ORIGINAL ARTICLE

3 Evolution of patients visiting the 4 emergency department due to alcohol 5 intoxication

6 Stephane Deman^{1*}, Sandra Verelst², Ives Hubloue³

7 ABSTRACT

8 **Background:** Only a few studies investigated the evolution of characteristics of patients presenting at the
9 emergency department (ED) due to alcohol intoxication. The aim of this study was to investigate the evolution
10 of three patient characteristics: age, gender, and blood alcohol concentration (BAC).

11 **Methods:** A retrospective review of medical records of patients visiting the ED at two large university hospitals
12 in Belgium was performed. All patients older than 16 years, presenting to the ED with a primary diagnosis of
13 alcohol intoxication in 2009 were compared with those presenting in 2014.

14 **Results:** Both hospitals had a marked increase in visits due to alcohol intoxication. Male-to-female ratio in one
15 hospital showed a redistribution toward women, whereas this remained stable in the other hospital. Average
16 BAC remained stable in both sexes and hospitals. More severe BAC-levels (>3 g/l) diminished in male patients
17 of one hospital but kept stable in women. The other hospital showed no change in more severe BAC-levels (>3
18 g/l) of both sexes.

19 **Conclusion:** Since total alcohol consumption in Belgium decreased, but total number of alcohol intoxicated
20 patients increased in both hospitals, there probably has been a change in alcohol consumption pattern.
21 Changes in the characteristics of patients visiting the ED due to alcohol intoxication still turns out to be demo-
22 graphic dependent, since the tendency of more young patients presenting could only be observed in one out
23 of two hospitals. Implementing a screening method for alcohol abuse should be considered at the ED.

24 **Keywords:** Alcohol abuses, evolution of characteristics, age distribution, gender, blood alcohol concentration,
25 alcohol consumption pattern, high-risk groups and trends.

26 Introduction

27 According to the World Health Organization (WHO), the
28 definition of intoxication is the following: “Intoxication
29 is a condition that follows the administration of a
30 psychoactive substance and results in disturbances in the
31 level of consciousness, cognition, perception, judgement,
32 affect, or behavior, or other psychophysiological
33 functions and responses.” Therefore, the acute alcohol
34 intoxication results from the consumption of large
35 amounts of alcohol [1,2].

36 Alcohol-related problems are a major health care
37 problem for which patients often seek help at the
38 emergency department (ED). 2%-40% of patients
39 presenting to the ED are having alcohol-related
40 problems, depending on the used methodologic criteria
41 [3,4]. The annual increase in alcohol-related visits
42 places a burden on an often already saturated ED. The
43 past decade there has been a shift in the characteristics

44 of patients visiting the ED due to alcohol intoxication. 44
45 Patients are becoming younger, and more women are 45
46 presenting [5,6]. 46

47 Following published data by Verelst et al. [7], we aimed 47
48 to analyze and compare similar data from 2009 and 2014 48
49 in order to investigate trends in characteristics of patients 49
50 and identifying high risk groups. 50

Correspondence to: Stephane Deman

*Department of Emergency Medicine and Research
Group on Emergency and Disaster Medicine, University
Hospital Brussels, Brussels, Belgium.

Email: stephane_deman@hotmail.com

*Full list of author information is available at the end of
the article.*

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Survey data remains a critical mean for monitoring alcohol consumptions patterns and trends although there is still limited work done about this topic. The knowledge about trends can be used by health care policy makers to focus on high risk groups. It can also help (para)medics to identify patients with alcohol-related problems more easily.

Materials and Methods

This observational study involved a retrospective medical record review of all patients presenting to the ED in 2009 or 2014 because of alcohol intoxication. Using physician discharge diagnosis codes, we identified all ED visits that appeared to be made primarily for alcohol intoxication. If the patient co-ingested other substances, the case was excluded.

The WHO International Classification of Diseases, 10th Revision, codes that were considered to be indicative of such a visit, when used as primary diagnosis, were acute alcohol intoxication (code F10.0) and dependence syndrome (code F10.2). 1,428 cases of University Hospital of Leuven (UHL) were obtained and 832 cases of University Hospital of Brussels (UHB).

Every case was then checked by the investigator to be sure all cases fulfilled the inclusion criteria. As a result, 484 UHL-cases and 440 UHB-cases were excluded.

The study was conducted at the ED of two tertiary referral academic teaching hospitals, in Leuven and Brussels (Belgium). Both ED's have an annual census of approximately 55,000 (UHL) and 68,000 (UHB) patients, with an average hospital admission rate of, respectively, 36% and 21%. In general, the treating physician routinely

asks the patients about their alcohol consumption level. If alcohol use is suspected, blood alcohol concentration (BAC) levels are usually routinely obtained.

