Ann Ist Super Sanità 2019 | Vol. 55, No. 4: 338-344
DOI: 10.4415/ANN_19_04_06

Ketamine abusers referring to emergency departments in northern Italy: a cross- sectional study

Raimondo Maria Pavarin, Silvia Marani and Elsa Turino

Osservatorio Epidemiologico Metropolitano Dipendenze Patologiche, DSM-DP, Azienda USL Bologna, Bologna, Italy

Abstract

Introduction. Ketamine is an essential medicine used as an anesthetic in low and middle-income countries and in veterinary medicine. Recreational use is widespread throughout the world, especially owing to its lower price compared to other substances. In Western countries its use has been mainly linked to subpopulations of young people who use drugs recreationally. Ketamine misuse is associated with amnesia, dependence, dissociation, lower urinary tract dysfunction and poor impulse control. Regular ketamine use is associated with abdominal pains.

Aims. The aims of this study are to analyze characteristics and main symptoms of ketamine abusers attending emergency departments (EDs) in the metropolitan area of Bologna, Emilia-Romagna Region, northern Italy.

Methods. We identified 74 records of ketamine-related visits: 30% female; 22% non-natives; mean age 25.6 years. Forty-two percent reported ketamine use alone, 46% reported the use of other illegal substance (cocaine 19%, heroin 18%), 26% alcohol misuse.

Results. The most common reported symptoms were neurological (soporous state 18%, agitation 14%, confusion 7%, panic attacks 7%, mydriasis 7%, tremors 7%), gastro-intestinal (abdominal pain 15%, vomiting 11%), urological (6.8%) and cardiac (palpitations 5%, chest pain 5%). Complications secondary to falls and cuts (7%) were the most frequent trauma complications. We highlight a significant number of visits regarding suicide attempts (10%) and overdose (4%).

Conclusions. The results highlight a particular population of problematic ketamine users identified using the hospital's ICT system. In particular, poly-drug users who consume ketamine in combination with heroin or cocaine presenting to the ED represent a specific target for targeted prevention projects on non-lethal overdoses and suicide attempts.

Key words

- ketamine
- emergency department
- overdose
- suicide attempt
- heroin

INTRODUCTION

Ketamine is an essential medicine, a remarkably safe anesthetic that has been used worldwide for over half a century. The drug does not depress respiration or the cardiovascular system and can be administered by trained non-physicians. Ketamine was first synthesized in 1962 and patented as an anesthetic in 1966. It was used in the Vietnam War for its capacity to induce a dissociative state in wounded soldiers; is still used as a battlefield anesthetic in low and middle-income countries and in veterinary medicine [1]. It is mainly obtained in powder form and administered by sniffing or inhaling. Other forms of ingestion include intramuscular routes or occasionally intravenous ones [2].

Illicit manufacturing, trafficking, and use of ketamine appear to have begun on a large scale in several Asian countries, and it has subsequently spread to other regions [3]. Recreational use is widespread throughout the world, but more common in the East and South-East Asia, especially owing to its lower price compared to other substances. In Western countries its use has been mainly linked to subpopulations of young people who use drugs recreationally and to the so-called 'rave' culture, but reports have indicated that ketamine is being used in social settings in many parts of the world, such as nightclubs and dance parties [4]. Study results report a utilization rate ranging from 0.1% and 4% in the general population, higher among the nightlife and entertainment places [5].

In Italy, on the basis of seizures carried out, it is as-

Address for correspondence: Raimondo Maria Pavarin, Osservatorio Epidemiologico Dipendenze Patologiche, DSM-DP, Azienda USL, Via San Isaia 94, 40100 Bologna, Italy. E-mail: raimondo.pavarin@ausl.bologna.it.

sumed that the phenomenon is linked to the arrival of liquid ketamine from India and that the abuse by young clubbers or ravers is on the rise [6]. Furthermore, a study on new drugs conducted by the Istituto Superiore di Sanità shows that ketamine is also used to cut MDMA [7]. Regarding study results, 1.1% (males 1.4%, females 0.8%) of a representative sample of Italian students aged 15-19 reported lifetime ketamine use [8]; 11% of 2015 people interviewed during raves and concerts in northern Italy [9], 5% of 354 residents aged 18-25 in Emilia Romagna and Veneto region [10] and 4% of 392 students aged 16-17 declared they had used ketamine at least once in their life [11].

