The use of drugs by UK recreational divers: illicit drugs

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Key words
Recreational divers, drugs, risk factors, health survey, questionnaire, epidemiology

Abstract
(St Leger Dowse M, Shaw S, Cridge C, Smerdon G. The use of drugs by UK recreational divers: illicit drugs. *Diving and Hyperbaric Medicine*. 2011;41(1):9-15.)
Aims: Anecdotal observations suggest the use of illicit drugs takes place amongst recreational divers but, to date, there has been little open debate within the diving community concerning possible prevalence. This study investigated the prevalence and type of illicit drugs used by recreational divers in the United Kingdom (UK).
Methods: Anonymous questionnaires were circulated via UK dive clubs, dive schools, dive shows and conferences. Questions incorporated diver and diving demographics and general health, which included anxiety, depression and panic attacks, alcohol use, smoking and illicit drug use since learning to dive and closest time to a dive. Questions pertaining to over-the-counter and prescription drug use were also asked.
Results: 479 divers responded (66% males and 34% females) in the age range 16 to 59 years. Of the respondents, 22% had used one or more illicit drug since learning to dive, reporting benzodiazepines, amphetamines, cocaine, ecstasy, LSD, cannabis, heroin, and 'magic mushrooms'. Illicit drugs had been used by 3.5% of respondents in the last 12 months, and 3% in the last month. Cannabis, cocaine and ecstasy use was reported within 6 hours of a dive. Logistic regression confirmed a relationship between illicit drug use and depression ($P = 0.014$), and also between illicit drug use and anxiety ($P = 0.024$).
Conclusion: These data support anecdotal reports that recreational divers use a range of illicit drugs. The significant relationship between illicit drug use and depression and anxiety supports the literature in non-diving populations.

Introduction

Illicit drugs may be defined as those that are unlawful to possess, manufacture, sell or use. In the United Kingdom (UK), illicit drugs are divided into three classes depending on the degree of harm deemed attributable to each drug. The use of illicit drugs within the diving community is a subject overdue for open debate. The estimated prevalence is largely based on anecdotal evidence, which suggests that illicit drug use and scuba diving activities may be widespread in the diving community and that drug use may be closely linked temporally with scuba diving. In divers participating in such activities, the residual effect of illicit drugs, the risks of illicit drug use, and how these factors may interact with the diving environment need to be considered by both diver and diving physician.

The effects of illicit drugs in non-diving populations are well documented, and the types, classification (USA and UK), duration of effects and detection times of the most common recreational drugs are summarised in Table 1.[1–8] Class A drugs are considered most harmful, whilst those deemed least harmful are in class C. The issue of illicit drug use in divers has been addressed sporadically through presentations, articles and internet debate.[9,10] The regular use of cannabis has been observed in native-fishing diver populations, and animal studies have investigated the effect of cannabis under increased pressure.[11–13] To our knowledge, no definitive data have been prospectively gathered in an attempt to establish the prevalence of illicit drug use within the UK diving community, although previously collected data have shown possible use of illicit drugs.[14] Even in the general population, reliable data regarding illicit drug use are not easy to obtain, with users covert and reticent with regard to reporting their illegal behaviours and addictions. The British Crime Survey (BCS), published annually, is regarded as the primary source in assessing general illicit drug use in the UK.[15,16]

Concern regarding the use of illicit drugs in diving is principally around the onset, type and residual effects, and how any psychological or physiological changes may affect a diver's ability to dive safely.[10,17–23] The aim of this study was to investigate the prevalence of illicit drug use amongst sport divers in the UK. The class and type of illicit drug used, and temporal proximity to diving were also recorded. The relationship between anxiety and depression as dependent variables with illicit drug use was considered.

