

Research paper

Trends in adolescent alcohol use in the Netherlands, 1992–2015: Differences across sociodemographic groups and links with strict parental rule-setting



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ABSTRACT

Background: From an international perspective, studying trends in adolescent alcohol use in the Netherlands is an important case study. Whereas Dutch adolescents topped the international rankings of alcohol consumption in the beginning of this century, they are nowadays found more toward the bottom of these rankings. This study examines time trends in adolescent alcohol use between 1992 and 2015, and tests whether these trends differ according to gender, age group, and educational track. Moreover, it examines to what extent the strictness of parental rule-setting can explain the identified trends.

Methods: Using data from ten waves of two nationally representative studies with a repeated cross-sectional design, trends were examined for eight different alcohol measures. Interaction analyses were conducted to test for subgroup differences. All analyses were controlled for educational track, family structure, and ethnicity. For the period 2007–2015, trends in parental alcohol-specific rule-setting were included as a predictor of the trends in adolescent alcohol use.

Results: Adolescent alcohol use increased substantially between 1992 and 2003, and decreased sharply thereafter. Trends were stronger for 12- to 15-year olds, compared to the 16-year olds, and for adolescents attending higher educational tracks, compared to adolescents attending lower educational tracks. Overall, gender differences remained constant over time. Between 2007 and 2015, strict parental alcohol-specific rule-setting increased substantially, and this (partly) explained the strong decline in adolescent alcohol use during this period.

Conclusion: This study shows clear time trend changes in alcohol use among Dutch adolescents. The phenomenal decrease in adolescent alcohol use since 2003 appears to be closely related to a radical change in parenting behaviours surrounding the alcohol use of their children. While national prevention programs may have encouraged stricter parenting behaviours, the decline in alcohol use should be interpreted in a broader context of internationally changing sociocultural norms regarding adolescent alcohol use.

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Introduction

Much of the mortality and disease burden in young people in developed nations is attributable to alcohol use (Gore et al., 2011; Toumbourou et al., 2007). In addition to short-term negative outcomes such as injuries and violence (Sleet, Ballesteros, & Borse, 2010), frequent and extensive drinking during adolescence may enhance the risk for alcohol dependence in adulthood

(McCambridge, McAlaney, & Rowe, 2011; Odgers et al., 2008). Against this background, there is a widespread concern about young people's use of alcohol.

A promising development is the declining trend in adolescent alcohol use since the beginning of the 21st century that has been reported in many countries, including Australia (Livingston, 2014), Estonia (Lai & Habicht, 2011), Finland (Sourander et al., 2012), Iceland (Sigfúsdóttir, Kristjansson, Thorlindsson, & Allegrante, 2008), and Sweden (Norström & Svensson, 2014). To date, systematic trend analyses of adolescent alcohol use in the Netherlands have been lacking from the literature. This is

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surprising; from an international perspective, studying trends in adolescent alcohol use in the Netherlands is an important case study. Whereas adolescents in the Netherlands topped international rankings of alcohol consumption in the beginning of this century (Hibell et al., 2004), in more recent comparisons they can be found more toward the bottom of these rankings (EMCDDA and ESPAD, 2016). The present study gives an overview of 23 years of history of drinking behaviours among adolescents in the Netherlands. We thereby pay special attention to the drinking behaviours of boys and girls, adolescents of different age groups, and adolescents attending different educational tracks. Moreover, we examine to what extent the strictness of parental alcohol-specific rule-setting can explain the identified trends.

Based on international reports of comparative research on adolescent alcohol use (Hibell et al., 2004), adolescent alcohol use reached its peak in the Netherlands in 2003. In that year, out of 35 European and North American countries, Dutch adolescents (15 and 16 year-olds) were not only most likely to have drunk alcohol in the past month; they also scored remarkably high on the quantity of alcohol consumed. 29% reported binge-drinking (i.e., drinking five or more alcoholic beverages in a short period of time) three times or more during the last 30 days. With respect to this measure, only Irish youth 'outperformed' the Dutch (Hibell et al., 2004). In contrast to these high rankings in 2003, Dutch adolescents ranked considerably lower in 2015: they ranked #19 out of 37 countries with respect to having drunk alcohol in the past month (EMCDDA and ESPAD, 2016). With regard to binge drinking in the past month, Dutch adolescents moved from the 2nd to the 15th place.

To the knowledge of the authors, only four studies so far have addressed time trends in adolescent alcohol use in the Netherlands. These studies were either not nationally representative (Geels et al., 2011; Poelen, Scholte, Engels, Boomsma, & Willemsen, 2005), reported trends on relatively short periods of time (de Looze, Raaijmakers et al., 2015; de Looze, Vermeulen-Smit et al., 2014), or did not control for potential changes over the years in the sociodemographic composition of the research sample (de Looze, Raaijmakers et al., 2015). This last point is an important limitation, as changes in the sociodemographic composition of 12–16 year olds may influence time trends in alcohol use. To illustrate, the percentage of adolescents attending (higher) academic educational tracks has gradually increased in the Netherlands, from 16% in 1992 to 22% in 2015 (CBS, 2016). This development may be due to the worsening reputation of lower educational tracks and a drive among parents to put their child in the highest possible track (Truijman & de Vries, 2010). Attending a higher educational track is a strong predictor of a lower likelihood of alcohol use among Dutch adolescents (de Looze, Vermeulen-Smit et al., 2014). Consequently, the relative increase of youth attending higher educational tracks may contribute to a decrease in adolescent alcohol use. Similarly, since 1992, the number of youth living with only one biological parent has increased (up to 20% of 15-year olds in 2015; CBS, 2016) and the number of adolescents with a non-native background has fluctuated (CBS, 2016). In order to rule out that trends in adolescent alcohol use can be attributed to such sociodemographic changes, factors such as educational track, family structure, and ethnicity should be taken into account when analysing time trends in adolescent alcohol use.

From a public health perspective, it is essential to investigate whether trends in alcohol use are similar across different subgroups of youth. Recent international studies (Kuntsche et al., 2011; Simons-Morton et al., 2009) suggest that, since the beginning of the 21st century, gender differences decreased in some developed countries, either due to a stronger decrease among boys (in countries where alcohol use decreased) or a stronger increase among girls (in countries where alcohol use was

on the rise). As these studies did not include the Netherlands, it is not known whether gender differences in adolescent alcohol use have decreased in the Netherlands as well. Moreover, there might be differences in alcohol trends between adolescents of different age groups and educational tracks. Since 2006, a number of national mass media campaigns and local prevention programs have been implemented in the Netherlands, which encouraged especially parents of adolescents below the age of 16 (which was the legal minimum age for the purchase of alcohol at that time) to set strict rules regarding their children's alcohol use (de Looze, Vermeulen-Smit et al., 2014). As messages from this type of campaign is typically picked up faster by higher socioeconomic groups, compared to lower socioeconomic groups (Godin, Dujardin, Fraeyman, & Van Hal, 2009; Niederdeppe, Farrelly, Nonnemaker, Davis, & Wagner, 2011), it can be expected that the alcohol use of not only younger adolescents (12–15 year olds), but also adolescents attending higher educational tracks, has declined faster in recent years compared to older adolescents (16 year olds) and adolescents attending lower educational tracks.

Finally, an important omission of current trend research on adolescent alcohol use is a lack of explanatory analyses. Most trend research is purely descriptive, but from a public health and policy perspective, there is a strong demand for research examining potential explanations of the observed trends. In the past few decades, the literature has shown that strict parental rule-setting on alcohol use is one of the most consistently identified predictors of adolescent alcohol use (Donovan, 2004; Van der Vorst, 2007). Moreover, research suggests that parents in the Netherlands have adopted stricter alcohol-specific parenting practices in the course of the '00s (de Looze, Vermeulen-Smit et al., 2014). This increase in strict parental rule-setting may have contributed to the hypothesized decline in adolescent alcohol use in the beginning of the 21st century. In this study, we will therefore examine to what extent strict parental rule-setting on adolescent alcohol use can explain the identified trends.

Aims and hypotheses

Using data from a series of nationally representative, repeated cross-sectional studies, this study examines trends in alcohol use among 12- to 16-year old adolescents in the Netherlands between 1992 and 2015. We aim to address the following research questions:

- 1) How have time trends in adolescent alcohol use developed in the Netherlands between 1992 and 2015?
- 2) Do these time trends reflect real changes in drinking behaviours of adolescents, or can they be (partly) ascribed to changes in the sociodemographic composition (in terms of educational track, family structure, and ethnicity) of 12- to 16-year olds?
- 3) Do the identified trends differ between boys and girls, adolescents of different age groups, and adolescents attending different educational tracks?
- 4) To what extent does the strictness of alcohol-specific parental rule-setting explain the identified trends in adolescent alcohol use?

