

# Relative risks of adolescent and young adult alcohol use: The role of drinking fathers, mothers, siblings, and friends

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## Abstract

The present study examined to what extent regular drinking of fathers, mothers, co-twins, siblings, and friends was related to adolescent regular drinking in three age groups: 12–15, 16–20 and 21–15-year olds. The sample consisted of 3760 twins (1687 boys, 2073 girls) with a mean age of 17.8 years. Data were based on twins' self-reported alcohol uses and reports about siblings' and friends' alcohol use, and on parents' self-reports. Results showed that generally in each of the three age groups, regular drinking of same-sex co-twins and friends posed the highest risk for regular drinking. Age differences indicated that these risks decreased with age. Irrespective of age, regular drinking of fathers and mothers posed the lowest risk. Findings were generally the same for males and females.

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## 1. Introduction

Alcohol misuse among adolescents is a substantial problem throughout the Western world. Recent figures indicate that experimentation with alcohol is rather normative in adolescence and that many of the adolescents develop a regular drinking pattern (Hibell et al., 2004; Poelen, Scholte, Engels, Boomsma, & Willemsen, 2005; Trimpos, 2004). For example, 85% of the secondary school pupils have experimented with alcohol and 58% had used alcohol in the previous month in 2003 in The Netherlands (Trimpos, 2004). Since adolescent alcohol use has been related to a wide range of problems such as school problems and aggression

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(Gruber, DiClemente, Anderson, & Lodico, 1996; Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994), alcohol related injury and deaths (Hingson, Heeren, Zakocs, Winter, & Wechsler, 2003), suicidal ideation (Light, Grube, Madden, & Gover, 2003) and even impaired brain development (Tapert, Caldwell, & Burke, 2004), ample research has been devoted to exploring the correlates of adolescent alcohol use. One substantial factor that has been identified is the drinking behavior of persons in the adolescents' direct social environment, most notably the peer group and the family. Various studies have examined the effects of parents' and friends' drinking, but have not yet provided a conclusive overview of the relative impact of the alcohol use of each of these persons. The aim of the present study was, therefore, to examine the relative risk of adolescent alcohol use by comparing the associations of adolescent alcohol use with fathers', mothers', siblings', and friends' use within a single sample.

### *1.1. Direct associations of parental, friends', and sibling alcohol use with adolescent alcohol use*

The direct link between parental drinking and adolescent drinking seems far from clear. A number of studies revealed that parental alcohol use is related to adolescent use (e.g., Ary, Tildesley, Hops, & Andrews, 1993; Ellickson & Hays, 1991; Hawkins et al., 1997; Van der Vorst, Engels, Meeus, Dekovic, & van Leeuwe, 2005; Webb & Baer, 1995; Webb, Baer, McLaughlin, McKelvey, & Caid, 1991), and that adolescents who had heavy drinking parents were more likely to drink heavy as well (Cohen & Rice, 1997). In contrast, however, other studies found no direct links between parental drinking and adolescent drinking (Boyle, Sanford, Szatmari, Merikangas, & Offord, 2001; Ouellette, Gerrard, Gibbons, & Reis-Berhab, 1999; Petersen, Hawkins, Abbott, & Catalano, 1994; Power, Stewart, Hughes, & Arbona, 2005; Reifman, Barnes, Dintcheff, Farrell, & Uhteg, 1998).

A vast body of research has documented that a strong association exists between friends' and adolescents' alcohol use (Andrews, Tildesley, Hops, & Li, 2002; Petraitis, Flay, & Miller, 1995; Sieving, Perry, & Williams, 2000; Thombs, Wolcott, & Farkash, 1997). For example, friends' drinking predicted adolescents' alcohol use initiation and cessation over a one-year period (Maxwell, 2002). Bot, Engels, Knibbe, and Meeus (2005) reported that when an adolescent's best friend was drinking intensively, it was likely that the adolescent also drank intensively one year later, irrespective of whether the friendship was stable across this one-year period. Likewise, perceptions of the number of drinking friends have found to be predictive of adolescents' later alcohol consumption (Ouellette et al., 1999; Simons-Morton & Chen, 2006). Thus, it appears that friends' alcohol use constitutes a significant risk factor for adolescent drinking, although recent studies suggest that it is peer selection rather than peer influence that contributes to similarity in health risk behaviors (Jaccard, Blanton, & Dodge, 2005).

