THE ROLE OF PARENTS IN PREVENTING ADOLESCENT ALCOHOL AND CANNABIS USE

Evelien Vermeulen-Smit

THE ROLE OF PARENTS IN PREVENTING ADOLESCENT ALCOHOL AND CANNABIS USE

De rol van ouders in het voorkomen van
alcohol en cannabis gebruik door adolescenten

(Met een samenvatting in het Nederlands)

PROEFSCHRIFT

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door

EVELIEN VERMEULEN-SMIT

geboren op 15 januari 1980
te Soest

To my God
Thanks for a world that can be studied, it is inspiring!
Give me the courage to examine it with the intention to find truth

To my children
You taught me that consistent rules are necessary, difficult and loving
I love you

Content

1 | GENERAL INTRODUCTION

In 2004, the Dutch National School Survey on Substance Use (DNSSU) reported a strong increase in alcohol use from 66% to 84% between 1992 and 2003 among 12-16 year olds (Monshouwer et al., 2004). At the same time, the ESPAD study (European School Survey Project on Alcohol and Other Drugs), comparing adolescent substance use internationally, found Dutch adolescents to be the heaviest drinkers in Europe (Hibell et al., 2004). During these years, there was a growing awareness of the hazardous effects of early drinking (Tapert et al., 2004; Verdurmen et al., 2006). Meanwhile, longitudinal studies showed the important role of parents in adolescent drinking. In particular, setting strict rules on alcohol use was found to delay adolescent drinking (Van der Vorst, 2007). In 2006, these developments provoked the start of a national prevention and accompanying research program in the Netherlands called "Alcohol and Parenting". This program aimed to delay adolescent drinking at least until the age of 16 (the legal age for selling alcoholic beverages in the Netherlands at the time) through improving alcohol-specific parenting, e.g. by raising parents awareness of the harmfulness of adolescent drinking, and the need to set rules on drinking. This thesis is primarily based on the research part of the "Alcohol and Parenting" program, which was designed to investigate the role of parents in adolescent drinking, in order to improve prevention practice. Along the years, the program (Alcohol and Parenting) altered into a broader program, including parenting in relation to adolescent tobacco and cannabis use, which was called "Tobacco, Alcohol, Cannabis and Parenting" from 2010 onwards. As little is known from earlier studies on the role of parents in preventing adolescent cannabis use (Vermeulen-Smit et al., 2010), this topic was additionally studied in this program and accordingly became part of this thesis.

Part I: The role of parents in preventing adolescent alcohol use

Adolescent alcohol use

Alcohol use by adults is common and generally accepted in the Netherlands and in Western Society. In the course of growing into adulthood many adolescents experiment with alcohol use. Yet, there is a growing awareness of the hazardous effects of early drinking (Tapert et al., 2004; Verdurmen et al., 2006). Several studies indicate that alcohol use and misuse among children under 16 is associated with elevated risks of a physical and a social nature (Bonomo et al., 2001; Hingson et al., 2000; Verdurmen et al., 2006). Immediate risks of adolescent drinking include violence, injuries, and unprotected sexual intercourse. In addition, there is evidence that adolescent drinking can disturb the development of

the brain (Hiller-Sturmhöfel and Swartzwelder, 2004; Tapert et al., 2002). Still, less evidence exists for the longitudinal association between adolescent drinking and decreased cognitive functioning (Boelema et al., 2009; Engels et al., 2013; Peeters et al., 2014a, b), especially in general populations. Furthermore, early and especially frequent and heavy drinking, increases the odds of alcohol-related problems later in life (Behrendt et al., 2008; Englund et al., 2008). Therefore, both delaying the onset of drinking and reducing heavy drinking are important goals for prevention efforts (Pitkänen et al., 2005).

