Use of the Screening Suggested by the National Institute on Alcohol Abuse and Alcoholism and of a Newly Derived Tool for the Detection of Unhealthy Alcohol Drinkers Among Surgical Patients

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ABSTRACT. Objective: The National Institute on Alcohol Abuse and Alcoholism (NIAAA) has developed a two-question tool for the detection of unhealthy drinking (NIAAA-2Q) that investigates excessive alcohol consumption per single occasion. NIAAA-2Q can be commuted into a four-question tool (NIAAA-4Q) by the addition of two questions aimed at investigating excessive weekly alcohol intake. NIAAA-2Q and NIAAA-4Q may prove useful in busy settings such as an anesthesiological environment. However, to date, no study has evaluated their efficacy in a surgical setting. The purpose of this study was to evaluate the accuracy of NIAAA-2Q and NIAAA-4Q in detecting unhealthy drinking among surgical patients using the more complex Alcohol Use Disorders Identification Test (AUDIT) comprising 10 questions as the criterion method. **Method:** NIAAA-4Q and AUDIT were administered to 200 surgical patients by three anesthetists. **Results:** A total of 23.5%, 12.5%, and 28.5% surgical patients were unhealthy drinkers according to AUDIT, NIAAA-2Q, and NIAAA-4Q, respectively. NIAAA-2Q negative and positive predictive values were 0.78 and 0.36, respectively, and positive and negative likelihood ratios were 1.80 and 0.90, respectively. NIAAA-4Q negative and positive predictive values were 0.93 and 0.65, respectively, and positive and negative likelihood ratios were 6.00 and 0.24, respectively. **Conclusions:** NIAAA-4Q demonstrated a better satisfactory agreement than NIAAA-2Q with AUDIT in detecting unhealthy alcohol drinking among surgical patients. These results suggest that the detection of unhealthy alcohol drinking may be increased by the administration of questions aimed at assessing the weekly average of alcohol intake. The modest time required for NIAAA-4Q administration is a major advantage in clinical practice with respect to AUDIT. Further research will compare NIAAA-2Q and NIAAA-4Q with other brief alcohol screening tests. (*J. Stud. Alcohol Drugs, 73,* 126–133, 2012)

UNHEALTHY ALCOHOL CONSUMPTION—that is, a spectrum of alcohol consumption ranging from at-risk drinking to alcohol use disorders (AUDs)—is one of the leading causes of morbidity and mortality worldwide (Saitz, 2005). In the surgical setting, unhealthy alcohol consumption is associated with an increased risk of infections, cardiopulmonary insufficiency, bleeding, delayed tissue healing, and alcohol withdrawal syndromes (Spies et al., 2001; Tønnesen, 1999). One month of preoperative abstinence is sufficient to reduce postoperative complications among subjects with AUDs (Tønnesen et al., 1999). Based on this evidence, surgical patients should be screened for unhealthy alcohol drinking to evaluate the alcohol-related risk of postoperative complications. However, unhealthy alcohol consumption frequently goes unrecognized (Martin et al., 2002).

In a recent study, less than 10% of unhealthy drinkers were correctly identified by anesthetists during a preoperative assessment (Kip et al., 2008). Lack of time is reported as one of the main causes for the lack of an efficient inquiry about alcohol consumption (Ferguson et al., 2003; Friedmann et al., 2000). Several efforts have been made to develop simple and time-saving tools for the screening of unhealthy alcohol consumption, including the 10-item Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993; see also Fiellin et al., 2000). Although AUDIT was developed for the detection of less severe categories of unhealthy alcohol consumption (Saunders et al., 1993), it is also a sensitive indicator of AUDs (Reinert and Allen, 2007). For this reason, the guide entitled *Helping Patients Who Drink Too Much,* prepared by the National Institute on Alco-

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hol Abuse and Alcoholism (NIAAA), suggests that general physicians and mental health clinicians should use AUDIT to screen their patients for unhealthy drinking (NIAAA, 2007).

