ORIGINAL ARTICLE

Improving the detection of illicit substance use in preoperative anesthesiological assessment

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ABSTRACT

Aim. Illicit substance use (ISU) is a worldwide burden, and its prevalence in surgical patients has not been well investigated. Co-consumption of legal substances, such as alcohol and tobacco, complicates the perioperative management and is frequently underestimated during routine preoperative assessment. The aim of this study was to compare the anesthesiologists' detection rate of ISU during routine preoperative assessment with a computerized self-assessment questionnaire.

Methods. In total, 2,938 patients were included in this study. Prior to preoperative assessment, patients were asked to complete a computer-based questionnaire that addressed ISU, alcohol use disorder (AUDIT), nicotine use (Fagerström) and socio-economic variables (education, income, employment, partnership and size of household). Medical records were reviewed, and the anesthesiologists' detection of ISU was compared to the patients' self-reported ISU.

Results. Seven point five percent of patients reported ISU within the previous twelve months. ISU was highest in the age group between 18 and 30 years (26.4%; P<0.01). Patients reporting ISU were more often men than women (P<0.01), smokers (P<0.01) and tested positive for alcohol use disorder (P<0.01). Anesthesiologists detected ISU in one in 43 patients, whereas the computerized self-assessment reported it in one in 13 patients. The detection was best in the subgroup self-reporting frequent ISU (P<0.01).

Conclusion. Anesthesiologists underestimate the prevalence of ISU. Computer-based self-assessment increases the detection of ISU in preoperative assessment and may decrease perioperative risk. More strategies to improve the detection of ISU as well as brief interventions for ISU are required in preoperative assessment clinics.

(Minerva Anestesiol 2010;76:29-37)

Key words: Drugs - Surgical procedure, operative - Outcome.

Illicit drug use (ISU) is a worldwide burden; 185 million people (3.1%) of the global population, including infants and the elderly, consume illicit drugs. Polydrug use is frequently observed.[1]

The effects of ISU on general anesthesia and perioperative complications or outcomes have not been well investigated. Higher anesthetic requirements and increased irritability of the upper airways have been reported in patients who consume cannabinoids.[2, 3] A recent systematic review found long-term cannabis smoking to be associated with increased respiratory symptoms.[4] Cocaine use is associated with increased risk of arrhythmias and myocardial infarction.[5] There are case reports of rhabdomyolysis and stroke in cocaine-abusing patients undergoing surgery.[6] Amphetamines can cause hyperthermia, rhabdomyolysis, coagulopathy and renal failure. Intraoperatively, cardiac arrests have been reported in chronic amphetamine users.[7, 8] Perioperative complications in opioid-abusing patients, such as hyperalgesia and withdrawal, can be avoided by using regional analgesia; however, complications such as torsades de pointes and ventricular tachycardias will remain

a risk.[9, 10] Furthermore, the co-consumption of legal substances, such as alcohol and tobacco, further complicates perioperative management [11-14] and remains undetected in routine preoperative assessment.[15]

Hence, consumers of illicit substances are counted among high-risk patients because of their complex psychiatric and physical comorbidities. They require tailored anesthesiological approaches, and physicians should consider a lower threshold for using invasive monitoring techniques. However, all of this is dependent on the problem being recognized in advance. The prevalence and resulting problem of ISU among patients presenting for elective surgery is uncertain, because neither the prevalence of ISU nor the screening methods used in routine preoperative assessment have been thoroughly investigated.

The aim of this study was to compare the detection of ISU by anesthesiologists during routine preoperative assessment with a computerized self-assessment.

Materials and methods

This study is part of a project investigating lifestyle risk factors and general anesthesia.[15] In this sample, we analyzed the ISU of patients in the preoperative assessment. The study was designed as a prospective observational study and was conducted in the preoperative assessment clinics of the Charité - Universitätsmedizin Berlin, Campus Charité Mitte and Campus Virchow Klinikum, Berlin, Germany between July 2006 and August 2007. The Charité - Universitätsmedizin Berlin is one of the largest hospitals in Europe, and the Department of Anesthesiology performs approximately 50,000 general anesthesia cases per year. Each patient undergoing elective surgery is examined by an anesthesiologist in the preoperative assessment clinic for two principle goals: 1) the clarification of anesthesia-related risks of the intended surgery and 2) the evaluation of the patient's individual level of risk. This contains a short routine form to be filled out before contact with the anesthesiologist concerning physical status, including the question (YES/NO) of whether the patient is taking or has been taking any illegal drugs.

