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Impact of Cross-Sectoral Alcohol Policy on Youth Alcohol Consumption

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ABSTRACT

Objective:

Cross-sectoral alcohol policy is recommended to reduce youth alcohol consumption, but little evidence is available on its effectiveness. Therefore, we examined whether regions and municipalities in the Dutch province of Noord-Brabant with stronger cross-sectoral alcohol policy showed larger reductions in alcohol consumption among adolescents aged 12–15.

Method:

Strong regional cross-sectoral alcohol policy was defined as participation in a regional alcohol prevention program. Strong municipal cross-sectoral alcohol policy was operationalized by measures on (a) sector variety: involvement of different policy sectors, and (b) strategy variety: formulation of different policy strategies. Relevant data from policy documents were searched for on the Internet. Data on trends in alcohol consumption were extracted from the 2007 and 2011 cross-sectional Youth Health Monitor that includes a random subset of adolescents aged 12–15 ($n = 15,380$ in 2007 and $n = 15,437$ in 2011). We used multilevel regression models.

Results:

Two of the three regions in which municipalities participated in a regional alcohol prevention program showed a larger reduction in weekly drinking than the region in which municipalities did not participate (-12.2% and -13.4% vs. -8.3%). Municipalities with strong compared to weak sector variety showed a larger increase in adolescents' age at consuming their first alcoholic drink (0.63 vs. 0.42 years). Municipalities with strong strategy variety showed a decrease (-3.8%) in heavy weekly drinking, whereas those with weak variety showed an increase (5.1%). Cross-sectoral alcohol policy did not affect trends in other alcohol outcomes.

Conclusions:

Our results suggest that strong cross-sectoral alcohol policy may contribute to reducing some aspects of youth alcohol consumption. Monitoring policy implementation is needed to assess the full impact.

High levels of alcohol consumption are an important public health problem among adolescents. In Europe in 2011, 57% of adolescents aged 15–16 had consumed an alcoholic beverage before age 14. The prevalence of heavy episodic drinking (between 1999 and 2011) was also substantial, ranging from 13% in Iceland to 64% in Denmark, with the Netherlands being in the upper level (58%) ([Hibell et al., 2012](#)). The number of adolescents under age 18 treated in a Dutch hospital for alcohol poisoning increased dramatically from about 300 cases in 2007 ([van Hoof et al., 2010](#)) to more than 700 cases in recent years (713 cases in 2013) ([STAP, 2014b](#)). Other health consequences of youth alcohol consumption are unsafe sexual behavior, alcohol-related disorders, and neurobiological damage. It has been shown that early onset of drinking and alcohol misuse over several years are associated with lower hippocampus volume ([De Bellis et al., 2000](#)). Youth alcohol consumption also has an impact on public safety (e.g., violence; [Shepherd et al., 2006](#)) and the adolescent's long-term development (e.g., school and work performances; [Masten et al., 2005](#); [Staff et al., 2008](#)).

At the Dutch national level, several actions were undertaken to reduce alcohol consumption among adolescents. A decade ago, a large mass media campaign on alcohol consumption and the brain was launched. Since 2009, broadcasting of alcohol-related television and radio commercials has been prohibited between 6.00 a.m. and 9.00 p.m. Furthermore, the legal sales age of 16 years, which was enforced starting in 1967, had been raised to 18 in 2014. To reduce youth alcohol consumption at a regional or municipal level, cross-sectoral alcohol policy is recommended, which means coordinated action of different policy sectors with the aim of coherently addressing multiple determinants of alcohol consumption and drinking-related behaviors to improve health ([Kickbusch, 2010](#); [Peters et al., 2014](#)). Such policies may be effective given that alcohol consumption is influenced by both personal (e.g., attitudes, expectations, and knowledge; [Kuntsche et al., 2004](#)), social (e.g., peer pressure, and low socioeconomic status; [Stolle et al., 2009](#)), and environmental (e.g., alcohol availability and affordability; [Stolle et al., 2009](#)) determinants. To target these different determinants, various policy strategies are needed—for example, communicative, educative, economic, regulatory, and enforcement strategies—which in turn requires the involvement of multiple policy sectors. Thus, strong cross-sectoral alcohol policy implies involvement of different policy sectors, which, in addition, implement different policy strategies.