AUDIT measures alcohol consumption, drinking behavior, adverse reactions, and alcohol-related problems (Saunders et al., 1993). Each question is scored from 0 to 4, with a total score ranging from 0 to 40. In the original validation study, a cut point of 8 achieved a sensitivity of 92% and a specificity of 94% in detecting not only the less severe categories of unhealthy consumption but also AUDs (Saunders et al., 1993). However, subsequent studies have reported lower values of sensitivity and specificity for the whole spectrum of unhealthy alcohol consumption (Fiellin et al., 2000). Namely, some studies found that the cut point of 8 was not totally accurate in the elderly and women, suggesting lower cut points for these subgroups of the population (Bradley et al., 2003; Morton et al., 1996; Neumann et al., 2004; for a review, see Fiellin et al., 2000; Reinert and Allen, 2002, 2007). Accordingly, the NIAAA guide recommends AUDIT scores of 8 or more for men up to 60 years of age and 4 or more for women and men older than 60 years of age (NIAAA, 2007). AUDIT has been effectively used in different medical settings, including primary health care, emergency care, internal medicine hospital, and psychiatry (Reinert and Allen, 2002, 2007; Roche et al., 2006). AUDIT scores have also been used to define AUD severity (Donovan et al., 2006) and identify subjects at increased risk for postoperative complications (low [<8], hazardous [8–12], and harmful [>13]) (Poon et al., 1994; Williams et al., 2008).

Although AUDIT has been extensively validated, it seems to be excessively time consuming for routine use in many clinical settings. For this reason, briefer screening tools have been developed. The AUDIT-consumption (AUDIT-C) consists of the first three questions of AUDIT related to alcohol intake (Reinert and Allen, 2007). AUDIT-C score ranges from 0 to 12 points, and the test is considered positive in different medical settings, including surgery, when a score of 5 or more is obtained (Au et al., 2007; Bradley et al., 2011; Bryson et al., 2008; Bush et al., 1998; Harris et al., 2011; Lembke et al., 2011; Shourie et al., 2007). Four categories of risk have been identified on the basis of the AUDIT-C score: low risk (1–4), moderate risk (5–8), high risk (9–10), and highest risk (11–12) (Bradley et al., 2011). A recent meta-analysis found no difference between AUDIT and AUDIT-C in the detection of unhealthy alcohol consumption among primary care patients (Kriston et al., 2008).

Another brief questionnaire consists of the third AUDIT question (Reinert and Allen, 2007). Namely, the standard version of this single question asks about the frequency of drinking six or more drinks per occasion. An improved version asks about the frequency of drinking four or more drinks per occasion in women and five or more in men, which are the amounts of alcohol associated with a prospective risk of many types of harm (Dawson et al., 2008). This improved version proved to be a good predictor of unhealthy alcohol intake (Canagasaby and Vinson, 2005; Seale et al., 2006; Smith et al., 2009; Taj et al., 1998; Vinson et al., 2004; Williams et al., 2001). Its sensitivity and specificity for detection of the less severe categories of unhealthy alcohol consumption and AUDs were 62%–82% and 79%–93%, respectively, in primary care (Seale et al., 2006; Smith et al., 2009; Taj et al., 1998) and 86% in emergency care (Williams et al., 2001). This single question alone may potentially be a more practical screen than AUDIT-C because response options and scoring for the latter may be difficult for clinicians to remember (Bradley et al., 2009). Accordingly, the NIAAA guide recommends this single question as an alternative to AUDIT (NIAAA, 2007). Specifically, the NIAAA suggests the administration of the following two questions (NIAAA-2Q): "Do you sometimes drink alcohol?" and "How many times in the past year have you had 4/5 (for women/men) or more drinks in a day?" NIAAA-2Q is considered positive when the answer to the second question is one or more. The NIAAA suggests that patients testing positive at NIAAA-2Q should be further investigated by means of the following two questions to assess the weekly average of alcohol intake: "On average, how many days a week do you have an alcoholic drink?" and "On a typical drinking day, how many drinks do you have?" According to the NIAAA, weekly average of alcohol intake should be 14 or fewer drinks for men up to age 65 years and 7 or fewer drinks for women and men older than 65 (NIAAA, 2007). This further evaluation increases the total number of questions from two (NIAAA-2Q) to four (NIAAA-4Q).