Patients

Approval from the local ethics committee was received in advance, and informed written consent was obtained from all patients. All patients ≥18 years of age were considered potential candidates (N=24,650). Patients were not included (N=21,455) if they were incapable of providing consent or refused to participate, had insufficient knowledge of the German language, were not willing to use or not capable of using a computer, were already participating in another clinical trial, were members of the hospital staff, were in police custody, were relatives of the study team or required urgent or emergency surgery. A total of 3,195 consecutive qualifying patients were invited to participate in the study. Of these, 257 were excluded because they did not fully complete the electronic questionnaire (N=251) or provided contradictory responses (N=6). The data from 2,938 patients were analyzed (Figure 1).

Measurements of the computer-based questionnaire

Patients were approached regarding participation in the study before the preoperative anesthesiological evaluation. After providing written informed consent, the patients were asked to complete the computer-based questionnaire. The data obtained included gender, date of birth, weight and height. The questionnaire included questions about ISU (Table I), the alcohol use disorder identification test (AUDIT [15, 16]) and the Fagerström Test for Nicotine Dependence (FTND).[17] Additionally, five socioeconomic factors (education, income, relationship status, size of household and employment) were assessed using the "Albums Standard Categories", which is a validated German socio-economic questionnaire.[18]

Education was transformed to a binary variable, *i.e.*, 12 or 13 years of school education (university entrance diploma) *vs.* 11 years or less (no university entrance diploma). Family income was divided into two categories: "equal or less than 1,475 Euros after tax per month" and "more than 1,475 Euros after tax per month" (1 Euro equaled ~ $1.28 US in July 2006). The average monthly household income after tax in Berlin in 2003 was 1,475 Euros.

TABLE I.—*Excerpt from the questionnaire: questions about illicit substance use (ISU).*

1. *Have you during the course of your life consumed any of the following drugs more than once: cannabis, marihuana, ecstasy (XTC, MDM, MDMA, ADAM), other synthetic drugs, drugs of natural origin, cocaine, morphine, heroine or other opioids?*
— Yes
— No (if 'No', skip question 2 and 3)
2. *Which of the following substances did you take?*
— Cannabis, marihuana
— Cocaine
— Ecstasy, i.e. XTC, MDM, MDMA, ADAM
— Heroine or other opioids
— Drugs of natural origin, i.e. mushrooms, cactus
— Other synthetic drugs, i.e. 100X, Love Drug, EVE
3. *How often did you take these drugs?*
— Not within the last twelve months
— One to three times within the last twelve months
— Four to twelve times within the last twelve months
— 13 to 52 times within the last twelve months
— 53 or more times within the last twelve months
— daily / almost daily

Participants were asked whether they were single or in a committed relationship. Additionally, they were asked for the size of their household, which was also transformed into binary categories: "one-person-household" and "household with more than one member". Working status was transformed to a binary variable: "working" meaning any legally paid work, self-employed work or paid work in a family business. Since all questions were multiple-choice questions, no keyboard typing was necessary for the completion of the questionnaire.

Detection rate

After completion of the questionnaire, patients underwent routine preoperative anesthesiological assessment. The anesthesiologist did not have access to the results of the computer-based questionnaire. All data were first analyzed at the end of the study.

It is our institutional practice that a standardized preoperative evaluation form must be filled out by the responsible anesthesiologist for every preoperative evaluation, with the sole exception of emergencies. The self-reported ISU was considered to have been "detected" during the routine preoperative evaluation if the field labeled "drugs" on our standardized form had been checked, if a specific referral to any form of ISU was made in the free text area of the form, or if anything suggesting that the patient might have used substances had been noted in the free text area of the form.

Outcome parameters

We retrospectively analyzed the following outcome parameters: duration of post anesthesia care unit (PACU) stay and time of hospitalization. Study patients were matched with controls for age (18-30 years, 31-50 years and ?51 years), sex, preoperative physical status (American Society of Anesthesiologists [ASA] physical status: P1 normal healthy patient, P2 patient with mild systemic disease, P3 patient with severe systemic disease, P4 patient with severe systemic disease that is a constant threat to life) and duration of surgical procedure (0-50 min, 51-100 min and ≥101 min).