In the light of these hazardous effects, adolescent drinking has been recognized as a major public health problem in Western Society, especially early drinking and heavy drinking. In 2006, 73% of the 16 year old US students reported any alcohol use and 56% reported having been drunk at some point in their lives (Johnston et al., 2007). In 2003, 18% of the 12-14 year old students in the US reported heavy episodic drinking, where 'heavy episodic drinking' is defined as taking at least five drinks (each of 10 mg pure ethanol) on a single occasion (Miller et al., 2007). In Northern Europe these numbers are even higher; nearly all 15-16 year old students (>90%) have drunk alcohol at some point in their lives, on average beginning at age 12, and getting drunk at age 14 (Anderson and Baumberg, 2006; Monshouwer et al., 2004). Among Dutch adolescents, in the 1990s and early 2000s, alcohol use increased substantially, especially among younger age groups (12-14 years old) (Geels et al., 2011; Monshouwer, 2008; Poelen et al., 2005). For instance, lifetime prevalence of alcohol use increased from 55% to 79% among 12-14 year olds, and from 81% to 90% among 15-16 year olds, between 1992 and 2003 (Monshouwer, 2008).

The role of parents in adolescent drinking

Parents play an important part in the initiation of alcohol use. The example set by parents with their own drinking has been shown to affect their children's alcohol use (White et al., 2000). Adolescents model their behavior after their parents' patterns, contexts, attitudes and expectancies of consumption. The family's structure and aspects of the parent-child relationship (parenting style, attachment, nurturance, abuse, conflict, discipline and monitoring) have also been linked to young people's alcohol use (Andrews et al., 1993; Ary et al., 1993; Kandel, 1980; White et al., 2000). Only in the last two decades, cross-sectional and longitudinal studies have demonstrated that the way parents raise their children with respect to alcohol – i.e. alcohol specific parenting – is of particular importance to adolescent drinking. Especially, providing restrictive rules about

alcohol use appears to be effective in delaying and reducing alcohol use among young adolescents (Engels et al., 2003; Koning et al., 2010; Van der Vorst et al., 2006; Van der Vorst et al., 2007; Yu, 2003).

Parental drinking

Several longitudinal studies have found parental drinking to predict children's alcohol use (Ary et al., 1993; Ellickson and Hays, 1991; Engels et al., 1999; Kandel and Andrews, 1987; Poelen et al., 2007; Seljamo et al., 2006; White et al., 2000). The association between parental and adolescent drinking has been explained both directly by modeling (Bandura, 1977; Webb and Bear, 1995) and indirectly through parenting behavior (Latendresse et al., 2008). That is, children tend to imitate parental behavior (directly) when they watch their parents drink or when they drink together (Van der Vorst et al., 2010a; Zhang et al., 1999). In addition, the influence of parental drinking can be explained indirectly. That is, (heavy) drinking parents have been found to be more lenient towards their children's whereabouts in general (Latendresse et al., 2008) and their alcohol use in specific (Verdurmen et al., 2008) which, in turn, are known predictors of adolescent drinking (Van der Vorst et al., 2006). Furthermore, genetic susceptibility plays a role in the relation between parent and offspring's drinking, and this becomes profoundly visible when it involves children of alcoholics (King et al., 2009). Although these explanations seem clear and several studies have found parental drinking to predict children's alcohol use, other longitudinal studies did not find such an association between parental and adolescent drinking (Peterson et al., 1994; Power et al., 2005; Reifman et al., 1998). Thus, longitudinal studies do not consistently confirm the mechanisms through which the influence of parental drinking on their offspring's alcohol use has been explained. These inconsistent findings may be explained by 1) the way parental drinking is operationalized in the particular studies, 2) parental gender, 3) whether analyses controlled for parenting practices and 4) the specific stage of adolescent drinking (Power et al., 2005). Studying the influence of particular paternal and maternal drinking patterns on adolescent drinking development may show which drinking patterns are most harmful to their offspring. Furthermore, controlling for parenting practices may indicate whether the influence of parental drinking on their children's drinking is merely direct, or can be explained (partly) through parenting behavior. Investigating these factors is important in order to advise parents on their drinking and parenting behavior and thereby to delay and reduce adolescent drinking.