Yet, there is little empirical evidence to support the claim that stronger cross-sectoral alcohol policy has a greater impact on youth alcohol consumption. The only evidence available on strategies to effectively reduce youth alcohol consumption concerns single types of actions. For example, educational actions implemented at schools or at home to target adolescents and their parents seem effective ([Koning et al., 2009](#); [Smit et al., 2008](#); [Spath et al., 2008](#)). These actions aim to raise public awareness and support for the problem but also to provide adolescents with the skills needed to resist peer pressure and to inform parents on how to set rules with regard to drinking. More comprehensive and stringent laws to control alcohol consumption ([Paschall et al., 2009](#))—particularly laws that affect availability, such as legal sales and drinking age ([Wagenaar & Toomey, 2002](#))—are also associated with lower levels of youth alcohol consumption. Laws and regulations are more effective when accompanied by explicit policies on enforcement and sanctioning ([Ogilvie et al., 2005](#)). However, evidence is lacking on the combined effect of these different strategies (i.e., cross-sectoral alcohol policy) on trends in youth alcohol consumption. By 2011, in the Dutch province of Noord-Brabant, the extent to which cross-sectoral alcohol policy was implemented to reduce youth alcohol consumption strongly varied between regions and municipalities. At the regional level, three alcohol prevention programs had started that all promoted the implementation of cross-sectoral alcohol policy. One project started earlier than the other two, and not all regions participated in these programs. Within a regional program, municipalities had control over what policies they could implement locally. For instance, most municipalities with limited support from the municipal board to implement cross-sectoral alcohol policy—because other health problems (e.g., overweight or drug use) were perceived to be more urgent—implemented educational programs only at primary and secondary schools. Municipalities in which, for instance, public disturbance as a result of alcohol intoxication was perceived to be a major problem additionally started to reduce youth alcohol consumption by maintaining public order and the legal sales age of 16.

Such variation in alcohol policies between regions and municipalities presents a unique opportunity to evaluate the impact of different intensities of cross-sectoral alcohol policy. The aim of this study is to investigate whether stronger cross-sectoral alcohol policy was associated with a larger reduction in alcohol consumption among adolescents aged 12–15. Municipalities with strong cross-sectoral alcohol policy were identified by participation in a regional alcohol prevention program, the involvement of different policy sectors, and the formulation of different policy strategies. We used data from a repeated cross-sectional survey for information on trends in youth alcohol consumption between 2007 and 2011 in each municipality. We assessed whether these trends varied according to the strength of cross-sectoral alcohol policy. We also investigated whether associations differed between boys and girls and between adolescents with high and low educational levels, as previous evidence suggests that the level of alcohol consumption ([Currie et al., 2012](#)) and the impact of actions implemented in various settings may differ between these subgroups ([Desousa et al., 2008](#); [Goncy & Mrug, 2013](#)).

METHOD

Study population and data: Individual level

Data on alcohol consumption among adolescents who live in the province of Noord-Brabant were obtained from the Brabant Youth Health Monitor. Every 4 years, a survey is conducted by the three regional Public Health Services in Noord-Brabant: Hart voor Brabant (HVB), West-Brabant (WB), and Brabant-Zuidoost (BZO). In each municipality (68 in 2007 and 67 in 2011), at least 550 adolescents aged 12–18 were invited to complete a questionnaire. These samples were randomly drawn from the Municipal Basic Administration system, in which personal data on each inhabitant is held. Parents received a postal invitation with the request to allow their child to complete the questionnaire, either on paper or on the Internet. Reminders and incentives (a cinema voucher for 1 in 10 adolescents who filled out the questionnaire online) were sent to increase the response rate. The surveys from 2007 and 2011 were selected for this study. Response rates in the three regional Public Health Services varied between 50.0% and 56.7% in 2007 and between 45.2% and 49.0% in 2011. All adolescents aged 12–15 ($n = 15,380$ in 2007 and $n = 15,437$ in 2011) were included in this study.

Variables: Individual level

Alcohol consumption.

The outcomes of interest were the age at which an individual consumed his or her first glass of alcohol (age at onset) and whether an individual participated in regular, weekly, heavy weekly, and heavy episodic drinking. The survey question about age at onset was answered only by those who had ever drunk alcohol ($n = 9,586$; missing 3.9%). Regular drinking was defined as the respondent having consumed one or more drinks on one or more occasions during the last 4 weeks ($n = 30,240$; missing 1.9%). Weekly drinking was defined as drinking at least half a glass of alcohol per week ($n = 29,981$; missing 2.7%) and heavy weekly drinking as drinking five or more drinks per week among those who drink weekly ($n = 6,278$; missing 0.0%). Weekly and heavy weekly drinking were based on four survey questions with regard to the number of weekdays the respondent drinks and the average number of drinks a respondent consumes on such a day. Heavy episodic drinking was based on one survey question and defined as drinking five or more drinks on one occasion, once or several times during the last 4 weeks ($n = 30,505$; missing 1.0%).

Demographics.