All patients older than 16 years with a primary diagnosis of alcohol intoxication were included. If a patient presented multiple times within the study period, with each presentation meeting the inclusion criteria, each visit was considered as a separate case. Patients with co-ingestion of alcohol were excluded from the study.

The following patient characteristics were extracted from both hospital information systems: age, gender and BAC levels.

Further analysis was done by transferring the retrieved data to a Microsoft Excel® spreadsheet. Statistics were performed using Statistical Package for the Social Sciences (IBM, New York). Descriptive statistics for continuous data included central tendency measures (mean and median) and the percentage frequency of occurrence was used for categorical-level data. Student's *t*-test and χ^2 test were used for comparison of the groups. For multiple group comparisons, we used analysis of variance.

Results

UHL included 423 patients in 2009 (137 women and 286 men) versus 521 patients in 2014 (208 women and 313 men), respectively, 0.77% and 0.96% ($p = 0.01$) of all ED visits. UHB included 155 patients in 2009 (54 women and 101 men) versus 237 patients in 2014 (89 women and 148 men), respectively 0.23% and 0.33% ($p = 0.01$) of all ED visits. Age range of included patients was 16-88 years, with an equal median age of 39 years old (Figure 1).

Figure 1. Age distribution of included patients.

Male-to-female ratio (M/F) in UHL-patients showed a significant redistribution toward women: 2.09 in 2009 versus 1.50 in 2014 ($p = 0.02$). This was due to a rise in following age groups: 16-20, 31-40 and 51-60 years old. M/F-ratio remained stable for UHB-patients: 1.87 in 2009 versus 1.66 in 2014 ($p = 0.59$), although we noticed a significant increase in age groups 21-30 and 31-40 years old (Figure 2).

As for the male age distribution, a relative redistribution toward the younger age groups 16-20 years old and 21-30 years old was seen in UHL. In contrast, a decrease was seen in the age group 31-40 years. Younger age groups remained stable in UHB-patients (Figure 3).

Mean BAC remained stable in both sexes and hospitals: 2.47 g/l for women and 2.62 g/l for men. Median female BAC in both hospitals was 2.45 g/l in 2009 versus 2.48 g/l in 2014. A significant increase in female BAC was seen in age groups 31-40 and 41-50 years old. More severe BAC-levels (>3 g/l) diminished in male patients of UHL ($p = 0.01$), but kept stable in women. This trend was not seen in UHB-patients. UHB showed no change in more severe BAC-levels (>3 g/l) of both sexes.

Median male BAC was 2.64 g/l in 2009 versus 2.60 g/l in 2014. A significant increase in male BAC was seen in age groups 16-20 years old (2.10 g/l in 2009 versus 2.21 g/l in 2014) and 51-60 years old (2.52 g/l in 2009 versus 2.66 g/l in 2014). A significant relative increase in male BAC was seen for alcohol levels between 2 and 2.99 g/l, which was not the case for higher BAC-levels.

Discussion

Over the last decades, caregivers and authorities mainly focused on the effect of illegal drugs and their influence on the ED, thereby ignoring the magnitude of alcohol. However, the alcohol is still the most favorable drug [8].

This survey showed in both hospitals a marked increase in number of patients presenting at the ED with a primary diagnosis of alcohol intoxication. These results are consistent with earlier studies in the US (47% between 2006 and 2014), England (50% between 2002 and 2014) and Canada (35% between 2003 and 2016) [4,9,10].

Although men continue to have much higher ED visits due to alcohol intoxication, visit rates rose faster in women. The significant increase in women can be explained by a possible escalation in harmful alcohol consumption amongst women or the rising health issue of 'binge drinking' although further investigation is needed. Binge drinking is defined as drinking at least four drinks for women and five drinks for men within a period of 2 hours [14-16].

This trend is worrisome since binge drinking during adolescence has been proved to be related to alcohol dependence during adult age, which is the cause of chronic alcohol use and alcohol addiction [17-19].

We did not observe a significant increase in adolescents, which is not consistent with global trends. This could implicate that the global trend of more young alcohol intoxicated patients presenting at the ED is demographic dependent although this should first be confirmed by further investigation [7,11,12].

Figure 2. Age distribution of included female patients.

Figure 3. Age distribution of included male patients.

172 Since alcohol consumption decreased by 18% over the last
 173 20 years in Belgium, but total number of ED visits due to
 174 alcohol intoxication increased, we can assume that there has
 175 been a change in alcohol consumption pattern [8,12,13].