To our knowledge, to date no study has evaluated the ability of NIAAA-2Q to detect unhealthy alcohol drinkers in a surgical setting. We predicted that, should NIAAA-2Q and AUDIT be comparable in this setting, there would be a substantial advantage in using the shorter NIAAA-2Q. Accordingly, in the present study the efficacy of NIAAA-2Q in detecting unhealthy drinkers was evaluated among surgical patients using AUDIT as the reference standard when both instruments were administered by anesthetists. Moreover, in the present study, at variance with the screening suggested by the NIAAA guide, the two questions aimed at assessing the weekly average of alcohol intake were administered to all patients, not only to patients testing positive at NIAAA-2Q. The results obtained from NIAAA-4Q were then compared with those obtained from AUDIT, used as a reference standard.

Method

Setting and patients

Subjects were systematically selected (every fifth patient) among inpatients admitted to the anesthesia and critical care unit of the University Teaching Hospital in Cagliari (Italy)

between January and June 2009. Each year, the hospital performs approximately 2,000 procedures that use anesthesia for thoracic, vascular, abdominal, and endocrine surgery. Exclusion criteria were age less than 18 years and lack of knowledge of the Italian language. All eligible patients were approached at the bedside by an anesthesiologist (one resident, A. Montisci, and two specialists, A. Marchi and G. Finco) and asked to take part in the study. In view of the noninterventional nature of the study, approval from an ethical committee was not required. However, patients were nonetheless informed of the study aims, assured that their answers would be kept strictly confidential, and asked to sign a consent form.

Data collection and questionnaires

Sociodemographic features and clinical data were collected during the anesthesiological visit. Anesthetists administered to patients the Italian translation of NIAAA-4Q first (Agabio and Gessa, 2006) and AUDIT second. NIAAA-2Q was considered positive when patients consumed at least four/five drinks in a day (for women/men). NIAAA-4Q was considered positive when patients consumed at least four/five drinks in a day (for women/men) and/or when weekly alcohol intake was greater than 14 drinks for men up to age 65 years and greater than 7 drinks for women and men older than 65 years of age. AUDIT was considered positive when it achieved a score of 8 or more for men up to 60 years of age and 4 or more for women and men older than 60 years of age. For comparison purposes, the AUDIT-C score was calculated by summing the scores for AUDIT questions 1 to 3.

Statistical analysis

Continuous variables are reported as the median and interquartile range because of skewed distributions. The interquartile range was calculated as the difference between the 75th and 25th percentile. Categorical variables are reported as the number and percentage of subjects.

The ability of NIAAA-2Q and also of NIAAA-4Q to detect unhealthy drinking was evaluated using AUDIT as a criterion standard to identify unhealthy alcohol drinkers by calculating the true positive rate (TPR, or sensitivity), false positive rate (FPR, or 1 − specificity), positive predictive value (PPV), negative predictive value (NPV), positive likelihood ratio (PLR), and negative likelihood ratio (NLR) (Pepe, 2004). TPR (sensitivity) is the proportion of affected patients with a positive test result; FPR (1 − specificity) is the proportion of unaffected patients with a positive test result; PPV is the proportion of patients testing positive who are correctly diagnosed; NPV is the proportion of patients testing negative who are correctly diagnosed; PLR measures the extent to which the odds of disease increase on testing positive; and NLR measures the extent to which the odds of disease decrease when testing negative. Confidence intervals (95%) for TPR, FPR, PPV, and NPV were calculated using the "exact" Clopper–Pearson method, and those of PLR and NLR were calculated using Simel's method. Multivariable likelihood ratio regression was used to test whether gender (female vs. male) and age (<60 years vs. ≥60 years) were associated with PLR or NLR (Leisenring and Pepe, 1998; Pepe, 2004). Statistical analysis was performed using Stata 11.1 (Stata Corp LP, College Station, TX).