Methods

Confirmation in writing was received from the Chair of the Cornwall and Plymouth Research Ethics Committee that ethics approval was not required for this study. A questionnaire entitled *Health of divers* was compiled using diver and diving demographic questions designed and used in previous field data studies, which included the number of years' diving experience, number of dives since learning to dive, number of dives in the last twelve months, and maximum depth ever dived.[14] General health,

Table 1
Type, class, duration, detection times and side effects of illicit drugs [1,7,8]

Stimulants	**Onset/duration of effects** ***Detection time in urine****	**Side effects** ***Impact on diving***
Amphetamine Class A/B* Schedule 2*	Rapid effect with intravenous and smoking use, slower orally, overall effect 4–8 hours (h), residual up to 12 h *Urine: 1–4 days*	CNS stimulation, increased heart rate, elevated BP, anxiety, delusions, light sensitivity, insomnia, irrational behaviour, headache, hallucinations, can cause convulsions. *May affect judgement and problem-solving ability, and increase hypothermia susceptibility underwater*.
Cocaine Class A Schedule 2	Within 5 minutes (min), with high lasting 15–30 min, general effects 1–2 h, up to several days for late phase following a binge *Urine: 2–4 days*	CNS stimulation, increased heart rate, elevated BP, increased body temperature, disorientated behaviour, euphoria, improved performance in simple tasks, dizziness, nausea and vomiting, increased light sensitivity, feelings of well-being, can cause convulsions. *May impair judgement and ability to respond appropriately whilst diving*.
Ecstasy (MDMA) Class A Schedule 1	Within 20–30 min, desired effect one h general effect 2–3 h *Urine: up to 4 days*	CNS stimulation, relaxation, euphoria, changes in perception, impaired performance, panic attacks, visual disturbance, anxiety, dry mouth, sweating, can cause convulsions. *May impair judgement and ability to respond appropriately whilst diving*.
Hallucinogens		
Cannabis/ Marijuana Class B Schedule 1	Within 10 min, high may last up to 2 h, behavioural and physiological effects return to baseline within 3–5 h, residual effects in specific behaviours up to 24 h *Urine: 1–3 days but may be 20 days or longer*	Increased cardiac output, vasodilatation, dry mouth, decreased coordination, impaired learning and memory, euphoria, relaxed inhibitions, subjective slowing of time, apathy, alterations in thought formation and expression, impaired motor performance. *May impair judgement and ability to respond appropriately whilst diving*.
LSD Class A Schedule 1	Intravenous 10 min, oral 20–30 min with high at 2–4 h and diminishing over 6–8 h, flashbacks may occur within a few days or more than one year after use *Urine: 2–5 days*	Changes in perception and mood, decreased coordination, subjective slowing of time, hypertension, increased heart rate, panic attacks, loss of personal boundaries, tachycardia, hypertension, sense of dissociation. *May impair judgement and ability to respond appropriately whilst diving*.
Magic mushrooms (*Psilocybe* & *Amanita Muscaria*) Class A Schedule 1	Within 30 min–2 h, high at about 4–10 h, after effects a further 2–6 h *Urine: approx 8 h*	Increased confidence, distortion of colour, sound and objects, changes in sense of time and movement. *May impair judgement and ability to respond appropriately whilst diving*.
Opiates		
Heroin Class A Schedule 1	Dependent on route and dosage, from 45 sec to several min, peak effects 1–2 h, overall effect 3–5 h *Urine: 2–3 days*	CNS depression, light-headedness, reduced respiratory rate, dizziness, euphoria, nausea and vomiting, sedation, intense euphoria, mental clouding. *May impair judgement and ability to respond appropriately whilst diving*.
Depressants, sedatives, hypnotics		
Barbiturates Class B Schedule 3	Long-acting effect within 1–2 h, total effect 12 h or longer *Urine: short-acting 1 day, long-acting 2–3 weeks*	CNS depression, cardiovascular system depression, decreased mental acuity, euphoria, depressed respiratory function, anxiety suppression. *May impair judgement and ability to respond appropriately whilst diving*.

*Detection times of a drug in urine are often expressed in lower and upper limits because the times are dependent on a number of variables such as the amount and frequency of use, which is then related to drug tolerance, body mass index, overall health, age, metabolic rate, and urine pH. The times of detection and duration of effect in Table 1 are therefore approximate. Drugs are classified by different countries according to their approved medical use, abuse liability, or level of penalty for illegal possession and dealing. The United Nations 1971 Convention on Psychotropic Substances is the pivotal recommendation and is a treaty signed by more than 150 nations. Class and Schedule given in this table are UK and USA respectively.