Statistical analysis

Descriptive statistics were calculated for all study variables. Results were expressed as the arithmetic mean (standard deviation) or relative frequencies (%) with 95%-confidence intervals, respectively. In cases of deviations from normality/symmetry of the underlying distributions, we present the results as median (25-75% percentiles) and tested differences between certain groups of patients by using the non-parametric Mann-Whitney test. Frequencies were tested with the χ^2 test. Agreement between different observations was judged by Cohen's kappa and tested for non-association (K=0).[19] We considered $P<0.05$ to be significant. All tests should be understood as constituting exploratory data analysis, such that no adjustments for multiple testing have been made. All numerical calculations were performed with SPSS, Version 15, Copyright© SPSS, Inc., Chicago, Illinois 60606, USA and StatXact 6®, CYTEL Software Corp., Cambridge, MA 02139, USA.

Results

Prevalence

In total, data from 2,938 patients were analyzed; of these, 1,414 were women (48.1%) and 1,524 were men (51.9%). A total of 476 patients (16.2%)

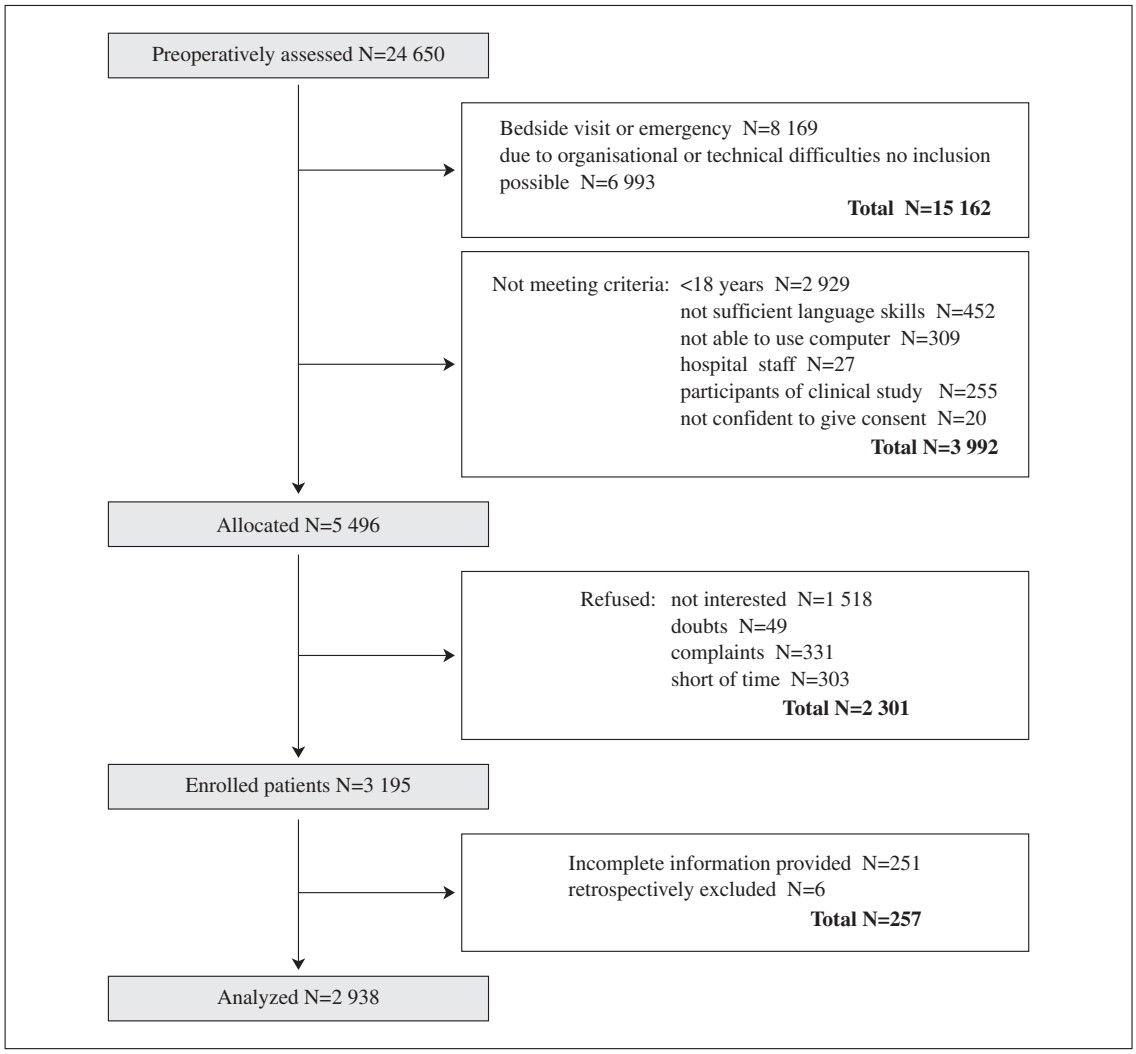

Figure 1.—Consort diagram.

indicated that they had at some time consumed drugs: 189 of the 1,414 female patients (13.4%) and 287 of the 1,524 male patients (18.8%).

Two hundred twenty-one patients (7.5%) had consumed an illegal drug within the previous 12 months: 68 (4.8%) of the female patients and 153 (10.0%) of the male patients. Within the previous 12 months, cannabinoids had been taken by 204 patients (6.9%), cocaine by 73 (2.5%), 3.4-methylendioxy-N-methylamphetamin (MDMA) or other amphetamines by 58 (2.0%), opiates by 23 (0.8%), drugs of natural origin by 22 (0.7%) and other synthetic drugs by 13 (0.4%). Ninety-two, that is 41.6%, of the patients with ISU within the previous 12 months reported polydrug use (Table I, Figure 2).