Psychologically, the acute use of ketamine caused hallucinations, symptoms of psychosis, delusion, agitation, confusion, and memory impairment. Many side dose-dependent effects (nausea and vomiting, bizarre dreams) have been documented and some of them have persisted for several days after administration. At low doses it causes euphoria, intensification of feelings of empathy and induces distortion of time and space, hallucinations and slight dissociative effects. At high doses it causes dissociative effects, hallucination, intoxication and pre/death experiences, known as "K hole". Long-term recreational use of ketamine can be associated with the development of dependence and tolerance, and there is evidence of gastro-intestinal toxicity (abdominal pain and abnormal liver function tests) and urological disorders [12], particularly hemorrhagic cystitis [13].

The main consequences for social behavior stem directly from the physical and psychological effects of ketamine and the tendency towards compulsive use by some users. The sudden anesthetic effects of ketamine create a high risk for accidents and make driving particularly dangerous following consumption. The main effects depend on the dose, the administration route and the context of consumption [14].

Ketamine misuse is associated with amnesia, dependence, dissociation, lower urinary tract dysfunction and poor impulse control [5]. Regular ketamine use is associated with vague abdominal pains of unknown etiology, colloquially termed "K cramps" [12].

Although a specific withdrawal syndrome has not yet been identified, substance dependence develops rapidly. While there are limited data regarding the physically addictive aspects of ketamine, it may result in a dependence, especially as tolerance to its effects builds very rapidly [15]. Many frequent users are concerned about addiction and report trying but failing to stop using ketamine [16].

Because of the illegal nature of the drug, we may never know how many people use ketamine, or the precise correlation between chronic high-dose intake and symptoms. Previous studies have suggested that 20% of users may develop symptoms but there is no consistent safe level or time frame for regular users [17].

From studies targeted on emergency department (ED) presentations of patients after the deliberate abuse of ketamine, common complaints include anxiety, chest pain, and palpitations; the most frequent complications are severe agitation and rhabdomyolysis [18]. From a study on acute clinical presentations of ketamine abusers in fifteen EDs in Hong Kong, the typical ketamine abuser was young (median age 22 years) and presented with impaired consciousness, abdominal pain, lower urinary tract symptoms, or dizziness, together with unexplained high blood pressure or tachycardia [19].

In order to identify prevention strategies targeted on this population with high-risk behaviors, but difficult to reach by addiction services, accesses to 11 EDs between 1 January 2009 and 30 June 2019 were examined.

The aims of this retrospective study are to analyze characteristics and main symptoms of ketamine abusers attending EDs in the metropolitan area of Bologna, Emilia-Romagna Region, northern Italy.

METHODS

A cross-sectional study design was used. The inclusion criteria were a history of ketamine use within 48 hours. Patients presenting more than 48 hours after the last ketamine intake were excluded.

The Bologna metropolitan area has activated a rapid drug alert system. This is coordinated by the metropolitan epidemiological observatory on pathological dependency (OEMDP), which links public and private dependency services, EDs, the 118 emergency services, the various police forces, and the death registry. The primary aim is for professionals and local operative units to share digitalized information on substances in circulation and trauma events (fatal and nonfatal overdoses). The system comprises a single database fed from various different sources and is accessible online via a protected web site. From the data available, the OEMDP studies the situation and analyzes patient characteristics and service contact details.

We searched the hospital patient database for all consultations related to ketamine use in 11 EDs between 1 January 2009 and 30 June 2019, in the metropolitan area of Bologna, Emilia-Romagna Region, northern Italy.

All the records collected from each ED were selected from presentation databases and using key words from ICD-10. A content analysis of the records was performed by a multidisciplinary team comprising physicians, sociologists, psychiatrists and epidemiologists.

All the information was obtained retrospectively, and data collection forms were abstracted for each case. Only cases of ketamine intoxication, defined as medical problems associated with self-reported ketamine use, were enrolled. The term "ketamine" was specifically researched in each record.

Information on ED arrival came from the information recorded electronically upon presentation at the ED: sex, age, nationality, residence, day, time and TRIAGE code.

Information on the reasons for ED admittance, hospitalization and the substances used was obtained by analyzing the ED case file. We highlight that more than one substance may have been used.

The distribution of ketamine complications was assessed with standard descriptive statistics. The continuous and categoric variables were analyzed with Student's T test and the chi-square test, respectively.

Significance level was set at 0.05. Stata 15.0 was used for the statistical analysis.

