

# Educational achievement

No. 2018/23D, The Hague, December 17, 2018

Backgrounddocument to:

Alcohol en hersenontwikkeling bij jongeren [in Dutch]

No. 2018/23, The Hague, December 17, 2018

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Health Council of the Netherlands



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# 01 introduction



This background document forms an integral part of the advisory report on Alcohol and Brain Development in Adolescents and Young Adults. In this document the peer-reviewed scientific evidence is described on the association between alcohol consumption during adolescence or young adulthood (age range 12-24 years) and measures of educational achievement.

Alcohol consumption during adolescence or young adulthood may influence the brain and its development and functioning. The committee hypothesizes that this, in turn, may influence educational achievement. In that case drinking alcohol during adolescence may have life-long consequences. Confounding and reverse causation cannot be ruled out: alcohol consumption is related to several other risk behaviours that are also related to school achievement, and adolescents may start drinking (heavily) as a result of their poor school performance or life situation.

A systematic search was performed for peer-reviewed longitudinal studies on the association between alcohol use during adolescence or young adulthood and measures of educational achievement.



# 02 methods



## 2.1 Identification and quality appraisal of longitudinal studies

The background document 'Methodology for the evaluation of the evidence' provides an extensive description and explanation of the methodology. In short, this systematic review includes longitudinal studies in adolescents or young adults with measures of alcohol exposure at baseline and measures of educational achievement as an outcome (see Annex for search strategy).

Published articles (in English) up to and including May 2018, were retrieved from Pubmed and PsychINFO, complemented by hand searches of reference lists, correspondence with researchers in the field and a systematic review about adolescent alcohol use and adult outcomes that covered the literature until 2008.<sup>1</sup> Studies about the acute effects of alcohol were excluded. Study samples of specific subgroups (i.e. subjects with ADHD or speech and language impairment, patients in drug clinics, patients with bipolar disorder) were also excluded. To be included, the studies needed to have data on alcohol exposure (independent<sup>a</sup> of other substance use). For example, the committee excluded studies in which only the combined use of marijuana and alcohol was studied. Studies based on retrospective data regarding alcohol consumption were not included.

<sup>a</sup> With 'independent' we refer to design and statistical analyses that were intended to study alcohol exposure not combined with the use of other substances. In addition, (residual) confounding by other factors related to alcohol exposure as well as the study outcomes can never be completely ruled out in observational studies.

Two papers on the same cohort, Coronary Artery Risk Development in Young Adults study, were found.<sup>2,3</sup> As Sloan et al. (2009)<sup>3</sup> reported on a longer follow-up than Braun et al. (2000)<sup>2</sup> the committee excluded the study of Braun et al. Furthermore, the results of Patte et al.<sup>4</sup> were excluded since the authors published a second paper on the COMPASS data in 2017 and exposure measures were overlapping.<sup>4,5</sup> The first paper was about the frequency of binge drinking<sup>4</sup>, the second, about the initiation of binge drinking (early vs. late) and the frequency of binge drinking.<sup>5</sup> As the second paper reported on more exposure measures, the committee only took the results of this study into account. In total the study selection resulted in 30 papers.

Risk of bias of the studies was assessed with the Newcastle Ottawa Scale (NOS). The NOS rating system scores studies from 0 (highest degree of bias) to 9 (lowest degree of bias). Scoring was based on consensus between the scientific secretaries of the Health Council. The committee judged studies with an NOS score of 7 or higher, with at least adjustment for confounding, to be of sufficient quality. So, if a study receives 7 points, but does not sufficiently correct for relevant confounders (i.e. 0 points on NOS item 5), the study is not judged as of sufficient quality.

## 2.2 Data extraction and data synthesis

Studies were extracted using structured extraction forms which included information on the study sample, measurement and grouping of exposure and outcomes measures, statistical analysis (including covariates,



stratification or matching factors), results, limitations and funding. All relevant exposure and outcome measures were extracted. The results presented in this background document were based on the most extensive statistical models, in terms of adjustment. Because of differences in age and social circumstances studies were grouped according to the study population: high school students versus college/ university students. Secondly, studies were grouped according to the outcome measure: educational attainment/drop out and school marks. All the studies will be briefly discussed one by one in terms of study sample, NOS score, and (baseline) drinking status. The studies of sufficient quality (see Section 2.1) will be discussed first, followed by the other studies. Conclusions are primarily based on the studies of sufficient quality, while the results of the studies with lower NOS scores are used as ancillary material.



# 03 results



### 3.1 Summary of study characteristics

The Committee identified 30 longitudinal studies (Table 1) based on 29 cohorts (some publications were based on the same cohort and some publications contained multiple cohorts), published between 1984 and 2018.<sup>3,5-33</sup> Seven studies were conducted in Europe,<sup>6,11,18-20,29,33</sup> 19 in North America,<sup>3,5,9,10,12-17,21-23,25-28,30,31</sup> 2 in Australasia,<sup>7,32</sup> 1 in both USA and Australia,<sup>8</sup> and 1 in Israel.<sup>24</sup> The number of participants ranged between 172 and 19,764. The study populations included adolescents or young adults, or subgroups such as high-school students, college or university

students, or twins. About half of the studies focused on heavy or binge drinking and the others on regular non-binge drinking. The NOS scores ranged between 4 and 9 (Table 2). In 16 studies no adjustment for relevant confounders was made.<sup>3,6,10,12,14,17-22,24,26,28-30</sup> In 16 studies the extent of the attrition bias could not be evaluated, because limited information was available about the participants who were excluded from the analyses.<sup>3,5,9,10,12,15,18,20,21,24-29,32</sup> In almost all studies, the subjects were already drinking at baseline.

**Table 1.** General characteristics of longitudinal studies (grouped by high school and college/university students, cohort, and publication date)

Studies	Sample	N	Exposure	Follow-up time	Baseline alcohol consumption	Endpoints	Risk of Bias <sup>a</sup>
<b>High school students</b>							
<i>Cohort from Technion-Israel Institute of Technology, Israel</i>							
Epstein and Tamir 1984 <sup>24</sup>	High school students, 16y	181	Drinking strong alcoholic beverages; yes/no	2y	Varying (46% of males and 20% of females drank strong alcoholic beverages by age 16y)	High school dropout	6
<i>Cohort from New York State, USA</i>							
Kandel 1986 <sup>10</sup>	Secondary school and high school students, 15-16 y	1,004	Ever alcohol use at baseline vs. never	9y	Not reported	Level of educational achieved	5
<i>National Longitudinal Survey of Youth, USA</i>							
Cook and Moore 1993 <sup>12</sup>	High school seniors, 17-18y	752	Number of drinks per week, frequent drinker; yes/no, being drunk frequently; yes/no	Approx. 6y	Varying (Drinks per week 2.6 (sd 7.5). Frequent drinker 0.14 (sd 0.34). Frequently drunk 0.10 (sd 0.29)	Number of years completed schooling after high school	6
Sloan 2011 <sup>9</sup>	Youth, 17-25y	7,757	Frequent binge drinker vs. non-frequent binge drinker and vs. non-binge drinker/abstainers	Approx. 26y	Varying (17% reported frequent binge drinking, 40% non-frequent binge drinking, and 43% non-binge drinking/abstinence)	Years of schooling completed	8
<i>RAND Adolescent Panel Survey, USA</i>							
Ellickson 1998 <sup>25</sup>	High school students, 12-13y	4,390	More alcohol use	5y	Varying (74.4% ever used alcohol)	High school dropout	8



