolescents. Substitution medications, particularly for opiate treatment, are generally appropriate only for individuals with long histories of use, severe use, or both and are likely to be less appropriate in younger than in older adolescents. To date, no systematic research has been done for pharmacotherapies targeting opiate dependence in adolescents. Moreover, existing evidence for these and other treatments are underwhelming and larger controlled trials are needed.

Recent evidence suggests about 60% of adolescents with substance use problems also have one or more co-occurring disorders, the most common of which include conduct disorder, oppositional defiant disorder, and depression. Other common psychiatric conditions include anxiety disorders and attention-deficit hyperactivity disorder (ADHD). Adolescent substance users with comorbid disorders generally report greater severity of symptoms and respond less well to treatment than do those without comorbid disorders. By contrast with pharmacological treatments that specifically target substance use in adolescents, better evidence has been established for pharmacological treatment of co-occurring conditions. Successful pharmacological treatment of co-occurring conditions, particularly affective disorders, is typically associated with reduced substance use problems.

Reasonable efficacy evidence exists for treatment of illicit drug use in older adolescent populations (eg, age 17–24 years). Methods that involve some drug substitution (eg, methadone or buprenorphine) showed strong evidence of improved social functioning, health, and treatment compliance. Promising evidence also exists of improved outcomes with prescription of heroin to people with opioid dependence. Further research is needed on these modalities specifically for adolescent populations.

Non-medical use of prescription medications, particularly opioid analgesics, has become a rising problem among adolescents and young adults. In the USA, in 2004, 10.5% of 12th graders reported past year non-medical use of Vicodin (hydrocodone and paracetamol) and 4.5% reported past year use of oxycodone. Other prescription drugs that are quite frequently used illicitly, especially in young adult college students, include stimulants, anxiolytics or sedatives, and sleeping medications. Peers are the most commonly reported source of these substances. In adolescents, methylphenidate and dexamphetamine are widely prescribed in the treatment of ADHD. The availability of ADHD drugs combined with their classification of high abuse potential has inspired concern that has not, at least to date, been justified, since prevalence of abuse is quite low.

### Harm reduction

In most communities, a substantial minority of adolescents show heavy and harmful patterns of illicit drug use that seem to be motivated by escaping distress and that are difficult to change. Harm-reduction interventions (table 4) attempt to prevent problems by

<table>
<thead>
<tr>
<th>Risk patterns</th>
<th>Main populations</th>
<th>Prevalence of harm</th>
<th>Recommended harm-reduction interventions</th>
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<tbody>
<tr>
<td>Tobacco</td>
<td>Regular use and dependence</td>
<td>Universal</td>
<td>Leading cause of drug-related harm overall</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Intoxication and regular use</td>
<td>Universal, male individuals</td>
<td>Second leading cause of harm, first in some regions</td>
</tr>
<tr>
<td>Cannabis</td>
<td>Regular use and dependence</td>
<td>Universal, male individuals</td>
<td>Low for health-related harms, high for criminal justice costs</td>
</tr>
<tr>
<td>Other illicit substances</td>
<td>Overdose, intoxication, dependence</td>
<td>Socially and developmentally disadvantaged, male individuals</td>
<td>Lower than legal drugs for health and social costs, high for law enforcement costs</td>
</tr>
<tr>
<td>All substances</td>
<td>Intoxication, regular use, dependence</td>
<td>Universal, young people, male individuals, disadvantaged</td>
<td>Substantial (see tables 1 and 2)</td>
</tr>
</tbody>
</table>

Level of evidence: *Effectiveness. †Evidence for feasibility but requires research for efficacy. ‡Efficacy.
targeting risky contexts or patterns of use, or by moderating the relation between use and problem outcomes, without necessarily affecting overall rates of use. The available evidence supports harm reduction approaches as an effective strategy that can save lives and reduce harm amongst adolescent alcohol and drug users, with effects measurable at a population level. Harm-reduction strategies including random breath testing and graduated driver licensing have effectiveness evidence that they can reduce vehicle accidents and related death and injury. Improved enforcement of drink-driving laws has been linked to reductions in youth suicide and risky sexual behaviour.

Environmental enhancement strategies, such as serving alcohol in shatter-resistant glasses, face little political opposition while reducing alcohol-related injuries. A wide body of research supports the view that needle and syringe exchange programmes have been effective in preventing HIV infection, without encouraging any increase in drug use. Targeted health interventions such as hepatitis B vaccination can reduce the risk of disease transmission through injecting drug use.

Research limitations and prospects
The development, evaluation, and implementation of interventions is dependent on social and political support. The availability of data is therefore affected by culture and context. The expense entailed in evaluation has largely limited published work to high-income countries (North America, Australasia, and Europe). Adolescent substance use is expected to become an increasing burden for developing countries in future. Emerging practices, such as globalisation in substance marketing and the increasing penetration of tobacco products into developing countries, might require a specific-focus for intervention and evaluation in coming years.

Conclusions
Substance use, especially heavy use of alcohol and illicit drugs, contributes substantially to the burden of disease in adolescents. Evidence suggests that rates of tobacco use, harmful alcohol use, and illicit drug use in young people can be reduced through the concerted application of a combination of regulatory, early-intervention, and harm-reduction approaches. Reviews have called for a more concerted effort to address harms associated with youth alcohol use through regulatory strategies and improved dissemination of brief intervention approaches. Long-term opportunities exist to reduce pathways to severe patterns of illicit drug use with early developmental prevention frameworks. Although harm-reduction approaches such as needle exchange programmes often face political controversy, they have a strong evidence base as interventions that contribute to saving lives and reducing disease in disadvantaged populations. Medical practitioners, together with other health professionals, have a responsibility to seek balanced policy by advocating for and practicing the best evaluated health interventions. Although great progress has been made over the past 3 decades, many interventions still only have evidence of efficacy, and need to be evaluated in real-world settings to establish effectiveness.

Conflict of interest statement
We declare that we have no conflict of interest.

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