Master of Science in Public Health

Master Thesis

Using routine emergency department data for syndromic surveillance of acute alcohol intoxication –

a methodological approach in developing syndrome definitions to detect alcohol-related emergency department visits

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Author: Carmen Schlump

Registration number:

Supervisor: Dr. Julia Thom

Supervisor: PD Dr. Linus Grabenhenrich, MPH

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Carmen Schlump

Berlin, 21.12.2021

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Abstract

Background:

The prevalence and intensity of alcohol use varies among subgroups in the population and changes over time. Routine emergency department data provide a potential for monitoring mental health use cases to gather information on frequencies and distributions of specified health events in real time. For this purpose, the development of syndrome definitions for the continuous recording and detection of acute changes in alcohol-related visits and acute alcohol intoxications was explored.

Methods:

Routinely collected data from 18 emergency departments in Germany were analysed. Syndrome definitions were developed by combining chief complaints and diagnoses to portray alcohol-related health events presenting to the emergency department. Identified cases were described by characteristics of their distributions and compared to another data source of inpatient health care. Further, cases were presented over time and by separate time period before and during the COVID-19 pandemic.

Results:

From a total of 2,123,492 emergency department attandances, 18,270 cases (0.86%) were identified as alcohol-related visits and 14,141 (0.67%) as acute alcohol intoxications for the observation period between 1 January 2018 to 2 May 2021. Among all acute alcohol intoxications, 71.8% were male and most cases presented in the age category of 45-54 years (20.0%). The syndrome definition continuously recorded cases and displayed acute changes due to the COVID-19 pandemic as well as trends in patient characteristics of identified acute alcohol intoxications.

Conclusion:

The potential and proof of principle for syndromic surveillance of alcohol-related visits, especially acute alcohol intoxications, using emergency department data was demonstrated. The syndrome definition to identify acute alcohol intoxications can be applied for various surveillance purposes. This systematic data collection provides a first foundation for timley information on patterns and changes of alcohol consumption to support prevention and intervention efforts in reducing alcohol-related harm.

Index of Abbreviations

AUD	Alcohol Use Disorder
WHO	World Health Organization
ED	Emergency Department
RKI	Robert Koch Institute
ESEG	Erkennung und Sicherung epidemischer Gefahrenlagen
NoKeDa	Notaufnahme-Kerndatenmodell
MTS	Manchester Triage System
ESI	Emergency Severity Index
CEDIS-PCL	Canadian Emergency Department Information System – Presenting Complaint List
ARV	Alcohol-related Visits
ATX	Acute Alcohol Intoxication
MHH	Medizinische Hochschule Hannover (Medical School Hanover)
HBSC	Health Behaviour in School-Aged Children
AUDIT	Alcohol Use Disorders Identification Test

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1. Background

In many countries, social and cultural life is characterized by high visibility and frequent consumption of alcoholic beverages. However, due to its toxic and psychoactive nature, the use of alcohol contributes as a causal factor to more than 200 disease patterns resulting in approximately 3 million deaths or 5.3% of all deaths in 2016 [1, 2].

Although the alcohol-attributable mortality in Germany is declining, 14,095 adults were still diagnosed with an alcohol-related cause of death in 2014 [3], reflecting that Germany remains one of the high-consumption countries with a per capita consumption (15+ years) of 12.8 litres of pure alcohol in 2019 surpassing the average of the EU member states [4, 5]. The effects of high consumption add up to an alcohol-related economic cost of 57 billion euros per year [4].

Contributing to alcohol-related harm is both the amount of consumption and the pattern of drinking that limits health and safety or leads to other alcohol-related consequences [1, 6]. Chronic alcohol use, characterized by consumption over a long period of time and in a regular manner, may progress to the development of alcohol use disorders (AUD). In this case, the affected person has difficulty controlling alcohol consumption due to strong cravings, which increasingly dominates the consumer's life, resulting in, among other things, the neglect of areas of responsibility or social contacts. With the development of tolerance, the affected person requires larger doses in order to cause an effect of the substance, which, conversely, is accompanied by symptoms of withdrawal when consumption is discontinued [7, 8]. Chronic alcohol use can also involve events of acute alcohol intake caused by a large amount in a short period of time [7].

Currently, the impact of the COVID-19 pandemic is of additional importance to the alcohol-related burden of disease regarding a number of stressors, such as financial difficulties or social isolation, which suggest that they may exacerbate harmful drinking behaviours and increase the prevalence of alcohol use disorders [9-11].

In contrast, the infection control measures introduced to contain the pandemic, which included the closure of restaurants, clubs and bars, may also have led to a decline in drinking amount and intensity as social gatherings providing opportunities to drink were removed [9-11].

1.1 Acute alcohol intoxication

While no threshold level of alcohol intake is considered safe consumption [12], the risk of physical and mental health impairments such as alcohol dependence increases with drinking patterns that involve high amounts and frequent intake [13, 14]. Consuming 5+ alcoholic drinks (4+ for women) on one occasion classifies a consumption pattern as binge drinking (often also referred to as heavy episodic drinking) [14, 15], which causes not only adverse health effects but also social consequences in form of intended and unintended risks to others and oneself [16], including car accidents [17] and suicides [18], violence [19], injuries [20] or infectious diseases [21].

Binge drinking can result in acute disturbances of cognition, consciousness, social behaviour and affect control or other changes in psychophysiology [14]. This is defined as acute alcohol intoxication, a potentially life-threatening condition due to high blood alcohol concentration that often requires treatment in emergency health care [22]. Patients may present with symptoms corresponding to different stages of acute alcohol intoxication [23] ranging from slurred speech, vomiting and impaired coordination to unconsciousness, absent reflexes and respiratory arrest [22, 23]. The principal diagnosis of acute alcohol intoxication is assigned in health care settings when there has been prior heavy alcohol use and no chronic alcohol condition is present at the time of intoxication [14, 22, 24].

Acute alcohol intoxication and its consequences resulting in high societal and economic burden is challenging to emergency health care and for public health authorities overall [22]. Therefore, the harmful use of alcohol is specifically addressed by the United Nations 2030 Agenda for Sustainable Development and calls for the implementation of strategies to prevent and treat alcohol-induced health conditions. One approach is to improve and integrate national surveillance frameworks into the health system to monitor the extent and trends of alcohol consumption and alcohol-related harm [1]. Following these approaches, Germany has made the reduction of harmful alcohol consumption a public health priority within the framework of the National Health Target (*Nationale Gesundheitsziel*) [25].

So far in Germany, the average consumption of pure alcohol is calculated as per capita consumption via production and sales volumes [26, 27]. Prevalences, consumption patterns and trends of alcohol use are collected through representative survey studies [13, 15, 28, 29] that are conducted at regular intervals, whereby some surveys specifically focus on the age groups of children and adolescents [30-32]. A disadvantage of these studies is that different definitions and operationalisation methods are used

to outline drinking patterns. Hence, comparability is not ensured. Additionally, surveys are resource-intensive and do not allow for continuous time series in real-time to detect acute changes. This became apparent regarding the effects of the COVID-19 pandemic on alcohol consumption, for which only few studies are available so far, mostly relating to the early phases of the pandemic [33-35].

The use of routine documentation from the health care system offers advantages to the extent that the data is collected in the care setting by default and even allows for examination of rare health events due to the high data gathering [36]. This can be recognised in the annual report of the German hospital diagnosis statistics (*Krankenhausdiagnosestatistik*) [37], which provides information on the disease by using the principal diagnosis and socio-demographic characteristics of inpatients, to record the volume of patients treated, e.g. for acute alcohol intoxications, as well as its annual development. Such information infrastructures derived from routine data are appropriate for surveillance efforts [38] such as monitoring health-related patterns and their changes over time within a population that shares a common element, like treatment in a health care setting [36, 39]. Routine data from emergency departments may also be suitable for this purpose, since a large proportion of the alcohol-related disease burden occurs not only in inpatient care but also in emergency care.

