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Acute Alcohol Intoxication in Dutch Adolescents Before, During, and After the First COVID-19 Lockdown

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A B S T R A C T

Purpose: The association between acute alcohol intoxication among adolescents and the COVID-19 lockdown has been studied previously in Trieste, Italy. They recommended that emergency services should be prepared for a potential peak of alcohol intoxication–related emergencies among adolescents as a result of the COVID-19 lockdown. Therefore, this study investigated the influence of the COVID-19 pandemic on the prevalence of acute alcohol intoxication among adolescents in the Netherlands.

Methods: To determine both the prevalence and characteristics of adolescents admitted for acute alcohol intoxication in 2019–2020, a retrospective cohort study was conducted. All adolescents <18 years of age admitted for acute alcohol intoxication in the 12 participating hospitals in the Netherlands in 2019–2020 were included. Adolescents were divided in periods before, during, and subsequent to the first COVID-19 lockdown and the beginning of the second lockdown, in comparison with the same periods in 2019.

Results: The prevalence of acute alcohol intoxication among adolescents decreased by 70% during the first lockdown (March 16–May 31, 2020) compared with the period before lockdown (January 1–March 15, 2020). Between the first lockdown phase and the reopening period (June 1–October 14, 2020), the prevalence significantly increased.

Conclusions: This study demonstrates that COVID-19 lockdown led to a decrease in acute alcohol intoxication among adolescents. This decrease is multifactorial, including the closure of bars/restaurants, sport clubs, schools and increased parental supervision due to obligatory working from home of parents. Based on the findings, this specific population requires close monitoring, especially in the reopening phases.

IMPLICATIONS AND CONTRIBUTION

This study demonstrates the relationship between the COVID-19 lockdown measures and acute alcohol intoxication among adolescents. Further research is needed to identify the predictors and to develop suitable alcohol policies for after the lockdown(s) are lifted.

As is the case in the rest of the world, the COVID-19 pandemic is posing an ongoing challenge in the Netherlands. The Dutch government attempted to restrict the spread of the coronavirus by establishing a national 'targeted' or so-called 'intelligent' lockdown, which spanned from March 16 until June 1, 2020. All schools, universities, offices, restaurants, and other commercial

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activities were closed or shut down as part of these measures. The government recommended that people should only leave their homes for justifiable reasons, such as purchasing essential goods, health conditions, and employment in the case of those who work in public utility services. These measures were relatively mild in comparison with surrounding countries, where complete restrictions on movement were implemented by their respective governments [1]. On June 1, 2020, these initial lockdown measures were lifted and the preventive measures eased, in light of the fact that COVID-19 infection rates in the Netherlands had substantially decreased. However, the second 'partial' lockdown was implemented in October 2020. Although the initial stage of this second lockdown had less invasive lockdown measures than the first, these were subsequently enhanced on December 15, 2020.

Research suggests that COVID-19 has negatively impacted the population's mental health [2–4], not to mention that the outbreak would lead to additional health problems across the globe, such as anxiety, stress, insomnia, depressive symptoms, fear, and anger [4]. The negative effect of the pandemic on mental health was consistently related to alcohol use indices in Italy [5], Australia [6,7], Canada [8], the United States of America [9,10], Germany [11], and the United Kingdom [12].

For example, in both Australia and the United Kingdom, alcohol sales increased as a result of the COVID-19 restrictions. Indeed, in Australia, the government eased liquor licensing restrictions, resulting in an increase in alcohol sales [6], whereas alcohol sales in the United Kingdom disproportionally increased in the first week of lockdown [13]. Conversely, countries like South Africa prohibited the sale of alcohol during the lockdown, which both lifted significant pressure off emergency care units and lowered mortality rates [14]. However, recently an American study about substance abuse among ninth- and tenth-grade students in eight high schools in Northern California stated that alcohol use did not significantly change before and during the COVID-19 lockdown [15].

Addressing alcohol-related harms and its attendant effects, such as, for example, domestic abuse, should form an integral part of countries' COVID-19 recovery plans [13]. For example, governments should provide public health warnings concerning excessive alcohol consumption during isolation periods, to protect vulnerable individuals [16]. This is important given that alcohol misuse is one of the leading causes of preventable mortality, contributing annually to around three million deaths worldwide [17].