Based on the existing literature, we expected that adolescent alcohol use increased between 1992 and 2003, and decreased thereafter. We expected that changes in the sociodemographic composition of 12–16 year olds may have affected, but cannot fully explain the trends. Furthermore, we expected the decrease after 2003 to be stronger for 12–15 year olds, compared to 16-year olds, and for adolescents attending higher educational tracks, compared to adolescents attending lower educational tracks. As there appears to be no convincing evidence supporting an increase or

decrease in gender differences in adolescent alcohol use in the Netherlands, no specific hypothesis was formulated on differences in trends between boys and girls. Finally, it was hypothesized that the strictness of parental rule-setting on adolescent alcohol use (partly) explained the observed trends in adolescent alcohol use.

Methods

Study procedures

From 1992 onwards, adolescent alcohol use has been monitored by means of nationally representative, repeated cross-sectional school surveys in the Netherlands. The Dutch National School Survey on Substance Use (DNSSSU) has been conducted every four years since 1992. From 2001 onwards, the four-yearly Health Behaviour in School-aged Children (HBSC) study has been conducted as well. Since 2005, this study included similar measures of alcohol use as the DNSSSU, resulting in the fact that adolescent alcohol use has been measured every two years since 2005.

For the current study, data were derived from the DNSSSU in 1992, 1996, 1999, 2003, 2007, 2011, and 2015 (De Zwart, Monshouwer, & Smit, 2000; Kuijpers, Mensink, & de Zwart, 1993; Kuipers, Stam, & De Zwart, 1997; Monshouwer, van Dorsselaer, Gorter, Verdurmen, & Vollebergh, 2004; Monshouwer et al., 2008; Verdurmen et al., 2012; van Dorsselaer et al., 2016) and the Dutch HBSC study in 2005, 2009 and 2013 (de Looze, Vermeulen-Smit et al., 2014; Van Dorsselaer, Van Zeijl, Van den Eeckhout, Ter Bogt, & Vollebergh, 2007; Van Dorsselaer et al., 2010). The sampling and survey procedures for the different surveys were identical. The present study includes data from adolescents aged 12 to 16 years old attending the first four classes of general secondary education.

The samples were obtained using a two-stage random sampling procedure. First, schools were stratified and drawn proportionally according to the level of urbanization. Second, within each school two to five classes (depending on school size) were selected randomly from a list of all classes provided by each participating

school. Within the selected classes, all students were drawn as a single cluster. The response rate of schools ranged between 40% (2013) and 72% (2003). The reasons for non-response at the school-level were mainly related to (being approached for) participation in other research.

Research assistants administered self-complete paper-and-pencil questionnaires and in 2015 computer assisted questionnaires in the classroom (lasting usually 40–50 min) in October/November of the corresponding year. Anonymity of the respondents was explained when introducing the questionnaire. Collecting all questionnaires in one envelope and sealing the envelope in the presence of the respondents further emphasized anonymity. Adolescent non-response was rare (<10%) and mainly because of illness.

Study sample

In total, 60,917 questionnaires were gathered from adolescents across the different studies and survey waves. Demographics of the total sample are presented in Table 1 by survey year. Numbers of respondents per survey year ranged from N = 5422 (2005) to N = 7069 (2003). About half of the adolescents in the samples were male. The mean age across all samples was 13.9 years. Especially in the earlier years, more adolescents were enrolled in vocational tracks. In more recent years (from 2009 onwards), relatively more students were enrolled in (especially the medium and high) academic tracks. This trend appears to reflect recent developments in the Dutch educational system (CBS, 2016) leading to higher percentages of young people attending higher educational levels. Furthermore, about 15–23% of the samples had an ethnic minority background and about 20% of the adolescents lived in an incomplete family (this percentage steadily increased from 14.0% in 1992 to 24.6% in 2015, which is also in line with national trends; CBS, 2015, 2016).

To enable generalizing the results to the Dutch school-going population aged 12 to 16, a weighting procedure was applied. Post-stratification weights were calculated by comparing the joint sample distributions and known population distributions of the

Table 1
Descriptive statistics (%) of socio-demographic variables by survey year.^a

Survey year	1992	1996	1999	2003	2005	2007	2009	2011	2013	2015
Gender (boy)	50.8	50.9	48.5	51.5	50.8	51.8	50.9	51.8	50.9	51.3
Age										
12	15.6	16.1	17.0	18.2	18.4	16.0	17.6	17.4	18.7	20.7
13	21.4	23.7	23.5	24.2	24.0	25.8	25.1	25.1	23.5	23.4
14	22.1	24.0	25.5	23.5	24.2	24.2	22.8	24.1	24.6	23.7
15	25.2	23.2	24.0	23.8	23.1	23.0	24.1	22.6	23.1	22.9
16	15.7	12.9	9.9	10.3	10.3	11.1	10.4	10.8	10.2	9.3
Educational track ^b										
Vocational	32.5	33.3	33.3	27.6	29.2	23.5	20.3	22.9	24.9	20.8
Academic (low)	32.4	30.4	26.8	31.6	28.4	33.4	32.6	31.2	24.3	32.2
Academic (medium)	18.8	19.2	22	24.3	24.4	24.9	23.2	24.3	28.9	26.4
Academic (high)	16.3	17.2	18	16.5	18.0	18.3	23.9	21.6	21.8	20.7
Ethnicity										
Minority background	16.9	21.7	23.4	15.9	20.0	13.1	16.2	13.9	15.6	15.7
Family structure										
Not living with both biological parents	14.0	16.7	19.6	19.7	21.6	20.2	20.2	24.6	26.1	24.6

^a N = 6025 in 1992, N = 5921 in 1996, N = 5785 in 1999, N = 7069 in 2003, N = 5422 in 2005, N = 6555 in 2007, N = 5642 in 2009, N = 6610 in 2011, N = 5571 in 2013, N = 6317 in 2015.

^b In 1992, 1996 and 1999, educational track was measured for the second, third and fourth grade of secondary school only. In many Dutch schools, there is not yet a differentiation in educational tracks in the first grade of secondary school (age 12). Adolescents can however be placed in, for example, a combination of two out of four tracks (e.g., the two highest academic tracks). From 2003 onwards, adolescents in the first grade of secondary school were also asked for their educational track. Answer categories included placement in combined tracks. In that case, the lowest educational track was recorded.

child's educational track, grade, gender, and (from 2003 onwards) level of urbanization of the corresponding year (national statistics were obtained from Statistics Netherlands, CBS).

Measures

Adolescent alcohol use

Frequency of use. Adolescents were asked how often they had drunk alcohol in their life so far (lifetime prevalence) and during the last four weeks (last month prevalence). Response categories ranged from 0 to 40 or more times on a 14-point scale (adapted from Monitoring the Future; Johnston, O'Malley, Miech, Bachman, Schulenberg, 2015; O'Malley, Bachman, & Johnston, 1983). In order to establish lifetime and last month prevalence the answers were re-coded into 0 and 1 (answers 1–40 or more).

Drunkenness. As the formulation of questions on drunkenness slightly differs between the HBSC and DNSSSU study, analyses on lifetime and last month drunkenness were based on data from the DNSSSU study only. Drunkenness was measured by asking adolescents how often they had been drunk or tipsy in their life so far (lifetime drunkenness) and during the last four weeks (last month drunkenness). Response categories ranged from 0 to 40 or more times on a 14-point scale (adapted from Monitoring the Future; Johnston et al., 2015; O'Malley et al., 1983). Answers were re-coded into 0 and 1 (answers 1–40 or more).

Early onset drinking behaviours. Early onset drinking behaviours have been included in the HBSC and DNSSSU study since 2003. Adolescents were asked how old they were when they drank alcohol (at least one glass) for the first time (early onset alcohol use) and when they got drunk for the first time (early onset drunkenness). Response categories were: never, 9 years or younger, 10, 11, 12, 13, 14, 15, 16 years or older. As per previous international reports from the HBSC and ESPAD studies (Currie et al., 2004, 2008, 2012; Hibell et al., 2004, 2009, 2012; Inchley et al., 2016), answers were re-coded into 0 (never drank alcohol or drank alcohol for the first time at age 14 or later) and 1 (drank alcohol for the first time before age 14).

Quantity of drinking. The quantity of drinking was assessed by means of two variables. First, binge drinking was measured by asking adolescents: 'How often, in the past four weeks, have you had five or more alcoholic drinks at one occasion (for example at a party or at a single night)?' Response categories were: never, once, twice, 3 or 4 times, 5 or 6 times, 7 or 8 times, 9 times or more. Answers were re-coded into 0 (never) and 1 (once or more). Second, the number of glasses consumed during a weekend was measured using a Quantity-Frequency Scale (Knibbe, Oostveen, & Van de Goor, 1991; Koning, Engels, Verdurmen, & Vollebergh, 2010). This scale measures the average number of alcoholic drinks consumed during a weekend by multiplying the number of drinking days during the weekend (Friday to Sunday) and the number of usual drinks on a weekend day. In order to establish a measure of heavy drinking during a weekend, answers were recoded into 0 (10 or fewer glasses) and 1 (more than 10 glasses).