1.2 Syndromic surveillance using emergency department data

In several countries, routine data from emergency departments (ED) has already been used for the syndromic surveillance of alcohol-related emergency department visits [40, 41] to observe the impact of public health interventions [42] and changes in ED utilization during acute events such as mass gatherings [43, 44] or the COVID-19 pandemic [45]. Syndromic surveillance involves the continuous collection, analysis, interpretation and reporting of data as the foundation for evidence-based policy planning and evaluation of public health interventions to protect and promote population health [46]. To make routine data exploitable for the classification of emergency department visits into specified health events, syndrome definitions are applied. These are formed by combining and grouping clinical information and symptoms that occur in the documentation of the ED setting into categories [47].

The systematic collection of routine data contributes to resource-efficient data use by not requiring any further administrative effort for the EDs and allows flexible and rapid integration and reporting on new indicators in acute crises which was demonstrated by England during the pandemic [48]. In addition, the surveillance of acute alcohol

intoxication can help identify populations at risk for whom the availability of real-time data can facilitate a timely public health response.

In Germany, the Robert Koch Institute (RKI) has been piloting a system for processing and analysing routine data from emergency departments for the purpose of real time public health surveillance and health care research since July 2018 [49]. In previous analyses, syndrome definitions for communicable diseases such as unspecific gastrointestinal infections [50] and acute respiratory illnesses [51] were applied to the data source. In the course of establishing a Mental Health Surveillance at the RKI [52], the emergency department data available to the system was then used for the syndromic surveillance of psychiatric emergencies and suicide attempts [53].

Although the high occurrence of alcohol-related visits in emergency departments is well known [14, 22, 54, 55], only few German studies focus on the description of this emergency department population [56, 57] and hardly address characteristics of acute alcohol intoxication visits [58, 59], which often are only presented as a proportion of the superordinate group of psychiatric emergencies [60-62]. Recently, trends in these ED attendances are of additional interest in the context of the COVID-19 pandemic, as it has led to changes in the way patients seek or receive treatment [63-66].

By implication, exploring the usability and potential of emergency department data for syndromic surveillance of acute alcohol intoxication may provide a first foundation for complementary and sustainable evidence gathering to address the reduction of harmful alcohol use. Therefore, a first pivotal step comprises the development of syndrome definitions in order to assess whether alcohol-related health events can be reliably reflected using information from ED documentation. Because no standardised approach for developing and evaluating syndrome definitions exists so far, the recent published work on the process of developing syndrome definitions of psychiatric emergencies and suicide attempts for mental health surveillance as well as the publication regarding the definition of syndromes to detect unspecific gastrointestinal infections can be considered as guidelines [50, 53].

1.3 Aim

The aim of this paper is the development of syndrome definitions to identify cases of acute alcohol intoxication based on routinely collected data from emergency departments. To examine the accuracy of the syndrome definitions and to discuss the potential of those for surveillance purposes, the descriptive results of the cases identified will be contextualized within the existing literature and compared to another data

source. Furthermore, cases of acute alcohol intoxication are presented over time and changes in patterns of this ED population are described for the period before and during the COVID-19 pandemic.

2. Methods

2.1 Setting and study population

For the present study, routine data from several emergency departments in Germany were used. The information from the routine documentation of emergency departments is provided by the ESEG project [67] (*Erkennung und Sicherung Epidemischer Gefahrenlagen*) and AKTIN emergency department registry [68] and is merged into a common database, where the multicentre data is transferred into a standardised and anonymised format. This pre-processed data mapped into the NoKeDa (*Notaufnahmekerndatensatz*) data model [69] is available to the RKI on a daily basis.

The participation of the included emergency departments is voluntary and they have actively consented to the use of data for the surveillance of mental health use cases, including acute alcohol intoxication. Only emergency departments that recorded either diagnoses or chief complaints and transmitted at least one visit per day throughout the entire study period were used. Subsequently, all attendances (ED visits) with complete information on admission date, age and sex were considered within this analysis. One observation in the dataset corresponds to one emergency department visit, thus recurring visits to the EDs cannot be assigned to the same person. Also, in order to maintain anonymity, attendances can not be affiliated to the associated emergency department.

The data included information on age (divided into age groups), gender (two characteristics for male and female), the disease severity (triage level) to determine treatment priorities via the Manchester Triage System (MTS) [70] or Emergency Severity Index (ESI) [71] and the date of admission (aggregated to calendar weeks and months) of each attendance. The cause for seeking treatment is recorded as chief complaint based on MTS presentation to narrow down the disease pattern plus the MTS indicator to specify the symptoms, or by a list of possible chief complaints, from which the patient's presenting cause can then be selected (“Presenting Complaint List”) provided by the Canadian Emergency Department Information System (CEDIS-PCL) [72]. For the recording of diagnoses, codes using International Classification of Diseases 10th Revision (ICD-10) – “German Modification” [73] with additional labels

for diagnostic certainty are collected, which can be assigned multiple times per attendance, while the chief complaint can only be received once.

2.2 Data protection and ethics

The specified granularity of the ED data available through the NoKeDa data model enables anonymized data transmission to the RKI, which ensures that individuals cannot be re-identified.

For this reason, the ethics committee of the physician's chamber of Hesse decided that no ethics approval was necessary. Furthermore, a positive data protection vote was obtained from the data protection officers of the RKI and the State of Hesse within the ESEG project. The AKTIN emergency department register received an ethics approval from Otto von Guericke University in Magdeburg (160/15) and is registered as a clinical trial (DRKS00009805) [74]. A vote of the scientific committee was also obtained for the use of data for research purposes of the mental health surveillance at RKI from the AKTIN emergency department register (project-ID 2021-003).

2.3 Syndrome definitions

To develop syndrome definitions, the NoKeDa data model was examined for appropriate chief complaints and diagnoses that portray patterns of alcohol consumption, which were then combined into categories. To strengthen the accuracy of the syndrome definitions, the published literature was searched for transparent reporting of included variables to capture alcohol-related presentations in the emergency department. In addition, an exchange with emergency department chiefs of those EDs affiliated with the AKTIN network was sought in order to include information from the setting, e.g. on coding practices.

An emergency department attendance was classified as a case if one selected variable (MTS presentation + MTS indicator or ICD-10 diagnosis) of the final syndrome definitions applied as listed in **Table 1**.

Because not all alcohol consumers who engage in binge drinking also meet the criteria of an alcohol use disorder, it was considered to establish syndrome definitions not only for acute but also for chronic patterns of alcohol use among emergency department visits. However, the identification of cases with chronic consumption using ED routine documentation has emerged to be insufficient. Emergency department chiefs reported that coding for chronic alcohol complaints occurs less often. Because the ED setting is intended to provide acute health care for emergencies, patients with a chronic alcohol condition usually present when they have acute comorbid complaints.

According to the ICD-10 manual [24], if a chronic alcohol problem is present at the time of intoxication, the patient is supposed to be coded for both the intoxication and the chronic event. However, due to invoicing modalities and low recognition of the background of the consumption pattern, chronic use is not adequately documented. After all, processes of internal data validation, limitations of the setting as well as the exchange with the emergency department chiefs have revealed that the coding requirements are not fulfilled regarding the detection and dual coding of chronic consumption patterns. Therefore, no separate syndrome definitions for alcohol use disorder were additionally formed.

Nevertheless, due to low addressing and frequent reference of acute alcohol intoxications to overall alcohol-associated attendances in German emergency departments within the published literature, the contextualization of case numbers and patient characteristics was intended to be improved by creating a syndrome definition for all alcohol-related visits to the ED.

2.4 Descriptive analyses

Identified cases by syndrome definitions were analysed descriptively as aggregated counts per week or month. In addition, the study period was divided into two periods, before and during the pandemic (before/after 2020-03-09) to describe cases separately by time period according to strata of age, sex and triage level, whose distributions are subsequently needed to specify the accuracy of syndrome definitions in identifying cases.

To assess internal consistency of the syndrome definition, the five most frequently assigned values for the variables diagnosis and chief complaint were determined. Next, the age and gender distribution of cases identified in 2019 was compared with another data source, the hospital diagnosis statistics for which the latest data was available for 2019 [37], in order to verify if patient characteristics of acute alcohol intoxications are reliably represented by the data and whether the results are consistent with those from other data sources.