Information on educational level (primary school, first year of secondary school, secondary low/vocational, secondary high, tertiary low vocational, other, and none) was dichotomized into low education (secondary low/vocational, and tertiary low vocational) and high education (secondary high). Other categorical variables used in our analyses were sex (boys and girls) and ethnicity (Dutch, Western foreigner, and non-Western foreigner). Ethnicity was based on the country of birth of the individual and his or her parents. Three categories were distinguished: Dutch (both parents born in the Netherlands), Western foreigner (one or both parents born in Europe, except Turkey, or other Western countries), non-Western foreigner (one or both parents born in non-Western countries, such as Surinam, Antilles, Aruba, Turkey, and

Morocco). The distinction between Western and non-Western was based on the country of birth of the adolescent or otherwise that of the mother or father.

Study population and data: Municipal level

Data on cross-sectoral alcohol policy strength were collected from policy documents (period 2007–2011) of the 67 municipalities in Noord-Brabant. Policy sectors included were health, safety, youth, events, and hospitality industry. We searched for these policy documents on the Internet (i.e., Google and municipal websites). The search term “policy” was used in combination with the sector of interest. Documents that covered at least 1 year of the specific policy period between 2007 and 2011 were included. When documents referred to accompanying action plans, these were also included when found. The search was performed by the first author of this article. Policy documents were found for three or more of the five different policy sectors in 56 of the 67 municipalities. These 56 were the municipalities included in our analyses. The documents of the 56 municipalities were scanned for the words alcohol and drinking to locate all formulated actions focusing on the prevention of youth alcohol consumption. Only those actions planned to start before 2011 were extracted.

Variables: Municipal level

Cross-sectoral alcohol policy strength.

We defined four regions. One covered the municipalities that did not participate in a regional alcohol prevention program. The other three had their own regional program: (a) HVB with “16 min geen goed begin” (<16 is not a good start), (b) WB with “Think before you drink,” and (c) BZO with “Laat je niet flessen” (Do not be fooled). All three regional programs aimed to involve different policy sectors and implement different policy strategies.

To describe the strength of cross-sectoral alcohol policy at the municipal level, two measures were defined: (a) sector variety (involvement of different policy sectors) and (b) strategy variety (formulated actions using both educative/communicative and regulatory/enforcement policy strategies). Sector variety was defined as the percentage of policy sectors (i.e., health, safety, youth, events, and hospitality industry) that mentioned at least one action to prevent youth alcohol consumption in their policy documents. Strategy variety was defined as the percentage of all formulated actions that used a regulatory or enforcement policy strategy. We operationalized sector variety and strategy variety as measures for the strength of cross-sectoral alcohol policy, because different policy sectors using different policy strategies are needed to tackle both personal and environmental determinants of youth alcohol consumption. We used the STAP lifeline scheme ([STAP, 2014a](#)) to classify policy strategies as educational, communicative, regulatory, or enforcement. As indicated by this scheme, actions that train or inform alcohol-selling personnel on the development, implementation, and maintenance of alcohol regulations are classified under the regulatory/enforcement policy strategies.

Sector variety and strategy variety were measured on a continuous scale, with higher percentages indicating a stronger variety, and divided into four quartiles. Based on these quartiles, three categories were determined: weak (first quartile), moderate (second and third quartiles), and strong (fourth quartile).

Demographics.

One categorical variable at the municipal level was used in our analyses, which was municipal size (<20,000, 20,000–99,999, and $\geq 100,000$ inhabitants).

Analyses

We investigated the association between three measures of cross-sectoral alcohol policy strength and trends in alcohol consumption between 2007 and 2011. A multilevel linear regression model was used for the outcome mean age at onset of alcohol use and a multilevel logistic regression model for the outcomes regular, weekly, heavy weekly, and heavy episodic drinking.

In five separate regression models, the dependent variables that were the measures of alcohol consumption were age at onset (continuous outcome: years – truncated at the age of 8) and regular, weekly, heavy weekly, and heavy episodic drinking (dichotomous outcomes: yes or no). The categorical measure of interest (i.e., cross-sectoral alcohol policy strength: either participation in a regional alcohol prevention program, sector variety, or strategy variety), year of survey (i.e., 2007 and 2011), and an interaction term between the measure of interest and year of survey were included in the regression models as independent variables. The variable survey year represents the trend in alcohol consumption (independent of levels of cross-sectoral alcohol policy strength), and the measure of interest represents the association of levels of cross-sectoral alcohol policy strength with alcohol consumption (independent of survey year). The interaction term was introduced to investigate whether the trend in alcohol consumption differs across levels of cross-sectoral alcohol policy strength and can be interpreted as follows: The impact of time (survey year 2011 vs. 2007) on alcohol consumption is different in municipalities with strong compared to weak cross-sectoral alcohol policy strength.