Siblings' alcohol use may constitute another potential risk factor for adolescents' alcohol use. However, the role of siblings in relation to adolescent drinking has been explored only in a few studies. These studies report direct associations between siblings' and adolescents' substance use in general (Brook, Whiteman, Gordon, & Brook, 2003; Needle et al., 1986) and alcohol use in specific (D'Amico & Fromme, 1997; Bahr, Hoffmann, & Yang, 2005; Boyle et al., 2001). All in all, previous research suggests that parents', siblings', and friends' alcohol use may be significantly related to adolescent drinking.

### *1.2. Relative impact of parental, friends', and sibling alcohol use on adolescent alcohol use*

Most of the studies in this area have focused either on parents, siblings, or best friends, but only few have simultaneously examined the relative impact of drinking of each of these persons for adolescent

drinking in one study. Comparison of parents' and peers' drinking has generally lead to the conclusion that the alcohol use of peers seems to be more important for adolescent alcohol use than parents' alcohol use. Jackson (1997) revealed that although parental alcohol use was significantly related to alcohol initiation and experimentation among adolescents, the association was much weaker than that of friends' use and number of using friends. Other studies provided further evidence for the dominance of peers' drinking over parents' drinking in that adolescent alcohol use was significantly higher related to friends' use than to parental use (Björkqvist, Båtman, & Åman-Back, 2004; Reifman et al., 1998).

One potential limitation of some studies on parental alcohol use is that they have combined fathers' and mothers' alcohol use in one overall measure of parental alcohol use. Although the use of this measure can be informative, it may only tell part of the story since fathers and mothers may each exert a unique influence on their offspring' drinking. A small number of studies reported sex differences in the effects of parental drinking, but the findings were mixed with respect to the dominance of the effects of one parent over the other. Zhang, Welte, and Wieczorek (1999) reported that fathers' but not mothers' drinking was directly related to adolescent drinking. Seljamo et al. (2006) found that both mothers' and fathers' self-reported alcohol use was related to adolescents' problematic alcohol use, but that the fathers' alcohol use was the most potent predictor. In contrast, in the studies by Rittenhous and Miller (1984) and Marsden et al. (2005), mothers' but not fathers' drinking was positively related to adolescent drinking. Furthermore, Hundleby and Mercer (1987), Reifman et al. (1998), and Björkqvist et al. (2004) did not find any differences between the direct associations of fathers' and mothers' drinking, and adolescent alcohol use.

The relative importance of siblings' drinking compared to friends' or parents' drinking has received very little scientific attention until now. The few studies that exist on alcohol use point out that sibling effects may be similar to peer effects, and stronger than parental effects. Windle (2000) reported that when parental, sibling, and peer alcohol use were considered simultaneously in one model, the effects of the parents were weakest. Similar findings were reported by Ary et al. (1993). Moreover, in a study on parents and siblings, Boyle et al. (2001) reported small and non-significant associations between adolescents' and parental alcohol use, while the associations with sibling alcohol use were strong.

### 1.3. Sex and age differences

Studies that explored the associations between parental, friends' and sibling use, and adolescent alcohol use have occasionally documented on the lack of sex differences in these associations. Björkqvist et al. (2004) and Andrews et al. (2002) reported that friends' use was related to adolescents' or young adults' alcohol use, and that this association did not differ for males and females. In addition, the studies by Björkqvist et al. (2004) as well as Seljamo et al. (2006) revealed that the associations with parental alcohol use were similar for boys and girls. Thus, it seems that female and male drinking is equally related to the drinking behavior of parents, friends, and siblings.

Whereas much research has focused on early, middle, or late adolescence, relatively little is known to what extent alcohol use of fathers, mothers, siblings, and friends is related to alcohol use in young adulthood. Findings from studies on adolescents can provide some insights, but may not be entirely generalized to young adults. While parents are still influential in the lives of adolescents, in young adulthood the influence of parents often declines, while the influence of friends remains (see Bot, Engels, Knibbe, & Meeus, resubmitted). Only a very small number of studies exist that have investigated the roles of parents, siblings, or friends in relation to young adults' drinking. They reported that friends' drinking was still associated with young adults' drinking in young adulthood (Andrews et al., 2002; Labouvie,

1996; Thombs et al., 1997), while parents' drinking was not (Thombs et al., 1997). These findings reflect that friends' drinking remains important in relation to adolescents' drinking from adolescence into young adulthood, while at the same time the impact of parents' alcohol use seems to decrease in importance.