Table 1. Sociodemographic characteristics of a sample of 200 surgical patients

Variable	*n* (%)
Gender	
Female	131 (65.5)
Male	69 (34.5)
School degree[a]	
Junior	47 (23.5)
Secondary	74 (37.0)
High	56 (28.0)
Graduate	23 (11.5)
Civil status	
Single	38 (19.0)
Married	139 (69.5)
Separated or widowed	23 (11.5)
Smoking status	
Nonsmoker	105 (52.5)
Smoker	33 (16.5)
Previous smoker	62 (31.0)

[a]A junior school degree requires 5 years of school; a secondary school degree requires an additional 3 years (8 years total); a high school degree requires another 5 years (13 years total); a graduate degree requires at least 4 additional years (≥17 years total).

Results

A total of 203 potentially eligible patients were systematically evaluated to reach the scheduled number of 200 subjects, corresponding to 10% of total admissions per year to our unit. All patients agreed to participate; one subject had to be excluded because of a lack of understanding of the Italian language and two because of the severity of their disease.

The 200 patients had a median (interquartile range) age of 58 (22) years (range: 18–87 years) and were mostly women (65.5%). Their sociodemographic characteristics are reported in Table 1. The numbers of unhealthy alcohol drinkers according to AUDIT, NIAAA-2Q, and NIAAA-4Q are shown in Table 2. As shown in Table 2, 47 patients (24 men and 23 women, 23.5%) were identified as unhealthy drinkers by AUDIT, 25 (18 men and 7 women, 12.5%) by NIAAA-2Q, and 57 (35 men and 22 women, 28.5%) by NIAAA-4Q.

The relationships between the NIAAA-2Q, NIAAA-4Q, and AUDIT scores are reported in Table 3. Among unhealthy alcohol drinkers identified by AUDIT, 8 (17.0%) tested positive on NIAAA-2Q, and 36 (76.6%) tested positive on NIAAA-4Q. On the other hand, among subjects not identified as unhealthy alcohol drinkers by AUDIT, 17 (11.1%)

Table 2. Unhealthy alcohol drinkers among a sample of 200 surgical patients according to AUDIT, according to NIAAA-2Q (patients who reported drinking ≥4/5 drinks per occasion [women/men]), and according to NIAAA-4Q (patients who reported drinking ≥4/5 drinks per occasion [women/men] and/or >7/14 drinks per week [women/men])

Unhealthy drinking	*n* (%)
According to AUDIT	
No	153 (76.5)
Yes	47 (23.5)
According to NIAAA-2Q	
No	175 (87.5)
Yes	25 (12.5)
According to NIAAA-4Q	
No	143 (71.5)
Yes	57 (28.5)

Notes: AUDIT = Alcohol Use Disorders Identification Test; NIAAA-2Q = National Institute on Alcohol Abuse and Alcoholism two-question tool for the detection of unhealthy drinking; NIAAA-4Q = NIAAA four-question tool for the detection of unhealthy drinking.

tested positive on NIAAA-2Q, and 21 (13.7%) tested positive on NIAAA-4Q. Values of TPR (sensitivity), FPR (1 − specificity), PPV, NPV, PLR, and NLR associated with the detection of unhealthy drinking by NIAAA-2Q as compared with AUDIT are given in Table 4.

Values of TPR (sensitivity), FPR (1 − specificity), PPV, NPV, PLR, and NLR associated with the detection of unhealthy drinking by NIAAA-4Q as compared with AUDIT are provided in Table 5. Because the diagnostic cut points of AUDIT and NIAAA-4Q depend on sex and age, we used likelihood ratio regression to test whether the odds of disease given a positive or negative NIAAA-4Q would change with sex and age. Whereas NLR was not associated with sex and age, PLR was associated with gender (relative likelihood ratio for women = 5.3, 95% CI [2.0, 13.8], $p < .001$) and to a much lesser degree with age (relative likelihood ratio for age ≥60 years = 7.3, 95% CI [1.01, 52.3], $p = .049$). Thus, the greatest PLR was detected for women ages 60 years and older (PLR = 81.0, 95% CI [10.8, 612.9]), although this estimate was quite imprecise owing to the variability of the effect of age.