Sociodemographic variables

Gender. Adolescents were asked to indicate whether they were a boy or a girl.

Age. Adolescents were asked to indicate their month and year of birth. Using the date of the data collection, their age was calculated.

Ethnicity. Ethnicity was based on the country of birth of adolescents and their parents. If at least one parent was born abroad, adolescents were identified as having a non-native background.

Family structure. Family structure was determined by a series of binary variables derived from three related questions. The first question asks who resides in the home where the respondent lives all or most of the time, including father, mother, stepfather and stepmother. The second question asks if the respondent has another home or another family and how often he or she stays there (half the time, regularly but less than half the time, sometimes, hardly ever). The third question asks who lives in the second home. Based on these items, a dichotomous variable was created, distinguishing between adolescents who lived with both biological parents in the primary household (1) and those who did not (0).

Educational track. The Dutch educational system has four educational tracks, ranging from vocational training (VMBO-b) to higher academic education (VWO). Adolescents were asked to indicate their educational track in the questionnaire.

Parental rule-setting on adolescent alcohol use

In the period 2007–2015, the HBSC and DNSSSU questionnaires included questions on adolescent perceptions of parental rules on alcohol use. In 2007, 2009, 2011, 2013 and 2015, adolescents were asked to indicate how likely it was that their parents allowed them to (1) drink one glass of alcohol at home in the presence of parents; (2) drink more than one glass of alcohol at home in the presence of parents; and (3) drink alcohol at a party with friends. Answer categories (5) ranged from 'definitely yes' to 'definitely not'. Based on adolescents' average score on these three items, a scale was constructed representing perceived parental rules on adolescent alcohol use.

Strategy for analyses

The analyses considered two characteristics of the data: (1) students from the same school (primary sampling unit) were drawn as a single cluster and (2) weights were applied to obtain a representative sample of Dutch secondary school students. In order to obtain correct 95% CI and p-values for a re-weighted and clustered sample, robust standard errors were obtained using the Huber-White Sandwich estimation implemented in Stata. All analyses were performed using Statistic software package Stata-V12.1 (Stata Corp., College Station, TX).

First, the weighted prevalence estimates for adolescent alcohol use in the different years were calculated. Multivariate (logistic) regression analyses were performed to test the significance of the time trends. Survey year was included as a dummy variable, using the year 1992 or 2003 as the reference year (depending on the alcohol measure). To test for linear trends, we repeated this analysis with survey year as a continuous variable, thereby controlling for demographic covariates.

To test whether the time-trends in adolescent drinking differ across gender, age, and educational subgroups, prevalence estimates were calculated separately for different subgroups. Interaction analyses were performed to test whether differences between groups were statistically significant. The interaction term (demographic factor * survey year) was added to the regression analyses. In these analyses, survey year was included as a continuous variable because using dummies would result in a large number of interaction terms, which increases the risks of overfitting the model. Interaction analyses were performed separately for the periods in which adolescent alcohol use increased (1992–2003) and decreased (2003–2015).

To test the extent to which strict parental rule-setting explained the trends in adolescent alcohol use, parental alcohol-specific rule-setting was added as a predictor in the trend analyses on adolescent alcohol use. If the size and significance of the odds ratios of adolescent alcohol use decreased as a result of the addition of the parental rules variable, it was concluded that parental rule-setting (partly) explains the observed trends in adolescent alcohol use.

To take into account the large dataset and the large number of tests, associations and interaction effects were considered significant if $p < 0.01$. Interaction effects were interpreted based on graphical plots of post hoc estimates of the interaction model.

Results

Overall time trends (RQ 1 and 2)

As Table 2 indicates, both lifetime and last month alcohol use increased between 1992 and 2003, and decreased thereafter. In 2013 and 2015, they had decreased to such an extent that they were even lower than those in 1992. To illustrate, lifetime alcohol use increased from 65.3% (1992) to 83.5% (2003) and then spectacularly decreased again to 42.7% (2015).

Prevalence rates of lifetime and last month drunkenness faced a peak in 2003 and 1999, respectively, and a decrease thereafter (Table 3). For lifetime drunkenness, prevalence rates in 2015 were lower than those in 1992 (e.g., 21.2 and 29.5% respectively).

Table 4 presents time trends in early (before age 14) drinking between 2003 and 2015. Overall, a clear decrease can be observed in early alcohol use (from 63.2 to 19.0%) and early drunkenness (from 14.7 to 3.6%) between 2003 and 2015.

Finally, Table 5 presents time trends in heavy drinking patterns (i.e., binge drinking in the past month; drinking more than 10 glasses of alcohol in a weekend) between 2003 and 2015. For both variables, a clear decrease is observed between 2003 and 2015 (from 36.4 to 15.9% and from 5.1 to 2.2%, respectively). For drinking

more than 10 glasses of alcohol in a weekend, however, there was an increase between 2013 and 2015 among the 14–16 year olds.

Multivariate analyses (Table 6) indicate that all of these trends remain significant after controlling for adolescent age, gender, educational track, ethnicity, and family structure. Adding these variables to the crude models slightly affected the results, but not in a consistent nor meaningful way. For conciseness, we therefore only present the fully controlled models.

Gender-specific trends (RQ 3)

Tables 7 (1992–2003) and 8 (2003–2015) indicate whether the observed trends in alcohol use differed according to adolescent gender, age, and educational track. Between 1992 and 2003 (Table 7), gender differences in all alcohol measures were significant (ORs ranging from 1.20 to 1.39, $ps < 0.001$), with boys reporting more alcohol use, compared to girls. Gender differences in alcohol use remained stable over time during this period, except regarding last month drunkenness ($OR = 0.97$, $p < 0.01$). The increase in last month drunkenness was steeper for girls, compared to boys.

Between 2003 and 2015 (Table 8), gender differences in lifetime and last month drunkenness were not significant anymore. For the other alcohol measures, significant gender differences continued to exist (ORs ranging from 1.12 to 2.05, $ps < 0.001$), and they remained stable over time between 2003 and 2015.

Age-specific trends (RQ 3)

Alcohol use was higher in older age groups across measures and survey waves. Between 1992 and 2003 (Table 7), when alcohol use increased overall, especially strong increases were observed in the younger age groups. Regarding lifetime and last month alcohol use, a stronger increase was observed among 12–13 year olds ($ORs = 1.06$, $ps < 0.01$) and 14–15 year olds ($ORs = 1.05$, $ps < 0.01$), compared to 16-year olds (also see Fig. 1). When comparing 12–13 year olds with 14–15 year olds, no interaction effect was found.

Table 2
Trends in lifetime and last month alcohol use (%) by adolescent age, gender, and educational track.

Measure	Survey year	Total	Gender		Age			Educational track ^a			
			Boys	Girls	12–13	14–15	16	Vocational	Academic (low)	Academic (medium)	Academic (high)
Lifetime alcohol use											
	1992	65.3	67.2	63.4	46.8	73.4	85.0	–	–	–	–
	1996	77.1	80.9	73.2	64.9	84.8	85.6	–	–	–	–
	1999	71.4	75.7	67.4	55.9	80.6	88.0	–	–	–	–
	2003	83.5	84.8	82.2	76.0	88.9	89.8	79.9	82.5	86.5	87.8
	2005	76.9	78.6	75.1	65.9	84.7	86.3	74.3	76.6	80.5	76.7
	2007	76.1	78.6	73.4	62.2	85.0	90.8	72.8	78.1	75.8	77.3
	2009	65.7	67.3	64.1	48.7	77.0	84.6	69.3	63.7	70.8	60.5
	2011	64.4	67.6	61.0	46.0	75.9	87.1	64.4	68.9	63.4	59.1
	2013	46.1	46.6	45.6	23.7	58.5	79.3	48.0	54.6	42.8	38.7
	2015	42.7	45.6	39.6	24.8	53.8	71.4	48.1	42.7	45.0	34.2
Last month alcohol use											
	1992	38.7	40.8	36.6	16.4	46.3	68.7	–	–	–	–
	1996	51.2	54.9	47.3	31.0	62.4	71.7	–	–	–	–
	1999	48.1	52.6	43.8	26.5	60.3	74.9	–	–	–	–
	2003	55.3	56.9	53.7	37.8	66.7	73.9	54.4	54.5	57.1	57.4
	2005	48.9	51.6	46.2	29.9	61.1	71.3	52.1	49.4	49.2	43.4
	2007	44.6	45.8	43.4	22.9	56.8	73.8	44.1	44.9	46.4	42.6
	2009	37.4	38.2	36.5	15.5	49.6	71.3	44.9	35.0	42.7	29.2
	2011	35.1	36.2	34.0	13.7	45.1	75.9	35.6	36.2	38.5	29.2
	2013	26.7	27.1	26.4	7.6	35.1	66.3	30.1	35.0	21.6	20.6
	2015	22.7	23.7	21.6	6.9	31.0	55.7	31.1	23.1	23.9	12.2

^a In 1992, 1996 and 1999, educational track was measured for the second, third and fourth grade of secondary school only. Therefore, for these survey waves, the data cannot be presented by educational track.