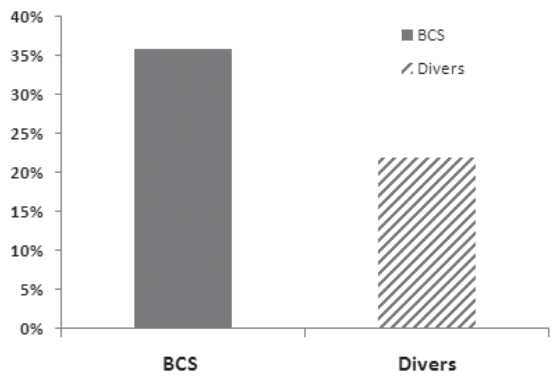
fixed-option questions based on the UK Sport Diving Medical Committee (UKSDMC) self-certification form were included.[24] Fixed-option yes/no questions were also asked concerning anxiety, depression, or panic attacks since learning to dive. Information regarding smoking and alcohol consumption was also requested. To detract from the primary focus of the study, respondents were asked to list current prescribed medication, and if appropriate any over-the-counter medication they had ever taken within six hours of diving.

Illicit drug questions to allow BCS comparison were included, detailing type of drug and when last used since learning to dive, with the following time increments: more than twelve months, in the last twelve months, in the last month.[15,16] Illicit drug type and temporal proximity to a dive were also recorded if appropriate as follows: 1 hour, 6 hours, 12 hours, 24 hours, 36 hours, 48 hours, 72 hours, 1 week, 2 weeks, 3 weeks. There was also a facility for free text. The age criteria (16 to 59 years) allowed some comparison between the study group and the BCS UK population. The illicit drug questions were unobtrusively placed in the main body of the questionnaire following questions regarding cigarette smoking.

The anonymous questionnaires (1,950), supplied with unstamped, addressed (Diving Diseases Research Centre), self-sealing envelopes were distributed randomly to divers between October 2007 and December 2009 via UK dive clubs/schools and national dive shows/conferences. The questionnaires were also available for download on the internet to complete and mail back, but questionnaires could not be returned electronically.

Data gathered focused on the prevalence, type and class of illicit drug used since learning to dive. There was no attempt to assess repetitive use, adverse outcomes, divers' knowledge of interactions of drugs with the diving environment or any increased risk of DCI.

Figure 1
British Crime Survey (BCS)[15] drug use "*in your lifetime*" compared with divers' drug use "*since you learnt to dive*"



STATISTICAL METHODS

Quantitative data are reported as range (median). Univariate analyses, including chi-square tests, were used to look at the relationships between the categorical variables drug usage (yes or no), anxiety, panic, depression and gender. An independent samples t-test was used to investigate any relationship between age and drug usage. Binary logistic regressions were used with anxiety and depression as dependent variables and drug usage, age and gender as independent variables. A significance level of $P = 0.05$ was used throughout. SPSS version 17 was used for statistical analysis.

Results

Completed questionnaires were received from 531 respondents with a response rate of 26% from hard copy questionnaires, and 2.4% from the world-wide web. A total of 479 (66% male, 34% female) records fulfilled the BCS age criteria of 16 to 59 (median 42) years and were suitable for analysis. Proportionately, there were more females than males in the younger 16 to 34 age groups, and more males than females in the older age groups. The 467 respondents (12 did not give their lifetime total dives) reported a total diving experience of 324,417 dives with a range of 2 to 9,000 (median 350) with 479 reporting a total of 27,741 dives with a range of 0 to 800 (median 40) in the last 12 months, and a depth-range experience of 4 metres' sea water (msw) to 100 msw. The number of years' diving experience ranged from 1 to 40 years.

ILLICIT DRUG USE

The BCS 2007/08 survey found that 35.8% of 16–59-year-olds had admitted to ever having used recreational drugs in their lifetime. An illicit drug had been used by 9.3% of the population in the previous 12 months, and 5.3% in the last month. A total of 105 divers (22%, 65 males, 40 females) had used one or more illicit drug since learning to dive, with 17 (3.5%) in the last 12 months, and 16 (3.3%) in the last month. These prevalences are compared in Figures 1 and 2.