Time series were formed, dissected by year for emphasizing the impact of COVID-19, to examine whether the syndrome definitions could continuously display cases, as well as acute developments and trends in emergency department attendances, which is intended to precise the potential of the data source for surveillance purposes of alcohol-related visits.

Data analysis was performed using the statistical software R (version 3.6.1) and the package *tidyverse*.

3. Results

A final study population of 2,123,492 attendances from 18 emergency departments was included in the study period from 1 January 2018 to 2 May 2021. Complete data on age and gender was available for all attendances, while triage information was provided for 91.0%. Chief complaints were received with a completeness of 86.1% and diagnoses were transmitted for 64.4% of all attendances.

3.1 Syndrome definitions and identified cases

To identify cases within emergency department attendances, one syndrome definition was created to capture *Alcohol-related Visits* (ARV), from which the second syndrome definition was derived to portray *Acute Alcohol Intoxications* (ATX) (**Table 1**).

Table 1 - Selected values included in the syndrome definitions Alcohol-related Visits (ARV) and Acute Alcohol Intoxication (ATX) using information on chief complaint and diagnoses

Alcohol-related Visits (ARV)	
MTS presentation	**MTS indicator**
Drunk impression	Inappropriate history, Airway compromise, Shock, Inadequate breathing, Unresponsive child, History of unconsciousness, Current seizure, New neurological deficit less than 24 hours old, New neurological deficit more than 24 hours old, Recent mild pain, Hypoglycaemia, History of head injury, Recent injury, Hypothermic, Inadequate history (of alcohol use), Altered conscious level not fully attributable by alcohol use, Altered conscious level fully attributable by alcohol use
Overdose and poisoning	Altered state of consciousness fully explained by alcohol use
ICD-10 diagnosis (C,S,P,NA)*	
F10.0	Mental and behavioural disorders due to use of alcohol: Acute intoxication
R78.0	Evidence of alcohol in blood sample
T51.0	Toxic effect: Ethanol
T51.9	Toxic effect: Alcohol, unspecified
F10.1	Mental and behavioural disorders due to use of alcohol: Harmful use
F10.2	Mental and behavioural disorders due to use of alcohol: Dependence syndrome
F10.3	Mental and behavioural disorders due to use of alcohol: Withdrawal state
F10.4	Mental and behavioural disorders due to use of alcohol: Withdrawal state with delirium
F10.5	Mental and behavioural disorders due to use of alcohol: Psychotic disorder
F10.6	Mental and behavioural disorders due to use of alcohol: Amnestic syndrome
F10.7	Mental and behavioural disorders due to use of alcohol: Residual disorders and late-onset psychotic disorder
F10.8	Mental and behavioural disorders due to use of alcohol: Other mental and behavioural disorder
F10.9	Mental and behavioural disorders due to use of alcohol: Unspecified mental and behavioural disorder
Acute Alcohol Intoxication (ATX)	
MTS presentation	**MTS indicator**
Drunk impression	Inappropriate history, Airway compromise, Shock, Inadequate breathing, Unresponsive child, History of unconsciousness, Current seizure, New neurological deficit less than 24 hours old, New neurological deficit more than 24 hours old, Recent mild pain, Hypoglycaemia, History of head injury, Recent injury, Hypothermic, Inadequate history (of alcohol use), Altered conscious level not fully attributable by alcohol use, Altered conscious level fully attributable by alcohol use
Overdose and poisoning	Altered state of consciousness fully explained by alcohol use
ICD-10 diagnosis (C,S,P,NA)*	
F10.0	Mental and behavioural disorders due to use of alcohol: Acute intoxication
T51.9	Toxic effect: Alcohol, unspecified

* label for diagnostic certainty: C = Confirmed; S = Suspected; P = Previous; NA = Not Available

Cases were detected either on the basis of chief complaints recorded by MTS or on the basis of the selected ICD-10 diagnoses, most of those classified from group F10

(mental and behavioral disorders due to use of alcohol). Chief complaints coded with CEDIS-PCL were not included because substance use by alcohol was not specified in any value. Only diagnosis of chronic alcohol use coded as mental and behavioural disorders (F10.0 – F10.9) were considered for the syndrome definition of ARV, as other chronic alcohol-related diseases [75] such as fetal alcohol syndrome or alcoholic liver disease have rarely been included in other work. For recording cases of acute alcohol intoxication, the less specific ICD-10 code T51.9 was suggested by ED chiefs, because of its frequent assignment in the ED setting within this population, whereby T51.0 was not included because the ICD-10 catalog specifically disclaims acute alcohol intoxications as a coding reason [73].

Among all ED visits, a total of 18,270 cases (0.86%) were identified by the syndrome definition ARV for the total study period. Furthermore, 14,141 cases (0.69%) met the criteria of the syndrome definition ATX for recording acute alcohol intoxications (**Table 2)**, which corresponds to a 77.40% proportion of ATX cases to all identified alcohol-related visits.

Table 2 - Characteristics of ED visits presenting to the 18 included emergency departments, described for the total study period (2018-01-01 to 2021-05-02), stratified by syndrome definitions

	Alcohol-related Visits (ARV)	**Acute Alcohol Intoxication (ATX)**	**Overall Visits**	**ATX/Overall Visits in %**
	N = 18,270	N = 14,141	N = 2,123,492	0.67%
Sex				
female	5,022 (27.5%)	3,993 (28.2%)	1,035,317 (48.8%)	0.39%
male	13,248 (72.5%)	10,148 (71.8%)	1,088,175 (51.2%)	0.93%
Age				
0-9	43 (0.2%)	36 (0.3%)	210,348 (9.9%)	0.02%
10-14	222 (1.2%)	207 (1.5%)	69,424 (3.3%)	0.30%
15-19	1,680 (9.2%)	1,538 (10.9%)	91,506 (4.3%)	1.68%
20-24	1,710 (9.4%)	1,561 (11.0%)	127,400 (6.0%)	1.23%
25-34	2,559 (14.0%)	2,034 (14.4%)	258,761 (12.2%)	0.79%
35-44	3,466 (19.0%)	2,632 (18.6%)	215,530 (10.1%)	1.22%
45-54	4,017 (22.0%)	2,826 (20.0%)	219,046 (10.3%)	1.29%
55-64	3,161 (17.3%)	2,286 (16.2%)	236,596 (11.1%)	0.97%
65-74	1,006 (5.5%)	715 (5.1%)	216,582 (10.2%)	0.33%
75-79	220 (1.2%)	158 (1.1%)	142,311 (6.7%)	0.11%
80+	186 (1.0%)	148 (1.0%)	335,988 (15.8%)	0.04%
Triage				
1 - Resuscitation	179 (1.0%)	145 (1.0%)	22,316 (1.1%)	0.65%
2 - Emergent	3,596 (19.7%)	2,834 (20.0%)	243,416 (11.5%)	1.16%
3 - Urgent	7,659 (41.9%)	6,271 (44.3%)	695,870 (32.8%)	0.90%
4 - Less Urgent	4,218 (23.1%)	2,834 (20.0%)	882,989 (41.6%)	0.32%
5 - Not Urgent	967 (5.3%)	765 (5.4%)	87,896 (4.1%)	0.87%
NA	1,651 (9.0%)	1,292 (9.1%)	191,005 (9.0%)	0.68%

For both ARV and ATX, a distinctive higher proportion of male (72.5%, 71.8%) versus female (27.5%, 28.2%) cases were shown. Alcohol-related visits and acute alcohol intoxications were most commonly presented in the 45-54 age group (22.0%, 20.0%), followed closely by the 35-44 age group with 19.0% (ARV) and 18.6% (ATX). The comparatively low proportion of the age group 15-19 years (4.3%) within the total ED population accounted for the highest proportion of ATX to overall visits (1.68%).

Furthermore, the results reflect that triage level 3 (Urgent) was assigned most frequently for cases of both syndrome definitions, accounting for 41.9% of ARV and 44.3% of ATX. Alcohol-related visits including acute alcohol intoxications also frequently received codes of triage level 2 (Emergent) and 4 (Less Urgent).

3.2 Accuracy and consistency of syndrome definitions

Cases of acute alcohol intoxication most frequently received a diagnosis of F10.0 (Mental and behavioral disorders due to use of alcohol: acute intoxication), accounting for 65.4% of all diagnoses assigned for this ED population, followed by the diagnosis T51.9 (Toxic effect: Alcohol, unspecified) with a proportion of 26.6% (**Table 3**).