Table 3
Trends in lifetime and last month drunkenness (%) by adolescent age, gender, and educational track.

Measure	Survey year	Total	Gender		Age			Educational track ^b			
			Boys	Girls	12–13	14–15	16	Vocational	Academic (low)	Academic (medium)	Academic (high)
Lifetime drunkenness ^a	1992	29.5	31.4	27.6	11.7	34.1	58.1	–	–	–	–
	1996	38.6	41.6	35.6	19.0	48.0	64.9	–	–	–	–
	1999	39.4	43.6	35.5	18.1	50.7	68.7	–	–	–	–
	2003	43.6	43.4	43.9	23.4	56.2	69.3	46.9	42.5	44.0	41.7
	2007	37.1	37.5	36.7	15.6	48.9	67.6	39.3	37.4	37.2	33.6
	2011	31.7	32.9	30.4	11.7	40.8	70.9	36.2	32.4	31.6	26.4
	2015	21.2	21.8	20.6	6.4	28.9	52.5	28.8	21.9	21.9	11.5
Last month drunkenness ^a	1992	10.8	12.3	9.4	2.5	12.1	26.6	–	–	–	–
	1996	17.7	19.9	15.5	5.3	22.9	37.7	–	–	–	–
	1999	18.9	22.1	15.9	5.9	25.6	39.2	–	–	–	–
	2003	18.5	17.3	19.6	5.5	25.5	39.8	20.9	17.7	19.2	16.3
	2007	16.8	16.8	16.7	3.9	23.1	38.9	18.1	16.7	17.1	14.7
	2011	15.4	16.1	14.8	3.1	19.4	47.0	16.3	14.3	18.6	12.7
	2015	11.0	11.2	10.8	1.8	15.5	32.5	15.2	10.6	12.8	5.4

^a As the formulation of the drunkenness items differed between the HBSC study and the Dutch National School Survey on Substance Use, data of the two surveys were not comparable. Therefore, only data from the Dutch National School Survey on Substance Use are presented.

^b In 1992, 1996 and 1999, educational track was measured for the second, third and fourth grade of secondary school only. Therefore, for these survey waves, the data cannot be presented by educational track.

Table 4
Trends in early onset of first alcohol use and first drunkenness (% before age 14) by adolescent age, gender, and educational track.

Measure	Survey year	Total	Gender		Educational track			
			Boys	Girls	Vocational	Academic (low)	Academic (medium)	Academic (high)
Early onset alcohol use (<age 14)	2003	63.2	64.9	61.3	55.5	65.3	65.7	68.3
	2005	60.7	62.9	58.5	57.0	61.9	63.7	60.9
	2007	49.0	51.2	46.6	44.7	52.9	49.1	47.2
	2009	41.1	44.0	38.0	45.0	41.4	41.4	36.8
	2011	33.4	35.6	31.0	33.1	36.9	33.2	28.9
	2013	25.3	27.3	23.3	31.2	28.6	24.0	16.8
	2015	19.0	21.7	16.2	24.0	20.8	17.4	13.3
Early onset drunkenness (<age 14)	2003	14.7	16.4	12.9	16.2	15.4	13.3	13.0
	2005	12.6	13.4	11.8	16.4	14.6	9.7	7.4
	2007	8.9	9.3	8.5	9.2	10.3	8.0	7.3
	2009	5.8	6.4	5.2	9.1	7.0	4.2	3.1
	2011	5.9	6.2	5.6	7.9	6.3	6.0	3.3
	2013	4.0	4.0	4.0	6.3	5.8	2.8	1.1
	2015	3.6	4.0	3.2	5.4	4.0	3.0	2.0

Table 5
Trends in quantity of drinking (%) by adolescent age, gender, and educational track.

Measure	Survey year	Total	Gender		Age			Educational track ^a			
			Boys	Girls	12–13	14–15	16	Vocational	Academic (low)	Academic (medium)	Academic (high)
Last month binge drinking	2003	36.4	38.2	34.6	22.1	44.4	57.3	45.8	38.0	32.2	26.2
	2005	37.9	40.6	35.0	20.4	47.9	62.1	46.1	40.8	35.0	24.5
	2007	30.2	31.6	28.6	12.7	38.8	58.3	37.9	31.6	28.7	20.2
	2009	25.8	26.4	25.1	9.3	33.9	56.0	37.6	25.7	27.0	15.0
	2011	23.3	24.6	21.9	6.9	29.5	59.4	28.1	25.6	23.3	15.1
	2013	20.0	20.4	19.6	5.0	25.8	54.7	25.7	28.1	15.6	10.8
	2015	15.9	16.9	14.9	3.8	21.5	45.2	24.7	16.3	16.6	5.7
	+ 10 glasses in a weekend ^b	2003	5.1	6.7	3.3	0.7	6.7	15.6	8.5	4.8	3.6
2007		4.1	5.4	2.7	0.5	4.8	14.4	6.2	3.9	4.1	1.6
2009		3.5	4.6	2.4	0.5	3.8	14.8	6.5	3.0	4.3	0.9
2011		3.6	5.2	1.8	0.3	3.7	15.8	5.2	4.0	3.6	1.2
2013		1.5	1.8	1.2	0.3	1.6	6.5	2.9	2.3	0.7	0.2
2015		2.2	2.7	1.7	0.1	3.0	7.9	3.9	2.3	2.3	0.2

^a In 1992, 1996 and 1999, educational track was measured for the second, third and fourth grade of secondary school only. Therefore, for these survey waves, the data cannot be presented by educational track.

^b In 2005, answer categories of the survey question on quantitative frequency in a weekend were different compared to the other years. Therefore, data from this year are not presented.

Table 6
Results of multiple logistic regression analyses examining trends in adolescent alcohol use.

Time	Lifetime alcohol OR	Last month alcohol OR	Lifetime drunk OR	Last month drunk OR	Early onset alcohol OR	Early onset drunkenness OR	Binge last month OR	+10 glasses in a weekend OR
1992	1	1	1	1	–	–	–	–
1996	2.19**	2.14**	1.84**	2.15**	–	–	–	–
1999	1.63**	1.94**	1.99**	2.47**	–	–	–	–
2003	3.14**	2.53**	2.31**	2.29**	1	1	1	1
2005	2.20**	2.00**	–	–	0.94	0.85	1.13	–
2007	1.77**	1.40**	1.61**	1.90**	0.53**	0.56**	0.68**	0.69
2009	1.06	1.02	–	–	0.40**	0.36**	0.57**	0.67
2011	0.92	0.88	1.22*	1.73**	0.27**	0.36**	0.46**	0.66*
2013	0.38**	0.55**	–	–	0.18**	0.24**	0.37**	0.28**
2015	0.34**	0.46**	0.68**	1.20	0.12**	0.22**	0.28**	0.42**
p for trend	<0.001	<0.001	<0.001	0.501	<0.001	<0.001	<0.001	<0.001

Note. The analyses were controlled for adolescent age, gender, educational track, ethnicity, and family structure.

* $p < 0.01$.

** $p < 0.001$.

Table 7
Results of interaction analyses of time x sociodemographic subgroup on adolescent alcohol use, 1992–2003.^{a,b}

	Lifetime alcohol OR	Last month alcohol OR	Lifetime drunk OR	Last month drunk OR
Main effects				
Boys (girls = ref.)	1.36**	1.28**	1.21**	1.20**
Age group				
12- to 13-year olds	0.19**	0.12**	0.10**	0.08**
14- to 15-year olds	0.61**	0.50**	0.46**	0.47**
16-year olds (=ref.)	1	1	1	1
Interaction effects				
Gender x survey year				
Boys (girls = ref.)	1.01	1.00	0.99	0.97*
Age x survey year				
12- to 13-year olds	1.06 [†]	1.06 [†]	1.01	1.00
14- to 15-year olds	1.05 [†]	1.05 [†]	1.03	1.01
16-year olds (=ref.)	1	1	1	1

Note. Analyses were controlled for socio-demographic characteristics (age, gender, educational track, ethnicity, family structure).

^a In 1992, 1996, and 1999, educational track was measured differently compared to other survey waves (see note below Table 1). Therefore, interaction analyses in the period 1992–2003 could not be controlled for educational track.

^b Early onset drinking behaviours and the quantity of drinking were not measured before 2003; therefore, no interaction analyses could be run for these variables.

* $p < 0.01$.

** $p < 0.001$.

[†] $p = 0.01$.

Regarding the increase in lifetime and last month drunkenness, no interaction effect was found for the different age groups; thus, prevalence rates increased for all age groups in a comparable way.