#### *1.4. The present study*

The present study is one of the first to explore the relative risks of adolescent and young adult alcohol use, directly comparing the associations between adolescent alcohol use and fathers', mothers', siblings' and friends' alcohol use. We used a genetic informative sample of monozygotic (MZ) and dizygotic (DZ) twins, allowing to substantiate possible genetic influences on relative risk for adolescent alcohol use. Based on previous research we expected to find that both fathers' and mothers' drinking would show weaker associations with adolescent drinking than siblings' and friends' drinking would. Given the mixed findings in previous studies, however, we did not anticipate a consistent pattern of sex differences in the associations of fathers' versus mothers' drinking.

Friends' and siblings' drinking were expected to show similar associations with adolescent alcohol use. In addition, we expected that the difference in risk posed by MZ and DZ same-sex twins would increase with increasing age. This hypothesis was based on behavior genetic research showing that genetic factors explain a large amount of variance in regular drinking, especially in older adolescents and young adults (Heath, Meyer, Jardine, & Martin, 1991; Hopfer, Crowley, & Hewitt, 2003; Maes et al., 1999; Viken, Kaprio, Koskenvuo, & Rose, 1999).

Since evidence indicates no sex difference in the associations between adolescents' and parents', friends, and siblings' use (e.g., Andrews et al., 2002; Björkqvist et al., 2004; Seljamo et al., 2006) we did not expect different findings for male and female adolescents. We did expect age differences in the associations, though. Based on previous research (Andrews et al., 2002; Labouvie, 1996; Thombs et al., 1997) we expected that with increasing age, the associations of adolescents' alcohol use with fathers' and mothers' use would weaken, but that the associations with friends' use would remain strong.

## **2. Methods**

### *2.1. Participants and measures*

The present study is based on a large scale twin-family study of The Netherlands Twin Register. This register was started in 1991 by recruiting adolescent twins aged 13–22 year and their families. The addresses of these families were derived from city councils in The Netherlands. In later years, additional volunteer twin families also participated. In the longitudinal study, with two- to three-year intervals, twins and their parents filled out mailed questionnaires about health, lifestyle and personality. Some individuals participated once, while others participated several times. Data reported in the present study are based on the 1993 data collection. Detailed information about the sample and data collection procedures of The Netherlands Twin Register is provided by Boomsma et al. (2002).

For the present study we selected the following item from the questionnaires: "How often do you drink alcohol?" Twins and their parents could respond to this question on one of eight categories: (1) "I do not drink alcohol", (2) "once a year or less", (3) "a few times a year", (4) "about once a month", (5) "a few times a month", (6) "once a week", (7) "a few times a week", and (8) "daily". An extensive description of the distribution of scores on this scale can be found in Poelen et al. (2005). In this study we aim at

describing the relative risk for adolescent and young adult regular drinking when having regular drinking family members and friends. Regular drinking for twins was defined as drinking a few times a month and more and for parents as drinking a few times a week and more. Self-reports were used to assess twins' alcohol use. If self-reported data were missing we used data co-twins provided on their twin siblings ( $n=31$ ). The participating twins were between the ages of 12 and 25 years with a mean age of 17.8 years ( $SD=3.1$ ). The sample consisted of 628 males from MZ twin pairs, 546 males from same-sex DZ twin pairs, 513 males from opposite sex DZ twin pairs, 920 females from MZ twin pairs, 641 females from same-sex DZ twin pairs and 512 females from opposite sex twin pairs. Twins from one-parent families ( $n=117$  twins) were excluded from the analyses resulting in a total sample of 3760 twins.

For 3457 fathers and for 3738 mothers self-reported data on alcohol use were available. The vast majority of the fathers and mothers were the biological parents of the adolescents and young adults. In case data on alcohol use of father or mother were missing, data on alcohol use reported two years later were used ( $n=76$  for fathers and  $n=59$  for mothers), because there was a high stability of alcohol use over time (for fathers  $r=.75$ ,  $p<.001$  and for mothers  $r=.78$ ,  $p<.001$ ). If these data were also not available, we used twin reports on their parents' alcohol use ( $n=219$  for fathers and  $n=67$  for mothers). Pearson correlation analyses showed a satisfactory resemblance between twin reports and parents' reports of parental alcohol use ( $r=.71$ ,  $p<.001$  for fathers' drinking, and  $r=.77$ ,  $p<.001$  for mothers' drinking).