176 Middle-aged people, and particular men, represent a
 177 large group of alcohol intoxicated patients in our study.
 178 This suggests that middle aged patients might be more
 179 vulnerable to heavy episodic drinking or chronic alcohol
 180 use/abuse [17-19].

181 Possible strategies for reducing the number of ED
 182 admissions due to alcohol intoxication could include:
 183 prohibiting alcohol advertisements, raising alcohol
 184 taxes, putting restrictions on the availability of alcohol,
 185 organizing information campaigns, identifying problem
 186 drinkers earlier by for example screening persons
 187 who committed violence, random breath testing,
 188 implementation of screening tests, effective treatment by
 189 doing early counseling, and offering follow-up contacts
 190 or self-helping strategies.

191 ED's should consider implementing a screening tool such
 192 as the Paddington Alcohol Test (PAT) or Cut-Annoyed-
 193 Guilty-Eye (CAGE) test for every patient visiting the ED
 194 or for the population identified as high risk group in this
 195 study. This would contribute to a more efficient detection
 196 of alcohol-related problems in an earlier state, for which
 197 intervention by a psychiatrist can be implemented.
 198 Contact with the primary physician is very important
 199 in handling this problem and ensuring close follow-up.
 200 These are all topics for debate [20-23].

Limitations

201
 202 The results of this study are subject to some limitations.
 203 First, since the selection of cases depends on the accuracy
 204 of the discharge diagnostic codes, the selection of cases
 205 might be incomplete. This limitation was minimized
 206 by starting from a large pool of 2,260 cases and then
 207 excluding 924 cases who did not matched the inclusion
 208 criteria. The reason for admission of each patient was
 209 manually rechecked for minimizing registration bias.
 210 Second, the study was performed in only two university
 211 hospitals in Belgium. The estimation of prevalence rates
 212 in Belgium or worldwide is, therefore, impossible. Third,
 213 some alcohol intoxicated patients might be undetected
 214 when presenting at the ED, since physicians might have
 215 missed the symptoms of alcohol intoxication. Moreover,
 216 no screening test was performed which makes missing
 217 patients more likely.

218 Fourth, the study took place in two hospitals with a
 219 referral center for patients with alcohol use disorders,
 220 in contrast to other surrounding hospitals, because it has
 221 a psychiatric service which is available 24/7. However,
 222 the availability of the psychiatric service has already
 223 been long-standing. Therefore, it is unlikely that the
 224 availability of this service is responsible for the increase
 225 in intoxicated patients over the 5-year period. Fifth,
 226 incomplete medical records which are the result of the
 227 retrospective study design could cause important data to
 228 be missed.

Sixth, both hospitals did not use a screening tool for detecting alcohol abuse. This way some cases could have been missed.

Finally, comparison of this study with other studies investigating the epidemiology of alcohol intoxication at the ED is difficult, since epidemiology of alcohol intoxication is multifactorial.

Conclusion

There has been a change in population drinking pattern, since total alcohol consumption in Belgium decreased, but total number of alcohol intoxicated patients increased. The rising phenomenon of social media and binge drinking could be an explanation for this change in consumption pattern, although further investigation is needed to confirm this.

This study confirms the rising burden of alcohol intoxicated patients on the ED and identified the most vulnerable groups.

Changes in the characteristics of patients visiting the ED due to alcohol intoxication still turns out to be demographic dependent, since the tendency of more young patients presenting could only be observed in one out of two hospitals. On the other hand, the rising tendency of more women presenting was observed in both hospitals, but only significant in one out of two. Further studies should focus on identifying the causes behind those patient groups and policy-makers should consider more focusing their interventions on the identified high risk groups to reduce harmful alcohol use.

These findings highlight the importance of the detection of alcohol misuse in the ED and early interventions to prevent the development of dependency. Therefore, the ED should consider a screening tool such as the PAT or CAGE-test. This would contribute to a more efficient detection of alcohol-related problems in an earlier stage, for which brief intervention by the psychiatrist can be implemented. Bearing in mind that ED admissions are only the tip of the iceberg, well-coordinated strategies against unhealthy alcohol use are urgently needed.

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List of Abbreviations

BAC	Blood alcohol concentration
ED	Emergency Department
M/F	Male-to-female ratio
UHB	University hospital of Brussels
UHL	University hospital of Leuven

Conflict of interest
The authors declared that they have no conflict of interest.

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Consent for publication
Given the observational design of the study, informed consent was waived.

Ethical approval
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Author details
Stephane Deman¹, Sandra Verelst², Ives Hubloue¹
1. Department of Emergency Medicine and Research Group on Emergency and Disaster Medicine, University Hospital Brussels, Jette, Belgium.
2. Emergency Department, University Hospital Leuven, Leuven, Belgium.

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