Between 2003 and 2015 (Table 8), when alcohol use decreased overall, interaction analyses indicate that the decrease was stronger for 12- to 15-year olds, compared to 16-year olds, for all measures (ORs ranging from 0.88 to 0.95, $ps < 0.001$; also see Fig. 1), except drinking more than 10 glasses of alcohol in a weekend (which may be related to the very low prevalence rates among the youngest age groups). When comparing 12–13 year olds with 14–15 year olds, the decreases were significantly stronger among 12–13 year olds regarding last month alcohol use ($OR = 1.05$, $p < 0.001$) and binge drinking ($OR = 1.08$, $p < 0.001$). Thus, the decrease in alcohol use for these measures was strongest in the youngest age group, and weakest in the oldest age group.

Trends by educational track (RQ 3)

As educational track was not measured for all adolescents in 1992, 1996, and 1999, interaction analyses by educational track were only conducted for the period 2003–2015 (Table 8). Clear and consistent differences in alcohol use were found, with adolescents in higher academic tracks reporting less alcohol use, compared to their peers in vocational and lower and medium academic tracks. Differences were especially large regarding the number of glasses consumed in a weekend ($OR = 4.97$, $p < 0.001$; vocational versus high academic track).

Interaction analyses indicate that alcohol use between 2003 and 2015 decreased more strongly among adolescents in the higher academic track, compared to the other educational

Table 8
Results of interaction analyses of time x sociodemographic subgroup on adolescent alcohol use, 2003–2015.

	Lifetime alcohol OR	Last month alcohol OR	Lifetime drunk OR	Last month drunk OR	First alcohol < age 14 OR	First drunk < age 14 OR	Binge last month OR	+10 glasses in a weekend OR
Main effects								
Boys (girls = ref.)	1.25**	1.12**	1.04	0.96	1.28**	1.21**	1.16**	2.05**
Age group								
12- to 13-year olds	0.13**	0.07**	0.07**	0.05**	–	–	0.08**	0.03**
14- to 15-year olds	0.49**	0.37**	0.40**	0.40**	–	–	0.39**	0.31**
16-year olds (=ref.)	1	1	1	1	–	–	1	1
Educational track								
Vocational	1.24**	1.60**	1.69**	1.58**	1.27**	2.12**	3.15**	4.97**
Academic (low)	1.44**	1.55**	1.53**	1.44**	1.39**	1.86**	2.43**	3.27**
Academic (medium)	1.27**	1.40**	1.33**	1.47**	1.23**	1.36**	1.74**	2.49**
Academic (high)	1	1	1	1	1	1	1	1
Interaction effects								
Gender × survey year								
Boys (girls = ref.)	0.99	0.98	1.00	1.01	1.00	0.98	0.98	0.97
Age × survey year								
12- to 13-year olds	0.91**	0.88**	0.93**	0.93**	–	–	0.87**	0.95
14- to 15-year olds	0.93**	0.93**	0.95**	0.96	–	–	0.94**	0.98
16-year olds (=ref.)	1	1	1	1	–	–	1	1
Educational track × survey year								
Vocational	1.08**	1.07**	1.06**	1.04	1.10**	1.09**	1.02	1.09
Academic (low)	1.05*	1.04	1.04	1.02	1.05**	1.07*	1.01	1.11*
Academic (medium)	1.03	1.03	1.04	1.04	1.04	1.07	1.03	1.13*
Academic (high)	1	1	1	1	1	1	1	1

Note. Analyses were controlled for socio-demographic characteristics (age, gender, educational track, ethnicity, family structure).

* $p < 0.01$.

** $p < 0.001$

tracks. This applies to all alcohol measures (ORs ranging from 1.04–1.13, $ps < 0.01$), except last month drunkenness and binge drinking.

Strictness of parental rule-setting as an explanation of the decline of youth drinking (RQ 4)

Overall, the percentage of adolescents who reported that their parents 'definitely do not allow' them to drink alcohol steadily increased from 26% in 2007 to 60% in 2015. A trend analysis (not

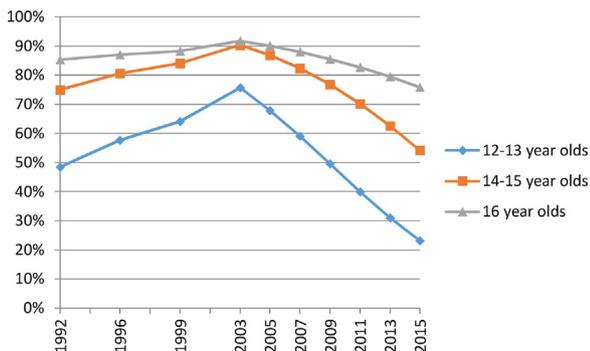


Fig. 1. Time trends in lifetime alcohol use by age group, 1992–2015.

reported in the tables) revealed that this was a significant increase ($p < 0.001$). When perceived parental rules on alcohol use were added as a predictor to the trend analyses (Table 9), the significance and size of the ORs of adolescent alcohol use declined substantially. This indicates that the declining trend in adolescent alcohol use between 2007 and 2015 can be partly explained by the increase in strict alcohol-specific rule-setting by parents during this period. Moreover, interaction analyses (not presented in the Table) indicate that exactly those subgroups who showed the strongest declines in alcohol use (i.e., 12–13 year olds and adolescents attending high academic track) reported the strongest increase in strict parental rule-setting, as compared to 16-year olds ($OR = 1.08$, $p = 0.01$) and adolescents attending the vocational track ($OR = 1.10$, $p < 0.001$).

Discussion

The current study shows that the year 2003 was a turning point in the history of adolescent alcohol use in the Netherlands. Between 1992 and 2003, adolescent alcohol use increased significantly and substantially, especially among early adolescents and (regarding drunkenness) among girls. After 2003, alcohol use strongly decreased, often to even lower rates than the ones in 1992. This decrease was partly explained by stricter parental rule-setting

Table 9
Results of multiple logistic regression analyses examining the role of alcohol-specific parental rule-setting on trends in adolescent alcohol use, 2007–2015.

		Lifetime alcohol	Last month alcohol	Lifetime drunk	Last month drunk	First alcohol < age 14	First drunk < age 14	Binge last month	+10 glasses in a weekend
		OR	OR	OR	OR	OR	OR	OR	OR
Model 1									
Trends, controlled for sociodemographic variables ^a	2007	1	1	1	1	1	1	1	1
	2009	0.61**	0.74**	–	–	0.76**	0.65**	0.83	0.96
	2011	0.53**	0.62**	0.76**	0.91	0.51**	0.64**	0.68**	0.95
	2013	0.22**	0.38**	–	–	0.34**	0.43**	0.54**	0.40**
	2015	0.19**	0.32**	.41**	.62**	0.24**	0.38**	0.41**	0.60*
	p for trend	0.81**	0.86**	0.90**	0.94**	0.83**	0.89**	0.90**	0.92**
Model 2									
+ perceived alcohol-specific parental rule-setting	2007	1	1	1	1	1	1	1	1
	2009	0.76**	0.88	–	–	0.91	0.73*	0.96	1.03
	2011	0.82	0.92	1.03	1.13	0.72**	0.84	0.94	1.11
	2013	0.30**	0.53**	–	–	0.45**	0.55**	0.72**	0.47**
	2015	0.30**	0.48**	0.59**	0.82	0.35**	0.54**	0.60**	0.77
	p for trend	0.84**	0.91**	0.94**	0.98	0.87**	0.93**	0.94**	0.95*

^a Sociodemographic variables include adolescent age, gender, educational level, ethnicity, and family structure.

* $p < 0.01$.

** $p < 0.001$.

on adolescent alcohol use. The decrease in alcohol use between 2003 and 2015 was especially strong among 12- to 15-year old adolescents, compared to 16-year old adolescents, and among adolescents attending higher educational tracks, compared to adolescents attending lower educational tracks. While gender differences in drunkenness appear to have decreased, they remained stable for other alcohol measures.

Societal explanations for the trends

The trends identified in this study are, to some extent, consistent with trends in other developed nations. Since the early 1990s, alcohol use has increased considerably in most developed countries (Bauman & Phongsavan, 1999). Many countries also noted a decreasing trend in adolescent alcohol use since the beginning of the 21st century (EMCDDA & ESPAD, 2016; Kristjansson et al., 2010; Lai & Habicht, 2011; Livingston, 2014; Norström & Svensson, 2014; Sigfúsdóttir et al., 2008; Sourander et al., 2012; de Looze, Raaijmakers et al., 2015), although the size of the decline in the Netherlands appears to be one of the most dramatic ones. Thus, explanations for the observed trends in the Netherlands are likely to include both factors specific to the Dutch context and factors that are more internationally applicable.