All models were controlled for sex (missing $n = 65$), age, education (missing $n = 917$), and ethnicity (missing $n = 169$). Respondents with missing data for at least one of these variables were excluded from statistical analyses, resulting in the following number of respondents being included in the analyses: baseline table ($n = 29,697$), age at onset ($n = 9,290$), regular ($n = 29,174$), weekly ($n = 28,936$), heavy weekly ($n = 6,107$), and heavy episodic drinking ($n = 29,429$). We also included municipal size to control for municipal differences. The models included municipality as cluster level to correct for correlations between adolescents within the same municipality. In addition, a three-way interaction term between sex or education, survey year, and sector variety or strategy variety was included to test whether associations statistically differ between these subgroups. To estimate separate trends in alcohol consumption for each stratum, the models including a three-way interaction term were repeated, each time with another stratum as reference category.

We present the estimated betas and odds ratios (ORs) for the interaction terms between levels of cross-sectoral alcohol policy strength and year of survey, from multilevel linear and logistic regression models, respectively. Our analyses were performed with R Version 2.13.1, and p values less than .05 were considered statistically significant.

To test the robustness of our results, we performed five sensitivity analyses. First, we controlled for the aggregated municipal baseline level of alcohol consumption (i.e., in 2007). Second, we performed a weighted analysis, with the complication that we cannot introduce municipality as cluster level. Each individual was given a weighting factor of that stratum (municipality, sex, and age) in which they were allocated. The

weighting factor was calculated by dividing the number of adolescents from the total population in each stratum with the number of adolescents that responded. Third, we investigated whether results remained similar when sector variety and strategy variety were included in our models as continuous instead of categorical independent variables. Fourth, we repeated our analyses in those municipalities with available documents from all five policy sectors to investigate the influence of possible information bias.

In our last sensitivity analysis, we wanted to investigate whether results were similar when municipal cross-sectoral alcohol policy strength is operationalized into one single measure instead of two measures. For this, we cross-classified municipalities according to the three categories of sector variety (weak, moderate, strong) and strategy variety (weak, moderate, strong). Nine possible combinations were used to define this new measure of municipal cross-sectoral alcohol policy strength.

Municipalities had weak cross-sectoral alcohol policy strength when both measures (i.e., sector variety and strategy variety) were classified as weak or one as weak and one as moderate, moderate when both measures were classified as moderate or one as weak and one as strong, and strong when both measures were classified as strong or one as moderate and one as strong.

RESULTS

The mean age of the survey population was 13.5 (SD = 1.1) years, 47.2% were boys, 87.5% were Dutch, and 49.3% had a high educational level ([Table 1](#)). The survey population of 2011 was very similar to that of 2007. Sector variety and strategy variety differed greatly among the 56 municipalities, and no clear overlap between these two measures could be detected ([Figure 1](#)). The percentage of municipalities with strong sector variety and strategy variety were, respectively, 18.4% and 26.5% in municipalities that participated in a regional alcohol prevention program and, respectively, 14.3% and 0.0% in those that did not participate. [Table 2](#) describes examples of extracted actions that used either educative/communicative or regulatory/enforcement policy strategies.

[TABLE 1]

[FIGURE 1]

[TABLE 2]

In all regions, the mean age at onset (A) increased between 2007 and 2011 ($p < .05$); the prevalence of regular (B), weekly (C), and heavy episodic drinking (E) decreased ($p < .05$); and the prevalence of heavy weekly drinking (D) stayed rather stable as it only increased in one region ([Figure 2](#)). Judged graphically, the reduction in regular, weekly, and heavy episodic drinking was larger, and heavy weekly drinking stayed stable only in the three regions with cross-sectoral alcohol policy compared to the region without. A significant stronger reduction in weekly drinking was present in two of the three regions with an alcohol prevention program compared to the region without: “<16 not a good start” (-12.2% vs. -8.3%; corrected OR = 0.70, 95% CI [0.55, 0.90], $p < .05$) and “Do not be fooled” (-13.4% vs. -8.3%; corrected OR = 0.76, 95% CI [0.60, 0.96], $p < .05$). Heavy weekly drinking stayed much more stable

in one of the three regions with an alcohol prevention program compared to the region without: “<16 not a good start” (1.0% vs. 8.0%; corrected OR = 0.60, 95% CI [0.37, 0.96], $p < .05$). Trends in the other three alcohol outcome measures were similar between regions.