Twins also provided information on their additional siblings other than their co-twin and we decided to take only the data of full siblings of twins into account. In total 1501 twins had at least one brother in addition to their co-twin and 1391 twins had at least one sister in addition to their co-twin. Twins indicated how often their brother(s) and sister(s) other than their co-twins drank alcohol, responses ranged from (1) "never" to (5) "daily". As in twins regular drinking of siblings was defined as drinking a few times a month and more. If at least one additional sibling drank a few times a month, this variable was categorized as regular drinking. The mean age of the siblings was 15.4 years for brothers of 12–15-year old twins, 15.8 for sisters of 12–15-year old twins, 19.6 years for brothers of 16–20-year old twins, 19.7 for sisters of 16–20-year old twins, 24.3 years for brothers of 20–25-year old twins, and 24.1 for sisters of 20–25-year old twins. These figures indicate that most of the siblings in the analyses were older than the adolescents and young adults that were the targets of this study.

Twins were also asked how many of their friends drank alcohol regularly, with response categories being (1) "no-one", (2) "a few friends", (3) "half of the friends", (4) "most friends" and (5) "all friends". To dichotomize this item categories 1 and 2, and categories 3, 4 and 5 were combined together. For 3684 twins data on their friends' regular drinking were available.

The participants were grouped into three age groups that were meaningful. The youngest group consisted of 12- to 15-year-olds and included all adolescents that were under the legal age to buy and drink alcohol. The second group contained middle and late adolescents aged 16 to 20. This age period is the period in which the adolescents are allowed to buy alcoholic beverages, and is also the period during which regular drinking patterns emerge. The oldest age group consisted of 21- to 25 year old young adults and reflected the period in which individuals become more autonomous young adults who often leave home and are less guided by parental supervision and monitoring.

In the vast majority of the families, both twins and parents were born in The Netherlands. The other families came from all over the world, such as Surinam, The Netherlands Antilles, Morocco and Turkey, Asia, Europe and North America. Educational levels of fathers in our sample show that 18.3% completed primary education, 33.8% completed lower general education or vocational education, 23.4% followed

intermediate vocational education or intermediate and higher general education and 24.4% finished higher vocational education or university.

## 2.2. Data analysis

We calculated prevalence rates and relative risks of regular drinking using SPSS 12.0.1 for Windows. The relative risk was calculated as the ratio of the percentage of regular drinkers with regular drinking family members and friends to the percentage of regular drinkers with non-regular drinking family members and friends. A relative risk is significant if the 95% confidence interval does not contain the value 1 and two relative risk are significantly different if there is no overlap in the two confidence intervals.

## 3. Results

### 3.1. Prevalence of regular drinking

Prevalence rates of regular drinking showed an increase with age, in particular from 12–15-year olds to 16–20-year olds (Table 1). This increase was significant for twins, their additional brother(s), sister(s) and friends (chi-squares ranged from  $\chi^2(2, n=1401)=71.54, p<.001$  for sister(s) to  $\chi^2(2, n=3684)=883.16, p<.001$  for friends). Moreover, results showed that parents of 21–25-year olds were less often regular drinkers than parents of 12–15-year old and 16–20-year old twins, but, given small chi-square values, this difference was marginal ( $\chi^2(2, n=3748)=23.01, p<.001$  for fathers and  $\chi^2(2, n=3746)=23.74, p<.001$  for mothers). Moreover, males were more often regular drinkers than females ( $\chi^2(1, n=1212)=7.94, p<.01$  for 12–15-year old twins,  $\chi^2(1, n=1852)=66.80, p<.001$  for 16–20-year old twins and  $\chi^2(1, n=696)=53.19, p<.001$  for 21–25-year old twins).

### 3.2. Relative risks

Relative risks in general show that the risk to be a regular drinker was higher if participants had regular drinking family members and friends than if participants had family members and friends who were non-

Table 1  
Prevalence of regular drinking for twins, siblings, friends, fathers and mothers (%)

	<u>12–15 years</u>	<i>n</i>	<u>16–20 years</u>	<i>n</i>	<u>21–25 years</u>	<i>n</i>
	Regular drinkers		Regular drinkers		Regular drinkers	
Male twins	16.2	549	70.9	842	80.4	296
Female twins	10.7	663	52.3	1010	53.8	400
Brother(s)	41.3	487	64.5	719	82.6	304
Sister(s)	30.4	438	52.5	684	58.4	279
Friends	11.5	1170	62.1	1829	67.9	685
Fathers	71.5	1212	72.4	1844	62.9	692
Mothers	49.5	1210	46.7	1843	38.1	693

Note. Regular drinking of twins and siblings was defined as drinking a few times a month and more. Regular drinking of friends of twins was defined as half of the friends or more drink alcohol regularly, regular drinking of parents as drinking a few times a week and more.

regular drinkers (Table 2). For example, 12–15-year old males with a regular drinking MZ twin brother were about 25 times more likely to be regular drinkers than 12–15-year old males with a non-regular drinking MZ twin brother and 12–15-year old males with a regular drinking mother were about 2.5 times more likely to be regular drinkers than 12–15-year old males with a non-regular drinking mother. All risk ratios were significant except the risk ratios calculated for fathers' and mothers' drinking among 12–15-year old females and fathers' drinking among 21–25-year old males, DZ twin sister's drinking and drinking of additional brother(s) among 21–25-year old males, and DZ twin brother's drinking among 21–25-year old females.