Age and sex

The highest frequency of ISU was found in the group of patients between 18 and 30 years of age at 26.4% (95%-CI: 25.4-33.8%, 132 of 499; χ^2=358.7, 2 df, P<0.01). Patients aged 26 through 50 reported an ISU of 8.2% (95%-CI: 6.6%-10.0%, 81 of 992) and patients aged 51 and above of 0.5% (95%-CI: 0.3% - 1.1%) (8 of 1,447). Patients reporting ISU were more often men than

TABLE II.—*Patient characteristics and socio-economic status.*

	ISU within last year (n = 221)	No ISU within last year (n = 2,717)	P
Age groups			
18 - 30 years	59.7% (N=132)	13.5% (N=367)	<0.01
31 - 50 years	36.7% (N=81)	33.5% (N=911)	
51 years and older	3.6% (N=8)	53.0% (N=1,439)	
BMI (kg/m^2)	24.0 [4.0]	26.3 [5.1]	<0.01
Sex (f/m)			
female	30.8% (N=68)	49.5% (N=1,346)	<0.01
male	69.2% (N=153)	50.5% (N=1,371	
AUD			
positive	38.0% (N=84)	12.5% (N=340)	<0.01
negative	62.0% (N=137)	87.5% (N=2,377)	
Smoking			
non-smoker	29.4% (N=65)	73.2% (N=1,988)	<0.01
smoker	70.6% (N=156)	26.8% (N=729)	
Level of Education			
no university entrance diploma	51.6% (N=112)	59.1% (N=1,605)	<0.05
university entrance diploma	49.4% (N=109)	41.9% (N=1,112)	
Household Income			
≤1475 €/month	56.6% (N=125)	39.2% (N=1,066)	<0.01
>1475 €/month	17.6% (N=39)	39.2% (N=1,066)	
not indicated	25.8% (N=57)	21.6% (N=585)	
Partnership			
no partner	43.4% (N=96)	23.2% (N=631)	<0.01
partner	56.6% (N=125)	76.8% (N=2,086)	
Persons living in household			
one	39.0% (N=91)	25.8% (N=700)	<0.01
two or more	61.0% (N=130)	74.2% (N=2,017)	
Working status			
not working	42.1% (N=93)	52.7% (N=1,431)	<0.05
working	57.9% (N=128)	47.3% (N=1,286)	

women (153 of 221 *vs.* 1371 of 2717; χ^2=28.4, 1 df, P<0.01) (Table II, Figure 2).