[FIGURE 2]

Municipalities with strong compared to weak sector variety showed a significantly larger increase in the age at onset between 2007 and 2011 (0.63 vs. 0.42 years; corrected $\beta = 0.25$, 95% CI [0.04, 0.45]), whereas trends in the other four alcohol outcome measures did not differ (Table 3). Strong compared to weak strategy variety was associated with a significantly smaller increase (which resembles a decrease) in heavy weekly drinking (-3.8% vs. 5.1%; corrected OR = 0.63, 95% CI [0.42, 0.95]), whereas trends in age at onset did not differ. In municipalities with moderate strategy variety, a trend was present revealing that regular, weekly, and heavy episodic drinking decreased less than in municipalities with weak strategy variety (regular drinking: -9.8% vs. -10.2%; corrected OR = 1.13, 95% CI [0.94, 1.35]; weekly drinking: -11.6% vs. -13.2%; corrected OR = 1.19, 95% CI [0.99, 1.42]; and heavy episodic drinking: -4.6% vs. -5.7%; corrected OR = 1.21, 95% CI [0.97, 1.50]).

[TABLE 3]

Because previous analyses only found an impact of sector variety and strategy variety on, respectively, the outcomes age at onset and heavy weekly drinking, we present results of the sex and education subgroup analyses only for those two outcomes (Table 4). The association between strong sector variety and age at onset could be demonstrated with statistical significance only among boys. The association between strong strategy variety and heavy weekly drinking could be demonstrated with statistical significance only among adolescents with high educational levels. None of the three-way interaction terms was statistically significant.

[TABLE 4]

In sensitivity analyses, very similar associations were found when we controlled for aggregated municipal baseline levels of alcohol consumption, when we used a weighted regression, or when we analyzed sector variety and strategy variety continuously (results not shown). Results were similar when repeating our analyses in those municipalities with documents from all five policy sectors available (results not shown), although the associations were not significant. Last, the use of one overall measure of cross-sectoral alcohol policy strength—combined measure of sector variety and strategy variety—showed very similar associations as strategy variety (results not shown).

DISCUSSION

This study was among the first to assess how the strength of cross-sectoral alcohol policy at a regional and municipal level was associated with trends in youth alcohol consumption. We found that stronger regional cross-sectoral alcohol policy was associated with a larger reduction in weekly drinking. Moreover, municipalities with stronger sector variety and strategy variety showed, respectively, a larger increase in the age at onset of drinking and a larger decline in the prevalence of heavy weekly

drinking among adolescents aged 12–15. Levels of cross-sectoral alcohol policy strength had no impact on regular drinking and heavy episodic drinking.

Strengths and limitations

Our study has several strengths. We measured levels of cross-sectoral alcohol policy strength at both a regional and a municipal level, we isolated two important measures of cross-sectoral alcohol policy strength from policy documents, we evaluated their potential impact using a quasi-experimental design, and we investigated multiple alcohol outcome measures. In many of these respects, our analysis is innovative compared to previously published studies.

However, a few limitations need to be considered. First, the use of a repeated cross-sectional instead of longitudinal design may have introduced confounding. Observed changes in a municipality may be influenced by unmeasured differences in characteristics of respondents included in the 2007 and 2011 sample. Second, our operationalization of municipal cross-sectoral alcohol policy strength may be subject to debate. No consensus has yet been reached on how to measure the extent of integration of public health policies ([Kickbusch & Gleicher, 2012](#); [McQueen et al., 2012](#); [Ståhl et al., 2006](#)). We therefore recognize that the concepts and indicators used in our study may be amenable to improvement in future research.

Third, geographical mobility of adolescents has probably diluted the association between cross-sectoral alcohol policy strength and geographic differences in alcohol consumption trends. Some municipalities in the province of Noord-Brabant have a low number of inhabitants and do not have secondary schools, sports clubs, or bars/clubs. Adolescents travel to other regions or municipalities to use these facilities and are thereby exposed to alcohol policies implemented at these other sites. Unfortunately, we could not additionally stratify our results by municipal size because the number of municipalities per stratum would be too small for statistical analyses.

Fourth, municipal cross-sectoral alcohol policy strength was based on policy documents accessed on the Internet. As a result, we could have missed documents that were not accessible. However, we found similar results when we restricted our analyses to municipalities for which documents from all five policy sectors were available.

Fifth, we only measured intentions to implement alcohol policies and not the actual implementation. We recognize that this could have led to low accurate measures of municipal cross-sectoral alcohol policy strength because (a) not all actions mentioned in policy documents may actually be implemented due to political or practical constraints; (b) local partners, such as schools, may implement actions that the policy documents did not anticipate; and (c) information on the intensity and reach of implemented actions could not be extracted from policy documents. Inaccurate measurement and the consequent misclassification of municipalities could have led to dilution of the observed associations between municipal cross-sectoral alcohol policy strength and trends in youth alcohol consumption.