Studies	Sample	N	Exposure	Follow-up time	Baseline alcohol consumption	Endpoints	Risk of Bias <sup>a</sup>
<i>Young in Norway, Norway</i>							
Wichstrom 1998 <sup>18</sup>	High school students, 12-20y	5,308	Alcohol intoxication; yes/no	Not reported	Varying (drop outs 5.11 litres/year; completers 3.21 litres/year)	Senior high school dropout	4
<i>Cohort from south-eastern US public school system, USA</i>							
Bray 2000 <sup>27</sup>	High school students, 6 <sup>th</sup> 8 <sup>th</sup> grade (around 11-13y)	1,392	Alcohol initiation prior to age 16, 17, or 18y	Around 8y	Not reported	High school dropout	6
<i>Seattle Social Development Program, USA</i>							
Hill 2000 <sup>31</sup>	Adolescents from high crime areas, 10y	808	Binge drinking trajectories vs. non-binge drinking	Around 11y	Not reported	High school completion	7
<i>Cohort from western New York, USA</i>							
Mason and Windle 2001 <sup>22</sup>	High school students, 13-19y	840	Drinking behaviour: combination of beer and liquor use, and heavy beer drinking.	1.5y	Varying (no further interpretable figures reported)	Cumulative grade point average on a 7 point Likert scale	6
<i>National Education Longitudinal Study of 1988, USA</i>							
Dee and Evans 2003 <sup>26</sup>	High school students, around 13y	7,317	10 <sup>th</sup> grade and 12 <sup>th</sup> grade (binge) drinking vs. not drinking	Around 2 to 4y	Varying (42% had had at least one drink in the last month of their sophomore year, and 52% in their senior year)	High school completion and college entrance	5
Chatterji 2006 <sup>13</sup>	High school students, around 15y	7,604	10 <sup>th</sup> grade and 12 <sup>th</sup> grade (binge) drinking vs. not drinking	8-10y	Varying (42% of males and 38% of females had had at least one drink in the last month of 10 <sup>th</sup> grade)	Graduation from high school on schedule; receiving a high school diploma; entering college; college graduation	8
<i>Longitudinal study of familial alcoholism, Arizona, USA</i>							
King 2006 <sup>23</sup>	Children of alcoholics and matched controls, mean age 13.2y	374	Past-year level of consumption of beer/wine, hard liquor (around 11y)	Around 11y	Not reported	College attendance; College degree completion	8
Haller 2010 <sup>30</sup>	Children of alcoholics and matched controls, mean age 14.2y	405	Frequency of binge drinking ( $\geq 5$ drinks per occasion); from 0 (never) to 7 (every day) in three waves	18y	Not reported	College completion by age 25y. Adolescent academic achievement	6
<i>National Longitudinal Study of Adolescent Health, USA</i>							
Crosnoe 2006 <sup>16</sup>	Middle and high school students, 12-17y	11,927	Past-year level of alcohol use; Past year frequency of binge drinking	1y	Varying (no further interpretable figures reported)	Academic failure based on reported grades on Math, Science, English, and Social Studies	9



Studies	Sample	N	Exposure	Follow-up time	Baseline alcohol consumption	Endpoints	Risk of Bias <sup>a</sup>
<i>1970 British Birth Cohort Study, UK</i>							
Viner and Taylor 2007 <sup>19</sup>	Adolescents, 16y	4,854	Binge drinking; yes/no. Frequency of regular drinking	14y	Varying (17.7% reported binge drinking)	Left school without qualification (high school or college)	6
<i>National Child Development Study, UK</i>							
Staff 2008 <sup>11</sup>	Adolescents, 16y	9,107	Heavy alcohol use; yes/no	26y	Varying (13% of females and 25% of males reported heavy drinking)	Educational attainment	8
<i>International Youth Development Study, Australia and/or USA</i>							
Hemphill 2014 <sup>8</sup>	High school students in Australia and USA, 12-13y	1,858	Lifetime; ever more than a few sips; yes/no. Current alcohol use; more than a few sips in the past 30 days; yes/no. Binge drinking past 2 weeks; yes/no. Frequent drinking; ≥3 drinks in the past month; yes/no.	2y	Varying (46.7% of females and 51% of males reported lifetime drinking)	Marks in the last year below or above average, self-reported	9
Kelly 2015 <sup>32</sup> Only Australia	Secondary school students, Australia, approximately 10-15y	2,287	Alcohol use vs. no use	8y	Not reported	High school completion	8
<i>FinnTwin12, Finland</i>							
Latvala 2014 <sup>33</sup>	Adolescents, 12y	4,761	Level of any alcohol use. Level of drinking to intoxication.	Max. 15y	Not reported	Grade point average in the latest report (age 14y). Current student status (age 17y). Educational attainment (young adulthood)	9
<i>Icelandic cohort of adolescents, Iceland</i>							
Svansdottir 2015 <sup>20</sup>	Adolescents, 15y	201	Alcohol consumption; yes/no	8y	Not reported	Dropout secondary education	5
<i>Pooling study of 3 UK cohorts</i>							
Green 2016 <sup>6</sup>	High school students, 15-16y from 3 cohorts: NCDS, BCS, T07	NCDS: 15,672 BCS: 12,735 T07: 1,181	Adolescent weekly drinking; yes/no	6-10y	Varying (Prevalence of weekly drinking: NCDS: 45.9% BCS: 52.2% T07: 5.7%)	Tertiary education attendance (i.e. education beyond 18y)	6
<i>Monitoring the Future, USA</i>							
Patrick 2016 <sup>15</sup>	High school students, 18y	10,020	Binge drinking on at least one occasion in past 2 weeks; yes/no	7y	Varying (29% reported binge drinking)	College attendance. College graduation. College drop out	7



Studies	Sample	N	Exposure	Follow-up time	Baseline alcohol consumption	Endpoints	Risk of Bias <sup>a</sup>
<i>COMPASS study, Canada</i>							
Patte 2017 <sup>5</sup>	High school students, 14-15	19,764	Early vs. late onset of binge drinking. Initiation of rare weekly or monthly binge drinking	2y	Non-binge drinking	Approximate overall mark of most recent Math course and English course	5
<i>Pooling study of 4 Australasian cohorts, Australia, New Zealand</i>							
Silins 2018 <sup>7</sup>	High school students from 4 cohorts: ATP, CHDS, MUSP, VAHCS, 13-15y	2,615 up to 3,384	Frequency of alcohol use, quantity of alcohol use	Max. around 17y	Not reported	High school non-completion. University degree non-attainment (both by age 30y)	8
<b>College / University students</b>							
<i>Coronary Artery Risk Development in Young Adults, USA</i>							
Sloan 2009 <sup>3</sup>	College students, 18+y	1,863	No drinking, light drinking, moderate drinking, heavy drinking, very heavy drinking. All vs. occasional drinking	15y	Varying (13.6% of total sample (n= 3,964) was non-drinker)	College graduation	7
<i>A Midwestern university cohort 87/88, USA</i>							
Wood 2000 <sup>14</sup>	College freshmen, 17-18y	429	Frequency of binge drinking	6y	Not reported	Educational attainment i.e. level of degree completion	6
<i>A San Diego cohort, USA</i>							
McCarthy 2002 <sup>21</sup>	Young adults treated for alcohol and drug problems and matched controls, 22-24y	172	Combined factor of quantity and frequency of alcohol use, proportion of time that drinking leads to drunkenness and alcohol use patterns	2y	Varying (Treated group: 55 drinks on 11 occasions per month. Controls 25 drinks on 12 occasions)	Educational attainment	5
<i>A Midwestern university cohort 2002, USA</i>							
Martinez 2008 <sup>17</sup>	First-time undergraduate students, assumed to be around, 18y	3,290	Heavy drinking as a composite measure of binge drinking occasions, felt high, got drunk on alcohol	4y	Not reported	Attrition from College	7 (however not enough adjustment for relevant confounders)
<i>Lulea and Växjö University cohorts, Sweden</i>							
Andersson 2009 <sup>29</sup>	First year university students at the start of the school year, 18+y	2,032	Alcohol involvement on AUDIT scale; high vs. low. Estimated blood alcohol concentration; high vs. low	1y	Varying (Mean score on the AUDIT scale ranged between 7.2-7.6)	First year university dropout	6