Smoking and alcohol use disorder

The number of smokers was higher among patients with ISU compared to patients without ISU (156 of 221; 70.6% *vs.* 729 of 2 717; 26.8%; χ^2=125.9, 1 df, P<0.01). Patients with ISU tested more often positive for alcohol use disorder than patients without ISU (84 of 221, 38.0%; *vs.* 340 of 2,717; 12.5%; χ^2=107.6, 1 df, P<0.01) (Table I).

Socio-economic characteristics

Patients who reported ISU were more likely to be without university entrance diploma (χ^2=5.9, 1 df, P<0.05), to live in a household receiving a below average income (χ^2=42.2, 2 df, P<0.01) and to be employed (χ^2=9.2, 1 df, P<0.01). They were less likely to be in a committed relationship (χ^2=44.8, 1 df, P<0.01) and more likely to live in a single household (χ^2=24.7, 1 df, P<0.01) than patients without ISU (Table II).

Detection rate

Of the 221 patients who reported ISU within the previous 12 months in the questionnaire, only 68 (30.8%, [95%-CI: 25.1% – 37.2%]) were detected during routine anesthesiological assessment (Table III, Figure 3). The detection rate was highest in the subgroup self-reporting ISU '53 or more times within the previous twelve months' (χ^2=65.0, 4 df, P<0.01; Table IV).