Interpretations

Our sensitivity analysis assessing the impact of municipal cross-sectoral alcohol policy strength by combining measures of sector variety and strategy variety showed similar associations with trends in alcohol consumption as the analysis that only assessed the impact of strategy variety. This suggests that certain elements of cross-

sectoral alcohol policy, especially the implementation of different policy strategies, may be more effective than other elements in addressing health outcomes. Yet, according to theories on public health policies, larger health impacts could be expected when a municipality seeks a cross-sectoral approach during both policy development and policy implementation ([McQueen et al., 2012](#); [Ståhl et al., 2006](#)). We observed a weak correlation between sector variety and strategy variety (data not shown). A previous study also found that the involvement of different policy sectors may coincide with little variation in the type of policy strategies used ([Peters et al., 2014](#)). This implies that collaboration between multiple sectors does not necessarily result in the implementation of action plans targeting both personal and environmental determinants. As for the measurement of municipal cross-sectoral alcohol policy strength, this implies a greater need for measuring the actual instead of intended implementation of actions.

We found that the involvement of different policy sectors as present in Noord-Brabant had a greater impact on the age at onset of drinking among boys (0.36 years = 4.3 months) than among girls (0.16 years = 1.9 months). This may relate to the fact that boys more often drink outside the home setting ([Goncy & Mrug, 2013](#); [Harford & Spiegler, 1983](#)) and may therefore be more sensitive to regulations ([Desousa et al., 2008](#)). Alcohol policies from sectors other than public health (e.g., safety and the hospitality industry) often aim to strengthen regulations and their enforcement in settings such as public areas and bars. Moreover, as such policies mainly focus on prohibiting underage sales, and underage drinking is more common among boys ([Currie et al., 2012](#)), these policies might reach boys more effectively than girls. The association between heavy weekly drinking and strategy variety (i.e., greater emphasis on regulatory and enforcement strategies) was more pronounced among adolescents with high educational levels than among those with low levels. This could be due to adolescents with high educational levels being more sensitive to regulations ([Chuang et al., 2009](#)) and less exposed to drinking among peers ([Currie et al., 2012](#)), which can influence the individual's own use ([Ali & Dwyer, 2010](#)). Such differential impacts imply that alcohol policies as implemented in Noord-Brabant between 2007 and 2011 could increase socioeconomic-related inequalities in alcohol consumption ([Currie et al., 2012](#)).

The positive effects achieved among adolescents aged 12–15 raise the question of how older adolescents were affected. In further analyses, we found that trends in alcohol consumption among adolescents aged 16–18 were not associated with cross-sectoral alcohol policy strength (results not shown). In Noord-Brabant, most of the actions that were implemented with the aim to reduce youth alcohol consumption focused on those under age 16. The impact of cross-sectoral alcohol policy strength on alcohol consumption among adolescents age 16 or older can be examined in forthcoming studies because, from 2011 onward, alcohol policies focused increasingly on older adolescents.

CONCLUSION

Our results suggest that at a regional and municipal level, strong cross-sectoral alcohol policy, defined as a large variety in policy sector involvement and policy strategy use, may contribute to reducing at least some aspects of youth alcohol consumption. However, no effects were found on many aspects of alcohol consumption, and observed effects were small (e.g., 2.4 months additional increase

in age at onset). Some effects may have been missed because only information on intended alcohol policies, and not actually implemented policies, was used. To assess the full impact of cross-sectoral alcohol policies, both their intentions and implementation should be monitored for their impact on youth alcohol consumption.

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TABLES AND FIGURES

TABLE 1. Characteristics of survey population included in analyses aged 12–15

Variable	Total (<i>n</i> = 29,697)	2007 (<i>n</i> = 14,744)	2011 (<i>n</i> = 14,953)
Age, in years, <i>M</i> (<i>SD</i>)	13.5 (1.1)	13.5 (1.1)	13.5 (1.1)
Sex, <i>n</i> (%)			
Boy	14,021 (47.2)	6,952 (47.2)	7,069 (47.3)
Girl	15,676 (52.8)	7,792 (52.8)	7,884 (52.7)
Ethnicity, <i>n</i> (%)			
Dutch	25,976 (87.5)	13,214 (89.6)	12,762 (85.3)
Western foreigner	1,391 (4.7)	570 (3.9)	821 (5.5)
Non-Western foreigner	2,330 (7.8)	960 (6.5)	1,370 (9.2)
Education, <i>n</i> (%)			
Primary	1,496 (5.0)	642 (4.4)	854 (5.7)
First year of secondary	2,645 (8.9)	1,112 (7.5)	1,533 (10.3)
Low: secondary low/secondary vocational/tertiary low vocational	9,925 (33.4)	5,250 (35.6)	4,675 (31.3)
High: secondary high/tertiary high vocational/university	14,632 (49.3)	7,052 (47.8)	7,580 (50.7)
Other	650 (2.2)	484 (3.3)	166 (1.1)
None	349 (1.2)	204 (1.4)	145 (1.0)