Alcohol-specific parenting practices

Social cognitive theory states that parents are the main socialization agents in their child's development (Bandura, 1986). Accordingly, parents are important when it comes to whether and how adolescents start or develop their alcohol use. General parenting practices, such as providing support and control (for a review see Ryan et al., 2010) have been related to adolescent drinking. Only in the last two decades, have alcohol-specific parenting practices been shown to be important deterrents of adolescents' drinking behaviors (e.g. Jackson et al., 1999; Reimuller et al., 2011; Van der Vorst, 2007; Yu et al., 2003). Furthermore, when both general and alcohol-specific parenting practices are taken into account, the latter seem to be of particular importance to adolescent drinking (Van Zundert et al., 2006; Verdurmen et al., 2012b). Therefore, we have a particular interest in the role of different aspects of alcohol-specific parenting, like parental communication, attitudes and restrictive rules about drinking on adolescent alcohol use.

While some studies show that frequent alcohol-specific communication reduces the risk of alcohol use in adolescents (Martyn et al., 2009; Pasch et al., 2010), others do not find an association (Ennett et al., 2001) or even suggest that frequent alcohol-specific communication might lead to an increase in adolescent alcohol use (Van der Vorst et al., 2010b). These mixed findings may be explained by the fact that those studies did not take quality of alcohol-specific communication into account. Indeed, several studies showed that instead of frequent alcohol-specific communication, a few solid conversations about alcohol may be more effective in keeping adolescents away from alcohol (Eijnden van den et al., 2011). That is, the quality of alcohol-specific communication (i.e., conversations about alcohol between parents and children through which parents can express their thoughts, rules and concerns about alcohol to their children in a constructive manner) has been found to correlate with reduced prevalence and intensity of adolescent alcohol use (Miller-Day and Kam, 2010; Spijkerman et al., 2008; Van der Vorst et al., 2010b).

Furthermore, parental attitudes towards adolescent drinking (i.e., disapproval of alcohol use among adolescents) have been related to later initiation of adolescent alcohol use (Koning et al., 2010) and lower levels of adolescent drinking (Bahr et al., 2005; Koning et al., 2010; 2012; Ryan et al., 2010).

Finally, alcohol-specific rules, which entail parents imposing rules on their children regarding their alcohol use have been found to be one of the parenting practices with the strongest association with later initiation (Van der Vorst, 2007)

and a lower intensity of adolescent alcohol use (Abar et al., 2009; Mares et al., 2012a; Van der Vorst et al., 2009; Van Zundert et al., 2006).

The aforementioned studies had strong designs using longitudinal data from the adolescent, a sibling and both parents, (Mares et al., 2012a; Van der Vorst, 2007). Still, samples are relatively small (Abar et al., 2009) and outcomes may be somewhat restricted to families with two biological parents and at least two children (Mares et al., 2012a; Van der Vorst, 2007). In this thesis, large nationally representative samples will be used to examine whether the recently observed associations between different alcohol-specific parenting practices and different levels of drinking can be consistently replicated among Dutch secondary school students. Moreover, these samples allow us to observe possible trends in drinking and alcohol-specific parenting among Dutch secondary school students and their parents. Further, we will be able to investigate the universality of parent's role in adolescent drinking, e.g. by studying the stability of associations 1) throughout the developmental stage of adolescence and 2) across socio-demographic groups of adolescents (moderation).

Moderating factors: The impact of parents on adolescent drinking may dependent upon the developmental stage of adolescents and may differ across gender and educational tracks.

First, alcohol use rises rapidly with increasing age. For instance, at the age of 10, 15% of Dutch adolescents have ever used alcohol, and 1% has ever been drunk, whereas at the age of 16 these percentages have increased to 91% and 61% (Monshouwer et al., 2004). While rates and levels of adolescent drinking increase when adolescents grow older, the strength of parents' influence on adolescent alcohol use throughout adolescence is under debate. On the one hand, throughout adolescence the parent-child relationship changes, as adolescents' spend less time with their parents and identity becomes more articulate (Larson et al., 1996). On the other hand, parent's support as well as their behavioral control (discussing the boundaries of acceptable behavior) have been found to remain important for their developing children (Beyers and Goossens, 2008). With respect to adolescent drinking the influence of parents has been found to remain important during adolescence (Wood et al., 2004), both directly and indirectly through peer selection (Engels et al., 2007). Parental rules on alcohol, for instance, have recently been found to affect adolescent drinking, even into early adulthood (Abar et al., 2009; Mares et al., 2013).

