

## Time of day as indicator of adolescent alcohol intoxication emergency department presentations

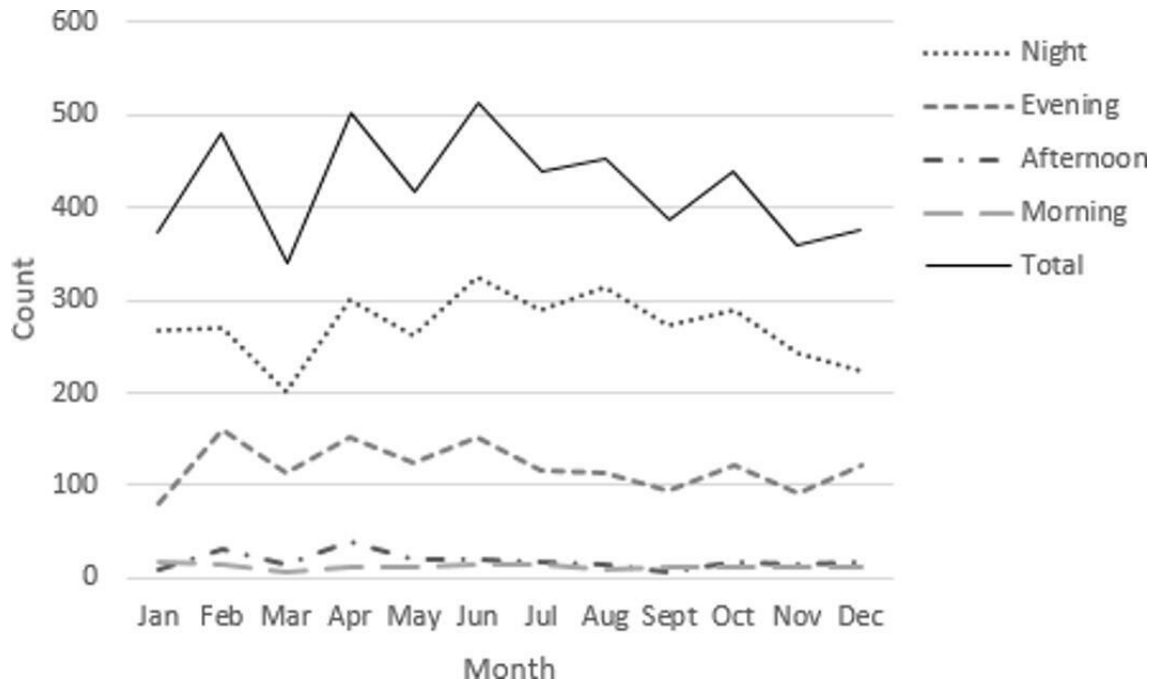
In line with other countries from wealthier parts of the world, the Netherlands shows clear trends of less alcohol use and less binge drinking by youth since the millennium shift.<sup>1</sup> Contrary to these trends, the number of underage patients who are admitted to a hospital with alcohol intoxication characteristics is an ongoing and stable health concern in the country.<sup>2</sup>

Knowledge about what time of day patients are brought into the hospital is important for the development of efficient prevention policies. The primary aim of this repeated cross-sectional study was to investigate how time of day variation (morning, afternoon, evening and night) was associated with patient and intoxication characteristics in Dutch adolescents admitted for alcohol intoxication. Furthermore, we also examined how alcohol intoxication hospital admission time trends developed between 2007 and 2017.

In this repeated cross-sectional study, the contents of 5511 patient files were analysed. During the data collection period (2007–2017), paediatric doctors reported cases of alcohol intoxication to the Dutch Paediatric Surveillance Unit, a nationwide surveillance system, with around 95% participation grade. Time of day for admittance was one question on the questionnaire with four answering options: morning (06:00–11:59), afternoon (12:00–17:59), evening (18:00–23:59) and night (00:00–05:59).

Our study shows that adolescent hospital admissions for alcohol intoxication are most frequently seen during the night (64.6%), followed by evening (28.0%), afternoon (4.7%) and morning (3.0%). This pattern is rather stable over the months, with a slight increase in the periods of warmer outdoor temperatures (April–August) as well as a peak in February (figure 1).