RESULTS

Out of 2 890 959 patient accesses aged 16-49 years referring to ED between 1 January 2009 and 30 June 2019, we obtained 7897 visits regarding illegal substance use, among which we identified 74 records of ketamine-related visits: 29.7% female; 58.1% non-residents; 21.6% non-natives; mean age 25.6 years. Most of them were aged between 20 and 24 years (39.2%) and between 25 and 29 years (29.7%), while 16% were less than 20 years and 16% over 29 years. The highest percentage of visits was in 2012 (7 cases) and in 2013 (7 cases). Forty-two percent reported ketamine use alone, 46% reported the use of other illegal substances (cocaine 18.9%, heroin 17.6%, cannabis 12.2%, amphetamines 9.5%, MDMA 9.5%, LSD 4.1%, opium 2.7%), 25.7% alcohol abuse, 5.4% psychiatric drugs *(Table 1)*. Among females we highlight the lower mean age (males 26.4 years, females 23.7, P 0.04) and the higher percentage of opium use (males no cases, females 9.1%, P 0.028).

Fifty-three percent accessed at night, 37.8% over the weekend, most of visits were in January (15%) and on a Sunday (31.1%). Fifteen percent were taken to the ED by ambulance, 67.6% was classified as serious during the triage (9.5% red code, 58.1% yellow code, 31.1% green code, 1.4% white code), 9.5% were admitted to the hospital.

Regarding ketamine use, 77% of patients accessed EDs less than 12 hours from the last ketamine intake, 5.4% self-injected (intramuscular injection) and all the others snorted (94.6%)

The most common reported symptoms were neurological, gastro-intestinal, urological and cardiac *(Table 2)*. Regarding neurological reported symptoms we highlight soporific state (17.6%), agitation (13.5%), confusional state (6.8%), panic attacks (6.8%), mydriasis (6.8%) and tremors (6.8%). A percentage ranging from 3% and 5% reported coma, epilepsy, hallucinations, dizziness, blurred speeches and neck pain. To note that soporific state was more common among females (males 11.5%, females 31.8%, P 0.036).

As regards gastro-intestinal symptoms, 15% reported abdominal pains and 10.8% vomiting, the latter was

Table 1
Metropolitan area of Bologna 01/01/2009-30/06/2018: visits for ketamine use to emergency departments

		Total (74)	Males (52)	Females (22)	P
Personal data	Non-native (%)	21.6	21.2	22.7	0.881
	Non-resident (%)	58.1	55.8	63.6	0.531
	Mean age	25.6	26.4	23.7	0.04
Arrival	Night (20:00-8:00)	52.7	50.0	59.1	0.474
	Weekends (Friday 17:00-Monday 08:00)	37.8	40.4	31.8	0.487
	Ambulance	14.9	19.2	4.6	0.105
Triage	Red	9.5	11.5	4.6	0.590
	Yellow	58.1	53.9	68.2	
	Green	31.1	32.7	27.3	
	White	1.4	1.9	-	
Ketamine use	Acute (within 12h of ketamine use)	77.0	76.9	77.3	0.974
	Intramuscular injection	5.4	3.9	9.1	0.362
Cocomitant current drug use	Only ketamine	41.9	44.2	36.4	0.531
	Alcohol	25.7	23.1	31.8	0.431
	Psychiatric drugs	5.4	3.9	9.1	0.362
	Illegal substance	46.0	44.2	50.0	0.649
Substance use	Cocaine	18.9	23.1	9.1	0.160
	Heroin	17.6	15.4	22.7	0.448
	Cannabis	12.2	11.5	13.6	0.801
	Amphetamines	9.5	7.7	13.6	0.425
	MDMA	9.5	9.6	9.1	0.944
	LSD	4.1	5.8	-	0.250
	Opium	2.7	-	9.1	0.028
Outcome	Hospital admission	9.5	13.5	-	0.071

Table 2
Visits for ketamine use to emergency departments: most common reported symptoms