Studies	Sample	N	Exposure	Follow-up time	Baseline alcohol consumption	Endpoints	Risk of Bias <sup>a</sup>
<i>College Life Study, USA</i>							
Arria 2013 <sup>28</sup>	First year students, 17-20y	1,145	Number of drinks per day	4y	Varying (Typically consumed 4.4 drinks per day [sd 2.9])	College discontinuity (i.e. a gap in enrolment of one or more semesters)	5

<sup>a</sup> Study quality / risk of bias was assessed with the Newcastle Ottawa Scale (0-9); see for clarification the document 'Methodology for the evaluation of the evidence'

Abbreviations: y: year; sd: standard deviation; NCDS: National Child Development Study; BCS: British Birth Cohort study; T07: West of Scotland Twenty-07; ATP: Australian Temperament Project; CHDS: Christchurch Health and Development Study; MUSP: Mater Hospital and University of Queensland Study of Pregnancy; VAHCS: Victorian Adolescent Health Cohort Study

**Table 2.** Detailed NOS scores (in alphabetical order)

	Selection				Comparability	Outcome			Total score (maximum 9)
	Representative-ness of exposed cohort	Selection of non-exposed cohort	Ascertainment of exposure	Outcome not present at start	Comparability of cohorts on the basis of the design or analysis	Assessment of outcome	Follow-up long enough	Adequacy of follow-up	
<b>High school students</b>									
<i>Studies of sufficient quality</i>									
Chatterji 2006 <sup>13</sup>	1 (A)	1 (A)	0 (C)	1 (A)	2 (AB)	1 (A)	1 (A)	1 (B)	8
Crosnoe 2006 <sup>16</sup>	1 (A)	1 (A)	1 (A)	1 (A)	2 (AB)	1 (A)	1 (A)	1 (B)	9
Ellickson 1998 <sup>25</sup>	1 (A)	1 (A)	1 (A)	1 (A)	2 (AB)	1 (A)	1 (A)	0 (C)	8
Hemphill 2014 <sup>8</sup>	1 (A)	1 (A)	1 (A)	1 (A)	2 (AB)	1 (A)	1 (A)	1 (A)	9
Hill 2000 <sup>31</sup>	0 (C)	1 (A)	0 (C)	1 (A)	2 (AB)	1 (A)	1 (A)	1 (A)	7
Kelly 2015 <sup>32</sup>	1 (A)	1 (A)	1 (A)	1 (A)	2 (AB)	1 (A)	1 (A)	0 (C)	8
King 2006 <sup>23</sup>	0 (C)	1 (A)	1 (B)	1 (A)	2 (AB)	1 (A)	1 (A)	1 (A)	8
Latvala 2014 <sup>33</sup>	1 (A)	1 (A)	1 (A)	1 (A)	2 (AB)	1 (A)	1 (A)	1 (A)	9
Patrick 2016 <sup>15</sup>	1 (A)	1 (A)	0 (D)	1 (A)	2 (AB)	1 (A)	1 (A)	0 (C)	7
Silins 2018 <sup>7</sup>	1 (A)	1 (A)	0 (C)	1 (A)	2 (AB)	1 (A)	1 (A)	1 (A)	8
Sloan 2011 <sup>9</sup>	1 (A)	1 (A)	1 (B)	1 (A)	2 (AB)	1 (A)	1 (A)	0 (C)	8
Staff 2008 <sup>11</sup>	1 (A)	1 (A)	0 (C)	1 (A)	2 (AB)	1 (A)	1 (A)	1 (B)	8
<i>Remainder of the studies</i>									
Bray 2000 <sup>27</sup>	1 (A)	1 (A)	0 (D)	1 (A)	1 (A)	1 (A)	1 (A)	0 (C)	6
Cook and Moore 1993 <sup>12</sup>	1 (C)	1 (A)	1 (A)	1 (A)	0 (C)	1(A)	1 (A)	0 (D)	6
Dee and Evans 2003 <sup>26</sup>	1 (A)	1 (A)	0 (C)	1 (A)	0 (C)	1 (A)	1 (A)	0 (D)	5
Epstein and Tamir 1984 <sup>24</sup>	1 (A)	1 (A)	1 (A)	1 (A)	0 (C)	1 (A)	1 (A)	0 (D)	6



	Selection				Comparability	Outcome			Total score (maximum 9)
	Representative- ness of exposed cohort	Selection of non-exposed cohort	Ascertainment of exposure	Outcome not present at start	Comparability of cohorts on the basis of the design or analysis	Assessment of outcome	Follow-up long enough	Adequacy of follow-up	
Green 2016 <sup>6</sup>	1 (A)	1 (A)	0 (C)	1 (A)	0 (C)	1 (A)	1 (A)	1 (B)	6
Haller 2010 <sup>30</sup>	0 (C)	1 (A)	1 (B)	1 (A)	0 (C)	1 (A)	1 (A)	1 (A)	6
Kandel 1986 <sup>10</sup>	1 (A)	1 (A)	0 (C)	1 (A)	0 (C)	1 (A)	1 (A)	0 (D)	5
Mason and Windle 2001 <sup>22</sup>	1 (A)	1 (A)	0 (C)	1 (A)	0 (C)	1 (A)	1 (A)	1 (A)	6
Patte 2017 <sup>5</sup>	1 (A)	1 (A)	0 (C)	1 (A)	1 (A)	0 (C)	1 (A)	0 (D)	5
Svansdottir 2015 <sup>20</sup>	1 (A)	1 (A)	0 (C)	1 (A)	0 (C)	1 (A)	1 (A)	0 (C)	5
Viner and Taylor 2007 <sup>19</sup>	1 (A)	1 (A)	0 (C)	1 (A)	0 (C)	1 (A)	1 (A)	1 (B)	6
Wichstrom 1998 <sup>18</sup>	1 (A)	1 (A)	0 (C)	1 (A)	0 (C)	1 (A)	0 (B)	0 (C)	4
<b>College / University students</b>									
<i>The remainder of the studies</i>									
Andersson 2009 <sup>29</sup>	1 (B)	1 (A)	1 (A)	1 (A)	0 (C)	1 (A)	1 (A)	0 (D)	6
Arria 2013 <sup>28</sup>	0 (C)	1 (A)	1 (B)	1 (A)	0 (C)	1 (A)	1 (A)	0 (C)	5
Martinez 2008 <sup>17</sup>	1 (A)	1 (A)	1 (A)	1 (A)	0 (C)	1 (A)	1 (A)	1 (A)	7
McCarthy 2002 <sup>21</sup>	0 (C)	1 (A)	1 (A)	1 (A)	0 (C)	1 (A)	1 (A)	0 (D)	5
Sloan 2009 <sup>3</sup>	1 (B)	1 (A)	0 (D)	1 (A)	0 (C)	1 (A)	1 (A)	0 (D)	5
Wood 2000 <sup>14</sup>	1 (B)	1 (A)	0 (C)	1 (A)	0 (C)	1 (A)	1 (A)	1 (A)	6