Table 6 shows the relationships between NIAAA-2Q, NIAAA-4Q, and AUDIT-C. Seventeen (8.5%) patients were at increased risk for postoperative complications according to AUDIT-C. Among these, 9 (52.9%) patients tested positive on NIAAA-2Q, and 16 (94.1%) tested positive on NIAAA-4Q. Conversely, 183 (91.5%) patients were identified as at low risk for postoperative complications; among these, 16 (8.7%) patients tested positive on NIAAA-2Q, and 41 (22.4%) tested positive on NIAAA-4Q.

Discussion

The present study evaluated the accuracy of NIAAA-2Q and NIAAA-4Q in detecting unhealthy alcohol consumption

Table 3. Relationships between NIAAA-2Q (patients who reported intake of ≥4/5 drinks per occasion [women/men]), NIAAA-4Q (patients who reported intake of ≥4/5 drinks per occasion [women/men] and/or >7/14 drinks per week [women/men]), and AUDIT score

	Unhealthy drinking according to NIAAA-2Q and NIAAA-4Q					
	NIAAA-2Q ≥4/5 drinks per occasion (women/men)		>7/14 drinks per week (women/men)		NIAAA-4Q One or both previous conditions	
Variable	No *n* (%)	Yes *n* (%)	No *n* (%)	Yes *n* (%)	No *n* (%)	Yes *n* (%)
Total subjects (*n* = 200)	175 (87.5)	25 (12.5)	160 (80.0)	40 (20.0)	143 (71.5)	57 (28.5)
AUDIT score						
0 (*n* = 65)	65 (100.0)	0 (0.0)	64 (98.5)	1 (1.5)	64 (98.5)	1 (1.5)
1 (*n* = 25)	24 (96.0)	1 (4.0)	25 (100.0)	0 (0.0)	24 (96.0)	1 (4.0)
2 (*n* = 23)	18 (78.3)	5 (21.7)	23 (100.0)	0 (0.0)	18 (78.3)	5 (21.7)
3 (*n* = 23)	21 (91.3)	2 (8.7)	21 (91.3)	2 (8.7)	19 (82.6)	4 (17.4)
4 (*n* = 46)	38 (82.6)	8 (17.4)	22 (47.8)	24 (52.2)	17 (37.0)	29 (63.0)
5 (*n* = 9)	5 (55.6)	4 (44.4)	4 (44.4)	5 (55.6)	1 (11.1)	8 (88.9)
6 (*n* = 4)	3 (75.0)	1 (25.0)	1 (25.0)	3 (75.0)	0 (0.0)	4 (100.0)
7 (*n* = 1)	0 (0.0)	1 (100.0)	0 (0.0)	1 (100.0)	0 (0.0)	1 (100.0)
8 (*n* = 1)	0 (0.0)	1 (100.0)	0 (0.0)	1 (100.0)	0 (0.0)	1 (100.0)
9 (*n* = 2)	1 (50.0)	1 (50.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (100.0)
15 (*n* = 1)	0 (0.0)	1 (100.0)	0 (0.0)	1 (100.0)	0 (0.0)	1 (100.0)
Total AUDIT positive patients (*n* = 47)	39 (83.0)	8 (17.0)	14 (29.8)	33 (70.2)	11 (23.4)	36 (76.6)
Total AUDIT negative patients (*n* = 153)	136 (88.9)	17 (11.1)	146 (95.4)	7 (4.6)	132 (86.3)	21 (13.7)

Notes: AUDIT = Alcohol Use Disorders Identification Test; NIAAA-2Q = National Institute on Alcohol Abuse and Alcoholism two-question tool for the detection of unhealthy drinking; NIAAA-4Q = National Institute on Alcohol Abuse and Alcoholism four-question tool for the detection of unhealthy drinking.