Table 2 shows that relative risks for regular drinking when having regular drinking versus non-regular drinking fathers and mothers were of comparable strength, although these risk ratios were relatively low for both fathers and mothers. In contrast, results showed that relative risks for regular drinking accounting for drinking of friends were relatively high, except among 21–25-year olds. The risk to be a regular drinker was calculated separately for regular drinking of the MZ co-twin (always same-sex), DZ same-sex co-twin and DZ opposite sex co-twin, and brother(s) and sister(s) other than the co-twin. Table 2 shows that the highest relative risks for regular drinking were found for regular, compared to non-regular drinking of the MZ co-twin followed by the risk ratio accounting for drinking of the DZ same-sex co-twin. Relative risks for regular drinking when having a regular compared to a non-regular drinking DZ opposite sex co-twin, were of similar strength as those of brother(s) and sister(s) other than the co-twin, and were non-significant in the oldest group.

### 3.3. Sex and age differences

In general the same pattern of relative risks emerged for males and females. However, among 12–15-year old adolescents' risk ratios accounting for regular drinking of siblings and friends were marginally higher

Table 2

Relative risks for adolescent and young adult alcohol use when having regular drinking of family members and friends compared to non-regular drinking family members and friends

		12–15			16–20			21–25		
		RR	95% CI	<i>n</i>	RR	95% CI	<i>n</i>	RR	95% CI	<i>n</i>
Males	Father	1.76	1.06–2.93	549	1.23	1.11–1.37	839	1.13	1.00–1.28	296
	Mother	2.30	1.51–3.49	548	1.15	1.06–1.25	838	1.13	1.01–1.25	295
	Friends	4.79	3.41–6.75	530	2.19	1.88–2.55	828	1.76	1.36–2.27	290
	MZ twin brother	25.12	11.26–56.02	217	3.67	2.54–5.29	302	1.58	1.11–2.26	107
	DZ twin brother	10.00	4.97–20.11	161	2.29	1.72–3.04	285	1.79	1.08–2.92	97
	DZ twin sister	4.61	2.59–8.23	166	1.47	1.24–1.74	254	1.06	0.87–1.29	89
	Brother(s)	2.70	1.47–4.96	239	1.29	1.11–1.50	317	0.93	0.77–1.12	111
	Sister(s)	4.53	2.45–8.36	186	1.38	1.19–1.60	290	1.41	1.14–1.73	120
Females	Father	1.67	0.96–2.93	663	1.43	1.21–1.69	1005	1.44	1.16–1.79	396
	Mother	1.42	0.91–2.21	662	1.40	1.24–1.58	1005	1.25	1.05–1.50	398
	Friends	7.55	5.11–11.16	640	2.50	2.13–2.93	1001	1.86	1.49–2.34	395
	MZ twin sister	25.45	12.36–52.39	313	3.50	2.71–4.53	440	4.23	2.69–6.65	166
	DZ twin sister	10.67	5.28–21.55	182	2.53	1.94–3.30	317	1.94	1.36–2.78	139
	DZ twin brother	5.71	2.46–13.24	167	2.21	1.49–3.25	251	1.34	0.80–2.25	93
	Brother(s)	3.43	1.23–9.55	248	1.22	1.00–1.49	402	1.74	1.08–2.79	193
	Sister(s)	3.69	1.82–7.49	254	1.79	1.45–2.20	394	1.82	1.27–2.62	159

Table 3

Odds ratios (OR) for adolescent and young adult alcohol use in relation to number of regular drinkers they were exposed to

	OR	95% CI	<i>n</i>
Not exposed to regular drinkers	–	–	317
Exposed to 1 regular drinker	3.53	2.02–6.19	670
Exposed to 2 regular drinkers	9.65	5.64–16.48	954
Exposed to 3 regular drinkers	30.57	17.87–52.28	831
Exposed to 4 regular drinkers	78.43	45.15–136.23	656
Exposed to 5 regular drinkers	129.06	69.52–239.58	289
Exposed to 6 regular drinkers	412.73	91.08–1870.276	43