Letters A, B, AB, C, D reflect scoring categories within the NOS. Within each NOS domain letters have their own meaning. See background document 'Methodology for the evaluation of the evidence' for further explanation.

### 3.2 High school students

The committee identified 24 studies among high school students on alcohol consumption in relation to educational achievement.<sup>5-13,15,16,18-20,22-27,</sup>

<sup>30-33</sup> Twelve of them were of sufficient quality and are discussed first, followed by the remainder of the studies.

### Studies of sufficient quality

#### *National Education Longitudinal Study of 1988, USA*

Chatterji (2006)<sup>13</sup> (NOS score: 8) determined the association between use of alcohol (drinking  $\geq 1$  time in the past month) and binge drinking ( $\geq 5$  drinks in a row  $\geq 1$  time in the past 2 weeks) and educational attainment 10



years later (the year 2000) in 15 year-old (n=7,604) USA high school students. Educational attainment was defined as high school graduation on schedule, receiving high school diploma by the year 2000, college entrance by the year 2000, or graduation from college by the year 2000. The aim of this study was mainly methodological, namely to gauge the sensitivity of the estimates to correlation between the unobservable determinants of both outcomes. The results suggest that alcohol use is associated with reductions in educational attainment (ranges between 0 to 7% reduction), but the authors state that there is little evidence that this association represents a causal relationship. The findings do suggest an association caused by unmeasured correlated determinants of alcohol use and educational attainment. The authors did the same analyses with a sample of 17 year-olds (n=5,421) and found reductions in educational achievement between 0 and 9%.

#### *National Longitudinal Study of Adolescent Health, USA*

Crosnoe (2006)<sup>16</sup> (NOS score: 9) investigated the association of alcohol use in 12-17 year old (n=11,927) USA high school students with academic failure one year later. Adolescent drinking (based on a 7 point score from no drinking to drinking nearly every day) or binge drinking (based on a 7 point score from no binge drinking to nearly daily binge drinking) were not risk factors for academic failure (based on reported grades in Math, Science, English, and Social Studies in the past year). However, academic failure was a risk factor for later adolescent drinking.

#### *RAND Adolescent Panel Survey, USA*

In a study by Ellickson et al. (1998)<sup>25</sup> in the USA (NOS score: 8), the use of alcohol (on a 12 point scale ranging from 0, never used, to 11, 20 or more days in the past month) among 4,390 high school students aged 12-13 years was not associated with school dropout assessed 5 years later (OR = 0.91, not significant, confidence interval not reported). At baseline almost 75% of the study participants had ever used alcohol.

#### *International Youth Development Study, Australia and/or USA*

Hemphill et al. (2014)<sup>8</sup> (NOS score: 9) assessed alcohol use in a cohort of 12-13 year old high school students in Australia and the USA (n=1858). At follow-up one and two years later they were asked whether their marks over the last year were lower or higher than average marks. At baseline 51% of males, and 47% of females reported lifetime alcohol use. No associations with below-average marks at grade 8 and grade 9 were found for baseline alcohol measures (lifetime alcohol use of more than a few sips, yes/no; current alcohol use of more than a few sips in the past 30 days, yes/no; frequent alcohol use of 3 or more drinks in the past 30 days, yes/no; binge drinking in the past two weeks, yes/no).

Kelly et al. (2015)<sup>32</sup> (NOS score: 8) included three samples of Australian adolescents (total n=2,287): the youngest sample (included from the 5<sup>th</sup> grade; age 10); the middle sample (included from grade 7); the oldest sample (included from grade 9). Alcohol exposure was measured at grade 9 i.e. at the start of the study for the oldest sample, and at the 4<sup>th</sup> wave for



the youngest sample. Using latent class analysis, they compared participants with high probabilities of alcohol use (but with low/negligible probabilities of other substance use) with participants who reported no alcohol or other drug use. Results indicated that alcohol use at grade 9 was associated with a higher chance of high school non-completion (OR 1.54; 95%CI 1.17-2.03).

#### *Seattle Social Development Program, USA*

Hill et al. (2000)<sup>31</sup> (NOS score: 7) investigated high school completion at the age of 21 years for different trajectories of binge drinking (n=808): non-bingers, early high (i.e. had a high frequency of binge drinking occasions at age 13 years and continued that pattern through the age of 18 years), increasers (i.e. initiated binge drinking around the age of 15 years and increased the frequency of occasions through the age of 18 years), and late onsetters (i.e. initiated binge drinking around the age of 16 years and slightly increased the frequency of occasions through the age of 18 years). The measurements at 10-12 years of age were used as baseline. Those who developed an 'early high' pattern of binge drinking or were 'late onsetters' had a significantly decreased likelihood of high school completion compared to the 'non-bingers' (OR = 0.21 and OR = 0.24 respectively [confidence interval not reported]). The 'increasers' did not have a significantly decreased chance of high school completion after controlling for drug use. Compared with the other groups, this group had the highest rates of drug use during adolescence. Thus, their drug use

was more likely a contributing factor to their problems than was their binge drinking behaviour, the authors state.

#### *Longitudinal study of familial alcoholism, Arizona, USA*

King et al. (2006)<sup>23</sup> (NOS score: 8) assessed college attendance and degree completion by the age of 25 years in a group of 374 USA adolescents who were 10-15 years old at baseline. By using a longitudinal growth curve model the researchers were able to capture the change in alcohol use during adolescence as a function over time. The authors do not report figures on the mean level of alcohol used at baseline. They observed a significantly reduced probability of degree completion for higher mean levels of, and acceleration in, alcohol use. No significant associations were found for college attendance. Moreover, the significance of the association for degree completion disappeared when the authors adjusted for antecedent risk factors (parental alcohol use, externalising symptoms, internalising symptoms and maternal monitoring). The authors state that adolescent alcohol use seems to serve to some extent as a marker for a larger constellation of risk factors, *identifying* those adolescents at risk for not getting a degree rather than *playing a causal role*.

#### *FinnTwin12, Finland*

In a study among 4,761 Finnish twin-individuals aged 11-12 years at baseline (NOS score: 9), Latvala et al. (2014)<sup>33</sup> found that drinking with



friends at the age of 12 years was associated with lower school performance at the age of 14 years ( $\beta = -0.18$ ,  $p < 0.01$ ). Any drinking and drinking to intoxication at the age of 14 years was associated with a lower educational status at the age of 17 years (any drinking:  $\beta = -0.06$ , drinking into intoxication:  $\beta = -0.09$ , both  $p < 0.01$ ). However, any drinking and drinking to intoxication at the age of 17 years was not associated with educational attainment in young adulthood (between ages 19-27 years old). For their analyses they used bivariate cross-lagged path models.