Second, gender differences in adolescent drinking have recently become small with respect to initiation and even drunkenness, while very heavy drinking (more than 11 glasses at one occasion) still occurs more frequently among boys when compared to girls (Verdurmen et al., 2012a). Moreover, the magnitude and mechanisms by which parents influence adolescent alcohol use might vary across gender. For instance, Kumpfer et al. (2008) suggest that parenting behavior may impact boys and girls differently. E.g. girls generally talk more to their mothers than boys do (Noller and Callan 1990). Yet, mothers ask their sons more questions about alcohol (Boone and Lefkowitz 2007) and are more permissive towards their daughters drinking (Reimuller et al., 2011).

Third, heavier drinking among students attending vocational education has been reported in several countries that, like the Netherlands, can differentiate between vocational and pre-academic tracks at the start of secondary school (when most pupils are 12–13 years of age). In these countries, adolescents attending vocational education drink larger quantities at one time than their peers attending pre-academic education (Smit et al., 2002; Verdurmen et al., 2012a; Vereecken et al., 2004). Still, little is known about whether the strength by which alcohol-specific parenting is related to adolescent drinking may vary across educational tracks.

As for prevention practice, it is of particular importance to examine whether the magnitude and mechanisms through which parents influence adolescent drinking may vary throughout adolescence and across gender and educational tracks.

Family interventions

The evidence of the effectiveness of family interventions in preventing adolescent drinking

In accordance with the abovementioned role of parents in adolescent drinking, several interventions have been developed for parents and families in order to prevent or reduce substance use and abuse in children. A review of both experimental and naturalistic follow-up studies concludes that most studies demonstrated positive effects of family-based interventions in reducing youth substance use and other high-risk behaviors (Thompson et al., 2005). Kumpfer et al. (2003) reviewed family-based intervention studies and found evidence of effectiveness for outcome types like bonding, communication, aggression and substance use in high-risk families. These authors stated that family-based interventions have effect sizes 2-9 times greater than approaches that are solely child

focused. Bolier and Cuijpers (2000) conducted a systematic literature review of controlled studies, describing seven family-based substance use prevention programs. The authors reported some evidence that family interventions may reduce alcohol use, in general populations. Still the overall evidence of the effectiveness of universal family interventions in delaying and reducing adolescent drinking remains to be studied.

Furthermore, in the Netherlands, family interventions in preventing underage drinking have rarely been examined (Koning et al., 2009). Likewise, active ingredients of these interventions are studied only seldom (Koning et al., 2011a). Although, Koning et al. (2009) found significant reductions in adolescent drinking when combining a school intervention with three annual parent meetings at school, an in-home family alcohol prevention program has never been studied in the Netherlands. Therefore, in the present thesis, we investigated the effectiveness of an inexpensive, easy-to-administer in-home family program aimed to delay adolescent drinking through its potential mediators.

In control: No alcohol!

"In control: No alcohol!" is a recently developed universal family program aimed to prevent alcohol use among elementary school children (11 years old) right before they transit to secondary education. This alcohol prevention program is based on the principles of a smoking prevention program called "Smoke-free Kids", which has been shown to be effective in a sample of US families (Jackson and Dickinson, 2006). The program is derived from two theories: Social Cognitive Theory (Bandura, 1986) and the Elaboration Likelihood Model (Petty and Cacioppo, 1986). While designing the alcohol prevention program, adjustments have been made based on recent evidence on alcohol-specific socialization, e.g., setting strict rules about alcohol, communicating constructively about alcohol issues, and monitoring daily activities (Koning et al., 2010; 2012; Van der Vorst et al., 2006; Yu, 2003).

The intervention consists of five magazines, eight pages each, which were mailed to the homes of families in the intervention condition with an interval of 4 weeks. Each of the five magazines includes information for mothers and games and assignments for mothers and children to complete together, addressing different important issues regarding youth alcohol use and child socialization. A website and accompanying logbook provided additional information, games and assignments for the adolescent to complete every month. Participating families in the control condition received a single brochure about alcohol and parenting

once. This brochure is the standard parent alcohol brochure at "the Netherlands Institute of Mental Health and Addiction" (treatment as usual).