Figure 2
British Crime Survey[15] and divers: drug use in the last 12 months and in the last month

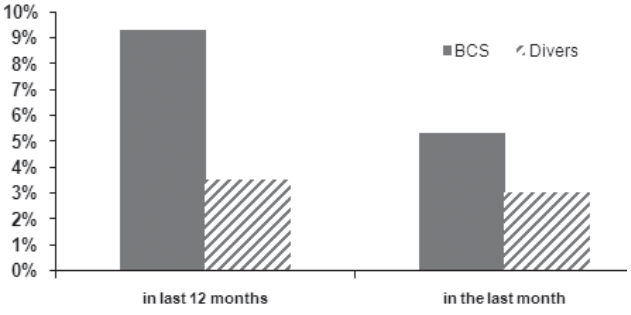
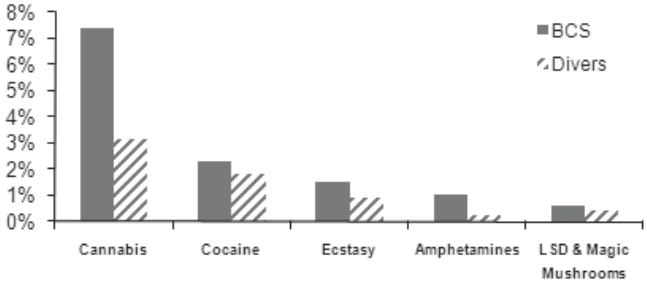


Figure 3
Type of drugs used in the last 12 months: British Crime Survey[15] versus divers



Cannabis was cited as the most frequently used illicit drug. The types of drugs used by divers compared with the BCS in the last 12 months show similar trends, although the use of cannabis is less in the divers (Figure 3). The use of Class A drugs in the BCS data and divers is shown in Figures 4 and 5.

Within those respondents who confirmed illicit drug use (n = 105) benzodiazepines, amphetamines, cocaine, ecstasy, LSD, cannabis, heroin, and hallucinogenic mushrooms were all reported. Table 2 shows the percentages of the total 217 reports of drugs by the 105 respondents; some divers reporting the use of more than one type of drug. Additionally, of the 105 respondents, 40% admitted to using a class A drug since learning to dive. A class A or B drug had been used by 22 divers (21%) between 5 minutes (free-text response) and 24 hours before diving, with the use of cannabis, cocaine, and ecstasy reported between 5 minutes (free-text response) and 6 hours before diving. Use of hallucinogens was reported by 67% of the illicit drug group, with 25% reporting having used both hallucinogens and stimulants since learning to dive. In the last month, 10% of the illicit drug group had used both hallucinogens and stimulants.

Table 2
Drug use by type; * some of the 105 illicit drug users reported using more than one type of drug

Drug	Number of reports	%
Cannabis	99	45.6
Cocaine	30	13.8
Magic mushrooms	21	9.7
Ecstasy	19	8.8
Amphetamines	19	8.8
LSD	17	7.8
Tranquillisers	7	3.2
Barbiturates	3	1.4
Heroin	2	0.9
Total	217*	100

ANXIETY, PANIC AND DEPRESSION WITH ILLICIT DRUG USE

Fixed-option data related to the general health of the divers allowed investigation regarding reports of anxiety, panic attacks and depression and any relationship with illicit drug use. A higher proportion of illicit drug users were anxious (7.6% compared to 2.7% for non-users) and a greater proportion were depressed (15.2% compared to 7.0%) (Table 3). There was evidence of a relationship between illicit drug usage by the divers in this study and both anxiety (P = 0.039) and depression (P = 0.014) but not panic (P = 0.66), based on chi-square tests. Logistic regression confirmed the relationship between anxiety and illicit drug use (odds ratio (OR) = 3.00, P = 0.024, 95% confidence intervals (CI) 1.15, 7.81). Neither gender nor age was significant.

Figure 4
British Crime Survey[15] class A drug use "*in your life time*" compared with divers' class A drug use "*since you learnt to dive*".