		Total (74)	Males (52)	Females (22)	P
Neurological	Soporous state	17.6	11.5	31.8	0.036
	Agitation state	13.5	13.5	13.6	0.984
	Confusional state	6.8	9.6	-	0.132
	Panic attacks	6.8	7.7	4.6	0.622
	Mydriasis	6.8	7.7	4.6	0.622
	Tremors	6.8	3.9	13.6	0.125
	Coma	4.1	5.8	-	0.250
	Epilespsy	2.7	3.9	-	0.351
	Hallucination	2.7	3.9	-	0.351
	Dizziness	2.7	3.9	-	0.351
	Blurred speeches	2.7	3.9	-	0.351
	Neck pain	2.7	3.9	-	0.351
Cardiovascular	Palpitations	5.4	5.8	4.6	0.831
	Chest pain	5.4	7.7	-	0.181
	Hyperpyrexia	4.1	5.8	-	0.250
Gastro-intestinal	Vomiting	10.8	5.8	22.7	0.032
	Abdominal pain	14.9	13.5	18.2	0.602
Urological	Complications (renal colic, urine leak, hematuria, stranguria)	6.8	5.8	9.1	0.603

more common amongst females (males 5.8%, females 22.7%, P 0.032). As regards cardiac symptoms, 5.4% reported palpitations, 5.4% chest pain and 4.1% hyperpyrexia. For what concerns other symptoms, 6.8% reported urological complications (renal colic, urine leak, hematuria and stranguria).

Furthermore, we observed some physical complications regarding suicide attempts (9.5%), traumas, falls or cuts (6.8%), overdose (4.4%), injecting complications (2.7%) and tongue bites (1.4%). To note that injecting complications were more common among females (males no cases, females 9.1%, P 0.028).

Results are reported in *Table 3*.

Table 3
Visits for ketamine use to emergency departments: other physical complications

	Total (74)	Males (52)	Females (22)	P
Self-harm/suicide attempt	9.5	11.5	4.6	0.347
Traumas (falls/cuts)	6.8	9.6	-	0.132
Overdose	4.4	2.1	9.5	10.63
Injecting complications	2.7	-	9.1	0.028
Tongue bite	1.4	1.9	-	0.513

DISCUSSION

In this paper we described a large series of ketamine users presenting to an acute medial setting over a ten-year period in northern Italy. The patients treated for ketamine represent 9.4 per thousand of the total number of patients attending the 11 EDs during the study period for reasons related to illegal substance use.

This study systematically reviewed and summarized visits to EDs for medical problems and trauma complications relating to self-reported ketamine use. Key findings include an apparently small number of patients who presented to EDs reporting symptoms associated with ketamine use. The most commonly reported symptoms were neurological, although a high number of gastro-intestinal, urological and cardiac symptoms were also reported. Complications secondary to falls and cuts were the most frequent trauma complications. Moreover, we highlight a significant number of visits regarding suicide attempts and overdose.

This study may have excluded additional patients with a history of ketamine use who were treated without medical personnel being aware of their histories. Furthermore, the size of the cohort is rather small, thus limiting its power to investigate ketamine risk factors.

These aspects limit the generalizability of the results to simple access for ketamine use, and do not allow for prevalence estimates. Notwithstanding these limitations, some data emerge that allow us to deepen our knowledge of this particular situation, affording useful indications when it comes to identifying risk profiles and verifying the usefulness of a surveillance system.

As regards a comparison with Italian literature, the data from our study are hard to compare, as they derive from a specific study on ED admissions and cannot be considered a picture of what is happening in Italy. In recent years, many studies on recreational ketamine use have been published in Italy, which, in addition to estimating the prevalence of use among young people [6, 8, 10, 11] have mostly dealt with the phenomenological aspects of the experience with the substance by young consumers [20-22], in particular the dissociative aspect [23-24], the consumption problems [9] and the meanings attributed to use [25].

The profile of the typical ketamine user presenting to EDs is male, aged around 25, Italian, mainly reporting weekend ketamine use at night or during the early hours of the day.

However, a significant portion of subjects present to EDs during the other days of the week, both in the morning and in the afternoon, and which may suggest that ketamine use is less related to social gatherings and party events.

Regarding the use of other substances, in addition to alcohol we highlight two distinct and separate consumer groups (party drugs attenders and heroin users, both sometimes in combination with cocaine), suggesting a different ketamine use if related to particular lifestyles or to heroin contexts.

As for the comparison with studies conducted in EDs, in a study conducted in Hong Kong percentages similar to those of our study are observed regarding gender, age, ketamine consumption styles, MDA use, amphetamine use and alcohol abuse; the percentage of subjects with ketamine use alone was much higher (66% vs 42%), the percentage of cocaine use was much lower (4% vs 19%) while no cases of heroin, cannabis, LSD and opium consumption were reported [17]. In a London teaching hospital, Wood *et al.* recorded 116 ED presentations involving recreational ketamine use, only 11% of which involved ketamine alone, co-ingested drugs included ethanol (39%), GHB/GBL (47%), cocaine (19%) and MDMA (53%) [26].