An earlier report on the post-test outcomes showed that seventy-five percent of the dyads reported they took part in at least three of five magazines, suggesting successful implementation (Mares et al., 2012b). Further, this pilot randomized controlled trial (RCT) has been shown effective in altering a number of general and alcohol-related parenting behaviors: parental monitoring, alcohol-specific communication and the establishment of a non-drinking agreement (Mares et al., 2012b). In the present thesis (chapter 5) the 1-year follow-up effects of this intervention on parenting behaviors as well as on adolescent alcohol cognitions are evaluated. As drinking in this sample is still rather scarce, adolescents' alcohol cognitions are included as expressed in adolescents' perceived harmfulness of drinking and their intention to drink, as these are known predictors of adolescent drinking (Hawkins et al. 1997; Marcoux and Shope 1997). The main aim is to study whether the intervention changes adolescents' alcohol cognitions and whether the program-induced parenting factors are accountable for the expected change.

Additionally, as we mentioned earlier, parenting behavior may impact boys and girls differently (Kumpfer et al., 2008). Still, the efficacy of family programs in preventing early drinking across gender is unclear. A few studies testing the efficacy of family programs in preventing substance use across gender showed mixed results (Jones et al., 2005; Pilgrim et al., 1998; Trudeau et al., 2007). Though inconclusive, they may indicate the existence of diverging efficacy of family programs across gender. Therefore, we explore gender differences in program effects and mediation paths.

Part II: The role of parents in preventing adolescent cannabis use

Since 2010, the prevention and research program that this thesis is based upon (Alcohol and Parenting), altered into a broader program including parenting in relation to adolescent tobacco, alcohol and cannabis use. Reasons to combine prevention strategies of multiple substances are twofold. First, co-occurrence rates of tobacco, alcohol and illicit drugs are high (Looze de et al., 2014a). Second, combining tobacco, alcohol and illicit drug prevention has potential benefits like being more cost-effective and lowering the burden for youth and their parents (Looze de et al., 2012a).

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Adolescent cannabis use

In contrast to alcohol use, drug use is illegal and mostly used out of parent's sight and approval. Still, approximately 30 percent of Dutch adolescents have used cannabis at the age of 16 (Verdurmen et al., 2012a; Looze de et al., 2014b), which is comparable to the average of European 15-16 year olds (29%) (Hibell et al., 2012). At the age of 18 more than 40% of Dutch adolescents has been using some kind of illicit drug (e.g. marijuana, cocaine or XTC) and about a third of 17-18 year old boys used any illicit drug during the past month (Monshouwer et al., 2008). Furthermore, illicit drug use is much higher among at-risk adolescents, like those attending special education and juvenile offenders (Kepper et al., 2011; Monshouwer et al., 2008; Van Laar et al., 2010). For instance, 80% of juvenile offenders and 54% of those attending special education for youth with behavioral problems have used cannabis at the age of 16, compared to 30% among students in regular education (Kepper e.a., 2009; 2011). Prevention of early onset and frequent adolescent cannabis use are important as they are associated with increased risks of academic failure (Fergusson et al., 2007) and mental health problems like depression (Graaf de et al., 2010) and psychosis (Schubart et al., 2010).

The role of parents in adolescent cannabis use

Recently, studies have reported on the relation between alcohol-specific parenting practices and adolescent alcohol use. That is, in addition to general parenting practices, like support and monitoring, alcohol-specific parenting, e.g. rules on drinking, are found to be of particular importance to delay adolescent drinking (Van Zundert et al., 2006). We may hypothesize that, in contrast to adolescent alcohol use, parents may have little direct influence on adolescent cannabis use, as it is illegal and mostly used without parents' awareness and approval. Still, the few studies that investigated cannabis-specific parenting suggest more direct practices, including parental attitudes towards cannabis use (Bahr et al., 2005; Oesterle et al., 2012; Olsson et al., 2003) and parents' anger in response to drug use (Parsai et al., 2009). Moreover, Miller-Day (Miller-Day, 2008) found that, after identifying seven parental strategies to deal with substance use, setting a "no tolerance rule" was the only effective strategy associated with less cannabis use among university students. Thus, in accord with the relation between alcohol-specific parenting and adolescent drinking, also cannabis-specific parenting practices may discourage adolescent cannabis use.