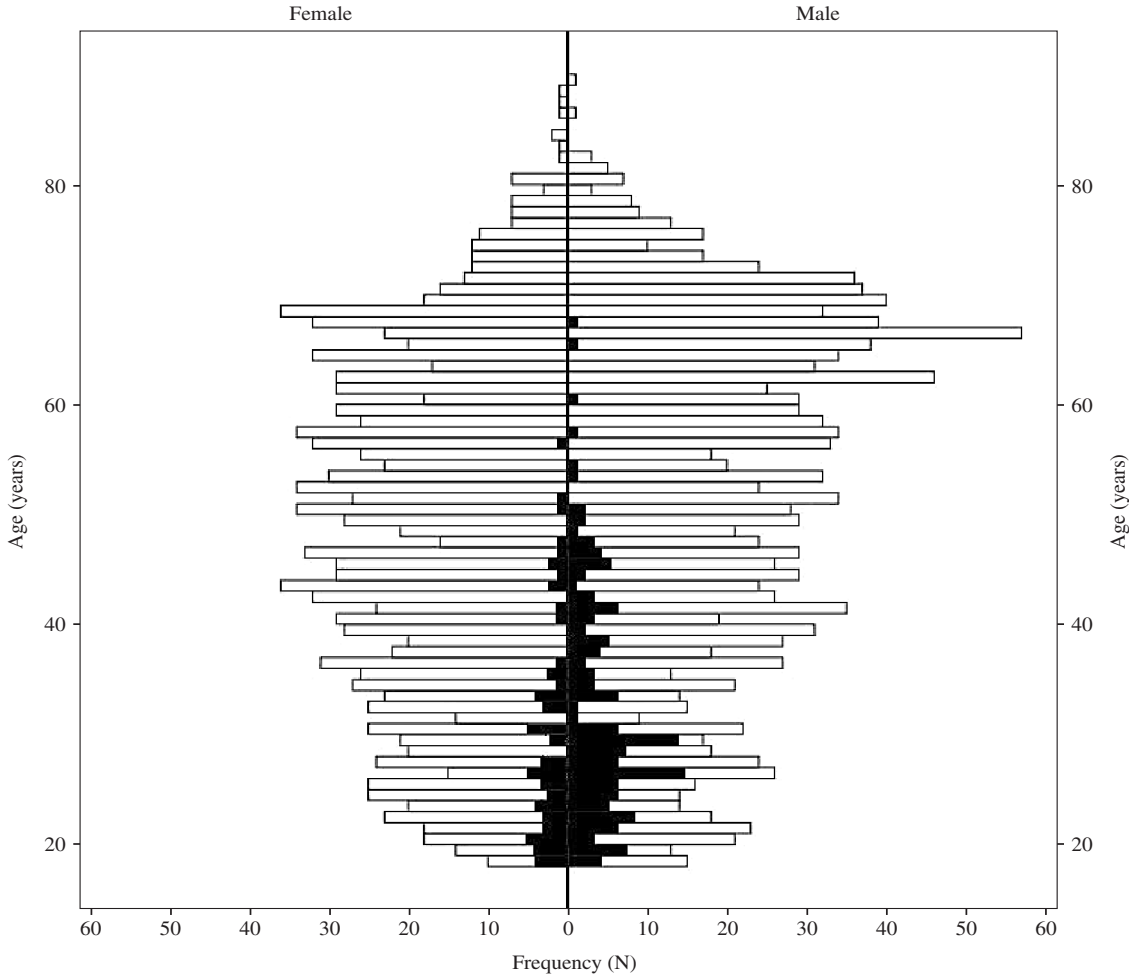

Figure 2.—Age pyramid of the examined collective (N=2 938) and frequency of ISU within the previous 12 months (darken bar = fraction of ISU).

Agreement

The agreement between self-report and physician's detection of ISU was poor for cannabinoids (κ=-0.0158 [95%-CI: -0.0701-0.0385]), designer drugs (κ=0.0748 [95%-CI: 0.0249-0.1745], P<0.05), drugs of natural origin (κ=0.0196: [95%-CI -0.0911-0.1302]), opioids (κ=0.1083 [95%-CI: 0.0090-0.2255], P<0.05), amphetamines (κ=0.2646 [95%-CI: 0.1256-0.4036], P<0.01) as well as cocaine (κ=0.2995 [95%-CI: 0.1921-0.4069], P<0.05).

Outcome

There were no differences in observed outcomes. Patients with ISU did not differ from patients without ISU with respect to duration of PACU stay (ISU 90.1 min [41.6] *vs.* non-ISU 88.6 min [62.3]; P=0.26) or duration of hospitalization (ISU 4.89 d±[6.13] *vs.* non-ISU 6.37 d [10.50]; P=0.45) after matching with an appropriate control group by age, sex, ASA classification and duration of surgical procedure.

Discussion

Self-assessment by computerized questionnaire indicates that 1 in 13 patients undergoing elective surgery had been taking illegal drugs within the previous 12 months. Anesthesiologists detected ISU in only 33% of these patients during routine preoperative assessment. We do not routinely screen