Table 3 - The five most frequent values of each case of acute alcohol intoxication (N = 14,141), presented as counts and its relative proportion of all reported ICD-10 diagnoses*, CEDIS-PCL codes, MTS presentations, and MTS indicators

	N	%
ICD-10 diagnosis		
F10.0 - Mental and behavioural disorders due to use of alcohol: Acute intoxication	8,280	65.4
T51.9 - Toxic effect: Alcohol, unspecified	3,369	26.6
T51.0 - Toxic effect: Ethanol	258	2.0
Z53 - Individuals who visited health care facilities for specific interventions but did not receive them	227	1.8
T65.9 - Toxic effect of an unspecified substance	39	0.3
CEDIS-PCL		
751 - Substance misuse/intoxication	5,973	65.9
752 - Overdose ingestion	334	3.7
855 - Direct referral	265	2.9
753 - Substance withdrawal	225	2.5
351 - Depression/suicidal/deliberate self-harm	222	2.4
MTS presentation		
Drunk impression	4,231	85.0
Overdose and poisoning	587	11.8
Unwell adult	69	1.4
Abdominal pain in adults	45	0.9
General indicators	42	0.8
MTS indicator		
Altered conscious level fully attributable by alcohol use	2,827	60.1
Recent mild pain	547	11.6
Altered conscious level not fully attributable by alcohol use	307	6.5
Inappropriate history	222	4.7
History of head injury	181	3.8

*refers not to the count of emergency department attendances, but to the count of coded diagnoses, since one emergency department attendance may receive multiple diagnosis values

Further, 85.0% of all allocated MTS presentation were documented as "Drunk impression". In accordance to these values, 65.9% of cases with this consumption pattern received the chief complaint "Substance misuse/intoxication" (751) coded with CEDIS-PCL. Chief complaints labeled by this coding system were not included in the development of the syndrome definitions, but of all identified cases that also received a CEDIS code, the assigned values are compatible with the expected content of acute alcohol intoxications.

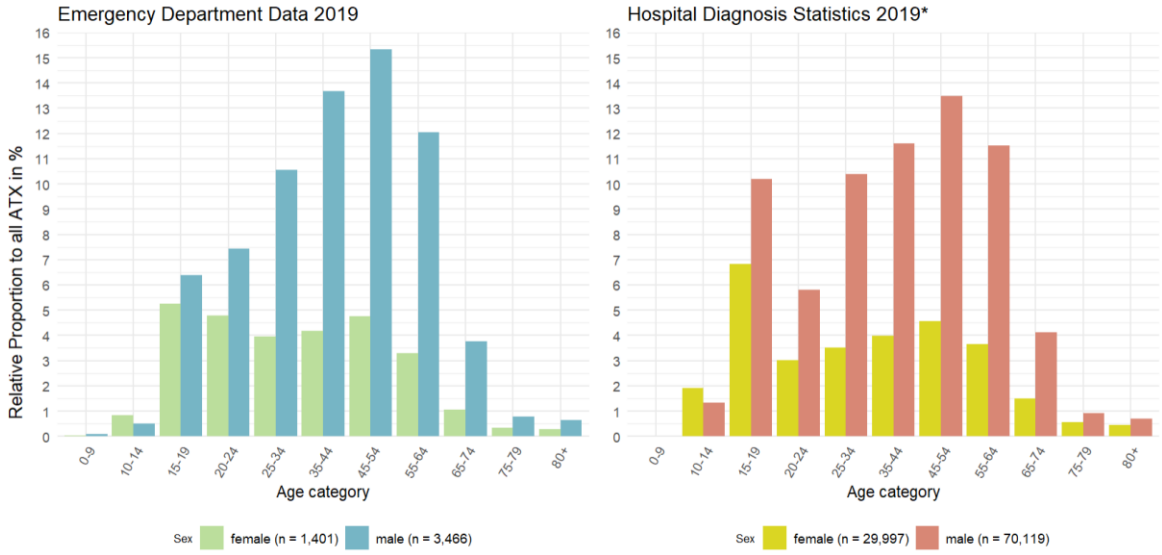
For both CEDIS and MTS coded chief complaints, indication of overdose ranked second with either 3.7% (752 - overdose ingestion) or 11.8% for "overdose and poisoning". Furthermore, among all MTS indicators recorded for ED attendances due to acute alcohol intoxication, "altered conscious level fully attributable by alcohol use" accounted for 60.1% or "altered conscious level not fully attributable by alcohol use" for 6.5%, while "recent mild pain" was assigned as the second most frequent value with 11.6%. A lower proportion of the chief complaint (CEDIS-PCL) values reflect chronic alcohol use, such as substance withdrawal (2.5%) and depression/suicidal/deliberate self-harm (2.4%).

The age and gender distribution of the identified acute alcohol intoxications by syndrome definition is similar to the distribution of hospital diagnostic statistics in its characteristics (**Figure 1 + Attachment 1**).

In accordance with the results from the ED data, the gender distribution of hospital diagnosis statistics reflected a higher proportion of male patients hospitalized with acute alcohol intoxication among all age categories (male: 70.03%, female: 29.96%), except for the 10-14 age category, according to which female patients were treated more frequently. This increase in female cases in this young age group of 10-14 years is also mirrored by the emergency department data for identified ATX cases (female: 0.84%, male: 0.51%). Equivalent to the emergency department data, the hospital diagnosis statistics also recorded the most frequent values in the 45-54 age group, with a significantly higher proportion of male patients (13.47%) compared to female patients (4.56%).

Differences in the two distributions were evident for the proportion of the 15-19 age category, which was captured at a higher rate in the hospital diagnosis statistics (17.03%) than in the cases detected by the syndrome definition for acute alcohol intoxications using emergency department data (11.65%). Both data sources reported almost no cases for patients aged 0-9.

Figure 1 - Comparison of age and sex distribution of all identified cases of acute alcohol intoxication using emergency department data of 2019 with age and sex distribution of reported acute alcohol intoxications by hospital diagnostic statistics for 2019: Relative proportion of age categories to all cases of acute alcohol intoxication, stratified by sex
[Retrieved and adapted from: Federal Statistical Office (2021): Hospital diagnosis statistics 2019 [37]]



*count of acute alcohol intoxications based on principal diagnoses received in German hospitals in 2019; classification characteristics: Residence: all residences, Length of stay: all cases, ICD10: F10.0 Mental and behavioral disorders due to alcohol use: acute intoxication, Subject: cases, Type of standardization: none

3.3 Changes in patterns of identified acute alcohol intoxications before and after the pandemic onset

The separated study periods divided into before and during COVID-19 differed from each other in the length of the period and resulted in study populations of different sizes. Comparison of the two study periods showed that changes in patient characteristics could be demonstrated using the data (**Attachment 2**).

Before the pandemic, 13,491 cases of ARV (0.89% of all attendances) compared to 4,880 cases (0.78%) since the pandemic were identified. As ATX were 10,402 cases (0.69%) in the pre-pandemic phase as well as 3,809 cases (0.61%) during the pandemic period classified.

The proportion of ATX to ARV changed slightly from 77.10% (before COVID-19) to 78.05% (while COVID-19). Also, the gap in sex differences was further widened after pandemic start (male: 75%, female: 25%) for cases of both syndrome definitions.