In addition to the role of general and cannabis-specific parenting practices, both cross-sectional and longitudinal studies have shown that parental cannabis use is (weakly) positively associated with adolescent cannabis use in general populations (Bares et al., 2011; Hops et al., 1996; Newcomb et al., 1983). We have a particular interest in the role of parents own (past or current) experience with cannabis use, as parents' experience with cannabis use in the past is much more common compared to parents currently using cannabis use among youth within the general population. Moreover, parents' own experience with cannabis use may not only be related to adolescent cannabis use but also to their rules against cannabis use.

Family interventions

The existing evidence for developmental harm caused by early illicit drug use highlights the need of preventive interventions, especially among high-risk adolescents such as adolescents attending vocational education, special education and juvenile offenders (Kepper et al., 2009; 2011; Monshouwer et al., 2008; Van Laar et al., 2010). Although combining the prevention of multiple substances among adolescents has many benefits, the effectiveness of family programs in delaying and reducing adolescent drug use still needs to be studied. In specific, it is unclear whether family programs - aimed to prevent either illicit drugs or multiple substances - can accomplish the intended effect, i.e. delaying and reducing adolescent cannabis and other illicit drug use (Gates et al., 2006). As the effectiveness of family programs in preventing adolescent illicit drug use may diverge from its effectiveness in preventing adolescent drinking, combining the prevention of multiple substances does not rule out the importance to evaluate the effectiveness of prevention programs and mediation pathways for illicit drug use separately.

Aims, methods and outline of this thesis

Aims

The role of parents in preventing adolescent drinking

The short summary of the literature indicates a number of knowledge gaps that are important in order to understand the mechanisms through which parents may prevent adolescent drinking. First, this study will examine whether specific patterns of paternal and maternal drinking and specific alcohol related parenting practices impact adolescent alcohol use throughout adolescence. Second, we will investigate whether the influence of parental drinking patterns and parent-

ing practices on adolescent drinking depends on the developmental stage of adolescence and differs across gender and educational track. Third, we studied whether parenting practices and adolescent alcohol use a) changed throughout the years wherein national and local campaigns aimed to delay adolescent drinking, b) could be influenced by family programs in general, and by c) a particular in home family program (In control: No alcohol!) in the Netherlands.

The role of parents in preventing adolescent cannabis use and other illicit drug use

The second part of this thesis comprises 2 chapters through which we will a) examine the potential role of cannabis-specific parenting and parental cannabis experience in adolescent cannabis use and b) provide an overview of the existing evidence of family programs in delaying and reducing adolescent cannabis and other illicit drug use in general as well as in high risk populations.

Methods

In order to reach these aims different datasets and study methods have been used, which have been outlined in table 1.

Table 1: Overview of methods used in the different chapters of this thesis

Chapter	Substance	Data and strategy of analyses	N	Child's age (years)
2	Alcohol	Longitudinal PAS[a] data SEM in Mplus	2319 parent-adolescent dyads	12-15
3	Alcohol	Trends DNSSU[b] 2007 and 2011 HBSC[c] 2009	3615 (2007); 2953 (2009); 3229 (2011) parent-adolescent dyads	12-16
4	Alcohol	Meta-analysis of RCTs	18 included articles	< 16
5	Alcohol	RCT In control: No Alcohol! 1 year follow-up	213 parent-adolescent dyads	11 at baseline
6	Cannabis and hard drugs	Cross-sectional DNSSU[b] 2011	3209 parent-adolescent dyads	12-16
7	Cannabis and hard drugs	Systematic review and meta-analysis of RCTs	39 included articles	< 21

[a] Prevention of Alcohol use in Students study (PAS); [b] Dutch National School Survey on Substance Use; [c] Health Behavior in School-aged Children