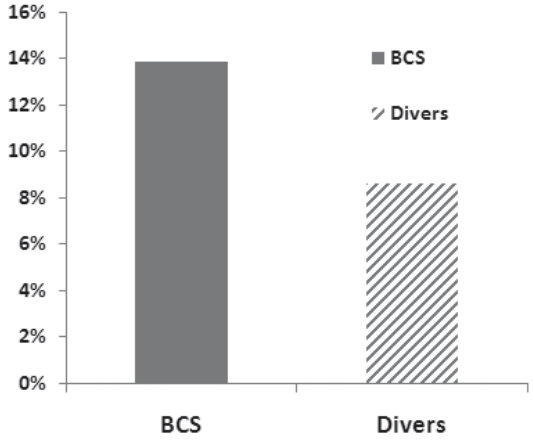


Figure 5
British Crime Survey[15] and divers: class A drug use in the last 12 months, and in the last month

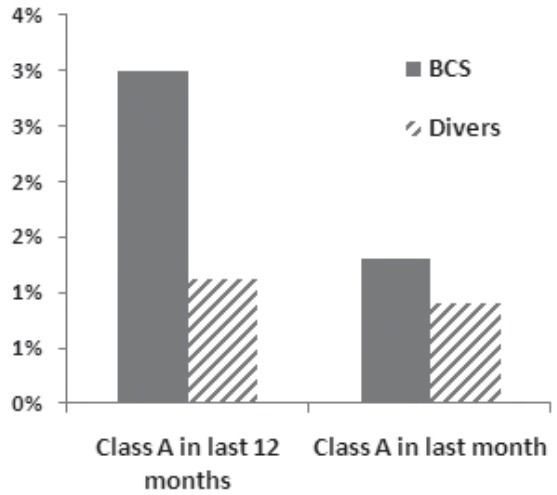


Table 3
Anxiety and depression with illicit drug use (%)

	Anxiety	Depression
Illicit drugs – Yes (n = 105)	8 (7.6)	16 (15.2)
Illicit drugs – No (n = 374)	10 (2.7)	26 (7.0)
Totals (n = 479)	18 (3.8)	42 (8.8)

Logistic regression also confirmed the relationship between depression and illicit drug usage (OR = 2.34, P = 0.014, 95% CI 1.19, 4.59). In this case, gender was significant (OR = 0.37, P = 0.002, 95% CI 0.19, 0.70), with females more likely to be depressed. Age was not a significant comparator.

Overall there was no relationship between illicit drug usage and gender (P = 0.44), but age was related to illicit drug use (P < 0.001, t-test), with illicit drug users tending to be younger (mean 38.0 years compared to 41.7 years for non-users).

Discussion

Recreational drugs change metabolic functions and perception of reality, distance and time and, therefore, can be considered to increase the risk of incidents whilst diving. These data demonstrate that some divers are using illicit drugs around the time of their diving activities and ignoring the limited advice given during dive training but widely available through public health campaigns. To date, there have been few specific studies designed to observe the use of illicit drugs in the recreational diving community, due in part to the difficulties in gathering credible data from a covert population.[8] This study cohort may suffer from potential selection bias in as much that divers who take drugs may be more willing to complete the questionnaire. Conversely, they may be less willing to participate in the event of respondents suspecting the primary aim of the study. The respondents in this study were not made aware of the primary subject matter of the project, with the title of the project and much of the data collected focusing on general health questions with which the divers would be familiar already,[24] and the diver, and diving demographics and basic health data gathered with other studies.[14,15]

The disadvantages of anonymous data collection from covert populations, such as illicit drugs users, are recognised and acknowledged.[8] However, the advantage of anonymous data gathering from covert groups is that respondents will often be considerably more overt in their willingness to provide sensitive data where they are confident that no traceable contact is likely. It was for this reason that divers could not up-load completed questionnaires on the internet, which may account for the high access to the questionnaire but low response rate from the internet. Repetitive illicit drug use, any adverse experiences, the divers' understanding of how a specific drug may interact with the diving environment or any associated DCI risks were not evaluated in this study, which could be deemed to be a weakness in the analysis of these data.

Although the proportion of divers in this study (22%) who admitted using illicit drugs since learning to dive is smaller than that of the general population in their lifetime (35.8%), and fewer divers (3%) had used recreational drugs in the last month than in the BCS (5.3%), these data still represent a sizeable minority.[15] In the main, the respondent population of divers were experienced divers. Whilst it is difficult to state whether the data gathered can be extrapolated to the larger diving community, it would be reasonable to consider that experienced divers would be more able to deal with the effects of illicit drugs underwater than a novice.