#### *Monitoring the Future, USA*

Patrick et al. (2016)<sup>15</sup> (NOS score: 7) used data from 28 consecutive samples of high school seniors from the USA (high school classes of 1976-2003; modal age at enrolment 18 years), in total resulting in 10,020 participants. They assessed whether binge drinking in the past two weeks was associated with different patterns of educational achievement 7 years later. At baseline 29% of the participants reported binge drinking. The authors observed no association between binge drinking at baseline and attending college (OR college attendance vs. no attendance: 0.97; 95% CI 0.85-1.08), or with shorter college education (OR graduation from 2-year college vs. 4-year college: 0.86; 95% CI 0.71-1.04). Conversely, high school binge drinkers were less likely to drop out of 4-year college (college dropout vs. 4-year graduation OR = 0.81; 95% CI 0.67-0.98).

*Pooling study of 4 Australasian cohorts, Australia, New Zealand*  
Silins et al. (2018)<sup>7</sup> (NOS score: 8) combined data from 4 cohorts from Australia and New Zealand and assessed the association between exposure to alcohol prior to the age of 17 years (age varied between cohorts) and high school non-completion and university degree non-attainment by the age of 30 years. At baseline participants were around 13-15 years of age. In the analyses data from 2,615 – 3,384 participants could be used. No association was found for school outcomes with either the maximum frequency of alcohol use or the maximum number of drinks per occasion.

#### *National Longitudinal Survey of Youth, USA*

Sloan et al. (2011)<sup>9</sup> (NOS score: 8) assessed the use of alcohol in the past 30 days in 7,757 17-25 year old adolescents in the USA. They compared frequent binge drinkers (females  $\geq 3$ ; males  $\geq 4$  episodes of binge drinking in the past 30 days), with non-frequent binge drinkers (at least 1 binge drinking episode, but less than 3/4 episodes), and non-binge drinkers/abstainers using propensity score matching. At baseline 17% reported frequent binge drinking, and 40% non-frequent binge drinking. At follow-up approximately 26 years later no difference was found in the years of schooling completed between frequent binge drinkers, and the two reference categories: occasional binge drinkers and non-binge drinkers/abstainers.



*National Child Development Study, UK*

Staff et al. (2008)<sup>11</sup> (NOS score: 8) studied the association between heavy alcohol use in 9,107 16 year olds in the UK on adult educational achievement by the age of 42 years in comparison to moderate or no use. They used propensity score matching in their analyses. At baseline 13% of the females and 25% of the males were heavy drinkers. The authors found that heavy drinking males were 7% less likely to have attained a postsecondary degree at the age of 42 years than males who did not drink or drank moderately at baseline. For males from working class backgrounds the association was somewhat stronger (8% less likely). No significant associations were found for women. The authors state that this is in part because alcohol use for females in the cohort was associated with childhood social advantage, rather than disadvantage.

**The remainder of the studies***Cohort from south-eastern US public school system, USA*

Bray et al. (2000)<sup>27</sup> (NOS score: 6) monitored the initiation of alcohol use before the age of 16, 17 or 18 years and dropout during approximately 8 years of follow-up in high school students in the USA (n=1,392). At baseline these adolescents were in grades 6-8. They did not observe a relation between the initiation of alcohol use before dropout and the subsequent rate of high school dropout (OR for dropout at age 16-18 years = 0.75; not significant, no confidence interval).

*National Longitudinal Survey of Youth, USA*

Cook and Moore (1993)<sup>12</sup> (NOS score: 6) observed that in 752 USA high school seniors (17-18 years) the number of drinks in the past week and being drunk frequently (drinking  $\geq 4$  times per week  $\geq 6$  drinks in the past month) were not significantly associated with number of years of completed schooling after high school. However, frequent drinkers (drinking  $\geq 2$  times per week in the previous week) completed 2.3 fewer years of college compared with those who did not frequently drink.

*National Education Longitudinal Study of 1988, USA*

Dee and Evans (2003)<sup>26</sup> (NOS score: 5) investigated a group of 7,317 USA high school students who were around 13 years old at baseline. Alcohol use was not measured at baseline, but at the first (sophomore year) and second (senior year of high school) follow-up moment. They investigated the influence of alcohol use in these years on high school completion and entering college during the remaining follow-up years (maximum 4 years after the sophomore year). Those who were drinking alcohol in their sophomore year were 3.5% less likely to complete high school and 7.8% less likely to enter college. For those who were heavy drinkers at that time, the percentages were higher: 5.1% for high school completion and 11.4% for entering college. Seniors who drank were 6.3% less likely to enter college; heavy drinkers were 8.8% less likely. All of these estimates were statistically significant. The authors discuss that this drinking-schooling relationship possibly reflects correlation rather than



causation, i.e. they also present results suggesting that students who are low academic achievers in their early teens are more likely to drink heavily as seniors.

#### *Cohort from Technion-Israel Institute of Technology, Israel*

In a sample of 181 16 year old high school students (males n=87; females n=94) Epstein and Tamir (1984)<sup>24</sup> (NOS score: 6) assessed the association between the consumption of strong alcoholic beverages at the age of 16 years and high school dropout at 18 years of age. At baseline 46% of the boys and 20% of the girls drank strong alcoholic beverages. At follow-up the researchers observed that twice as many boys who dropped out of high school consumed strong alcoholic beverages at baseline than boys who completed school (26.6% vs 13.7%;  $p < 0.002$ ). No results for girls were reported.

#### *Pooling study of 3 UK cohorts*

Green et al. (2016)<sup>6</sup> (NOS score: 6) combined data from 2 cohorts in England, National Child Development Study and British birth cohort study, and 1 in Scotland, West of Scotland Twenty-07, to assess the association between weekly alcohol consumption (y/n) at ages 15-16 years and attending tertiary education (i.e. being in fulltime education after the age of 18 years) measured after 6 to 10 years of follow-up. Together the included cohorts had data from 29,588 high school students. In the structural equation model the authors find a significant association between

adolescent alcohol consumption and an increased probability of attending tertiary education (probit coefficient 0.074 SE 0.017).

#### *Longitudinal study of familial alcoholism, USA*

Haller et al. (2010)<sup>30</sup> (NOS score: 6) found that binge drinking in a group of 405 14 year olds from a high risk community sample in the USA was not associated with school achievement (one year later) measured as average grades reported by the parents, nor with college completion by the age of 25 years. At the second wave, 17% of the participants reported binge drinking. The authors retrieved their results through structural equation modelling.

#### *Cohort from New York State, USA*

Kandell et al. (1986)<sup>10</sup> (NOS score: 5) examined the consequences of adolescent drug use, including alcohol use, in a cohort of 15-16 year old high school students in the USA (n=1,004). Nine years later they ascertained, among other things, the level of education achieved and found no significant association with alcohol use at baseline. The authors did not report how much alcohol participants drank when they entered the study.