In an emergency department in Trieste, Italy, the relative frequency of severe alcohol intoxication after the COVID-19 lockdown increased significantly [5]. In particular, the authors of this study suggested that emergency services must prepare for a possible peak of alcohol intoxication–related emergencies among adolescents during this period. This peak constitutes an alarming sign for the mental health of adolescents.

The present study aims to examine hospital admission data of adolescents admitted for acute alcohol intoxication (AAI) to Dutch hospitals, before the first lockdown, during the first lockdown, as well as both after the re-opening and during the start of the second lockdown.

Methods

To determine the prevalence of adolescents admitted for AAI in the Netherlands before, during, and after the lockdowns, a retrospective cohort study was conducted. Across 12 major district general hospitals around the Netherlands (Reinier de Graaf Gasthuis, Delft, Langeland Hospital, Zoetermeer, Groene Hart Hospital, Gouda, Medical Centre Leeuwarden, Wilhelmina Hospital, Assen, Van Weel-Bethesda Hospital, Dirksland, Zuyderland hospital Sittard, Dijklander Hospital, Hoorn, Admiraal de Ruyter hospital Goes, Maxima Medical Centre, Veldhoven, Gelre Hospital, Zutphen, and Catharina Hospital, Eindhoven), all patients admitted for AAI who were younger than 18 in 2019–2020 were registered. Based on the data collected by the Dutch Paediatric Surveillance Unit (NSCK) between 2007 and 2017, we discerned that the data collection in these 12 hospitals reported, on average, 35.1% of the yearly cases of AAI <18 years between 2007–2017. All these 12 hospitals have a multidisciplinary outpatient clinic for 'adolescents and alcohol' to reflect on the AAI incident.

The pediatricians from the participating hospitals provided anonymized data on patients admitted for AAI from January 1, 2019 until December 31, 2020 via a standardized protocol. The inclusion criteria were adolescents <18 years of age and being admitted with AAI (positive blood alcohol concentration [BAC] and/or clinical features of alcohol intoxication).

The first lockdown in the Netherlands lasted from March 16 to May 31, 2020. During this period, there were several measures undertaken to restrict movement, including working from home, closing of events and meeting places, to prevent the virus spreading [18]. On June 1, 2020, the first lockdown ended because of a substantial decrease in the infection rate in the Netherlands. However, on October 15, 2020, additional preventive measures were again taken by the Dutch government to reduce the virus from spreading, including closing restaurants and limiting contact.

The primary outcome of this study is the prevalence of adolescents admitted for AAI in the Netherlands before, during, and after the COVID-19 lockdowns. To estimate the effect of the abovementioned lockdown measures on the admission data of adolescents admitted for AAI, the patients in this study were divided into different time periods: before the first lockdown (January 1–March 15, 2020), during the first lockdown (March 16–May 31, 2020), after the first lockdown (June 1–October 14, 2020), and the beginning of the second lockdown (October 15–December 31, 2020). The same periods in 2019 were used as a reference group (January 1–March 15, 2019, March 16–May 31, 2019, June 1–October 14, 2019, and October 15–December 31, 2019). The second lockdown did not end on December 31, 2020, and thus, this study only illustrates the effects of the beginning of the second lockdown. To compare these different phases with various durations, the prevalence was defined as the number of cases for each thirty-day period.

The secondary outcomes of this study were the BAC (in mg/ml) and proportion of adolescents with a positive drug screening. As covariates, characteristics such as sociodemographic information (age, sex, and educational level) were taken into account. All the patients were classified into the different time periods by the pediatricians in the 12 hospitals, which made the data non-identifiable for the research team.

All the variables for each patient were entered into an SPSS data set. SPSS for Windows, version 25, was used to analyze the data. Descriptive statistics were used to show the baseline characteristics of the study population. Proportions were expressed as percentages, with 95% confidence intervals (CIs). All

continuous data were expressed as mean (standard deviation) or median (interquartile range) based on the Shapiro Wilk test.