The increase in adolescent alcohol use in the 1990s may be related to the introduction of alcopops and designer drinks (ready-made, pre-mixed spirit-based drinks) in the Netherlands, as well as in other countries. These 'new drinks' had a trendy design and a sweet, non-alcoholic taste (Romanus, 2000; Lanier, Hayes, & Duffy, 2005), which may have enticed especially young children and girls, who would otherwise not drink, to embark on the use of alcohol (Metzner & Kraus, 2008). They were among the most popular alcoholic beverages among Dutch adolescents in secondary education in the 1990s (De Zwart et al., 2000; Ter Bogt, Van Dorsselaer, & Vollebergh, 2002). Second, the 1990s were a period of growing wealth in the Netherlands. Adolescents' income increased (CBS, 2001; NIBUD, 2002), and even for many early adolescents, it became affordable to purchase alcoholic drinks.

Our finding that parents have increasingly set strict rules regarding their children's alcohol use between 2007 and 2015, provides support for the idea that parents played an important role in the observed decrease in adolescent alcohol use between 2007 and 2015 in the Netherlands. The perceived increase in parental rule-setting by adolescents, as reported in this study, is consistent with a study by de Looze and colleagues (2014b), which shows that parents themselves reported stricter rule-setting and more negative attitudes towards adolescent drinking in the period between 2007 and 2011.

Why parents have adopted stricter attitudes and practices regarding adolescent alcohol use, is hard to say. First, in the beginning of the 21st century, there was a boost in scientific research on the potentially hazardous effects of alcohol on adolescent development. Especially studies suggesting brain damage as a result of heavy drinking among adolescents (Hiller-Sturmhöfel & Swartzwelder, 2004; Tapert, Granholm, Leedy, & Brown, 2002) triggered concerns among parents, teachers, and policy makers. Even though evidence for long-term brain damage among adolescents who drink alcohol was – and still is – disputed (Boelema et al., 2015), many Dutch parents may have started wondering whether the liberal approach toward adolescent drinking, that was prevailing until then, was detrimental to the health of their children.

Second, the implementation of national mass media campaigns and prevention programs between 2006 and 2012 in the Netherlands, aimed at reducing alcohol use among adolescents, may have influenced parental attitudes and behaviours towards adolescent drinking. Based on research showing that alcohol-specific parenting is one of the strongest predictors of adolescent alcohol use (Donovan, 2004; Van der Vorst, 2007), these campaigns and programs targeted parents, not adolescents themselves. One of the goals of the campaign was to postpone alcohol use among adolescents at least until the age of 16, which was the legal age for the purchase of alcohol at that time. Parents were informed about the harms of early drinking and were encouraged to set strict rules regarding the alcohol use of their child. This strong focus on early drinking in the campaign may also

explain why the decreasing trends were especially strong among early adolescents.

Government investment and national campaigns have not ceased since 2012. In 2014, the legal purchasing age for alcohol increased from 16 to 18. This coincided with the launch of a social norms campaign, again targeting parents, which stressed the unacceptability of alcohol use among 16- and 17-year olds (Rijksoverheid, 2015). Interestingly, we note a remarkably sharp decrease in alcohol use among 16-year olds between 2011 and 2015. This may reflect a change in sociocultural norms on alcohol use among 16- and 17-year olds, as a result of the new purchasing age and social norms campaign. More likely, however, is that the recent decrease among 16-year olds reflects a delayed (cohort) effect, as adolescents who were 16 years old in 2013 and 2015 have been raised in a strict sociocultural context regarding alcohol use from the moment they entered adolescence.

Finally, simultaneous to the campaigns targeting parents, schools have been encouraged to adopt stricter policies around adolescent alcohol use. This effectively resulted in stricter policies at schools: while only about 40% of schools prohibited any alcohol use by adolescents during school occasions in 2003, 93% of schools did so in 2015 (Tuithof, van Dorsselaer, & Monshouwer, 2017). The stricter policies at schools and the stricter societal approach toward adolescent alcohol use in general may have further contributed to the decrease in alcohol use among adolescents.

A general trend toward a healthier lifestyle?

Important to note is that the recent decline in adolescent alcohol use in the Netherlands, as well as in other countries, fits in an overall trend towards a healthier lifestyle among European youth. Between 2002 and 2010, not only alcohol use, but also the use of tobacco and cannabis declined (Hublet et al., 2015; ter Bogt et al., 2014). Furthermore, young people report healthier eating habits (Vereecken et al., 2015), engage more often in physical activity (Kalman et al., 2015), have fewer injuries (Molcho, Walsh, Donnelly, Gaspar de Matos, & Pickett, 2015), are less likely to be bullied (Chester et al., 2015), more often use contraception when sexually active (Ramiro et al., 2015), and rate their health as 'excellent' more often (Cavallo et al., 2015).

The general trend toward healthier behaviour may be a result of a diversity of policy actions that have been implemented in the past decade. Besides the increased implementation of a variety of alcohol prevention programs across Europe (Anderson & Baumberg, 2006; Rehm et al., 2011), many countries have implemented a ban on smoking in public areas (including bars and restaurants), a ban on selling tobacco to minors, and policies aiming to increase physical activity and healthy eating in school children (Kuntsche & Ravens-Sieberer, 2015). As some risk behaviours, such as the use of tobacco and alcohol, often co-occur (Jessor, 2014; de Looze, ter Bogt et al., 2015), policy measures such as the ban on smoking (and associated norms) may have indirectly contributed to the decline in adolescent alcohol use. An alternative explanation is that parents have adopted stricter parenting practices in general, affecting not only alcohol use. Others have suggested that the more general decrease in risk behaviours is linked to changes in the way young people spend their leisure time (i.e., an increase in time spent online and the use of social media; Pennay, Livingston, & MacLean, 2015). However, research in this field is limited and inconsistent (Nicholls, 2012; Pennay et al., 2015); future research may examine whether, and if so, how, changes in the focus of youth leisure time and the use of digital technology may have affected trends in alcohol use.

Strengths and limitations

Limitations of this study include the selective response at the school-level, for which we corrected by weighting our data for adolescents' educational track, grade, gender, and level of urbanization. As weighting procedures can however not completely compensate for non-response biases, the effect sizes in our study may be slightly in- or deflated. Second, we used self-report data on adolescent alcohol use, which entails the risk of socially desirable answers. To ensure that adolescents would complete our questionnaire honestly, research assistants stressed anonymity before administering the questionnaires. Finally, the additional analysis on parental rules was limited to the period 2007–2015, as data prior to 2007 were not available.

This study also has a number of strengths, such as the use of large and nationally representative datasets and a strict, standard protocol for the data collection across the different study waves. It adds to previous trend studies as the time span of the reported trends is long (23 years in total), and it corrects for important sociodemographic factors. Moreover, it provides an explanation for the observed trends in the beginning of the 21st century.

Conclusion

This study gives an overview of 23 years of history of drinking behaviours among adolescents in the Netherlands. Between 1992 and 2003, adolescent alcohol use increased substantially, and it decreased spectacularly thereafter. Parents appear to have played a crucial role in the phenomenal decline in adolescent alcohol use in the Netherlands since the beginning of the 21st century. We call for future studies that systematically and internationally test links between trends in adolescent alcohol use, parenting behaviours, and societal developments.

Conflict of interest statement

The authors of this manuscript certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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References

- Anderson, P., & Baumberg, B. (2006). *Alcohol in Europe: A public health perspective*. London, England: Institute of Alcohol Studies.
- Bauman, A., & Phongsavan, P. (1999). Epidemiology of substance use in adolescence: prevalence, trends and policy implications. *Drug and Alcohol Dependence*, 55(3), 187–207.