#### *Cohort from Western New York, USA*

Mason and Windle (2001)<sup>22</sup> (NOS score: 6) assessed the use of beer and liquor and heavy beer drinking in 840 USA high school students aged



13-19 years of age at baseline. Four data waves were used, covering a period of 1.5 year. The use of alcohol in the time between baseline and first follow-up varied. However, it does not become clear what the exact frequency of use was at that time. Alcohol use at 6 months was negatively associated with school grades 1.5 years later ( $\beta = -0.10$ ;  $p < 0.01$ ).

#### *COMPASS study, Canada*

Patte et al. (2017)<sup>5</sup> (NOS score: 5) studied the association between the initiation of binge drinking and the recent course average mark for Math and English in 19,764 Canadian high school students. At baseline they were in grade 9 or 10 and aged 14-15 years, none were binge drinking at that time. Two years later the scores were assessed for groups who started binge drinking early (i.e. in grade 10 or lower) or later (in grade 11 or above). Those who started binge drinking later were more likely to achieve an A, or B mark for Math or an A, B or C mark for English than a mark below 60% compared to students who began binge drinking earlier (RR A score on Math course 1.76; 95% CI 1.56-1.99; RR A score on English course 2.09; 95% CI 1.76-2.47). Further, initiating a higher frequency of binge drinking (especially monthly or weekly compared to never) was associated with a lower likelihood of achieving a mark above 60% (e.g. RR A score on Math course for those who started weekly binge drinking was 0.69; 95% CI 0.56-0.84).

#### *Icelandic cohort of adolescents, Iceland*

Svansdottir et al. (2015)<sup>20</sup> (NOS score: 5) assessed alcohol consumption in the past 30 days in a group of 201 schoolchildren in Iceland who were 15 years old at baseline. Follow-up measurements took place 8 years later. The authors present regression models with different adjustments for confounding, but no fully adjusted model. All models show a significant increased risk for secondary school drop out for those who drank alcohol at baseline, compared to non-drinkers (model with adjustment for gender, parental education, and neighbourhood characteristics OR = 2.14; 95% CI: 0.93-4.93; model with adjustment for gender, self-esteem and depression OR = 2.36; 95% CI 1.03-5.40).

#### *1970 British Birth Cohort Study, UK*

In a study in the UK, Viner and Taylor (2007)<sup>19</sup> (NOS score: 6) assessed educational achievement at age 30 years in a group of 4,854 16 year-olds. The authors assessed the association with frequency of alcohol consumption in the previous year and binge drinking in the previous 2 weeks. At baseline almost 18% were binge drinkers. Binge drinking at baseline was associated with leaving school without any qualifications (OR = 1.3; 95% CI 1.0-1.6). Regular alcohol consumption, however, was not associated with leaving school without qualifications (weekly or less often alcohol consumption vs. rarely or never: OR = 0.9; 95% CI 0.7-1.1; alcohol consumption two or more times per week vs. rarely or never: OR =



1.0; 95% CI 0.8-1.3). The risk estimates for binge drinking and frequency of alcohol consumption were adjusted for each other.

#### *Young in Norway, Norway*

In Wichstrom' study (1998)<sup>18</sup> (NOS score: 4) of 5,308 Norwegian high school students aged 12-20 years at baseline, he observed that those who dropped out of school were more often intoxicated and consumed more alcohol at baseline than those who did not drop out. Adjusted risk estimates and follow-up period were not reported.

### **3.3 Conclusions on high school students**

The main findings are summarised in Table 3. It was not possible to quantitatively summarise the findings.

### **Educational attainment**

The committee identified 10 studies of sufficient quality on the association between alcohol use and educational attainment. In 5 of these higher alcohol consumption was associated with a higher risk of achieving a lower level of education. In one of the studies an association in the opposite direction was observed: i.e. higher alcohol used was associated



**Table 3.** Overview of results of educational achievement in high school students

Studies <sup>a</sup>	Alcohol consumption at baseline	Alcohol consumption during study	Results for educational attainment and dropout	Results for school marks
<b>Studies of sufficient quality (NOS-score 7 to 9)</b>				
Chatterji 2006 <sup>13</sup> USA*	Varying	Drinking ≥1 drink in the last month; yes/no  Heavy drinking ≥5 drinks in a row at least once in past 2 weeks; yes/no	No association with educational attainment for the 10th grade cohort.  Reduction in the probability of entering college for the 12 <sup>th</sup> grade cohort	
Crosnoe 2006 <sup>16</sup> USA	Varying	Past year level of drinking Frequency of past year of binge drinking		No association with academic failure
Ellickson 1998 <sup>25</sup> USA	Varying	More alcohol use	No association with high school drop out	
Hemphill 2014 <sup>8</sup> Australia and USA**	Varying	Lifetime alcohol use; yes/no Current alcohol use in the past 30 days; yes/no Binge drinking; yes/no Frequent drinking; ≥3 drinks in the past month; yes/no		No association with self-reported below average marks in the past year
Hill 2000 <sup>31</sup> USA	Not reported	Trajectories of binge drinking vs. non-binge drinking	Decreased chance of high school completion for 2 out of 3 binge trajectories (3rd trajectory same direction but not significant)	
Kelly 2015 <sup>32</sup> Australia**	Not reported	Alcohol use; yes/no	Higher likelihood of high school non-completion	
King 2006 <sup>23</sup> USA**	Not reported	Levels of alcohol use and growth of alcohol use during adolescence	No association with college attendance and degree completion	
Latvala 2014 <sup>33</sup> Finland	Not reported	Drinking with friends at age 12y  Drinking frequency at age 14y Drinking frequency at age 17y Intoxication frequency at age 14y Intoxication frequency at age 17y	Lower student status at age 17y No association with educational attainment in young adulthood Lower student status at age 17y No association with educational attainment in young adulthood	Lower school performance (grades) at age 14y
Patrick 2016 <sup>15</sup> USA	Varying	Binge drinking; yes/no	No association with college attendance No association with shorter education (i.e. 2y vs. 4y. College graduation) Lower likelihood of dropping out of 4-year college	
Silins 2018 <sup>7</sup> Australia and New Zealand (pooling study)	Not reported	Frequency of alcohol use Number of standard drinks consumed	No association with high school completion or University degree attainment	
Sloan 2011 <sup>9</sup> USA <sup>#</sup>	Varying	Frequent binge drinking vs. non-binge drinking/abstaining Frequent binge drinking vs. occasional binge drinking	No association with number of years of schooling	