From the studies it emerges that ketamine is often taken alone in private settings to explore its hallucinogenic effects. The users are aware of the drug's potency, but do not pay attention to long-term negative effects [27]. While the use of ketamine was initially confined to certain subcultures, it has recently become more mainstream [16], and the highest endorsed settings of use are at home or at a friend's house [15].

Moreover, ketamine has been used as a cutting agent for drugs such as cocaine, amphetamine and heroin and may be taken by problem opiate users [14]. It is generally the last substance experimented with [28] and, despite those who reported ever using this drug describing a pattern of occasional use [4], it appears to be a substance that had been added to an already extensive drug use repertoire [29].

Regarding the main symptoms of ketamine abusers attending EDs, our results confirm what has been reported by other authors [18, 19, 29], particularly relating to neurological (soporific state, confusional state, blurred speeches, dizziness, agitation state, hallucination), cardiovascular (chest pain, palpitations), gastrointestinal (abdominal pain, vomiting), urological disorders and traumas.

It should be noted that in our study only 10% of patients were subsequently hospitalized, as confirmed by other EDs studies, which reported that 72% of cases were discharged directly from the ED, and no case where ketamine alone had been ingested required admission to critical care [26]. Most of patients developed no or only minor complaints [19], and majority of patients were discharged from the ED within a few hours of presentation [18].

Regular ketamine use is associated with vague abdominal pains, with or without vomiting, of unknown aetiology, colloquially termed "K cramps" [9, 30].

Agitation, hallucinations and physical harm/trauma have been associated with the recreational use of ketamine, while cardiovascular features occur less frequently [12].

From studies there is evidence from beyond the recreational use setting linking ketamine with urological pathology, and it was estimated that up to a third of long-term ketamine users may be affected [12, 15].

Some physical complications (overdose, suicide attempt, injecting complications) instead seem typical of our cohort, in which nearly half used some other illegal substance and one in four misused alcohol. To be noted that 30% of the patients using some other illegal substance also abused alcohol.

Non-fatal emergencies attributed to ketamine use are considered to be very rare. The main concern with acute ketamine use is the reduction in the user's awareness and monitoring of their physical environment [31]. When ketamine is reported in post-mortem samples, it is often either alongside another intoxicant or in the setting of trauma [12, 32].

The international literature reports that for every suicide there are between eight and 22 visits to an ED for suicidal behavior, so this is the best place to intercept new suicidal cases [33], even if it is observed that those attempting suicide are often discharged from the ED without undergoing psychiatric assessment, notwithstanding their suicide risk [34]. Among the seven subjects having attempted suicide in our study, 4 used cocaine (1 also alcohol) and 3 heroin (2 also alcohol). Cocaine and heroin use are known risk factors for suicide, and individuals dependent on these substances are more likely to die from suicide than peers [35, 36].

Regarding overdoses, we identified three subjects, all of whom had used both heroin and alcohol. Among heroin users, overdose frequently occurs, and the main risk factors associated are age at the start of addiction, severity of the addiction and the concomitant use of other substances, especially alcohol [37]. Experiencing a non-fatal overdose substantially increases the risk of subsequent overdose mortality and heroin users admitted to an ED after an overdose are a special, high-risk sub-population warranting a distinct prevention methodology [38].

Regarding traumas, the main physical dangers of most non-medical ketamine use are believed to arise mainly from the setting, or an interaction between the

user and the setting of use, as ketamine can leave the user in a confused state [39]. This can, for example, result in burns, falls, drowning, traffic accidents and becoming a victim of crimes such as sexual assault [29]. It must, however, be considered that although there are anecdotal reports of a high risk of accidental injury while acutely intoxicated with ketamine, there are few scientific data on this risk [16].

CONCLUSIONS

Our results highlight a particular population of problematic ketamine users that can be identified in time by using the data present in the hospital's ICT system.

In particular, poly-drug users who consume ketamine in combination with heroin or cocaine presenting to the ED represent a specific target for targeted prevention projects on non-lethal overdoses and suicide attempts.

Conflict of interest statement

There are no potential conflicts of interest or any financial or personal relationships with other people or organizations that could inappropriately bias conduct and findings of this study.