Before the pandemic, the 45-54 age group recorded the most cases for both syndrome definitions (21.8%, 19.6%), while the frequencies of the 35-44 and 55-64 age categories drew near those of the 45-54 age group after the pandemic, ranging

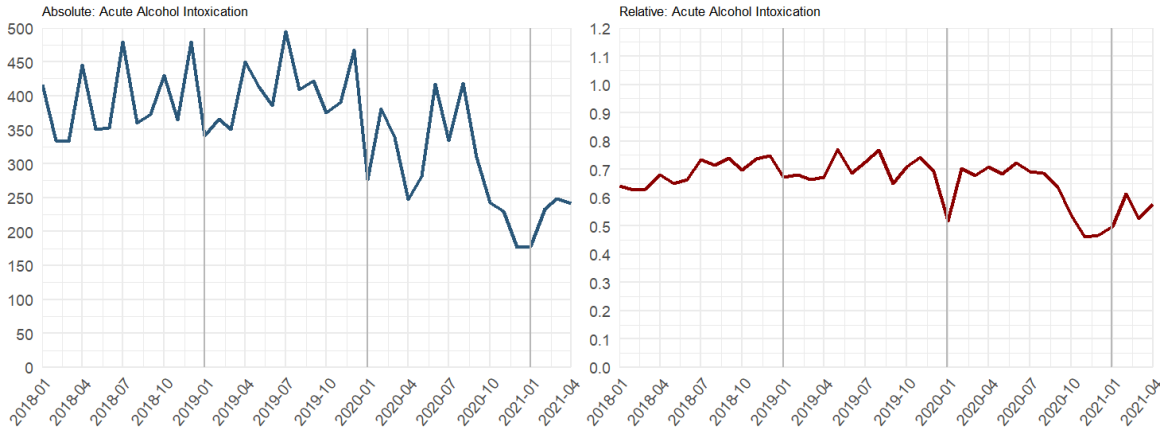
approximately between 20-23% for both syndrome definitions within these 3 age groups. In this regard, the 20-24 age group recorded the largest decrease in cases for ARV from 10.6% to 5.8%, and for ATX from 12.5% to 6.9%. Likewise, in the age categories 15-19 and 25-34, a reduction in the number of cases for both syndrome definitions was also noticeable.

In both study periods, triage level 3 stood out as the most frequently assigned value, but recorded an increase for cases identified by ARV with 40.3% and ATX with 42.7% (pre-pandemic phase) to 46.5% (ARV) and 48.9% (ATX) of cases since the pandemic.

Moreover, the age and gender distribution of acute alcohol intoxications highlights changes in gender proportions across age categories for the period after the beginning of the COVID-19 pandemic compared with the study period before the pandemic (**Attachment 3**). The lower proportions in the 15-19 and 20-24 age groups were displayed (**Attachment 4**) and a decrease in female cases observed particularly among 20-24 year-olds (4.74% to 2.18%) and 25-34 year-olds (4.11% to 2.47%). The greatest change within male cases was evident in the 55-64 age group with an increase from 11.53% to 15.62%.

The time series demonstrated that the syndrome definition ATX had identified cases and fluctuations continuously over the entire study period (**Figure 2).**

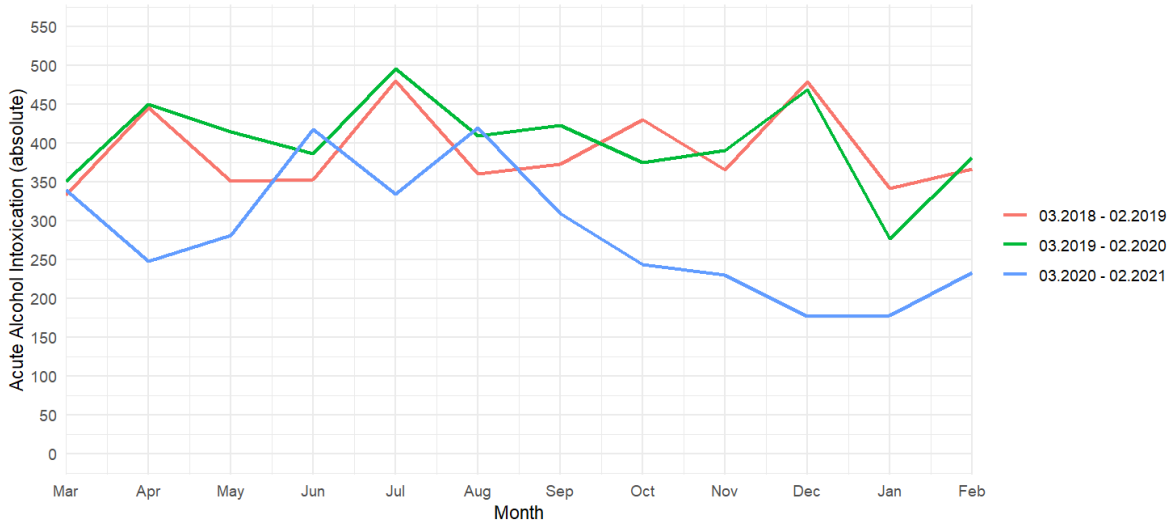
Figure 2 – Illustration of identified cases of acute alcohol intoxication (absolute number and relative proportion of all emergency department attendances per week) over the entire study period (2018-01-01 to 2021-05-02)



The frequency of emergency department visits presenting with acute alcohol intoxication within a week varied from 177 cases (2020-12-01) to 495 cases (2019-07-01). For the week 2020-11-01, the lowest relative proportion (0.46%) of acute alcohol intoxication compared to all emergency department attendances and the highest proportion (0.77%) was recorded in the week of 2019-05-01.

For intensified visualization of the impact by COVID-19, the time series of acute alcohol intoxications were stratified by year (each period ranges from March to March aggregated by month), including the pandemic period from 2020-03-02 to 2021-02-22, which illustrated the changes in the number of cases and enabled the comparison of developments and trends in monthly attendances compared to the years before the pandemic (**Figure 3**).

Figure 3 – Identified cases of acute alcohol intoxication (absolute frequency per month) stratified by year (ranging from March to March) as time series



For the months of March to August, the time course during the pandemic phase displayed opposite trends in case numbers, especially in April and July which are peaking in 2018 and 2019. Then from August onwards, a distinct decline in identified acute alcohol intoxications was observed, which recorded the lowest case numbers in December, where a peak was also noted in previous years.

4. Discussion

The development of syndrome definitions to detect cases of acute alcohol intoxications and alcohol-related visits using emergency department data was explored for the first time in Germany by this work. The proof of principle and potential for syndromic surveillance of acute alcohol intoxications was demonstrated by the ability of the syndrome definition to continuously capture cases and their progression over time for the entire study period. In the context of the COVID-19 pandemic, the utility of ED data to detect and visualize acute changes in case numbers and their distribution patterns was demonstrated.

4.1 Contextualization and characteristics of identified cases

Because the available findings in the literature of alcohol-related visits and acute alcohol intoxications in the emergency department setting were collected prior to COVID-19, the pre-pandemic period is used to classify the results of this work for improved comparability (2018-01-01 to 2020-03-09). One study [57] compared the occurrence of alcohol-related attendances (18+ years) to describe changes in characteristics of this population (in 2009 with 2014) presenting to an ED in Essen based on the assignment of ICD-10 codes (F10.0 - F10.9) and identified 3.7% (2009) and 4.2% (2014) of all emergency department visits as alcohol-related. Within this work, the proportion of ARV to all ED attendances was therefore lower with 0.89% (pre-pandemic phase), but the proportion of male patients among alcohol-related visits resulted in 70% according to Kirchner et al. [57], which was also reported by te Wildt and colleagues [56], and is reflected by the 71.4% male patients (ARV) who presented to ED before the COVID-19 period in this work. Furthermore, Kirchner et al. [57] reported a mean age of 45 years (2009) and 46 years (2014), which corresponds to the most common age category of 45-54 years (21.8%) of identified alcohol-related visits in the present work, which however also included patients under 18 years of age.

Te Wildt et al. [56] examined alcohol-related visits (coded with F10.0 - F10.9) presenting to the MHH (*Medizinische Hochschule Hannover*) emergency department in 2002 and reported acute alcohol intoxication as the leading diagnosis within this group adding up to 71.4%, which is lower than the proportion of ATX to ARV at 77.1% within the study period before COVID-19.

Two studies based on the same analysis of psychiatric emergencies in the ED of Ulm University Hospital [58, 59] showed an average age of 39.2 years (2000) and 34.1 years (2010) for patients presenting with acute alcohol intoxication (F10.0), which is below 45-54 years, the age category with which most identified cases of ATX presented (19.6%), but the 35-44 age group ranked second with 17.6%. The higher proportion of female cases in the age group of 10-14 years was also observed by the Health Behaviour in School-Aged Children (HBSC) - study 2017/18 in the 30-day prevalence of binge drinking at age 11 [30]. While a sharp increase in cases of acute alcohol intoxication within the adolescent age group of 15-24 from 22% (2000) to 41.7% (2010) was reported [58, 59], cases of ATX in this age range are placed in between at 24.2% within this study. The proportion of assigned diagnosis for acute alcohol intoxication to overall emergency department visits accounted for 2.32% in

2000 and 1.89% in 2010 [59], exceeding the 0.69% (2018-01-01 to 2020-03-09) of these present evaluations in both time periods.