Studies <sup>a</sup>	Alcohol consumption at baseline	Alcohol consumption during study	Results for educational attainment and dropout	Results for school marks
Staff 2008 <sup>11 b</sup> UK	Varying	Heavy drinking; yes/no	Males: lower likelihood of attaining a postsecondary degree by age 42y Females: no association.	
Remainder of the studies (NOS-score 4 to 6)				
Bray 2000 <sup>27</sup> USA	Not reported	Initiation of alcohol use at age 16y, 17y, or 18y; yes/no	No association with high school drop out	
Cook and Moore 1993 <sup>12</sup> USA <sup>#</sup>	Varying	Number of drinks per week  Drinking $\geq 2$ times per week in previous week; yes/no Drinking $\geq 4$ times $\geq 6$ drinks in past month; yes/no	No association with number of years of completed schooling after high school Fewer years of college No association with number of years of completed schooling after high school	
Dee and Evans 2003 <sup>26</sup> USA*	Varying	Drinking $\geq 1$ drinks in the last month; yes vs. no Heavy drinking $\geq 5$ drinks in a row at least once in past 2 weeks; yes/no	Both associated with a lower chance of high school completion and entering college	
Epstein and Tamir 1984 <sup>24</sup> Israel	Varying	Strong alcoholic beverages; yes/no	Higher chance of high school drop out	
Green 2016 <sup>6</sup> UK (pooling study)	Varying	Weekly drinking; yes/no	Increased likelihood to attain tertiary education	
Haller 2010 <sup>30</sup> USA***	Not reported	Frequency of binge drinking ( $\geq 5$ drinks per occasion); from 0 (never) to 7 (every day) at three waves	No association with college completion at age 25y	No association with adolescent academic achievement (based on average grade)
Kandel 1986 <sup>10</sup> USA	Not reported	Ever drank; yes/no	No association with highest educational level achieved	
Mason and Windle 2001 <sup>22</sup> USA	Varying	Drinking behaviour (combination of drinking beer, liquor drinking, and heavy drinking)		Decreased school rates
Patte 2017 <sup>5</sup> Canada	Non-binge drinking	Early versus late onset of binge drinking.  Initiating rarely/sporadic binge drinking, monthly or weekly binge drinking (all versus non-binge drinking)		Early onset associated with lower likelihood of high recent marks in Math and English Higher frequency of binge drinking associated with lower likelihood of high recent marks in Math and English
Svansdottir 2015 <sup>20</sup> Iceland	Not reported	Alcohol use; yes/no	Higher likelihood of secondary school drop out	
Viner and Taylor 2007 <sup>19 b</sup> UK	Varying	Frequency of use, increasing scale Binge drinking; yes/no	No association with educational achievement Increased chance of leaving school without any qualifications	



Studies <sup>a</sup>	Alcohol consumption at baseline	Alcohol consumption during study	Results for educational attainment and dropout	Results for school marks
Wichstrom 1998 <sup>18</sup> Norway	Varying	More alcohol Alcohol intoxication; yes/no	More high school dropout More high school dropout	

<sup>a</sup> Corresponding signs mean corresponding cohort.

<sup>b</sup> Cohort included in Green et al., 2016<sup>6</sup>.

with a lower likelihood of dropout in that study. In the other 4 studies of sufficient quality no differences were observed between drinkers and non-drinkers. The associations were found in studies that focused on level of alcohol use as well as in studies that focused specifically on binge drinking.

Of the remaining 10 studies on educational attainment, 6 found an association with a lower level of education in drinkers, 3 did not find a significant association and in 1 study were those who used more alcohol more likely to attain a tertiary education.

### School marks

Three studies of sufficient quality on alcohol use and school marks achieved were identified. One of them found an association between alcohol use at young age and lower school marks. The other 2 studies found no evidence for an association.

Of the remaining 3 studies, 2 found an association with lower school marks. The other found no significant association.

### 3.4 College/university students

The committee identified 6 studies on alcohol consumption in relation to educational achievement which were conducted in college or university students.<sup>3,14,17,21,28,29</sup> None of them were of sufficient quality, this was mainly due to the fact that they did not correct for relevant confounders (NOS item 5).

#### *Lulea and Växjö University cohorts, Sweden*

Andersson et al. (2009)<sup>29</sup> (NOS score: 6) assessed 2,032 Swedish first year university attendants from 2 universities at the start of the academic year. Both were part of a larger intervention study. At one of the included universities, a general primary prevention programme for hazardous alcohol consumption and stress management started right after baseline. In addition freshmen with high ratings of stress and/or alcohol use were offered a secondary intervention programme. The other university was from the control group. Alcohol use was measured with the Alcohol Use Disorder Identification Test (AUDIT) and the estimated blood alcohol concentration (eBac) questionnaire. Dropout in the first year was



ascertained using university registers. High scores compared to low scores on the AUDIT and eBac were not associated with first year university dropout in this study.

#### *College Life Study, USA*

Arria et al. (2013)<sup>28</sup> (NOS score: 5) assessed typical number of alcoholic drinks per day in the past year among 1,145 first year students aged ~17-20 years in the USA. University discontinuity was defined as a gap in enrolment of one or more semesters. The authors categorised this measure into continuous enrolment in university (reference category); early discontinuity (i.e. during the first 2 years); late discontinuity (i.e. during the second 2 years). College dropout in the first 2 years of college was not significantly associated with baseline alcohol use, whereas dropout in year 3 and 4 was (OR = 1.09; 95% CI: 1.02-1.16).

#### *A Midwestern University Cohort 2002, USA*

Martinez et al. (2008)<sup>17</sup> received an NOS score of 7 points, however, as they do not sufficiently correct for relevant confounders, the study is not judged to be of sufficient quality. The authors assessed college enrolment at each semester over a 4-year period, among 3,290 American first-time undergraduate students (assumed to be around 18 years at baseline). In their study they predicted the risk of first-time non-enrolment (i.e. college dropout). Heavy drinking was measured as a composite of three 9-point ordinal scales asking the number of occasions per week in the past month

that students drank five or more drinks in a sitting, felt high, or got drunk on alcohol. In the crude analysis heavy drinking was not associated with college dropout (OR 1.06 ns.). However, after the inclusion of event attendance variables (gathering of faculty with students, residence hall social event or party, fraternity or sorority event or party, on-campus dance or concert, party at off-campus housing, party or event at another campus, off-campus bar or club, and intercollegiate sports event) heavy drinking was associated with college dropout (OR 1.23;  $p < 0.05$ ). According to the authors, event attendance is a so called suppressor in the relation between heavy drinking and attrition.

#### *A San Diego cohort, USA*

McCarthy et al. (2002)<sup>21</sup> (NOS score: 5) used data from 100 young adults who were participating in an alcohol and drug treatment programme and 72 matched controls from a community sample (age in both groups between 22-24 years). Controls were matched on family history of substance abuse, age, gender, ethnicity and SES. At baseline the treated group reported 55 drinks on 11 occasions and the control group drank on average 25 drinks on 12 occasions. In a path analysis the authors used one factor for alcohol use in which four variables were combined: quantity of alcohol use, frequency of alcohol use, proportion of time that drinking leads to drunkenness, and alcohol use patterns. They found a significant negative association with baseline drinking and educational attainment



two years later in the treated group (-0.22;  $p < 0.01$ ), but not in the control group.

#### *Coronary Artery Risk Development in Young Adults, USA*

Two papers on the Coronary Artery Risk Development in Young Adults study were found, this cohort consisted of 5,115 18-30 year old young adults at baseline.<sup>2,3</sup> As Sloan et al. (2009) reported on a longer follow-up than Braun et al. (2000) the committee only presents the results of Sloan et al. (2009) in this overview. Sloan et al. (2009)<sup>3</sup> (NOS score: 5) identified 5 alcohol categories: abstainers (no alcohol during baseline year); occasional drinkers (some consumption during the past year but 0 usual drinks weekly); light drinkers (1-7 drinks per week); moderate drinkers (8-14 drinks per week); heavy drinkers (15-21/28 drinks per week); very heavy drinkers (>21/28 drinks per week). At baseline 13.6% of the complete sample ( $n=3,964$ ) did not use alcohol. In a subgroup of college attendants at baseline ( $n=1,863$ ) the authors found a significant decreased probability of college graduation in very heavy drinkers, compared to occasional drinkers (OR = 0.24; 95% CI 0.07-0.81) within 15 years of follow-up, but not for the other drinking categories.