Table 4. Accuracy of NIAAA-2Q (patients who reported intake of ≥4/5 drinks per occasion [women/men]) in detecting unhealthy alcohol drinkers as compared with AUDIT used as a criterion method

Variable	Point estimate	Lower 95% CI	Upper 95% CI
True positive rate (sensitivity)	0.19	0.10	0.33
False positive rate (1 specificity)	0.10	0.01	0.16
Positive predictive value	0.36	0.20	0.55
Negative predictive value	0.78	0.72	0.84
Positive likelihood ratio	1.80	0.87	3.90
Negative likelihood ratio	0.90	0.78	1.00

Notes: NIAAA-2Q = National Institute on Alcohol Abuse and Alcoholism two-question tool for the detection of unhealthy drinking; AUDIT = Alcohol Use Disorders Identification Test; CI = confidence interval.

Table 5. Accuracy of NIAAA-4Q (patients who reported intake of ≥4/5 drinks per occasion [women/men] and/or > 7/14 drinks per week [women/men]) in detecting unhealthy alcohol drinkers as compared with AUDIT used as a criterion method

Variable	Point estimate	Lower 95% CI	Upper 95% CI
True positive rate (sensitivity)	0.79	0.64	0.89
False positive rate (1 specificity)	0.13	0.00	0.19
Positive predictive value	0.65	0.51	0.77
Negative predictive value	0.93	0.88	0.97
Positive likelihood ratio	6.00	3.90	9.30
Negative likelihood ratio	0.24	0.14	0.43

Notes: NIAAA-4Q = National Institute on Alcohol Abuse and Alcoholism four-question tool for the detection of unhealthy drinking; AUDIT = Alcohol Use Disorders Identification Test; CI = confidence interval.

in 200 surgical patients using AUDIT as a reference standard. The frequency of unhealthy alcohol drinking detected by AUDIT (23.5%) was similar to that recently reported among inpatients (26%; Roche, 2006). NIAAA-2Q (12.5%) detected a rate corresponding to approximately half this value, whereas NIAAA-4Q (28.5%) detected an almost identical rate. Namely, the NPV and PPV of NIAAA-2Q in detecting unhealthy drinkers when tested against AUDIT were 0.78 and 0.36, respectively; the same values of NIAAA-4Q were 0.93 and 0.65, respectively. These values depend not only on the performance of NIAAA-2Q and NIAAA-4Q but also on the prevalence of disease (23.5% as determined by AUDIT). The NPV of 0.78 and 0.93 imply that the majority of subjects (78% and 93%) with a negative NIAAA-2Q and NIAAA-4Q, respectively, will also have a negative AUDIT. On the other hand, the PPV of 0.36 and 0.65 imply that only 36% and 65% of patients with a positive NIAAA-2Q and NIAAA-4Q, respectively, will actually have a positive AUDIT. This information should be evaluated together with data provided by the diagnostic likelihood ratios, which do not depend on the prevalence of disease and are more widely used by clinicians. Namely, PLRs of 1.80 and 6.00 indicate

Table 6. Relationship between NIAAA-2Q (patients who reported intake of ≥4/5 drinks per occasion [women/men]), between NIAAA-4Q (patients who reported intake of ≥4/5 drinks per occasion [women/men] and/or >7/14 drinks per week [women/men]), and AUDIT-C

	Unhealthy drinking according to NIAAA-2Q and NIAAA-4Q					
	NIAAA-2Q ≥4/5 drinks per occasion (women/men)		>7/14 drinks per week (women/men)		NIAAA-4Q One or both previous conditions	
AUDIT-C score	No *n* (%)	Yes *n* (%)	No *n* (%)	Yes *n* (%)	No *n* (%)	Yes *n* (%)
≥5						
Men, *n* = 16	8 (50.0)	8 (50.0)	4 (25.0)	12 (75.0)	1 (6.2)	15 (93.8)
Women, *n* = 1	0 (0.0)	1 (100.0)	1 (100.0)	0 (0.0)	0 (0.0)	1 (100.0)
Total, *n* = 17	8 (47.1)	9 (52.9)	5 (29.4)	12 (70.6)	1 (5.9)	16 (94.1)
<5						
Men, *n* = 53	43 (81.1)	10 (18.9)	41 (77.4)	12 (22.6)	33 (62.3)	20 (37.7)
Women, *n* = 130	124 (95.4)	6 (4.6)	114 (87.7)	16 (12.3)	109 (83.8)	21 (16.2)
Total, *n* = 183	167 (91.3)	16 (8.7)	155 (84.7)	28 (15.3)	142 (77.6)	41 (22.4)