Received on 13 June 2019.
Accepted on 12 July 2019.

REFERENCES

1. Taylor P, Nutt D, Curran V, Fortson R, Henderson G. Ketamine: the real perspective. Lancet. 2016;387(10025):1271-2. doi.org/10.1016/S0140-6736(16)00681-4
2. Jansen K L. A review of the nonmedical use of ketamine: use, users and consequences. J Psychoact Drugs. 2000;32(4):419-33. doi:10.1080/02791072.2000.10400244
3. Liao Y, Tang YL, Hao W. Ketamine and international regulations. Am J Drug Alcohol Abuse. 2017;43(5):495-504. doi: 10.1080/00952990.2016.1278449
4. Degenhardt L, Dunn M. The epidemiology of GHB and ketamine use in an Australian household survey. Int J Drug Policy. 2008;19(4):311-6. doi: 10.1016/j.drugpo.2007.08.007
5. Ho RC, Zhang M W. Ketamine as a rapid antidepressant: the debate and implications. BJPsych Advances. 2016;22(4):222-33. doi: 10.1192/apt.bp.114.014274
6. Mayer R, Pacifici R, Scaravelli G, Palmi I, Zuccaro P. Ketamina: uso ed abuso. Boll Farmacodip Alcool. 2003;26(2):24.
7. Bedetti C, Barbaro MC, Bertini A. Le nuove droghe: spunti per un'azione didattica. Roma: Istituto Superiore di Sanità; 2002.
8. Governo Italiano – Dipartimento per le Politiche antidroga. Relazione annuale al Parlamento sul fenomeno delle tossicodipendenze in Italia anno 2018 (dati 2017). Available from: www.politicheantidroga.gov.it/it/attivita-e-progetti/relazioni-annuali-al-parlamento/
9. Pavarin RM. Substance use and related problems: a study on the abuse of recreational and not recreational drugs in Northern Italy. Ann Ist Super Sanita. 2006;42(4):477.
10. Pavarin RM. Giovani, consumi problematici e dipendenze con e senza sostanze: i risultati di una ricerca multicentrica. In: Pavarin R, Corbetta D (Eds). Dipendenze con e senza sostanze: teoria, ricerca e modelli di intervento. SALUTE E SOCIETA', p. 19-74. Milano: FrancoAngeli; 2015.
11. Prosa D, Arduino M, Michelone ME. Indagine sulla diffusione di sostanze fra gli studenti di Casale Monferrato. Boll Farmacodip Alcoolis. 2003;26(1):27.
12. Kalsi SS, Wood DM, Dargan PI. The epidemiology and patterns of acute and chronic toxicity associated with recreational ketamine use. Emerg Health Threats J. 2011;4(1):7107. doi: 10.3402/ehtj.v4i0.7107
13. Shahani R, Streutker C, Dickson B, Stewart RJ. Ketamine associated ulcerative cystitis. A new clinical entity. Urology. 2007;69:810. doi: 10.1016/j.urology.2007.01.038
14. European Monitoring Centre for Drugs and Drug Addiction – EMCDDA. Report on the risk assessment of ketamine in the framework of the joint action on new synthetic drugs. Geneva: Office for Official Publications of the European Communities; 2002.
15. Muetzelfeldt L, Kamboj SK, Rees H, Taylor J, Morgan CJA, Curran HV. Journey through the K-hole: phenomenological aspects of ketamine use. Drug Alcohol Depend. 2008;95(3):219-29. doi: 10.1016/j.drugalcdep.2008.01.024
16. Morgan CJ, Curran HV, Independent Scientific Committee on Drugs (ISCD). Ketamine use: a review. Addiction 2012;107(1):27-38. doi: 10.1111/j.1360-0443.2011.03576.x
17. Wood D, Cottrell A, Baker SC, Southgate J, Harris M, Fulford S, Woodhouse C, Gillatt D. Recreational ketamine: from pleasure to pain. BJU internazional. 2011;107(12):1881-4. doi: 10.1111/j.1464-410X.2010.10031.x
18. Weiner AL, Vieira L, McKay Jr CA, Bayer MJ. Ketamine abusers presenting to the emergency department: a case series. J Emerg Med. 2000;18(4):447-51.
19. Ng SH, Tse ML, Ng HW, Lau FL. Emergency department presentation of ketamine abusers in Hong Kong: a review of 233 cases. Hong Kong Med J. 2010;16(1):6-11.
20. Bertolazzi A. La ketamina nei contesti dance: una droga "dissociata". In: Cipolla C, Martoni M (Eds). Droghe nella notte. Milano: FrancoAngeli; 2009.
21. Fonda GV. Ketamina: stili di consumo. Milano: FrancoAngeli, 2013.
22. Pavarin RM 2014. Il consumo socialmente integrato di sostanze illegali: danni, precauzioni, regole e mercato. Milano: FrancoAngeli; 2014.
23. Corazza O. Ketamina, "near death experiences" e stati non ordinari di coscienza. Osservazioni medico-antropologiche sul fenomeno dell'esperienza dissociativa. Boll Farmacodip Alcoolis. 2001;XXIV(4):88-93.
24. Rollo S, Samorini G. Ketamina. Il fattore K della psychedelia, 1998. Available from: http://lab57.indivia.net/wp-content/uploads/KETAMINA-samorini-rollo.pdf
25. Pavarin RM. Sostanze legali e illegali: motivi e significati del consumo. Milano: FrancoAngeli; 2008.
26. Wood DM, Nicolaou M, Dargan PI. Epidemiology of recreational drug toxicity in a nightclub environment. Subst Use Misuse. 2009;44:1495-502. doi: 10.1080/10826080802543580
27. Ravn S, Demant J. Prevalence and perceptions of ketamine use among Danish clubbers. A mixed-method study. Nord Stud Alcohol Dr. 2012;29(4):397-412.
28. Reynaud-Maurupt C, Bello PY, Akoka S, Toufik A. Characteristics and behaviors of ketamine users in France in 2003. J Psychoactive Drugs. 2007;39(1):1-11. doi:

10.1080/02791072.2007.10399859

29. Dillon P, Copeland J, Jansen K. Patterns of use and harms associated with non-medical ketamine use. J Psychoactive Drugs. 2003;69(1):23-8.
30. Poon TL, Wong KF, Chan MY, Fung KW, Chu SK, Man CW, Yiu MK, Leung SK. Upper gastrointestinal problems in inhalational ketamine abusers. J Dig Dis. 2010;11:10610 doi: 10.1111/j.1751-2980.2010.00424.x
31. Jansen KL. Non-medical use of ketamine. BMJ 1993;306:601-2. doi: 10.1136/bmj.306.6878.601
32. Schifano F, Corkery J, Oyefeso A, Tonia T, Ghodse AH. Trapped in the "K-hole": overview of deaths associated with ketamine misuse in the UK (1993-2006). J Clin Psychopharmacol. 2008;28(1):114-6. doi: 10.1097/JCP.0b013e3181612cdc
33. Pompili, M. (2010) Suicide on my mind. A look back and ahead at suicide prevention in Italy. Minerva Medica. 2010;101(5):353-61.
34. Hickey L, Hawton K, Fagg J, Weitzel H. Deliberate self-harm patients who leave the accident and emergency department without a psychiatric assessment: a neglected population at risk of suicide. J Psychosom Res. 2001;50(2):87-93.
35. Pan CH, Jhong JR, Tsai SY, Lin SK, Chen CC, Kuo CJ. Excessive suicide mortality and risk factors for suicide among patients with heroin dependence. Drug Alcohol Depend. 2014; 145: 224-230. doi: 10.1016/j.drugalcdep.2014.10.021
36. Marzuk PM, Tardiff K. Prevalence of cocaine use among residents of New York City who committed suicide during a one-year period. Am J Psychiatry. 1992;149(3):371-5. doi: 10.1176/ajp.149.3.371
37. Kerr T, Fairbairn N, Tyndall M, Marsh D, Li K, Montaner J, Wood E. Predictors of non-fatal overdose among a cohort of polysubstance-using injection drug users. Drug Alc Dep. 2007;87(1):39-45. doi: 10.1016/j.drugalcdep.2006.07.009
38. Stoové MA, Dietze PM, Jolley D. Overdose deaths following previous non fatal heroin overdose: Record linkage of ambulance attendance and death registry data. Drug Alc Rev. 2009;28(4):347-52. doi: 10.1016/j.drugalcdep.2006.07.009
39. Jansen KL, Darracot-Cankovic R. The nonmedical use of ketamine, part two: A review of problem use and dependence. J Psychoact Drugs. 2001 ;33(2):151-8. doi: 10.1080/02791072.2001.10400480