#### *A Midwestern University Cohort 87/88, USA*

Wood et al. (2000)<sup>14</sup> (NOS score: 6) included a sample of 429 college freshmen with a high and a low family risk of the development of alcoholism. During the 6 years of follow-up they found a significant

negative correlation (-0.15;  $p < 0.001$ ) between frequency of heavy drinking during college years and level of educational attainment. In an additional analysis they found that prior academic achievement moderated the relationship between alcohol involvement and educational attainment. In individuals who were higher on secondary school class ranking, more negative associations were found than in those with lower levels of prior academic achievement.

### **3.5 Conclusions on college/university students**

The main study findings are summarised in Table 4. It was not possible to quantitatively summarise the findings.

There were no studies of sufficient quality on the association between alcohol use and educational attainment in college/university students. Of the remaining 6 studies, 4 found an association with heavier alcohol use and a higher likelihood of relatively worse school performance, 2 found no significant association.



**Table 4.** Overview of results of educational achievement in college/university students

Studies	Alcohol consumption at baseline	Alcohol consumption during study	Results for educational attainment and dropout	Results for school marks
<b>Other studies (NOS-score 5 to 6)</b>				
Andersson 2009 <sup>29</sup> Sweden	Varying	Higher levels of alcohol involvement Higher levels of alcohol concentration in the blood	No association with first year university dropout	
Arria 2013 <sup>28</sup> USA	Varying	Typical number of drinks per day	Higher likelihood of university discontinuity in the last 2 years of university No association with university discontinuity in the first 2 years of university	
Martinez 2008 <sup>17</sup> USA <sup>a</sup>	Not reported	Heavy drink; yes/no	Higher likelihood of college drop out	
McCarthy 2002 <sup>21</sup> USA	Varying	Combination of different alcohol measures; i.e. frequency, quantity, drunkenness, patterns of alcohol use	No association with educational attainment	
Sloan 2009 <sup>3</sup> USA	Varying	Very heavy drinking (>28 drinks/week for men and >21 drinks/week women) vs. occasional drinking No drinking, light drinking, moderate drinking and heavy drinking vs. occasional drinking	Decreased likelihood of college graduation No association with college graduation	
Wood 2000 <sup>14</sup> USA	Not reported	Frequency of binge drinking	Negative correlation with level of educational achievement	

<sup>a</sup> One study had an NOS score of 7 but was not considered to be of sufficient quality as they did not correct for the relevant confounders specified by the committee.



# 04 discussion and conclusions



## 4.1 Limitations

In addition to some of the general limitations of studies about alcohol consumption in adolescents (mentioned in the background document ‘Methodology for the evaluation of the evidence’), such as self-reporting of alcohol consumption and publication bias, the committee wants to address some limitations specific for the outcome ‘educational achievement’.

Alcohol consumption may affect educational achievement, but also the opposite could be true, i.e. educational achievement may affect alcohol consumption. Furthermore, it cannot be ruled out that the associations we found are caused by a ‘third factor’, i.e. a factor that is associated with a higher level of alcohol use as well as with poorer school achievement.<sup>34</sup>

When studying school dropout, per definition, everybody was still at school at the start of the study. This makes it more difficult to determine to what extent a difference in likelihood of school dropout was already present at baseline. Besides, it is difficult to distinguish the role of alcohol use from the role of other factors: e.g. alcohol consumption by adolescents and young adults can be an indicator of a social environment with lower educational opportunities. For example, two of the included studies that found an association with higher alcohol use and lower school performance (one of sufficient quality), doubt the causality of their findings and discuss alternative explanations for their findings.<sup>13,26</sup>

## 4.2 Final conclusions

In about the half of the studies of sufficient quality, an association was found between higher alcohol consumption and an increased likelihood of poorer educational outcomes. No specific conclusions could be drawn on binge drinking.

There were enough studies of sufficient quality to draw conclusions. However, given the above-mentioned limitations, the committee concludes that the association between alcohol consumption and educational achievement is unclear.



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annex



# A search strategy

## Pubmed search 'educational echievement'

September 2017

### Exposure

alcohol[MeSH Terms] OR alcohol\*[Title/Abstract] OR alcohol abuse[MeSH Terms] OR heavy drink\*[Title/Abstract] OR underage drinking[MeSH Terms] OR underage drink\*[Title/Abstract] OR binge drinking[MeSH Terms] OR binge drink\*[Title/Abstract] OR alcohol consumption[MeSH Terms] OR alcohol consum\*[Title/Abstract] OR alcoholism[MeSH Terms] OR alcoholism[Title/Abstract] OR alcohol drinking[MeSH Terms] OR ethanol[MeSH Terms] OR ethanol\*[Title/Abstract] OR Alcohol abstinence[MeSH Terms] OR age of first drink[Title/Abstract] OR age at first drink[Title/Abstract] OR (drinking behaviour[MeSH Terms] AND alcohol[MeSH Terms]) OR (drinking behaviour[MeSH Terms] AND alcohol\*[Title/Abstract]) OR (drinking behav\*[Title/Abstract] AND alcohol[MeSH Terms]) OR (drinking behav\*[Title/Abstract] AND alcohol\*[Title/Abstract]).

N=905,312.

### Design

cohort studies[MeSH Terms] OR cohort stud\*[Title/Abstract] OR longitudinal studies[MeSH Terms] OR longitudinal stud\*[Title/Abstract] OR prospective studies[MeSH Terms] OR prospective stud\*[Title/Abstract].  
N=1,740,465.

### Study population

students[MeSH Terms] OR student\*[Title/Abstract] OR adolescence[MeSH Terms] OR adolescen\*[Title/Abstract] OR teenage\*[Title/Abstract] OR young adults[MeSH Terms] OR young adult\*[Title/Abstract]  
N=232,019.

### Outcomes

Educational achievement[mesh] OR educational achiev\*[tiab] OR educat\* achievement[tiab] OR school achiev\*[tiab] OR educational attainment[tiab] OR school attainment[tiab] OR academic achiev\*[tiab] OR educat\* status[tiab] OR school dropouts[mesh] or school dropout\*[tiab] OR school dropping out[tiab] OR student dropout\*[tiab] OR student dropping out[tiab] OR grade point average[tiab] OR academic grade\*[tiab] OR school grade\*[tiab].

N=82,995.

### Total of combined searches

N=557.



The Health Council of the Netherlands, established in 1902, is an independent scientific advisory body. Its remit is “to advise the government and Parliament on the current level of knowledge with respect to public health issues and health (services) research...” (Section 22, Health Act).

The Health Council receives most requests for advice from the Ministers of Health, Welfare and Sport, Infrastructure and Water Management, Social Affairs and Employment, and Agriculture, Nature and Food Quality. The Council can publish advisory reports on its own initiative. It usually does this in order to ask attention for developments or trends that are thought to be relevant to government policy.

Most Health Council reports are prepared by multidisciplinary committees of Dutch or, sometimes, foreign experts, appointed in a personal capacity. The reports are available to the public.

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