- Boelema, S. R., Harakeh, Z., van Zandvoort, M. J. E., Reijneveld, S. A., Verhulst, F. C., Ormel, J., et al. (2015). Adolescent heavy drinking does not affect maturation of basic executive functioning: Longitudinal findings from the TRAILS study. *PLoS One*, 10.
- CBS [Statistics Netherlands] (2001). *Jeugd 2001: Cijfers en Feiten [Youth 2001: figures and facts]*. Voorburg, the Netherlands: Centraal Bureau voor de Statistiek.
- Cavallo, F., Dalmasso, P., Ottová-Jordan, V., Brooks, F., Mazur, J., Välimaa, R., et al. (2015). Trends in self-rated health in European and North-American adolescents from 2002 to 2010 in 32 countries. *European Journal of Public Health*, 25(Suppl. 2), 13–15.
- Chester, K. L., Callaghan, M., Cosma, A., Donnelly, P., Craig, W., Walsh, S., et al. (2015). Cross-national time trends in bullying victimisation in 33 countries among children aged 11, 13 and 15 from 2002 to 2010. *European Journal of Public Health*, 25(Suppl. 2), 61–64.
- CBS (2015). Steeds meer minderjarige vrouwen bij één ouder. [Increasing numbers of minors live with single parents]. Den Haag: Centraal Bureau voor de Statistiek. Retrieved from: <http://www.cbs.nl/nl-nl/menu/themas/dossiers/jongeren/publicaties/artikelen/archief/2015/steeds-meer-minderjarige-vrouwen-bij-een-ouder.htm>.
- CBS (2016). *Jaarrapport 2016. Landelijke Jeugdmonitor. [Report of the Year 2016. National Youth Monitor]*. Den Haag: Centraal Bureau voor de Statistiek.
- Currie, C., Roberts, C., Morgan, A., Smith, R., Settertobulte, W., Samdal, O., & Barnekow, V. (Eds.). (2004). *Young people's health in context: International report from the HBSC 2001/02 survey. Health policy for children and adolescents, No. 4*. Copenhagen, Denmark: WHO Regional Office for Europe.
- Currie, C., Nic Gabhainn, S., Godeau, E., Roberts, C., Smith, R., Currie, D., Pickett, W., Richter, M., Morgan, A., & Barnekow, V. (Eds.). (2008). *Inequalities in young people's health: HBSC international report from the 2005/06 Survey. Health policy for children and adolescents, No. 5*. Copenhagen, Denmark: WHO Regional Office for Europe.
- Currie, C., Zanotti, C., Morgan, A., Currie, D., de Looze, M., Roberts, C., Samdal, O., Smith, O. R., & Barnekow, V. (Eds.). (2012). *Social determinants of health and well-being among young people. Health Behaviour in School-aged Children (HBSC) study: International report from the 2009/2010 survey. Health policy for children and adolescents, No. 6*. Copenhagen, Denmark: WHO Regional Office for Europe.
- de Looze, M., Raaijmakers, Q., ter Bogt, T., Bendtsen, P., Farhat, T., Ferreira, M., et al. (2015). Decreases in adolescent weekly alcohol use in Europe and North America: Evidence from 28 countries from 2002 to 2010. *European Journal of Public Health*, 25(Suppl. 2), 69–72.
- de Looze, M., Vermeulen-Smit, E., ter Bogt, T. F. M., van Dorsselaer, S. A. F. M., Verdurmen, J., Schulten, I., et al. (2014). Trends in alcohol-specific parenting practices and adolescent alcohol use between 2007 and 2011 in the Netherlands. *International Journal of Drug Policy*, 25, 133–141.
- de Looze, M., ter Bogt, T., Raaijmakers, Q., Pickett, W., Kuntsche, E., & Vollebergh, W. (2015). Cross-national evidence for the clustering and psychosocial correlates of adolescent risk behaviours in 27 countries. *European Journal of Public Health*, 25, 50–56.
- De Zwart, W. M., Monshouwer, K., & Smit, F. (2000). *Jeugd en Riskant Gedrag. Kerngegevens 1999. Roken, Drinken, Drugsgebruik en Gokken onder Scholieren vanaf Tien Jaar [Youth and risky behaviour. Key data 1999. Smoking, drinking, drug use, and gambling among scholars aged ten years and older]*. Utrecht: Trimbos-instituut.
- Donovan, J. E. (2004). Adolescent alcohol initiation: A review of psychosocial risk factors. *Journal of Adolescent Health*, 35, e7–e18.
- EMCDDA, & ESPAD (2016). *ESPAD report 2015 — Results from the European school survey project on alcohol and other drugs*. Luxembourg: EMCDDA–ESPAD Joint Publications, Publications Office of the European Union.
- Geels, L. M., Bartels, M., Van Beijsterveldt, T. C. E. M., Willemsen, G., Van der Aa, N., Boomsma, D. I., et al. (2011). Trends in adolescent alcohol use: Effects of age, sex and cohort on prevalence and heritability. *Addiction*, 107, 518–527.
- Godin, I., Dujardin, S., Fraeyman, J., & Van Hal, G. (2009). Differences in the perception of a mass media information campaign on drug and alcohol consumption. *Arch Public Health*, 67, 161–168.
- Gore, F. M., Bloem, P. J. N., Patton, G. C., Ferguson, J., Joseph, V., Coffey, C., et al. (2011). Global burden of disease in young people aged 10–24 years: A systematic analysis. *Lancet*, 377, 2093–2102.
- Hibell, B., Andersson, B., Bjarnasson, T., Ahlström, S., Balakireva, O., Kokkevi, A., et al. (2004). *The 2003 ESPAD report, alcohol and other drug use among students in 35 European countries*. Stockholm, Sweden: CAN.
- Hibell, B., Guttormsson, U., Ahlström, S., Balakireva, O., Bjarnason, T., Kokkevi, A., et al. (2009). *The 2007 ESPAD report. Substance use among students in 35 European countries*. Stockholm, Sweden: CAN.
- Hibell, B., Guttormsson, U., Ahlström, S., Balakireva, O., Bjarnason, T., Kokkevi, A., et al. (2012). *The 2011 ESPAD report. Substance use among students in 36 European countries*. Stockholm, Sweden: CAN.
- Hiller-Sturmhöfel, S., & Swartzwelder, H. S. (2004). Alcohol's effects on the adolescent brain: What can be learned from animal models. *Alcohol, Research and Health*, 28, 213–221.
- Hublet, A., Bendtsen, P., de Looze, M., Fotiou, A., Donnelly, P., Vilhjalmsdottir, R., et al. (2015). Trends in the co-occurrence of tobacco and cannabis use in 15-year-olds in 28 countries of Europe and North-America, 2002–10. *European Journal of Public Health*, 25(Suppl. 2), 73–75.
- Inchley, J. (Ed.). (2016). et al. *Growing up unequal: Gender and socioeconomic differences in young people's health and well-being. Health Behaviour in School-aged Children (HBSC) study: International report from the 2013/2014 survey. Health policy for children and adolescents, No. 7*. Copenhagen, Denmark: WHO Regional Office for Europe.
- Jessor, R. (2014). Problem behavior theory: A half century of research on adolescent behavior and development. In R. M. Lerner, A. C. Petersen, R. K. Silbereisen, & J. Brooks-Gun (Eds.), *The developmental science of adolescence: History through autobiography*. New York: Psychology Press.
- Johnston, L. D., O'Malley, P. M., Miech, R. A., Bachman, J. G., & Schulenberg, J. E. (2015). *Monitoring the Future national survey results on drug use: 1975–2014: Overview, key findings on adolescent drug use*. Ann Arbor: Institute for Social Research, The University of Michigan.
- Kalman, M., Inchley, J., Sigmundova, D., Iannotti, R. J., Tyniälä, J. A., Hamrik, Z., et al. (2015). Secular trends in moderate-to-vigorous physical activity in 32 countries from 2002 to 2010: a cross-national perspective. *European Journal of Public Health*, 25(Suppl. 2), 37–40.
- Knibbe, R. A., Oostveen, T., & Van de Goor, I. (1991). Young people's alcohol consumption in public drinking places: Reasoned behaviour or related to the situation? *British Journal of Addiction*, 86, 1425–1433.
- Koning, I. M., Engels, R. C. M. E., Verdurmen, J. E. E., & Vollebergh, W. A. M. (2010). Alcohol-specific socialization practices and alcohol use in Dutch early adolescents. *Journal of Adolescence*, 33, 93–100.
- Kristjansson, A. L., James, J. E., Alegrante, J. P., Sigfusdottir, I. D., & Helgason, A. R. (2010). Adolescent substance use, parental monitoring, and leisure-time activities: 12-year outcomes of primary prevention in Iceland. *Preventive Medicine*, 51, 168–171.
- Kuipers, S. B. M., Mensink, C., & de Zwart, W. M. (1993). *Jeugd en riskant gedrag 1992. Roken, drinken, drugsgebruik en gokken onder scholieren vanaf tien jaar. [Youth and risky behaviour 1992. Smoking, drinking, drug use, and gambling among students aged ten years and older]*. Utrecht, The Netherlands: Nederlands Instituut voor Alcohol en Drugs (NIAD).
- Kuipers, S. B. M., Stam, H., & De Zwart, W. M. (1997). *Jeugd en riskant gedrag 1996. Roken, drinken, drugsgebruik en gokken onder scholieren vanaf tien jaar [Youth and risky behaviour 1996. Smoking, drinking, drug use, and gambling among students aged ten years and older]*. Utrecht, The Netherlands: Netherlands Institute of Mental Health and Addiction.
- Kuntsche, E., & Ravens-Sieberer, U. (2015). Monitoring adolescent health behaviours and social determinants cross-nationally over more than a decade: Introducing the Health Behaviour in School-aged Children (HBSC) study supplement on trends. *European Journal of Public Health*, 25(Suppl. 2), 1–3.
- Kuntsche, E., Kuntsche, S., Knibbe, R., Simons-Morton, B., Farhat, T., Hublet, A., et al. (2011). Cultural and gender convergence in adolescent drunkenness. *Archives of Pediatrics and Adolescent Medicine*, 165, 152–158.
- Lai, T., & Habicht, J. (2011). Decline in alcohol consumption in Estonia: Combined effects of strengthened alcohol policy and economic downturn. *Alcohol and Alcoholism*, 46(2), 200–203.
- Lanier, S. A., Hayes, J. E., & Duffy, V. B. (2005). Sweet and bitter tastes of alcoholic beverages mediate alcohol intake in of-age undergraduates. *Physiology & Behavior*, 83, 821–831.
- Livingston, M. (2014). Trends in non-drinking youth among Australian adolescents. *Addiction*, 109, 922–929.
- McCambridge, J., McAlaney, J., & Rowe, R. (2011). Adult consequences of late adolescent alcohol consumption: A systematic review of cohort studies. *PLoS Medicine*, 8(2), e1000413.
- Metzner, C., & Kraus, L. (2008). The impact of alcopops on adolescent drinking: A literature review. *Alcohol & Alcoholism*, 43, 230–239.
- Molcho, M., Walsh, S., Donnelly, P., Gaspar de Matos, M., & Pickett, W. (2015). Trend in injury-related mortality and morbidity among adolescents across 30 countries from 2002 to 2010. *European Journal of Public Health*, 25(Suppl. 2), 33–36.
- Monshouwer, K., van Dorsselaer, S., Gorter, A., Verdurmen, J., & Vollebergh, W. (2004). *Jeugd en riskant gedrag 2003. Kerngegevens uit het peilstationsonderzoek 2003: roken, drinken, drugsgebruik en gokken onder scholieren vanaf tien jaar. [Youth and risky behaviour 2003. Smoking, drinking, drug use, and gambling among students aged ten years and older]*. Utrecht, The Netherlands: Netherlands Institute of Mental Health and Addiction.
- Monshouwer, K., Verdurmen, J., van Dorsselaer, S., Smit, E., Gorter, A., & Vollebergh, W. A. M. (2008). *Jeugd en riskant gedrag 2007. Kerngegevens uit het peilstationsonderzoek scholieren. [Youth and risky behaviour 2007. Key data from the DNSSSU study.]* Utrecht, The Netherlands: Netherlands Institute of Mental Health and Addiction.
- NIBUD (2002). *Nationaal Scholierenonderzoek 2001/2002 [National students research 2001/2002]*, derived from www.NIBUD.nl.
- Nicholls, J. (2012). Everyday, everywhere: Alcohol marketing and social media-current trends. *Alcohol and Alcoholism*, 47(4), 486–493.
- Niederdeppe, J., Farrelly, M. C., Nonnemaker, J., Davis, K. C., & Wagner, L. (2011). Socioeconomic variation in recall and perceived effectiveness of campaign advertisements to promote smoking cessation. *Social Science & Medicine*, 72(5), 773–780.
- Norström, T., & Svensson, J. (2014). The declining trend in Swedish youth drinking: Collectivity or polarization? *Addiction*, 109, 1437–1446.
- O'Malley, P. M., Bachman, J. G., & Johnston, L. D. (1983). Reliability and consistency in self-reports of drug use. *International Journal of the Addictions*, 18, 805–824.
- Oggers, C. L., Caspi, A., Nagin, D. S., Piquero, A. R., Slutske, W. S., Milne, B. J., et al. (2008). Is it important to prevent early exposure to drugs and alcohol among adolescents? *Psychological Science*, 19, 1037–1044.
- Pennay, A., Livingston, M., & MacLean, S. (2015). Young people are drinking less: It is time to find out why. *Drug and Alcohol Review*, 34, 115–118.