FIGURE 1. Box plot of sector variety and strategy variety across 56 municipalities in the Dutch province of Noord-Brabant. HVB = Hart voor Brabant; WB = West-Brabant; BZO = Brabant-Zuidoost.

TABLE 2. Examples of extracted actions, classified into type of policy strategy

Educative or communicative policy strategy
For adolescents
– Theatre
– Lessons
– Books
– Information points
– Websites
– Newspaper articles
– Defensibility trainings
– Awareness actions
For parents
– Information evenings at school
– Information evenings at sports clubs
– Information evenings in bars or clubs
– Information letters or folders
– Websites
– Newspaper articles
– Parenting tips
– Awareness actions
Regulatory or enforcement policy strategy
Regulation
– Instructions and courses for employees or volunteers at alcohol-selling venues
– Alcohol-free zones (streets and events)
– School regulations
– Sports clubs regulations
– Event and hospitality industry regulations (happy hours, closing times, safety)
Enforcement
– Arresting publicly drunk adolescents
– Enforcement of event and hospitality industry regulations (including minimum drinking age)

FIGURE 2. Alcohol consumption among adolescents aged 12–15 in the Dutch province of Noord-Brabant. Δ represents the crude trend in mean age at onset and the crude trend in the prevalence (%) of regular, weekly, heavy weekly, and heavy episodic drinking. HVB = Hart voor Brabant; WB = West-Brabant; BZO = Brabant-Zuidoost. *P value for year of survey < .05. **Bold** indicates statistical significance ($p < .05$) of the interaction term between year of survey and regional alcohol prevention program.

TABLE 3. Association between municipal cross-sectoral alcohol policy strength and alcohol outcomes among adolescents aged 12–15

Sector variety	Weak (n = 8)			Moderate (n = 38)			Strong (n = 10)		
	2007	Δ	Ref.	2007	Δ	β/OR [95% CI]	2007	Δ	β/OR [95% CI]
Age at onset	12.67	0.42	Ref.	12.62	0.53	0.10 [-0.06, 0.27] ^a	12.68	0.63	0.25 [0.04, 0.45]^a
Regular drinking	23.2	-7.7	Ref.	25.0	-10.2	0.92 [0.76, 1.13] ^b	25.8	-8.9	1.02 [0.79, 1.31] ^b
Weekly drinking	25.1	-10.1	Ref.	27.1	-12.4	0.99 [0.81, 1.21] ^b	29.7	-11.5	1.06 [0.82, 1.36] ^b
Heavy weekly drinking	17.4	0.9	Ref.	21.3	2.6	1.00 [0.67, 1.50] ^b	22.8	-2.4	0.77 [0.47, 1.28] ^b
Heavy episodic drinking	11.7	-4.2	Ref.	13.3	-5.3	1.00 [0.78, 1.28] ^b	13.5	-4.9	1.05 [0.77, 1.44] ^b

Strategy variety	Weak (n = 12)			Moderate (n = 31)			Strong (n = 13)		
	2007	Δ	Ref.	2007	Δ	β/OR [95% CI]	2007	Δ	β/OR [95% CI]
Age at onset	12.64	0.51	Ref.	12.63	0.51	0.02 [-0.13, 0.16] ^a	12.66	0.57	0.08 [-0.10, 0.25] ^a
Regular drinking	25.0	-10.2	Ref.	24.5	-9.8	1.13 [0.94, 1.35] ^b	25.7	-8.9	1.12 [0.90, 1.39] ^b
Weekly drinking	28.4	-13.2	Ref.	26.3	-11.6	1.19 [0.99, 1.42] ^b	28.4	-11.9	1.08 [0.88, 1.34] ^b
Heavy weekly drinking	20.3	5.1	Ref.	20.4	2.2	0.89 [0.64, 1.25] ^b	23.5	-3.8	0.63 [0.42, 0.95]^b
Heavy episodic drinking	13.4	-5.7	Ref.	12.8	-4.6	1.21 [0.97, 1.50] ^b	13.6	-5.9	0.96 [0.74, 1.25] ^b

Notes: "2007" represents the mean age at onset and the prevalence (%) of regular, weekly, heavy weekly, and heavy episodic drinking in 2007; Δ represents the crude trend in mean age at onset and the crude trend in the prevalence (%) of regular, weekly, heavy weekly, and heavy episodic drinking. **Bold** indicates statistical significance ($p < .05$). OR = odds ratio; CI = confidence interval; Ref. = reference. ^aβ [95% CI]; ^bOR [95% CI].