4.2 Accuracy of the syndrome definition displaying patterns and trends of acute alcohol intoxication

While previous work focusing on infectious diseases used temporal characteristics such as seasonality [50] to assess whether syndrome definitions reflect the health event sufficiently, the present approach was to compare patient characteristics of identified cases of acute alcohol intoxication with those treated in hospital inpatient care. Prominent features of this patient population were revealed by frequencies within age categories and their distribution by gender, which was particularly evident in increasing frequent attendances with higher age up to 45-54 years, as well as more prevalent presentations of female patients in the young age group of 10-14 years and otherwise male dominance of attendances across all age categories. The low occurrence with acute alcohol intoxication of the normally strongly represented age group in the emergency department (80+ years) could also be mirrored.

Although the hospital diagnosis statistics and representative survey studies [15, 28] indicate a high burden of binge drinking among the age category of 15-19 years, this group was not observed to be equally frequent within the emergency department population of this work. However, within the overall emergency department population, acute alcohol intoxication was shown to be a relevant health event for adolescents and young adults aged 15-19 (1.68%).

Next, a sharp decrease in cases after August was observed by the time series, which was also reported in a Dutch study on the pandemic impact on alcohol-related ED presentations [45], starting simultaneously to the second COVID-19 wave in Germany (calendar week 40/2020 to 8/2021: corresponding to 2020-09-28 to 2021-02-28). The second wave recorded higher numbers and more severe outcomes of infections and peaked at year-end 2020.

A strong accuracy of the syndrome definitions in identifying cases enhances the usability of the data source for a continuous surveillance of acute alcohol intoxication. The number of identified cases within the total ED population is below those reported by another paper. However, largely similar patterns of age and gender distribution of visits presenting with acute alcohol intoxication were demonstrated by the placement of findings into the literature and by comparison with another data source. Deviations in the results compared to the literature may be due to the analysis of these studies including only one emergency department and a past observation period.

The hospital diagnosis statistics are an annual census of patients discharged from full inpatient treatment in a hospital [76]. The type of illness is recorded by principal diagnosis, which, after evaluation of the clinical evidence, is intended to record the main reason for admission to hospital at the end of treatment [77]. The principal diagnosis is also relevant to the hospitals' billing, so it is assumed that the quality of the diagnosis is high [76, 77]. Although admission of patients presenting to ED with acute alcohol intoxication to inpatient hospital care is largely conducted [54, 55], many patients refuse observation and treatment in the ED and discharge themselves against medical advice from ambulatory care premature [54]. Since emergency departments combine both ambulatory treatment and transfer to inpatient care, this results in different documentation standards and invoicing modalities for the two settings, which has an impact on the data quality or availability and thus comparability of the data sources [78]. Also, the patients presenting to hospital and emergency department care might differ in patterns of their illness severity or comorbidity, as the focus of health care provision (emergency versus inpatient care) varies, leading to different populations seeking out the setting [79]. The hospital diagnosis statistics amounts to almost complete coverage of hospitals in Germany [76], whereas the present work provided a descriptive analysis of 18 EDs based on chief complaints and often suspected diagnoses to create the syndrome definition, for which data completeness was not assured, unlike hospital diagnostic statistics. Therefore, the comparison of age and gender distributions of acute alcohol intoxications recorded in the hospital diagnosis statistics serves rather to examine, whether the population whose imaging was intended, could be displayed in their distinctive characteristics by the emergency department data. Accordingly, the primary goal of emergency department surveillance is not to identify confirmed diagnoses on an individual level to describe population prevalence’s, but to detect changes in patients’ characteristics and over time.

To achieve that object and for the assessment of sufficient accuracy, the syndrome definitions provided consistent identification of cases for both acute alcohol intoxication and alcohol-related visits, which allows for a continuous observation and detection of acute trends for surveillance purposes. Since the COVID-19 pandemic led to changes in the emergency department utilization, the ability to identify differences was confirmed for acute alcohol intoxication by the description of population´s characteristics and over time. However, further in-depth analyses were not possible within the framework of this study. Internal validations on included diagnoses and chief complaints support the assessment of a sufficient portrayal of this population using emergency department data.

4.3 Limitations and potential

An estimate of population prevalence is not achievable within this framework by using routine data from emergency departments, because ED populations are not representative of the general population (e.g. in age structure, regional differences). Since the selection of emergency departments is based on voluntary participation, the 18 EDs included in this work are not necessarily reflective of all emergency department populations.

Accordingly, when interpreting the results, it should be emphasized that the proportion of risk consumers (>20g pure alcohol/day for males and >10g pure alcohol/day for females) is unevenly distributed in the federal states [26]. In addition, differences within populations drinking behaviour and emergency department utilization may occur, when largescale regional events provide opportunities for excessive alcohol consumption (e.g. Munich´s Oktoberfest, carnival in Cologne) or school vacation periods and festivities vary within federal states. Covariates including regionality and temporal specification of cases to week-days may contribute to the capture of exactly this relation of alcohol-related harm with sporting or social events, public holidays and weekends, of which the relevance to ED settings has already been demonstrated [44, 80]. Hence, using emergency department data for surveillance of acute alcohol intoxication can serve the purpose of detecting the impact of events to ED utilization and acute changes in real time to guide fast public health interventions. Beyond, it may help also to prepare emergency department care for heightened alcohol-related disease burden in future events and around festivities, since an increased workload and resource usage in the emergency department have been found to be caused by alcohol-associated visits [81]. Based on the time series of this work, it was possible to illustrate peaks in April and December for the years 2018 and 2019, which, among other causes, might reflect the influence on higher emergency attendances due to acute alcohol intoxications by the national festivities of Easter and Christmas, which are for example accompanied by extended school vacations.

Further, regional differences played a role during the COVID-19 pandemic, as the implementation of measures to contain the pandemic led partly to different restrictions at the federal state level according to incidence rates, meaning that in some regions participation in social events was possible, while in other parts of Germany the clubs, bars and events had closed [82]. In this context, the potential and need of the data source to be used for monitoring acute changes in real-time and recording the impact

of interventions becomes apparent, as the crisis situation continuously caused rapid changes in social life and thus in health care provision.

Since the routine documentation in emergency departments is not primarily collected for research purposes but rather follows the needs of treatment and decisions on follow-up therapy, the precision in identifying cases may be influenced by structural changes in the emergency department or the coding process by hospital staff. For example, the documentation of diagnoses in the emergency department may be influenced by specifications of the invoicing modalities, which is not evident from the available data. For the billing of ambulatory cases, it is sufficient to specify a single diagnosis, which removes the necessity of coding further diagnoses. When several diagnoses are assigned to a patient, the data are transmitted without a hierarchy, so that no principal diagnosis is discernible. In addition, information in the form of free text cannot be used [78, 83].

The ICD-10 manual's requirement to code acute alcohol intoxication as the principal diagnosis in the absence of a chronic alcohol problem [14, 22], while on the other hand, assigning both the acute intoxication (F10.0) and the chronic health event (e.g. F10.2 - alcohol dependence syndrome) to a patient when presenting with an alcohol use disorder in addition to the acute intoxication [14, 24], is met only to a limited extent in the emergency department setting, because often the underlying consumption pattern is not further examined and therefore not documented. The listings for the most frequently applied diagnoses of ATX indicate that additional F10.1- F10.9 codes are not frequently issued, which is consistent with the feedback from emergency department chiefs. In this regard, the coding practice in the EDs may confound the distinction between acute and chronic health events and lead to an overestimation of identified acute alcohol intoxication (excluding chronic consumption), as it is likely that not all patients with chronic alcohol use who present with acute intoxication are documented according to the intended coding guideline.