Divers were asked to record the closest time to diving that they had ever used an illicit drug. The fixed-option response for time of illicit drug use to time of dive was from one hour upwards, with space provided for additional information and this resulted in times as short as 5 minutes being recorded. Although a longer interval between the use of an illicit drug and diving should, in theory, diminish any potential risk, the timings before diving of some drug use should be of concern. With the effects of cannabis, for example, starting at 10 minutes or less depending on method of use, lasting up to 2 hours, and residual influence in specific behaviours evident up to 24 hours, these divers potentially place themselves at increased risk of a diving incident, though this cannot be substantiated. It might also be argued that divers are not exercising a responsible duty of care to their diving companions, given the psychological and physiological implications of illicit drug use.

Hallucinogens were the drugs most widely used by the divers, with cannabis/marijuana the most common. In theory, the psychological effects, such as alterations in thought formation and expression, altered time and space perception, and dulling of attention could affect a diver's ability to track depth and air, or manage a diving incident both below and above the water. Physiological changes of tachycardia and vasodilatation have a potential to impair in-water performance through effects on the cardiovascular system or by contributing to hypothermia.

Although the pharmacodynamics of drugs at surface pressure are well documented, as yet there is not a complete and thorough understanding of the pharmacodynamics of drugs under increased pressure. The question of the theoretical impact of illicit drug use on the recreational diver and safe diving practices may be an issue that researchers cannot conclusively address. Anecdotally it is known that, when questioned, divers do not always admit to illicit drug or even alcohol use when presenting at a hyperbaric chamber for a diving incident, or completing an incident report to a diving officer. Specific history of illicit drug use in the context of a diving accident should be routinely sought to

gain further insight into the importance of illicit drugs as a contributing factor to dive accidents. Whilst it remains unlawful to possess or use these drugs, it is unlikely that data from recompression chambers or diving officers would be of any tangible use. Additionally, the animal model may not be the appropriate research tool with which to attempt to address these issues. Field data have shown that divers do not always adhere to dive plans, tables, or computers, and other factors may intervene to render a dive unsafe, such as sea or weather conditions. How a diver responds to a diving emergency may depend on their experience, health, or even simply 'how he feels on the day'. Therefore, perhaps the way forward lies in a programme of education focusing on the effects, types, classes, and duration of effects of the most commonly used illicit drugs.

Although the fixed-option response limited the quality of the general health questions, the significant relationship between illicit drug use and anxiety and depression in our data broadly supports the literature from non-diving populations.[1,4,5,25,26] The prevalence of divers, both illicit drug users and non users, reporting anxiety or depression should be of concern to both physicians and educators in the diving industry. In this study, a small number of the respondents suffered from depression, took illicit drugs and were also taking a range of prescribed medication for other conditions: a potentially hazardous cocktail.

During the time of this study, one UK diving organisation, when asked regarding their training advice on recreational drug use, confidently replied that "*it was covered in their lectures*". However, when pressed for details, it transpired that the lectures encompassed only very basic information, stating that "*it is not safe to dive and use drugs*". There was no provision for class, effect, residual and detection times, and type of illicit drug use and effects. Conversations with sport, commercial and military divers on the subject of illicit drugs have revealed attitudes ranging from bravado through to sheer disbelief if not naivety that illicit drug use was taking place freely within the diving community. It would appear there is an educational vacuum in this area needing to be addressed both for the physician and the diver. Whether this is due to complacency by those in authority that divers would simply not 'do drugs', or whether it is an inability to admit that illicit drug use is taking place, or both, remains unclear. What is clear, however, is that there is plainly an opportunity for the dive training agencies worldwide to implement a programme of awareness on all aspects of illicit drug use whilst diving, not only to promote safer diving but to provide greater understanding generally of illicit drug use and abuse.

Conclusions

This study supports anecdotal reports that divers use illicit drugs around the timing of their diving activities. A clear relationship between depression and anxiety and the use of illicit drugs was demonstrated. With the pharmacodynamics of drugs at increased pressure not fully understood, and with the sport of diving more widely available to a greater spectrum of the population from all ages and health circumstances, the diving community has a duty of care to address the associated potential risks of illicit drug use in the diving environment and to provide information and education on this subject to divers.

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