Notes: NIAAA-2Q = National Institute on Alcohol Abuse and Alcoholism two-question tool for the detection of unhealthy drinking; NIAAA-4Q = National Institute on Alcohol Abuse and Alcoholism four-question tool for the detection of unhealthy drinking; AUDIT-C = Alcohol Use Disorders Identification Test–consumption.

that the finding of a positive NIAAA-2Q and NIAAA-4Q is approximately two and six times more likely, respectively, in AUDIT-positive (i.e., unhealthy alcohol drinkers) than among AUDIT-negative subjects. The corresponding NLRs of 0.90 and 0.24 imply that a negative NIAAA-2Q and NIAAA-4Q are 10% and 76% less likely, respectively, in the same patients. In other words, among AUDIT-positive patients, the finding of a positive NIAAA-4Q is approximately three times more likely than a positive NIAAA-2Q, and a negative NIAAA-4Q is approximately seven times less likely than a negative NIAAA-2Q. Interestingly, the highest PLR for NIAAA-4Q was observed in women ages 60 years and older. In clinical practice, a low PPV is often preferable to a low NPV (Allen et al., 1995). Indeed, patients wrongly classified as unhealthy drinkers would undergo further investigation, leading to recognition of their true alcohol intake. In conclusion, these results demonstrate how the detection of unhealthy alcohol drinking may be considerably increased by the administration of questions aimed at assessing the weekly average of alcohol intake.

This study had some limitations, including the lack of a gold-standard method for assessing unhealthy alcohol consumption, such as an interview performed by a skilled clinician. Consequently, this study was unable to evaluate the sensibility and specificity of NIAAA-2Q and NIAAA-4Q against the real number of unhealthy alcohol drinkers and their different categories. However, the present study was aimed at evaluating the performance of NIAAA-2Q and NIAAA-4Q compared with AUDIT, used as a reference standard, when these instruments are administered by anesthetists to surgical patients. Another limitation of the present study is that NIAAA-2Q, NIAAA-4Q, and AUDIT may explore different parts of the spectrum of unhealthy alcohol drinking. As an example, the question relative to alcohol consumption per occasion (i.e., the second question of NIAAA-2Q) is more accurate in detecting the less severe categories of unhealthy alcohol consumption than AUDs (Seale et al., 2006). Other studies have found a lack of overlap between AUDIT and biochemical markers of unhealthy alcohol drinking (Reinert and Allen, 2002). Accordingly, discrepancies between data from AUDIT, NIAAA-2Q, and NIAAA-4Q were also observed in the present study. Specifically, more than 80% of AUDIT-positive patients were NIAAA-2Q negative, nearly 30% did not exceed the weekly limit, and—on the whole—23% were NIAAA-4Q negative. Possible explanations for the discrepancy found in the present study between AUDIT and NIAAA-2Q may be, at least in part, the result of the large number of women recruited in the present study (65.5%) and the very low number of patients (2%) who achieved a score equal to or greater than 8 on AUDIT (i.e., the original cut point of this questionnaire). Other possible explanations for this discrepancy may be the high integration of alcohol in Italian cultural norms (Scafato et al., 2006) and the tendency of patients with AUDs to deny their drinking habits (Morse and Flavin, 1992). Therefore, patients may possibly have underreported their alcohol consumption, with the result being a high number of negative answers, especially to the question relative to the alcohol consumption per occasion.

Alcohol screening tests produce similar results in different medical settings (Williams and Vinson, 2001). For instance, the question relating to alcohol consumption per occasion gave similar results in patients followed at emergency care departments and at home (Canagasaby and Vinson, 2005). Conversely, the expertise of the persons who administer the questionnaires and the way they are presented are important determinants of the reliability of a test (Reinert and Allen, 2007). Interestingly, a recent study found that anesthetists achieved the worst results in detecting unhealthy alcohol drinkers when compared with other medical operators (Shourie et al., 2007). It is highly likely that the results of the present study were conditioned by the operators who administered the screening tests rather than by the surgical setting.