Over the years (2007–2017), the number of admissions during the morning and afternoon is stable, but there was a strong increase in night-time admissions and a mild increase in evening admissions. The latter two time frames also caused an overall increase in alcohol intoxication treatments in the Netherlands in the decade from our data collection (figure 2).



**Figure 1** Trends in time of hospital admission. Trends in time of day variation (night, morning, afternoon, evening) in absolute number of hospital emergency department presentations for acute alcohol intoxication, 2007–2017.

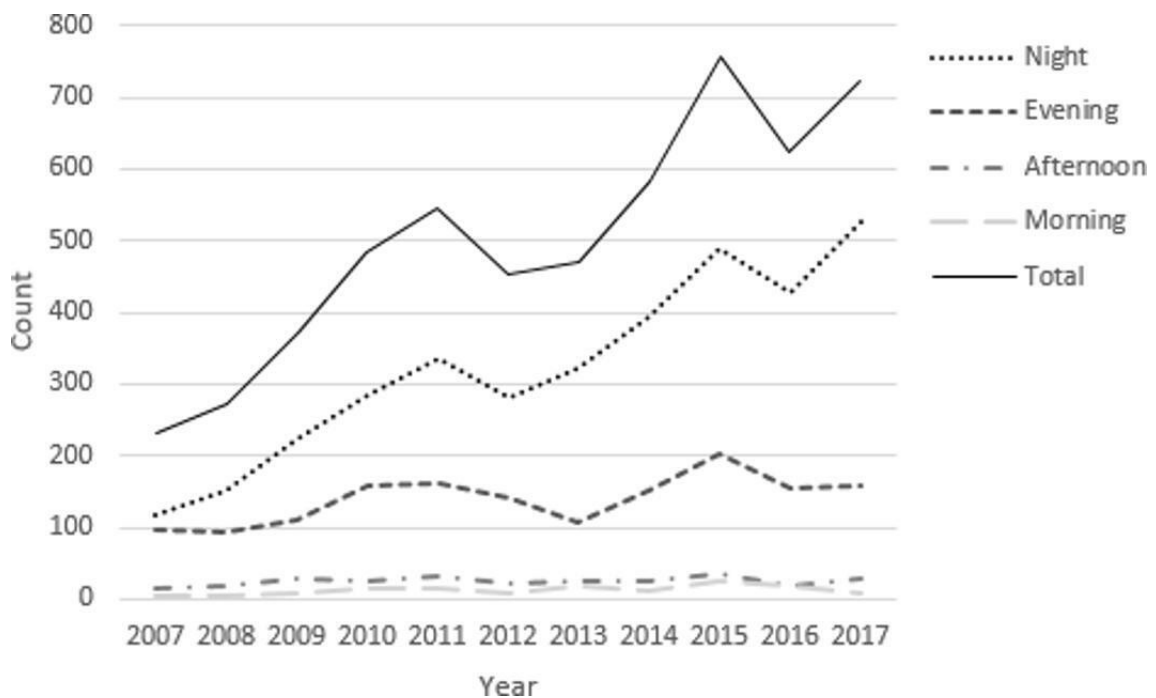
Our analyses further show that during morning and afternoon admission, the propensity for male patients is higher. Children from parents who disapprove alcohol consumption are most likely to drink at afternoons and evenings, while children who are (partially) allowed to drink have the biggest chance to end up in a hospital during night-time(online

supplemental table 1). The group who is admitted during afternoon hours turns out to be the youngest(online supplemental table 2).

Prevention of adolescent alcohol intoxication in the Netherlands should be specifically targeted at adolescents at risk of night-time admissions. Afternoon admissions require special attention

as these adolescents were younger and more frequently showed rule-breaking behaviour. Future research will also focus on the possible role of national (holidays, carnival) and local (fairs) events in relationship to alcohol intoxication in minors.

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**Figure 2** Time of year variation in adolescent acute alcohol intoxication hospital admissions. Trends in time of day variation (night, morning, afternoon, evening) per month during the period 2007–2017.

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**Funding** The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests** None declared.

**Patient consent for publication** Not required.

**Provenance and peer review** Not commissioned; externally peer reviewed.



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**To cite** Veld L, Speller A, van Hoof J, *et al.* *Arch Dis Child* 2021;**106**:1241–1243.