To analyze the primary objective of this study and the prevalence of adolescents with AAI per period, a Poisson regression analysis was performed. Prevalence for the thirty-day period was calculated by dividing the total number of cases of adolescents admitted for AAI in each given time period by the number of days in the period, then multiplying this by 30. When analyzing the prevalence/30-day difference for each time period, a Poisson regression (this regression model could be used because the prevalence/30 days consisted of count data in a Poisson distribution, the time period was the independent variable, there was independence of observations, and the mean and variance of the model were identical) was used. A Poisson regression model with 95% CIs was used to estimate change in prevalence during the various time periods. CIs not including one were considered to be statistically significant.

To analyze the secondary outcome of this study and the abovementioned covariates, multiple tests were performed. The BAC and age were not normally distributed continuous variables, and therefore, a Mann-Whitney U test was used. For the gender differentiation per period, a chi-square test was used. The Fisher exact test was performed to analyze the proportion of positive drug screening. The significance level was set to $p = .05$.

Ethical approval for the study was obtained from the Medical Ethical Testing Committee Zuid-Holland (research protocol approval ID is G20.175) and the research committee of the Reinier de Graaf Gasthuis.

Results

Between January 1, 2019 and December 31, 2020, 482 adolescents <18 years were admitted for AAI to one of the 12 participating hospitals. The median age was 16 years. The median BAC was .19 mg/ml. A positive drug screening, most frequently for cannabinoids, was observed in 12.0% of all included patients.

Table 1 displays the primary and secondary outcome measures. The prevalence of adolescents admitted for AAI especially decreased during the first lockdown period compared with the prelockdown period (January 1 to March 15, 2020). None of the adolescents admitted during the first lockdown phase had a positive drug screening.

The results of the Poisson regression model show that the prevalence of adolescents admitted for AAI decreased by 70% ($p = .002$, CI .14–.63) between the pre-lockdown period (January 1–March 15, 2020) and the first lockdown phase (March 16–May 31, 2020), see Figure 1. However, the patient characteristics (age, sex, BAC and the proportion of positive drug screenings) did not differ with respect to those adolescents admitted for AAI during these periods, see Table 2.

Between the first lockdown phase (March 16–May 31, 2020) and the reopening phase (June 1–October 14, 2020), the prevalence of adolescents admitted for AAI significantly increased ($p = .047$, CI 1.01–4.88), see Figure 1. However, the reopening period did not significantly differ from the second lockdown period (October 15–December 31, 2020) ($p = .074$, CI .23–1.07).

The Poisson regression model showed that there was no significant difference in the prevalence of cases of AAI between the weeks after the reopening (June 1–October 14, 2020) and the same period in 2019 ($p = .758$, CI .50–1.66).

Table 1
Demographic characteristics of adolescents admitted for AAI divided per study phase

	2019				2020			
	Jan 1–Mar 15	Mar 16–May 31	Jun 1–Oct 14	Oct 15–Dec 31	Jan 1–Mar 15 Prelockdown	Mar 16–May 31 First lockdown	June 1–Oct 14 Reopening	Oct 15–Dec 31 Second lockdown
Prevalence in cases/30 days	24	25	22	19	30	9	20	10
Absolute number of cases	60	63	99	49	74	22	90	27
Duration of period in days	74	77	136	78	75	77	136	78
Prevalence rate ratio (CI)[a]	1.00	1.04 (.60–1.82)	.92 (.51–1.64)	.79 (.43–1.45)	1.25 (.73–2.14)	.38 (.17–.81)[b]	.83 (.46–1.51)	.42 (.20–.87)[b]
Median age in years (IQR)	16 [2]	15 [1]	16 [2]	16 [2]	16 (2)	15 [2]	16 [2]	15 [2]
Proportion of males (CI)	55.2% (42.5%–67.3%)	49.2% (37.3%–61.2%)	50.5% (40.8%–60.2%)	52.1% (38.3%–65.5%)	52.7% (41.5%–63.7%)	54.5% (34.7%–73.1%)	56.7% (46.4%–66.4%)	55.6% (37.3–72.4)
Proportion with positive drug screenings (CI)	6.9% (2.7%–16.4%)	12.7% (6.6%–23.1%)	14.1% (8.6%–22.3%)	14.3% (7.1%–26.7%)	14.9% (8.5%–24.7%)	.0% (.0%–14.9%)	12.2% (7.0%–20.6%)	11.1% (3.9%–28.1%)
Median BAC in mg/ml (IQR)	.19 (.07)	.19 (.07)	.19 (.06)	.21 (.07)	.19 (.05)	.18 (.12)	.19 (.08)	.20 (.06)