Also, data incompleteness of diagnoses and chief complaints, which might vary across EDs, reduces the likelihood of the syndrome definitions in identifying cases.

Since international awareness was directed to the fact that the burden attributed to alcohol in emergency department visits is underestimated [84], it can also be assumed within this present work, although the documentation and coding practice deviates from Germany and clarification on the circumstances of the intoxication within the medical anamnesis is repeatedly urged in manuals for health provision and the literature [14, 22, 85, 86]. As mentioned, the documentation of the emergency department

follows foremost the recording of the harm in order to initiate further treatment and might therefore underestimate the occurrence of acute alcohol intoxications when in connection with an injury, accident or suicide attempts and cases may also go unnoticed if the patient presents with the ingestion of polysubstance.

Furthermore, patients experiencing acute alcohol intoxications that do not seek medical care cannot be represented within the emergency department population. This was portrayed by the present work in the decrease of cases during the second wave of the pandemic, which does not necessarily mean lower amounts of alcohol consumption. Some studies [87, 88] suggest reduced utilization of emergency departments, which also affected other diseases than alcohol-related [64, 89], due to fear of infection with COVID-19 and should be considered as one possible of a likely multifactorial cause of the decline in ED utilization [45]. However, it should also be noted that the impact of the pandemic on limited access to the gastronomy and event sector may have led to a decrease in binge drinking behaviour because the availability of alcohol is found to be a risk factor for this consumption pattern, particularly among youth [90, 91]. These backgrounds need further investigation and cannot be addressed within the scope of this paper.

Further, emergency department chiefs reported a seasonal pattern in alcohol-intoxicated emergency department visits during the summer months. This was attributed to drinking habits shifting from indoor to public places and therefore individuals engaging in harmful alcohol use becoming more visible on the street, which makes it more likely to be picked up for instance by police or ambulances. The seasonality of alcohol-related emergency department visits in summer has not been previously addressed in the literature. Within this work, an increase in acute alcohol intoxications for the month of July in 2018 and 2019 was exemplified. However, given the increased visibility of harmful alcohol use in public settings, the inclusion of otherwise underrepresented groups such as the homeless in the emergency department population can also be considered an advantage of this data source, as their living arrangements take place in public spaces and drinking excesses are less likely to be located into indoor settings such as one' s own residence. Homeless men and women represent a vulnerable population, within which harmful alcohol use and chronic consumption are highly prevalent [92].

Ultimately, repeated visits to the emergency department might contribute to an overestimation of acute alcohol intoxication, since cases are identified as attendances and

not individuals within this study. Alcohol-related emergency department visits are known as frequent visitors [56, 93] of the ED.

4.4 Enhancement opportunities and prospects

Optimization of syndrome definitions can be approached by obtaining additional data sources of health care to estimate the validity of the syndrome definitions, such as documentation of ambulance services [53], or by using otherwise collected predictors of alcohol-related harm [94] like alcohol-related traffic statistics or incidence rates of infections with COVID-19.

Further, international validation studies examining the accuracy of syndrome definitions including substance use [95-97] with one publication focussing on alcohol [94], have measured the accuracy of developed syndrome definitions capturing the health event by comparing identified cases to reviewed discharge diagnoses or nursing triage notes from emergency department documentation. Although the results of these studies do not provide a good estimate of the validity to syndrome definitions developed in this work due to different consumption patterns portrayed and coding systems used as well as limitations of the national setting, these approaches could serve as leads for more profound investigations.

The inclusion of additional emergency departments by the surveillance system can strengthen the representativeness of the data and support a more accurate portrayal [53] of alcohol-related health events. In particular, given the potential of syndromic surveillance to detect acute trends due to regional changes such as large events, the inclusion of location variables (zip code), which are available to the NoKeDa data model but have not yet been requested for analysis in mental health surveillance to preserve anonymity of patients, may be beneficial. Correspondingly, a larger data pool aids the prevention of patient's re-identification and might allow for less granularity of data, whereupon aggregation of cases to week-days for analysing emergency department activities for example on weekends would be possible.

By continuously observing temporal changes in acute alcohol intoxications, prevention or intervention needs of populations at risk can be identified. As binge drinking has a negative impact on cognitive, emotional and social development [28] and increases the risk of developing patterns of harmful drinking behaviour and alcohol use disorder in adulthood [98], there is a particularly high need for information regarding alcohol use among children and adolescents [99]. The introduction of already established screening tools to capture consumption patterns such as *Alcohol Use Disorders Identification Test* (AUDIT) [100, 101] can assist in differentiating alcohol-related

populations within the emergency department by acute and chronic alcohol use. Thus, the interface function of the emergency department [79] can be used to allocate tailored interventions to diverse needs of treatment intensity and duration in patients with acute health event or those involving chronic consumption. This might improve health care provision for subgroups of alcohol-related emergency department visits and result in a reduction of frequent emergency department visitors and therefore to a decreased alcohol-related burden of care in the long term. In this regard, the emergency department setting can also be perceived as a good opportunity for brief interventions among patients presenting with different patterns of harmful alcohol use like binge drinking or underage drinking [100-102].

With this in mind, improved recognition of patterns of alcohol use within the emergency department population may support the coding process by hospital staff. This would also allow for a more accurate identification of cases using the syndrome definitions by avoiding misclassification, as well as differentiation of alcohol use disorders from acute alcohol intoxications (excluding chronic use) if the guideline for coding [24] is followed, because dual coded patients could then be separated from those receiving only one code for acute alcohol intoxication. Training or coding instructions for hospital staff when handling alcohol-associated patients towards a standardised documenting across emergency departments might also be beneficial.

5. Conclusion

The syndrome definitions developed can be used to describe alcohol-related emergency department visits, particularly acute alcohol intoxications, for which the visualization of prominent characteristics in these patients was demonstrated. Identified cases were able to be illustrated over time and the impact of the COVID-19 pandemic could be displayed.

Therefore, sufficient accuracy of the syndrome definition to detect acute alcohol intoxication using emergency department data was assumed. The syndrome definition of acute alcohol intoxication may be principally fielded in several surveillance purposes like observing trends in harmful alcohol use during events and mass gatherings and to capture acute changes for timely public health response. Furthermore, the effectiveness of interventions and the alcohol-related burden of care within the ED setting can be monitored.

This study provides the first foundation for systematic and sustainable evidence gathering to support prevention targets on alcohol induced harm.

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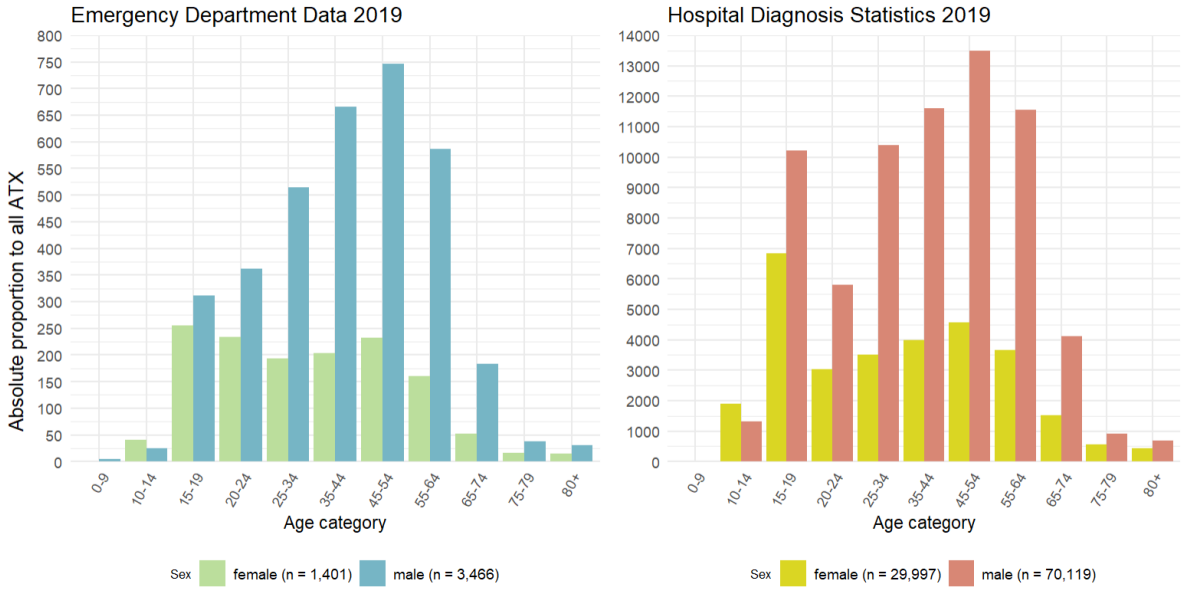
Attachment