- Poelen, E. A. P., Scholte, R. H. J., Engels, R. C. M. E., Boomsma, D. I., & Willemsen, G. (2005). Prevalence and trends of alcohol use and misuse among adolescents and young adults in the Netherlands from 1993 to 2000. *Drug and Alcohol Dependence*, 79, 413–421.
- Ramiro, L., Windlin, B., Reis, M., Nic Gabhainn, S., Jovic, S., Gaspar de Matos, M., et al. (2015). Gendered trends in early and very early sex and condom use in 20 European countries from 2002 to 10. *European Journal of Public Health*, 25 (Suppl. 2), 65–68.
- Rehm, J., Zatonksi, W., Taylor, B., & Anderson, P. (2011). Epidemiology and alcohol policy in Europe. *Addiction*, 106, 11–19.
- Rijksoverheid (2015). *Jaarevaluatie campagnes Rijksoverheid 2014. [Year evaluation of campaigns Dutch national government]*. The Hague, The Netherlands: Rijksoverheid.
- Romanus, G. (2000). Alcopops in Sweden — A supply side initiative. *Addiction*, 95 (Suppl. 4), S609–S619.
- Sigfúsdóttir, I. D., Kristjánsson, A. L., Thorlindsson, T., & Allegrante, J. P. (2008). Trends in prevalence of substance use among Icelandic adolescents 1995–2006. *Substance Abuse Treatment Prevention and Policy*, 3, 12–20.
- Simons-Morton, B., Farhat, T., ter Bogt, T. F. M., Hublet, A., Kuntsche, E., Gabhainn, S. N., et al. (2009). Gender specific trends in alcohol use: Cross-cultural comparisons from 1998 to 2006 in 24 countries and regions. *International Journal of Public Health*, 52, S199–S208.
- Sleet, D. A., Ballesteros, M. F., & Borse, N. N. (2010). A review of unintentional injuries in adolescents. *Annual Review of Public Health*, 31, 195–212.
- Sourander, A., Koskelainen, M., Niemelä, S., Rihko, T., Ristkari, T., & Lindroos, J. (2012). Changes in adolescent mental health and use of alcohol and tobacco: A 10-year time-trend study of Finnish adolescents. *European Child and Adolescent Psychiatry*, 21, 665–671.
- Tapert, S. F., Granholm, E., Leedy, N. G., & Brown, S. A. (2002). Substance use and withdrawal: Neuropsychological functioning over 8 years in youth. *Journal of the International Neuropsychological Society*, 8, 873–883.
- Ter Bogt, T., Van Dorsselaer, S., & Vollebergh, W. (2002). *Roken, drinken en blowen door Nederlandse scholieren (11 t/m 17 jaar) 2001: Kerngegevens middelengebruik uit het Nederlands HBSC-onderzoek. [Smoking, drinking, and smoking dope among Dutch students (11–17 year) 2001: Key data substance use from the Dutch HBSC study]*. Utrecht, The Netherlands: Netherlands Institute of Mental Health and Addiction.
- ter Bogt, T. F. M., de Looze, M., Molcho, M., Godeau, E., et al. (2014). Do societal wealth, family affluence and gender account for trends in adolescent cannabis use? An HBSC study of 30 countries. *Addiction*, 109, 273–283.
- Toumbourou, J. W., Stockwell, T., Neighbors, C., Marlatt, G. A., Sturge, J., & Rehm, J. (2007). Interventions to reduce harm associated with adolescent substance use. *Lancet*, 369, 1391–1401.
- Tuithof, M., van Dorsselaer, S., & Monshouwer, K. (2017). *Het beleid van scholen rond tabak, alcohol en cannabis. [School policies on tobacco, alcohol and cannabis]*. Utrecht, The Netherlands: Netherlands Institute of Mental Health and Addiction.
- Van der Vorst, H. (2007). *The key to the cellar door. The role of the family in adolescents' alcohol use. PhD dissertation*. Nijmegen, The Netherlands: Radboud University.
- Van Dorsselaer, S., Van Zeijl, E., Van den Eeckhout, S., Ter Bogt, T., & Vollebergh, W. (2007). *HBSC 2005. Gezondheid, welzijn en opvoeding van jongeren in Nederland. [Health, well-being and upbringing of youth in the Netherlands]*. Utrecht, The Netherlands: Netherlands Institute of Mental Health and Addiction.
- Van Dorsselaer, S., de Looze, M., Vermeulen-Smit, E., de Roos, S., Verdurmen, J., ter Bogt, T., et al. (2010). *HBSC 2009. Gezondheid, welzijn en opvoeding van jongeren in Nederland. [Health, well-being and upbringing of youth in the Netherlands]*. Utrecht, The Netherlands: Netherlands Institute of Mental Health and Addiction.
- van Dorsselaer, S., Tuithof, M., Verdurmen, J., Spit, M., van Laar, M., & Monshouwer, K. (2016). *Jeugd en riskant gedrag 2015: kerngegevens uit het Peilstationsonderzoek Scholieren. [Youth and risky behaviour 2015. Key data from the DNSSSU study]*. Utrecht, The Netherlands: Netherlands Institute of Mental Health and Addiction.
- Verdurmen, J. E. E., Monshouwer, K., Van Dorsselaer, S. A. F. M., Lokman, S., Vermeulen-Smit, E., & Vollebergh, W. A. M. (2012). *Jeugd en riskant gedrag 2011. Kerngegevens uit het peilstationsonderzoek scholieren. [Youth and risky behaviour 2011. Key data from the DNSSSU study]*. Utrecht, The Netherlands: Netherlands Institute of Mental Health and Addiction.
- Vereecken, C., Pedersen, T. P., Ojala, K., Krølner, R., et al. (2015). Fruit and vegetable consumption trends among adolescents from 2002 to 2010 in 33 countries. *European Journal of Public Health*, 25(Suppl. 2), 16–19.