AAI = acute alcohol intoxication; BAC = blood alcohol concentration; CI = confidence interval; IQR = interquartile range.
[a] The prevalence in cases/30 days meets the assumptions of a Poisson distribution.
[b] The prevalence rate ratio is significantly different compared with Jan 1–Mar 15, 2019.

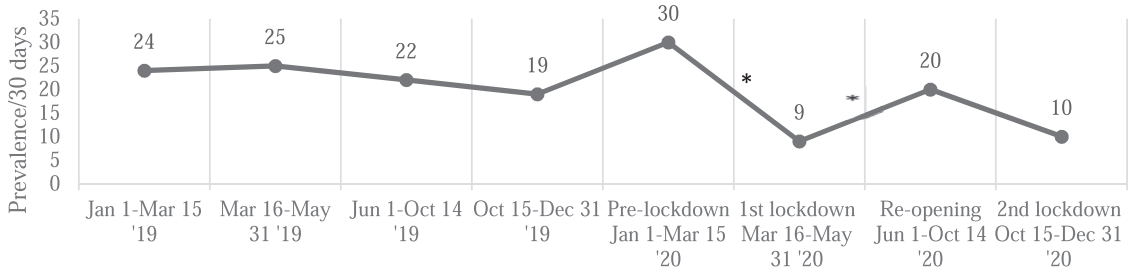

Figure 1. Prevalence of adolescents admitted for AAI for per 30 days within the different time periods. * Significantly different compared with the previous time period.

Because of the small sample size, the apparent decrease of concurrent substance use from 14.9% in the prelockdown period to .0% in the lockdown period was not statistically significant ($p = .064$, Figure 2).

Discussion

This study states that the prevalence of adolescents admitted for AAI decreased between the prelockdown period and the first lockdown phase. Furthermore, between the first lockdown and reopening phase, the prevalence of adolescents admitted for AAI significantly increased.

The aforementioned Italian study concluded that there was a decrease in adolescents admitted for AAI during their lockdown period and then a rebound effect after the lockdown ended [5]. The Italian government introduced stricter measures during their lockdown than the Dutch government [1], which may have led to this peak in Italy when the lockdown ended. However, no such peak was noticed after the first lockdown ended in the Netherlands; in fact, the reopening period after the first lockdown was comparable with the same period in 2019. The aforementioned American study stated that alcohol use did not significantly change before and during the COVID-19 lockdown [15].

Furthermore, there was no significant difference in the prevalence of AAI cases between the reopening period and the second lockdown. This indicates that the influence of lockdown measures in the beginning of the second lockdown had less of an effect on adolescents admitted for AAI than that during the first lockdown. This might be because schools were closed during the first lockdown, whereas in the beginning of the second lockdown, they remained open for two months until December 15, 2020. Therefore, more social contact may have been possible for these adolescents during the start of the second lockdown, thus resulting in AAI. Moreover, depression and anxiety in adolescents steadily increased since the COVID-19 pandemic [19], which might have resulted in excessively drinking alcohol as a form of self-medication.

Table 2
Demographic characteristics of adolescents admitted for AAI during both the prelockdown and lockdown period

	2020		*p*-value
	Jan 1–Mar 15 Prelockdown	Mar 16–May 31 First lockdown	
Prevalence in cases/30 days	30	9	.002[a]
Median age in years (IQR)	16 [2]	15 [2]	.079[b]
Proportion of males (CI)	52.7% (41.5%–63.7%)	54.5% (34.7%–73.1%)	.879[c]
Proportion with positive drug screenings (CI)	14.9% (8.5%–24.7%)	.0% (.0%–14.9%)	.064[d]
Median BAC in mg/ml (IQR)	.19 (.05)	.18 (.12)	.325[b]

AAI = acute alcohol intoxication; BAC = blood alcohol concentration; CI = confidence interval; IQR = interquartile range.
[a] The prevalence in cases/30 days meets the assumptions of a Poisson distribution.
[b] Mann-Whitney U test.
[c] Chi-square test.
[d] Fisher exact test.