TABLE 4. Association between municipal cross-sectoral alcohol policy strength and alcohol outcomes, including the interaction term with sex ($n = 29,697$) and education ($n = 24,557$), among adolescents aged 12–15

Sector variety	Weak ($n = 8$)			Moderate ($n = 38$)			Strong ($n = 10$)		
	2007	Δ		2007	Δ	β /OR [95% CI]	2007	Δ	β /OR [95% CI]
Age at onset									
Sex: Boys	12.55	0.26	Ref.	12.49	0.55	0.20 [-0.04, 0.44] ^a	12.52	0.66	0.36 [0.05, 0.66]^a
Sex: Girls	12.77	0.54	Ref.	12.72	0.51	0.03 [-0.18, 0.24] ^a	12.81	0.61	0.16 [-0.12, 0.44] ^a
Education: High	12.75	0.55	Ref.	12.65	0.53	0.10 [-0.13, 0.32] ^a	12.67	0.72	0.23 [-0.06, 0.52] ^a
Education: Low	12.70	0.35	Ref.	12.72	0.51	0.07 [-0.17, 0.32] ^a	12.87	0.50	0.19 [-0.12, 0.50] ^a
Heavy weekly drinking									
Sex: Boys	17.0	6.2	Ref.	23.4	3.4	0.71 [0.40, 1.27] ^b	22.4	1.8	0.70 [0.34, 1.44] ^b
Sex: Girls	17.7	-3.3	Ref.	19.8	1.9	1.39 [0.79, 2.46] ^b	23.2	-6.1	0.85 [0.42, 1.73] ^b
Education: High	14.2	1.4	Ref.	20.1	4.0	1.07 [0.59, 1.94] ^b	19.3	-2.2	0.69 [0.32, 1.47] ^b
Education: Low	21.7	0.4	Ref.	23.3	0.8	0.91 [0.51, 1.62] ^b	27.7	-4.8	0.75 [0.37, 1.53] ^b
Strategy variety	Weak ($n = 12$)			Moderate ($n = 31$)			Strong ($n = 13$)		
	2007	Δ		2007	Δ	β /OR [95% CI]	2007	Δ	β /OR [95% CI]
Age at onset									
Sex: Boys	12.50	0.60	Ref.	12.47	0.51	-0.04 [-0.26, 0.17] ^a	12.60	0.49	0.06 [-0.20, 0.32] ^a
Sex: Girls	12.75	0.44	Ref.	12.75	0.52	0.07 [-0.12, 0.26] ^a	12.71	0.62	0.09 [-0.14, 0.32] ^a
Education: High	12.63	0.56	Ref.	12.67	0.57	0.04 [-0.17, 0.24] ^a	12.69	0.52	-0.00 [-0.25, 0.25] ^a
Education: Low	12.74	0.47	Ref.	12.72	0.46	0.01 [-0.21, 0.22] ^a	12.81	0.54	0.09 [-0.17, 0.34] ^a
Heavy weekly drinking									
Sex: Boys	22.7	8.4	Ref.	21.5	4.1	0.91 [0.56, 1.46] ^b	24.4	-2.7	0.67 [0.37, 1.20] ^b
Sex: Girls	18.3	2.6	Ref.	19.6	0.7	0.89 [0.56, 1.42] ^b	22.9	-4.6	0.62 [0.36, 1.08] ^b
Education: High	18.4	8.1	Ref.	18.6	3.6	0.80 [0.49, 1.30] ^b	21.8	-5.8	0.46 [0.25, 0.84]^b
Education: Low	22.6	3.2	Ref.	23.3	-0.4	0.87 [0.53, 1.40] ^b	26.7	-3.1	0.73 [0.41, 1.28] ^b

Notes: "2007" represents the mean age at onset and the prevalence (%) of heavy weekly drinking in 2007. Δ represents the crude trend in mean age at onset and the crude trend in the prevalence (%) of heavy weekly drinking. None of the three-way interaction terms (year of survey, cross-sectoral alcohol policy measure, and sex/education) was significant. **Bold** indicates statistical significance ($p < .05$). OR = odds ratio; CI = confidence interval; Ref. = reference. ^a β [95% CI]; ^bOR [95% CI].