Accepted 22 March 2021  
Published Online First 3 May 2021

*Arch Dis Child* 2021;**106**:1241–1243.  
doi:10.1136/archdischild-2020-321209

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**Table 2:** Hospital Characteristics of underage alcohol intoxication 2007-2017 by admission time

	Morning	Afternoon	Evening	Night	Total	<i>p</i> -value
Mean BAC in g/L (SD)	n=144 1.87 (0.69)	n=227 1.86 (0.56)	n=1393 1.90 (0.56)	n=3194 1.92 (0.53)	n=4958 1.91 (0.55)	.237 <sup>a</sup>
Mean core temperature in °C (SD)	n=74 35.9 (0.98)	n=90 35.8 (0.83)	n=632 35.7 (1.52)	n=1599 35.7 (1.22)	n=2935 35.7 (1.29)	.685 <sup>a</sup>
Mean length of admission in days (SD)	n=90 0.90 (0.95)	n=161 1.00 (0.52)	n=925 0.94 (0.50)	n=2030 0.89 (0.56)	n=3206 0.91 (0.56)	<b>&lt;.05<sup>a</sup></b>

<sup>a</sup>*p*-value calculated using one-way ANOVA test. **Bold** highlights significant *p*-values.

**Table 1:** Characteristics of underage alcohol intoxication 2007-2017 by admission time

	Morning n=163 (2.96%)	Afternoon n=258 (4.68%)	Evening n=1543 (28.0%)	Night n=3547 (64.4%)	Total (n=5511)	p-value
<i>Demographic characteristics</i>						
Mean age in years (SD)	15.88 (1.02)	14.80 (1.30)	14.93 (1.17)	15.61 (1.10)	15.39 (1.18)	<b>&lt;.001<sup>F</sup></b>
Sex						<b>&lt;.001<sup>X2</sup></b>
Male (%)	103 <sub>a</sub> (63.2%)	153 <sub>a</sub> (59.3%)	765 <sub>b</sub> (49.6%)	1906 <sub>c</sub> (53.7%)	2927 (53.1%)	
Female (%)	60 <sub>a</sub> (36.8%)	105 <sub>a</sub> (40.7%)	778 <sub>b</sub> (50.4%)	1641 <sub>a</sub> (46.3%)	2584 (46.9%)	
Residential area						<b>.001<sup>X2</sup></b>
High pop density (%)	88 <sub>a,b</sub> (54.0%)	144 <sub>b</sub> (55.8%)	808 <sub>b</sub> (52.4%)	1676 <sub>b</sub> (47.3%)	2716 (49.3%)	
Lower pop density (%)	75 <sub>a,b</sub> (46.0%)	114 <sub>b</sub> (44.2%)	735 <sub>b</sub> (47.6%)	1871 <sub>a</sub> (52.7%)	2795 (50.7%)	
Educational level						<b>&lt;.001<sup>X2</sup></b>
Low (%)	80 <sub>a,b,c</sub> (53.7%)	150 <sub>c</sub> (63.3%)	694 <sub>b</sub> (52.8%)	1535 <sub>c</sub> (48.7%)	2459 (50.7%)	
Middle (%)	35 <sub>a</sub> (23.5%)	36 <sub>b</sub> (15.3%)	321 <sub>a</sub> (24.4%)	811 <sub>a</sub> (25.7%)	1203 (25.7%)	
High (%)	22 <sub>a,b</sub> (14.8%)	39 <sub>a,b</sub> (16.5%)	221 <sub>b</sub> (16.8%)	635 <sub>a</sub> (20.1%)	917 (20.1%)	
Other* (%)	12 <sub>a</sub> (8.1%)	11 <sub>a</sub> (4.7%)	78 <sub>a</sub> (5.9%)	173 <sub>a</sub> (5.5%)	274 (5.6%)	
Season						<b>&lt;.001<sup>X2</sup></b>
Spring (%)	32 <sub>a,b</sub> (20.1%)	95 <sub>c</sub> (37.1%)	436 <sub>b</sub> (28.6%)	869 <sub>a</sub> (24.9%)	1432 (26.4%)	
Summer (%)	45 <sub>a</sub> (28.3%)	56 <sub>a</sub> (21.9%)	391 <sub>a</sub> (25.6%)	983 <sub>a</sub> (28.2%)	1475 (27.1%)	