A retrospective South-African study showed that the amount of unnatural deaths caused by accidents, for example, significantly decreased during the period of total lockdown and national alcohol ban [14]. In the Netherlands, there was no alcohol ban during this period, although it is illegal to buy if one is under the age of 18. During the lockdown in the Netherlands, it was harder for adolescents <18 years to illegally consume alcohol because restaurants and sport clubs were closed. This is because checking IDs is done less thoroughly in restaurants and sport clubs than in supermarkets, for example, in the Netherlands [20], thus resulting in fewer alcohol sales to minors during the lockdown. Moreover, Dutch citizens were instructed to work from home during the lockdown [18], resulting in greater parental supervision of adolescents. Nevertheless, there is a possibility that some adolescents with AAI during first lockdown may have stayed home instead of going to the hospital to receive care because family members or friends may have been worried about the COVID-19 exposure in hospitals.

The strengths of this study are as follows. First, it provides a representative sample of cases of AAI in the Netherlands. Based on data collected by NSCK, we know that the 12 participating major district general hospitals reported 35.1% of the yearly cases of AAI <18 years between 2007 and 2017. Second, the results of our study can be used for primary prevention purposes during the ongoing, challenging, and unknown time period of the COVID-19 pandemic. It must be stressed that the Italian context was not wholly comparable with the Dutch, in light of the aforesaid differences in lockdowns. A limitation of this study is that minor adjustment to lockdown measures by the government, such as changes in the number of citizens allowed to gather together on the streets, was not taken into account. The time periods were based on prominent preventive COVID-19 lockdown measures, such as the closing and reopening of restaurants.

Overall, this study indicates that the COVID-19 lockdowns led to a decrease in adolescents admitted for AAI. This might be related to preventive measures, including the closure of bars, sport clubs, restaurants, and schools or other lockdown measures. Compared with recent other literature, adolescent alcohol

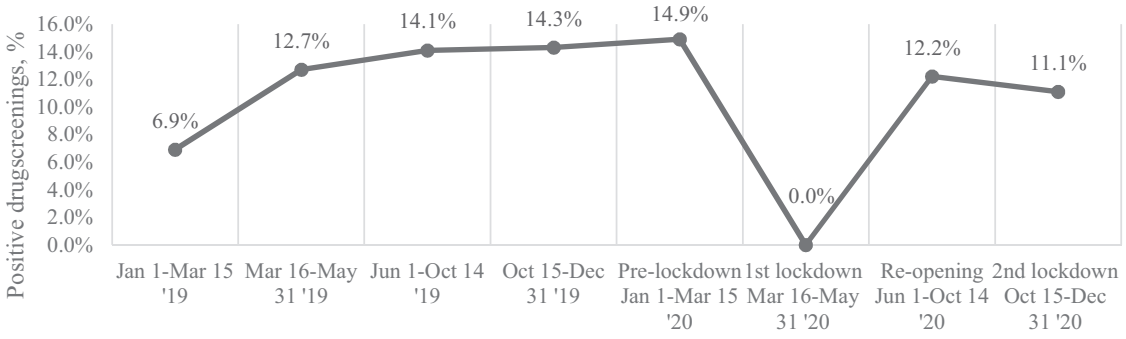

Figure 2. Prevalence of adolescents admitted for AAI with positive drug screenings in the different time periods.

misuse during the COVID-19 lockdown declined among the Dutch, increased among the Italians, and remained unchanged among the Americans. These differences were likely multifactorial—parental supervision, access to alcohol, sale of alcohol, contact with peers, and so on—but reveal cross-cultural influences in the response to COVID-19. This patient population needs to be closely monitored in the future, especially during the ongoing COVID-19 pandemic. More research is needed into the predictors and psychosocial factors that incite excessive drinking to explore the development of alcohol policies and primary prevention and therapeutic strategies for after the lockdown(s). It would be interesting to compare the Dutch and Italian data with the European data, which hopefully is rapidly coming.

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