Note. All odds ratios were significant at  $p < .001$ .

among females compared to risk ratios among males, although these differences were not significant. Risk ratios accounting for regular drinking of fathers and mothers were marginally higher among males than among females (for females these ratios were not significant) in this age group. Additionally, regular drinking of 21–25-year old females was to a greater extent associated with regular drinking of their same-sex twin sibling than regular drinking of males in this age group. Also, among 21–25-year old males drinking of friends was relatively more important than it was among females in this age group. The relative risk accounting for drinking of the MZ co-twin decreased with age for both males and females, only in 21–25-year old females the relative risk remained relatively high and was higher than in 16–20-year old females. Further decreases in relative risk ratios were most prominent in males from 12–15-year to 16–20-year olds.

### 3.4. Additional analyses

Our focus was on the relative risks posed by each of the parents, siblings and friends separately. To nevertheless examine whether a particular relationship or the overall exposure of multiple influences was associated with to adolescent and young adult regular drinking we computed an index that assessed the number of regular drinkers the participants were exposed to. This index ranged from (0) indicating the participants were exposed to 0 regular drinkers (neither parents, friends nor siblings were regular drinkers) to (6) indicating that the participants' fathers, mothers, friends, co-twins and additional brothers and sisters were all regular drinkers. We used this index to compute the odds ratios for regular drinking in relation the number of regular drinkers the participants were exposed to. Table 3 shows that participants were of higher risk for regular drinking if they were exposed to more regular drinkers. Results did not show significant interaction effects with sex and age (odds ratios ranging from .01 ( $p = .999$ ) to .35 ( $p = .302$ ), indicating that this relation was similar among both males and females and among 12–15-year olds, 16–20-year olds and 21–25 year olds.

## 4. Discussion

The present study examined the relative risks to drink regularly in adolescence and young adulthood when having regular drinking parents, siblings, and friends. We found that generally the risk to be a regular drinker when parents, siblings, and friends were regular drinkers was significant in adolescence as well as young adulthood. Nevertheless, the relative risks to drink regularly turned out to be age dependent as it showed that the risk of drinking siblings and friends declined with age. Our study also shows that



despite the decline, in late adolescence the risk posed by drinking friends is still significantly larger than the risk of drinking parents. In young adulthood, this is still the case for males.

In contrast to the majority of studies on the association between parental alcohol use and adolescent alcohol use, we examined fathers' and mothers' alcohol use separately. Our study corroborated previous studies that reported that fathers' and mothers' drinking was equally related to adolescent alcohol use (Björkqvist et al., 2004; Hundleby & Mercer, 1987; Reifman et al., 1998). They contradict those who suggested that fathers were more important (Seljamo et al., 2006; Zhang et al., 1999) or that mothers were more important (Marsden et al., 2005; Rittenhous & Miller, 1984). An explanation for the fact that we, in contrast to other studies, did not find differences in risk posed by father and mother drinking, may be that our study examined adolescent and young adult regular drinking whereas other studies examined other stages of alcohol use. For example, Marsden et al. (2005) reported on drinking intensity, Zhang et al. (1999) on average alcohol consumption, and Seljamo et al. (2006) on frequency of intoxication. It may be the case that fathers and mothers have the same impact on how often their children drink, but not on how much they drink per se.

We found that friend's regular drinking posed a considerable risk for adolescents' and young adults' regular drinking. This risk was highest in the younger group but was still substantial in the late adolescent and young adult groups. For example, 12- to 15-year-old males and females had a relative risk of 4.79 and 7.55, respectively, to drink regularly when having regular drinking friends, whereas this was 1.76 and 1.86 for young adult males and females. Finding that friends' drinking still poses a risk for drinking in young adulthood is in line with results from other studies (Andrews et al., 2002; Labouvie, 1996; Thombs et al., 1997). Our findings make clear that friends continue to play a significant role with respect to regular drinking during the transition from adolescence into young adulthood.