Attachment 1 - Comparison of age and sex distribution of all identified cases of acute alcohol intoxication using emergency department data of 2019 with age and sex distribution of reported acute alcohol intoxications by hospital diagnostic statistics for 2019: Absolute proportion of age categories to all cases of acute alcohol intoxication, stratified by sex

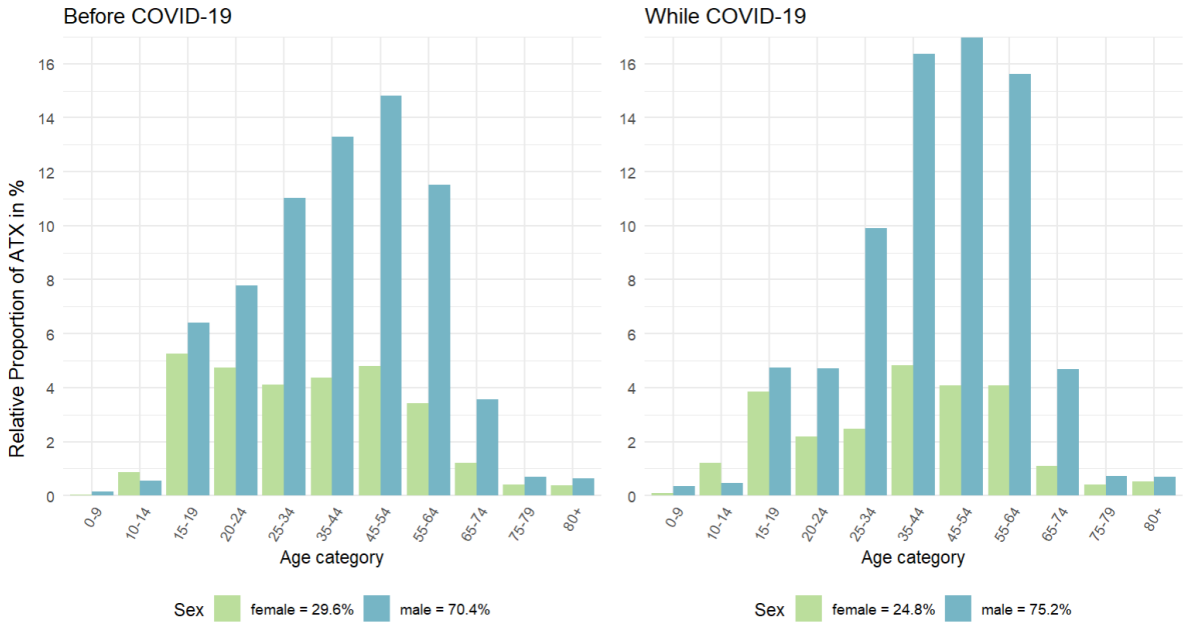
[Retrieved and adapted from: Federal Statistical Office (2021): Hospital diagnosis statistics 2019 [37]]



Attachment 2 - Characteristics of ED visits presenting to the 18 included emergency departments, described across the pre-pandemic period (2018-01-01 to 2020-03-09) and period during the pandemic (2020-03-09 to 2021-05-02), stratified by syndrome definitions

	Period before COVID-19 pandemic				*Period while COVID-19 pandemic*			
	Alcohol-related Visits (ARV)	**Acute Alcohol Intoxication (ATX)**	**Overall Visits**	**ATX/Overall Visits in %**	**Alcohol-related Visits (ARV)**	**Acute Alcohol Intoxication (ATX)**	**Overall Visits**	**ATX/Overall Visits in %**
	N = 13,491	N = 10,402	N = 1,511,705	0.69%	N = 4,880	N = 3,809	N = 623,635	0.61%
Sex								
female	3,859 (28.6%)	3,076 (29.6%)	738,364 (48.8%)	0.42%	1,195 (24.5%)	944 (24.8%)	302,680 (48.5%)	0.31%
male	9,632 (71.4%)	7,326 (70.4%)	773,341 (51.2%)	0.95%	3,685 (75.5%)	2,865 (75.2%)	320,955 (51.5%)	0.90%
Age								
0-9	24 (0.2%)	20 (0.2%)	152,186 (10.1%)	0.01%	19 (0.4%)	16 (0.4%)	59,567 (9.6%)	0.03%
10-14	156 (1.2%)	145 (1.4%)	52,608 (3.5%)	0.28%	68 (1.4%)	64 (1.7%)	17,253 (2.8%)	0.37%
15-19	1,320 (9.8%)	1,213 (11.7%)	67,802 (4.5%)	1.79%	364 (7.5%)	328 (8.6%)	24,191 (3.9%)	1.36%
20-24	1,432 (10.6%)	1,303 (12.5%)	93,804 (6.2%)	1.39%	283 (5.8%)	263 (6.9%)	34,276 (5.5%)	0.77%
25-34	1,986 (14.7%)	1,574 (15.1%)	186,296 (12.3%)	0.84%	588 (12.0%)	471 (12.4%)	73,878 (11.8%)	0.64%
35-44	2,451 (18.2%)	1,835 (17.6%)	153,215 (10.1%)	1.20%	1,028 (21.1%)	807 (21.2%)	63,430 (10.2%)	1.27%
45-54	2,936 (21.8%)	2,040 (19.6%)	156,069 (10.3%)	1.31%	1,107 (22.7%)	801 (21.0%)	64,146 (10.3%)	1.25%
55-64	2,185 (16.2%)	1,556 (15.0%)	164,145 (10.9%)	0.95%	1,005 (20.6%)	750 (19.7%)	73,820 (11.8%)	1.02%
65-74	702 (5.2%)	497 (4.8%)	150,559 (10.0%)	0.33%	309 (6.3%)	220 (5.8%)	67,179 (10.8%)	0.33%
75-79	166 (1.2%)	115 (1.1%)	102,116 (6.8%)	0.11%	54 (1.1%)	43 (1.1%)	41,020 (6.6%)	0.10%
80+	133 (1.0%)	104 (1.0%)	232,905 (15.4%)	0.04%	55 (1.1%)	46 (1.2%)	104,875 (16.8%)	0.04%
Triage								
1 - Resuscitation	122 (0.9%)	101 (1.0%)	15,006 (1.0%)	0.67%	58 (1.2%)	45 (1.2%)	7,433 (1.2%)	0.61%
2 - Emergent	2,653 (19.7%)	2,093 (20.1%)	163,883 (10.8%)	1.28%	963 (19.7%)	754 (19.8%)	80,976 (13.0%)	0.93%
3 - Urgent	5,433 (40.3%)	4,442 (42.7%)	483,595 (32.0%)	0.92%	2,267 (46.5%)	1,863 (48.9%)	216,193 (34.7%)	0.86%
4 - Less Urgent	3,169 (23.5%)	2,121 (20.4%)	641,087 (42.4%)	0.33%	1,070 (21.9%)	724 (19.0%)	246,726 (39.6%)	0.29%
5 - Not Urgent	720 (5.3%)	558 (5.4%)	64,215 (4.2%)	0.87%	257 (5.3%)	213 (5.6%)	24,262 (3.9%)	0.88%
NA	1,394 (10.3%)	1087 (10.5%)	143,919 (9.5%)	0.76%	265 (5.4%)	210 (5.5%)	48,045 (7.7%)	0.44%

Attachment 3 - Distribution of cases detected by syndrome definition of acute alcohol intoxication (ATX) by sex and age groups, presented by pre-pandemic period (2018-01-01 to 2020-03-09) and period during the pandemic (2020-03-09 to 2021-05-02)



Attachment 4 - Time progression of identified cases of acute alcohol intoxication, stratified by age category