BLE III.—*ISU within the previous year, substance subcategories.*

	Cannabinoids (N=204)	Cocaine (N=73)	Amphetamines (N=58)	Opiates (N=23)	Natural Origin (N=22)	Other synthetic Drugs (N=13)
: (jrs)	30.5 [9.7]	31.0 [8.9]	30.4 [7.5]	40.7 [10.5]	34.1 [10.0]	31.0 [9.2]
II (kg/m^2)	24.0 [4.0]	23.8 [3.4]	23.6 [3.2]	24.5 [4.5]	23.0 [3.0]	22.6 [2.5]
Female	30.4% (N=62)	37.0% (N=27)	27.6% (N=16)	47.8% (N=11)	27.3% (N=6)	23.1% (N=3)
Male	69.6% (N=142)	63.0% (N=46)	72.4% (N=42)	52.2% (N=12)	72.7% (N=16)	76.9% (N=10)
DIT						
Positive	39.7% (N=81)	57.5% (N=42)	60.3% (N=35)	34.8% (N=8)	50.0% (N=11)	69.2% (N=9)
Negative	60.3% (N=123)	42.5% (N=31)	39.7% (N=23)	65.2% (N=15)	50.0% (N=11)	30.8% (N=4)
oking						
Non-smoker	29.4% (N=144)	24.7% (N=18)	29.3% (N=17)	13.0% (N=3)	40.9% (N=9)	30.8% (N=4)
Smoker	70.6% (N=60)	75.3% (N=55)	70.7% (N=41)	87.0% (N=20)	59.1% (N=13)	69.2% (N=9)
ıcation						
No university entrance Diploma	49.5 % (N=101)	43.8% (N=32)	51.7% (N=28)	65.2% (N=15)	31.8% (N=7)	53.8% (N=7)
University entrance diploma	50.5% (N=103)	56.2% (N=41)	48.3% (N=30)	34.8% (N=8)	68.2% (N=15)	46.2% (N=6)
usehold income						
≤1475€/month	56.9% (N=116)	61.6% (N=45)	60.3% (N=35)	65.2% (N=15)	63.6% (N=14)	53.8% (N=7)
>1475€/month	17.2% (N=35)	15.1% (N=11)	13.8% (N=8)	17.4% (N=4)	27.3% (N=6)	38.5% (N=5)
ıot indicated	26.0% (N=53)	23.3% (N=17)	25.9% (N=15)	17.4% (N=4)	9.1% (N=2)	7.7% (N=1)
tnership						
No partner	45.1% (N=92)	49.3% (N=36)	44.8% (N=26)	56.5% (N=13)	50.0% (N=11)	53.8% (N=7)
Partner	54.9% (N=112)	50.7% (N=37)	55.2% (N=32)	43.5% (N=10)	50.0% (N=11)	46.2% (N=6)
sons living in household						
One	42.2% (N=86)	46.6% (N=34)	44.8% (N=26)	39.1% (N=9)	40.9% (N=9)	38.5% (N=5)
Two or more	57.8% (N=118)	53.4% (N=39)	55.2% (N=32)	60.9% (N=14)	59.1% (N=13)	61.5% (N=8)
rking status						
Not working	41.7% (N=85)	41.1% (N=30)	36.2% (N=21)	73.9% (N=17)	40.9% (N=9)	30.8% (N=4)
Working	58.3% (N=119)	58.9% (N=43)	63.8% (N=37)	26.1% (N=6)	59.1% (N=13)	69.2% (N=9)
ced consumptions	42.6% (N=87)	95.1% (N=70)	98.3% (N=57)	69.6% (N=16)	100.0% (N=22)	100.0% (N=13)
Cannabinoids	-	89.0% (N=65)	91.4% (N=53)	60.9% (N=14)	100.0% (N=22)	76.9% (N=10)
Cocaine	31.9% (N=65)	—	75.9% (N=44)	65.2% (N=15)	63.6% (N=14)	76.9% (N=10)
Amphetamines	26.0% (N=53)	60.3% (N=44)	-	30.4% (N=7)	68.2% (N=15)	61.5% (N=8)
Opiates	6.9% (N=14)	20.5% (N=15)	12.1% (N=7)	—	13.6% (N=3)	23.1% (N=3)
Natural origin	10.8% (N=22)	19.2% (N=14)	25.9% (N=15)	13.0% (N=3)	—	30.8% (N=4)
Other synthetic drugs	4.9% (N=10)	13.7% (N=10)	13.8% (N=8)	13.0% (N=3)	18.2% (N=4)	—

Multiple answers possible

TABLE IV.—*Detection rate and frequency of ISU within the last twelve months (χ^2=65.0, 4 df, P<0.01).*

Frequency of ISU (self-report)	Detection rate	[95%-CI]
One to three times within the last twelve months	12.3% (10/81)	[6.7% – 21.5%]
Four to twelve times within the last twelve months	48.9% (22/45)	[35.0% – 63.0%]
13 to 52 times within the last twelve months	35.0% (7/20)	[18.0% – 56.8%]
53 or more times within the last twelve months	53.3% (8/15)	[30.1% – 75.2%]
Daily / almost daily	46.7% (21/45)	[36.0% – 59.6%]

for ISU using laboratory testing in our preoperative anesthesiological assessment clinic. Moreover, Rootman *et al.* have shown that laboratory screening for ISU as a standard procedure is often omitted and, if carried out, is mostly due to suspicion.[20] Barriers to detection include underreporting by the patients, physician discomfort concerning drug-related questioning and the absence of a validated questioning tool for ISU screening. Interestingly, we found that the highest rates of ISU detection by the anesthesiologists were not in the subgroup reporting 'daily / almost daily' drug use, but in the subgroup reporting ISU '53 or more times within the previous twelve months'. This may reflect the desire on the part of very heavy users to conceal the extent of their ISU.