Our study also provides information about the role of sibling drinking in adolescence and young adulthood that has not been reported in previous research. We used a genetic informative design, allowing to explore whether adolescents were at higher risk to drink regularly when they had a regular drinking MZ twin compared to DZ twin. Such findings may give some indication about the genetic influences on regular drinking. Genetic influences can be identified by comparing the degree of similarity in drinking behavior of MZ and DZ (same-sex) twin pairs. Genetic effects would be indicated by significant differences between the risk of having drinking MZ twins and having drinking DZ twins. As was shown, the relative risk to drink regularly when having an MZ twin was not significantly higher than having a same-sex DZ twin who drinks regularly. This was true for the younger age group, as was expected, but also for the older age groups. The findings on the younger adolescents support the idea that alcohol use in this age period may be to a large extent affected by environmental factors (McGue, Sharma, & Benson, 1996a; McGue, Sharma, & Benson, 1996b). Our results on the older groups suggest that environmental factors may be substantially related to regular drinking in this age period too, as has also been reported in previous studies. For example, Pagan et al. (2006) found that environmental factors accounted for up to 80% of the variance in regular drinking in 25-year old females. Our study suggests that environmental factors, most notably siblings and friends, contribute to regular drinking but does not provide evidence for genetic effects on regular drinking in adolescence or young adulthood, as has been reported in previous research (Heath et al., 1991; Hopfer et al., 2003; Maes et al., 1999; Viken et al., 1999). However, it should be kept in mind that our type of analyses does not qualify for decomposing genetic and shared and unique environmental influences, and that behavior genetic analyses are necessary to elucidate whether regular drinking in during this age period is genetically influenced.

According to social learning theory (Bandura, 1977) modeling of behavior is likely to occur when an individual is similar to the model, for example, in age or sex. Consequently, it could have been expected that same-sex siblings would have been more powerful models than opposite-sex siblings and that regular

drinking of same-sex siblings would be a greater risk than regular drinking of opposite-sex siblings. Previous studies have documented that alcohol use of siblings is related to adolescent alcohol use but have usually not differentiated between same- and opposite-sex siblings (Bahr et al., 2005; D'Amico & Fromme, 1997; Needle et al., 1986). Our study showed that having a regular drinking opposite-sex sibling was a considerable risk, comparable to the risk of having a same-sex sibling who drinks regularly. This finding is in line with Boyle et al. (2001) and suggests that irrespective of the sex of the sibling, the sibling context constitutes a major source of influence on adolescent and young adult drinking. In addition to genetic factors which may affect sibling similarity, siblings may influence adolescents and young adults in much the same way as a regular drinking friend does, through modeling, encouragement, and social facilitation (Rowe & Gulley, 1992).

With respect to age differences in the risks posed by drinking family members and friends, our findings were in accord with our expectations. As other studies also revealed, the alcohol use of friends remained a considerable correlate of drinking when adolescents entered young adulthood, being more important than alcohol use of parents (Andrews et al., 2002; Labouvie, 1996; Thombs et al., 1997). Nevertheless, the overall pattern of age differences indicated that the risk posed by having drinking fathers, mothers, siblings, as well as friends decreased with age. The largest decrease was witnessed for MZ and same-sex DZ twins, who constituted large risk factors in 12- to 15-year olds, but seemed to be less strongly related to regular use in the older age groups, except for the 21–25 year old females. An explanation why the decrease in the risk posed by drinking of twins was substantial may be that in late adolescence and young adulthood in The Netherlands, adolescents often leave home and start a life on their own. As a result, the interactions with siblings (including twins) are likely to become less frequent and consequently the influence of siblings will decline.

As expected, there were few sex differences in the relative risk for regular drinking. In general, the drinking of fathers, mothers, friends and siblings seems to have the same role for males and females, as was also shown in other studies (Andrews et al., 2002; Björkqvist et al., 2004; Seljamo et al., 2006). Not finding sex differences in the associations of paternal and maternal drinking with males' and females' drinking questions the assumption that alcohol use of the same-sex parent is more influential (Harburg, Davis, & Caplan, 1982; Newcomb, Huba, & Bentler, 1983). The only sex difference that emerged from our study was the risk posed by regularly drinking MZ twins in young adulthood. In case of having such a co-twin, females were more likely to drink regularly than males were. It may be that female MZ twins more frequently interact with each other than male MZ twins when they are older or have left home, resulting in more similarity in drinking behavior. An alternative hypothesis would be that the social environment differs for males and females and that genes are expressed to a greater extent in females.

While interpreting our findings, a number of caveats should be kept in mind. Our study was cross-sectional, and does not allow for drawing any causal conclusions. The goal of the study was to examine what the relative risks were for regular drinking among adolescents and young adults when having regular drinking family members and friends. We can only know what the risk to drink regularly, for example, among 12- to 15-year olds is when having drinking fathers or mothers. We can not infer from our data, however, that drinking of fathers and mothers actually exerts an influence on changes in adolescent or young adult drinking over time.