Autumn (%)	34 <sub>a,b</sub> (21.4%)	43 <sub>a</sub> (16.8%)	329 <sub>a,b</sub> (21.6%)	845 <sub>c</sub> (24.2%)	1251 (23.0%)	
Winter (%)	48 <sub>a</sub> (30.2%)	62 <sub>a</sub> (24.2%)	370 <sub>a</sub> (24.2%)	795 <sub>a</sub> (23.8%)	1275 (23.5%)	
<i>Intoxication characteristics</i>						
Alcohol-specific parental rule-setting						<b>&lt;.001<sup>X2</sup></b>
Zero-tolerance (%)	28 <sub>a</sub> (44.4%)	52 <sub>b</sub> (62.7%)	395 <sub>b</sub> (66.2%)	733 <sub>a</sub> (45.5%)	1208 (51.3%)	
Partial permission (%)	18 <sub>a</sub> (28.6%)	18 <sub>a,b</sub> (21.7%)	105 <sub>b</sub> (17.6%)	401 <sub>a</sub> (24.9%)	542 (23.0%)	
Approval (%)	17 <sub>a,b</sub> (27.0%)	13 <sub>b,c</sub> (15.7%)	97 <sub>c</sub> (16.2%)	478 <sub>a</sub> (29.7%)	605 (25.7%)	
Reason of admission						<b>&lt;.001<sup>X2</sup></b>
Reduced consciousness (%)	126 <sub>a</sub> (80.8%)	211 <sub>a,b</sub> (88.3%)	1352 <sub>a</sub> (92.2%)	2930 <sub>a</sub> (86.6%)	4619 (88.1%)	
(Traffic/Other) Accident (%)	19 <sub>a</sub> (12.2%)	18 <sub>a,b</sub> (7.5%)	77 <sub>b</sub> (5.2%)	316 <sub>b</sub> (9.3%)	430 (8.2%)	
Aggression/violence (%)	8 <sub>a</sub> (5.1%)	3 <sub>b</sub> (1.3%)	24 <sub>c</sub> (1.6%)	100 <sub>a,b</sub> (3.0%)	135 (2.6%)	
Other** (%)	3 <sub>a</sub> (1.9%)	7 <sub>a</sub> (2.9%)	14 <sub>a,b</sub> (1.0%)	37 <sub>a,b</sub> (1.1%)	61 (1.2%)	
Place of consumption						<b>&lt;.001<sup>X2</sup></b>
Parents' or own house	12 <sub>a</sub> (7.8%)	27 <sub>a</sub> (10.9%)	142 <sub>a</sub> (9.5%)	330 <sub>a</sub> (9.6%)	511 (9.6%)	
House of friends/acquaintances	65 <sub>a,b</sub> (42.2%)	40 <sub>c</sub> (16.1%)	557 <sub>b</sub> (37.4%)	1669 <sub>a</sub> (48.8%)	2331 (43.9%)	
In the streets	20 <sub>a</sub> (13.0%)	116 <sub>b</sub> (46.8%)	520 <sub>c</sub> (34.9%)	526 <sub>a</sub> (15.4%)	1182 (22.2%)	
Public place (bar, canteens)	35 <sub>a</sub> (22.7%)	19 <sub>b</sub> (7.7%)	120 <sub>b</sub> (8.1%)	543 <sub>c</sub> (15.9%)	717 (13.5%)	
Other***	22 <sub>a,b</sub> (14.3%)	46 <sub>b</sub> (18.5%)	150 <sub>a</sub> (10.1%)	354 <sub>a</sub> (10.3%)	572 (10.8%)	

<sup>F</sup> p-value calculated using one-way ANOVA test. <sup>X2</sup> p-value calculated using the chi-square test. **Bold** highlights significant p-values.

\* Defined as 'working', 'special needs education' or 'other, not further specified' \*\* Including suicide attempt, multiple reasons and vomiting \*\*\* Including vacation, at work, at school and other's places  
Each subscript letter denotes a subset of the time of day categories whose column proportions do not differ significantly from each other at the 0.05 level.