Another limitation of the present study is that neither AUDIT, NIAAA-2Q, nor NIAAA-4Q was specifically designed for preoperative assessment. For instance, they do not specify whether alcohol consumption occurred over the previous month, a relevant time span for the prediction of postoperative complications (Tønnesen et al., 2009). However, questionnaires are important in revealing potential problems that may require further investigation (Fiellin et al., 2000). As a general rule, the hospital stay provides an opportunity to assess alcohol consumption, particularly when there is a high degree of collaboration, as was the case in the present study. Clearly, to take advantage of this opportunity, the screening instruments should be systematically administered to all patients before surgery (or immediately afterward if the surgery cannot be delayed).

More than 50% and 90% of patients at risk of postoperative complications according to AUDIT-C were positive on NIAAA-2Q and NIAAA-4Q, respectively. These results, moreover, suggest that administration of the two questions aimed at assessing the weekly average of alcohol intake may increase the detection of unhealthy drinkers. It has recently been found that exceeding the drinking limit per occasion is not associated with postoperative complications (Bradley et al., 2011). This result may lead to high alcohol consumption per occasion in surgical settings being neglected. However, surgical patients should be screened for alcohol consumption that might put them at risk for not only postoperative complications but also for future health issues. Although small amounts of alcohol taken regularly may have beneficial effects (Corrao et al., 2004), there are many circumstances in which the intake of any amount of alcohol is risky. Alcohol should be avoided by persons taking selected medications or affected by a disease worsened by alcohol (Moore et al.,

2007). These conditions may be especially frequent among hospitalized patients. A systematic and accurate inquiry of alcohol intake would allow surgeons to refer patients with at-risk drinking to general physicians and specialists for more detailed evaluation (Kork et al., 2010). A recent study found that cooperation between primary care physicians and surgeons increased the frequency of referrals to preoperative alcohol cessation programs (Tønnesen et al., 2010).

Despite the lack of data on the efficacy of brief interventions performed on inpatients, all unhealthy drinkers admitted to a general hospital should be informed of the possible risks associated with alcohol consumption (McQueen et al., 2009). Brief interventions may be more successful among patients with nondependent unhealthy alcohol use who do not view their drinking as problematic (Williams et al., 2010). Accordingly, the time before surgery should be considered a "teachable moment" for unhealthy drinkers, and the surgical team should take advantage of this time (Shourie et al., 2006).

Finally, this study confirms that unhealthy alcohol consumption is underdetected in hospital patients (Kip et al., 2008; Moore et al., 1989). Only 1% of our patients were classified as unhealthy alcohol drinkers on medical charts by hospital surgeons. This is in stark contrast to the estimates provided by NIAAA-2Q, NIAAA-4Q, and AUDIT. Although men were more frequently at-risk drinkers, the percentage of women with unhealthy drinking was not negligible. This finding suggests that women should be screened for unhealthy alcohol consumption to the same extent as men.

In conclusion, the identification of unhealthy alcohol drinkers among surgical patients is fundamental in allowing surgery to be delayed whenever possible and helping patients to enter an alcohol cessation program. If urgent surgery is required, knowledge of alcohol intake will lead to improved management of the risk of postoperative complications. Patients may also receive counseling about the alcohol-related risks that may be manifested following discharge from the hospital. However, the findings of the present study reveal how unhealthy alcohol consumption is substantially underestimated in the surgical setting. Because physicians report a lack of time as one of the main causes of ineffective screening, a simple and rapid tool such as NIAAA-4Q might prove useful in a busy setting. In the present study, NIAAA-4Q was shown to be reasonably more accurate than NIAAA-2Q in detecting unhealthy alcohol drinking compared with AUDIT. The relatively high rate of false positives obtained was counterbalanced by the high true positive rate and by the prognostic importance of the outcome. Further research should be undertaken to replicate the results obtained in larger samples of surgical patients and to compare the features of NIAAA-2Q and NIAAA-4Q with those of other brief screening tests, like AUDIT-C, in surgical patients and with other populations.

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