The self-reported prevalence of ISU in this study is similar to those in previously published surveys. In this study, 16.2% of respondents had consumed illicit drugs during their lifetime. An ISU lifetime

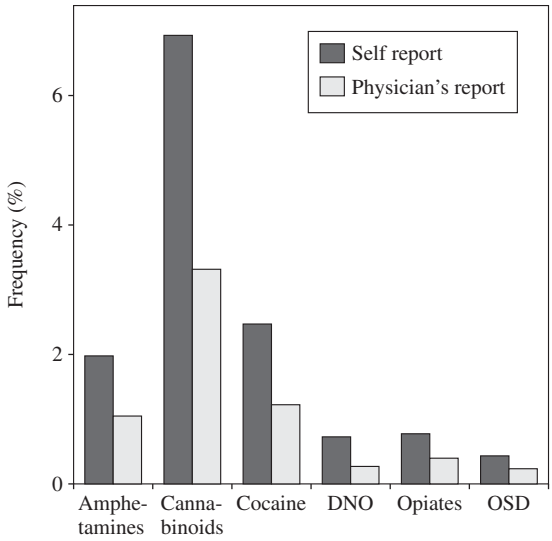

Figure 3.—Self-report and physician detected use of amphetamines, cannabinoids, cocaine, drugs of natural origin (DNO) and other synthetic drugs (OSD) in patients in the preoperative assessment clinics (%).

prevalence of more than 25% has previously been reported in a German study of 18-64 year olds.[21] This difference may be caused by the fact that our sample contained a significant proportion of older patients. The prevalence of respondents reporting ISU within the previous 12 months was 7.5%, which is similar to rates reported in the United States of America.[22] The group of patients in the 18 to 30 age bracket reported a significantly higher prevalence of ISU (26.4%). This subgroup of patients may be at significantly increased perioperative risk, and anesthesiologists should be aware that ISU may be an issue in 1 in 4 patients under the age of 30.

There are no reliable data regarding either the significance of the frequency of ISU or the value of preoperative illegal drug abstinence on outcomes following anesthesia. ISU patients and matched non-ISU patients were young and without comorbidities and did not differ in outcome measures. There was a trend towards even shorter hospital lengths of stay in ISU patients. This phenomenon has been previously described [23] and may be attributed to the patients' high level of motivation to leave the hospital in order to access illegal or legal substances.

The prevalence of comorbidities in surgical patients increases with advancing age.[24] More than half (57.1%) of older methadone patients are reported having had at least one mental health problem in the previous year and high rates of physical health problems, e.g., arthritis (54.3%) and hypertension (44.9%). The majority of these respondents were classified as having fair to poor physical health (57.7%).[24] Therefore, early recognition during clinical routine [25] and early intervention strategies tailored to the needs of the patients may result in improved mental and physical outcomes for young ISU patients.[26]

New data suggest that brief intervention strategies could be an effective tool to reduce ISU.[27] Preoperative assessment clinics may provide an appropriate setting for brief interventions, highlight high-risk behavior, and ultimately cause lifestyle change; in this manner, the numerous health and psychosocial consequences of ISU might be reduced or avoided.[28]

Limitations

We chose a quick computer-based self-assessment for reasons of practicality. As a result, we were unable to obtain data regarding grades of dependence. Adherence to DSM IV diagnostic criteria would have provided more precise information and strengthened our evidence. It is possible that exposure to the computerized questionnaire before seeing the anesthesiologist may have encouraged patients to be more proactive in reporting their ISU to the physician. Accordingly, it may well be that we have overestimated the anesthesiologists' detection rates. Acutely intoxicated patients are unable to give written consent and are more likely to need emergency surgery. Hence, these patients were not included in this study, and the prevalence of ISU in surgical patients altogether may even be higher than we report.

Conclusions

Anesthesiologists detected ISU in only one in 43 patients during preoperative assessment. The use of the computer-based questionnaire increased the detection to one in 13. We suggest that every patient presenting to a preoperative assessment clinic should be exposed to a structured computerized self-assessment questionnaire about ISU as

increased preoperative recognition of ISU may decrease perioperative risk. In addition, computer-based self-reporting of ISU is an effective tool to reach patients with substance-related problems who would have been ignored in routine health care. Therefore, computerized screening of ISU may serve as part of a bridging intervention to offer patients individually adapted therapeutic interventions, *e.g.*, motivational interviewing, brief intervention or intensive addiction therapy.

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Acknowledgements.—The authors thank Professor K. D. Wernecke of SoStAna for his advice on statistical methodology and Martin MacGuill for his help in the preparation of this article.

R. Kleinwächter and F. Kork have contributed equally to this work.

Received on September 15, 2009 - Accepted for publication on October 20, 2009.

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