In the analyses we looked at regular drinking of family members and friends as risk factors, but did not examine additional predictors or potential confounders such as socioeconomic status or alcohol specific parenting. For example, recent studies (Van der Vorst, Engels, Dekovic, & Meeus, 2006) showed that alcohol specific rule enforcement and norms were related to adolescent alcohol use. Adding these factors to the analyses might have significantly changed the risk factors.

We have used self-reports to assess parental and MZ and DZ twin alcohol use. Self-reports are considered a satisfactory method to assess alcohol use if confidentiality is assured and questionnaires are filled in alone (Morgan, 1997). Data on the alcohol use of the friends were based on adolescent reports, which might raise concerns about the validity of this measure. The validity of using adolescents' perceptions of alcohol use by their friends is open to debate. Whereas some scholars argue that adolescents may quite accurately estimate the alcohol use of close friends (Engels & Bot, 2006), others have pointed to the existence of the false consensus effect (Sherman, Presson, Chassin, Corty, & Olshavsky, 1983; Wolfson, 2000). According to this notion, adolescents may over- or underestimate their peers' alcohol use as a function of their own alcohol use. Thus, it may be that the relative risk for friends' drinking is slightly overestimated.

The data we used came from a data collection from 1993. The reason for using this data collection instead of more recent ones was that in this data collection, in contrast to other data collections, we obtained adolescent and parent self-reports on alcohol use. Furthermore, only in the 1993 data collection the younger age group (i.e., 12–15-year olds) was present, and the sample size was largest. Using this data collection may nevertheless raise the question about the relevance of the data and findings. Although recent studies have revealed some age trends in alcohol consumption in this data set (Poelen et al., 2005), there is no theoretical nor empirical indication that the associations between alcohol use of family members and friends, and that of adolescents, have changed.

Different stages of adolescent drinking may be differently affected by alcohol use of parents, siblings and friends. Previous research, for example, suggests that parental drinking may impact initiation more than transition to regular drinking or problem drinking (e.g., Colder & Chassin, 1999; Power et al., 2005; Simons, Conger, & Whitbeck, 1988). Our findings pertain to regular drinking in adolescence and young adulthood, but may not translate to other stages of drinking.

We examined the relative risk posed by additional brothers and sisters, but we did not differentiate between older and younger siblings in these analyses. The reason was that the sample sizes, and thus statistical power, would have become too small. It is generally believed that the direction of effects is primarily from the older to the younger sibling (Boyle et al., 2001; Van der Vorst, Engels, Dekovic, & Meeus, 2006). Thus, the relative risk of having older siblings who drink is likely to be higher than the relative risk of having younger siblings who drink. By combining older and younger siblings in our study we could not distinguish between these two risks, and the relative risk of additional sibling drinking we described is therefore approximate.

Finally, the findings from this study pertain to the Dutch situation. In The Netherlands, the legal age to purchase and drink alcoholic beverages is 16, and governmental campaigns are implemented to persuade parents to discourage their offspring to drink. Nevertheless, recent figures show that the majority of adolescents under age 16 have used alcohol (Engels, Scholte, van Lieshout, de Kemp, & Overbeek, 2006; Trimbos, 2004) and that in 90% of the cases, 12- to 16-year olds will succeed in buying alcohol from supermarkets, bars or liquor stores (Bieleman, Biesma, Kruize, & Snippe, 2004). Because of the specific Dutch situation, findings may not be readily generalized to other countries. It is recommended that replication studies are conducted in countries in which the legal ages to buy and drink alcohol are different from those in The Netherlands. It might, for example, be expected that because of the changes in parental and friend influence from early adolescence to young adulthood, relative risks may be quite different in countries where individuals are not allowed to drink until the age of 21. Furthermore, future studies should look at the differences in effects of older or younger siblings in order to be more accurate in establishing the risks posed by drinking siblings.

All in all, during adolescence and young adulthood, having regular drinking parents, twins, siblings and friends was a risk factor for adolescent regular drinking. Same-sex sibling and friend drinking was more important than father and mother drinking, which did not seem to change in importance over time. Although the risk posed by drinking twins and friends decreased with age, it was still associated with regular drinking in late adolescence and young adulthood. Generally, the results were similar for males and females. These findings suggest that social influences on regular drinking change with age and are sex independent. They also imply that prevention programs might broaden their focus in terms risk factors. That is, when prevention programs focus on peer influences in early adolescence, they usually consider the friend context. Our study makes clear that especially among the younger adolescents, sibling alcohol use poses a significant risk as well and parents might be made aware of this.

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