Outline of this thesis

The first part of this thesis will address the aforementioned gaps in the literature concerning the role of parental drinking patterns and alcohol-specific parenting practices in the general population and across sociodemographic groups (e.g. gender and educational track), and answer the question whether adolescent drinking and alcohol-specific parenting behavior can be influenced by family programs in general, and, more specifically, in the Netherlands. The aim of **chapter 2** is to investigate whether differential paternal and maternal drinking patterns are associated with the initiation and development of adolescent drinking. Furthermore, possible differences in these associations across gender and educational track are examined. In **chapter 3**, we examine whether trends exist in alcohol-specific parenting practices and in adolescents' (aged 12-16) alcohol use between 2007 and 2011. Additionally, this study examines whether trends in alcohol-specific parenting practices and alcohol use differ across adolescent age, gender and educational level. In **chapter 4**, we quantify the effectiveness of family interventions in preventing adolescent drinking in general populations, by conducting a meta-analysis of randomized controlled trials. **Chapter 5** describes the results of a randomized controlled trial through which we investigated the effectiveness of an easy-to-administer in-home family intervention, the "In control! No alcohol" pilot study. In an earlier report on the post-test outcomes (Mares et al., 2012b) this program has been shown effective in altering a number of general and alcohol-related parenting behaviors: parental monitoring, alcohol-specific communication and the establishment of a non-drinking agreement (Mares et al., 2012b). Chapter 5 describes the 1-year follow-up effects of this intervention on parenting behaviors as well as on adolescent alcohol cognitions. The main aim is to study whether the intervention changes adolescents' alcohol cognitions and whether the program-induced parenting factors are accountable for the expected change, in general as well as across gender.

In the second part of this thesis we investigate the role of parents in adolescent cannabis use. In **chapter 6**, we investigate the role of general and cannabis-specific parenting and parental cannabis experience in adolescent cannabis and other illicit drug use. In **chapter 7,** a systematic review and meta-analysis is performed on the effectiveness of family interventions (universal, selective and indicated) in preventing adolescent cannabis and other illicit drug use.

PART I

THE ROLE OF PARENTS IN PREVENTING ADOLESCENT ALCOHOL USE

2 | THE INFLUENCE OF PATERNAL AND MATERNAL DRINKING PATTERNS WITHIN TWO-PARTNER FAMILIES ON THE INITIATION AND DEVELOPMENT OF ADOLESCENT DRINKING

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Abstract

As it is still unclear to what extent parental drinking is a predictor of children's alcohol use, we tested the association of specific paternal and maternal drinking patterns with both initiation and development of adolescent alcohol use. Longitudinal data (four annual measurements) of parent-child dyads (N = 2319) have been used. Parental drinking patterns have been identified using latent class analysis. The association of parental drinking patterns with the initiation and development of 12-15 year olds' drinking have been examined with latent growth curve modeling. Only two out of six parental drinking patterns were related to adolescent drinking. That is, having a heavy drinking father or two heavy episodic drinking parents particularly predicts early and heavier adolescent drinking. When controlled for parenting behaviors and background variables, such as adolescent gender, age and socioeconomic status (SES), these findings remained significant. Interaction analyses revealed that the influence of parental heavy (episodic) drinking differs across gender and is especially strong among adolescents with lower SES. Thus, parental heavy (episodic) drinking, and not so much the frequency of drinking, predicts the initiation and development of alcohol consumption in their offspring. Parents and professionals must be aware that parental heavy drinking affects their offspring, particularly adolescents with lower SES, resulting in earlier and heavier drinking among this high-risk group.

Introduction

It is unclear to what extent parental drinking is a predictor of their children's alcohol use. Longitudinal studies do not consistently confirm the mechanisms through which the influence of parental drinking on their offspring's alcohol use has been explained. The association between parental and adolescent drinking has been explained both directly by modeling (Bandura, 1977; Webb and Bear, 1995) and indirectly through parenting behavior (Latendresse et al., 2008). That is, children tend to imitate parental behavior (directly) when they watch their parents drink or when they drink together (Van der Vorst et al., 2010; Zhang et al., 1999). In addition, the influence of parental drinking can be explained indirectly. That is, (heavy) drinking parents have been found to be more lenient towards their children's whereabouts in general (Latendresse et al., 2008) and their alcohol use in specific (Verdurmen et al., 2008) which, in turn, are known predictors of adolescent drinking (Van der Vorst et al., 2006). Furthermore, genetic susceptibility plays a role in the relation between parent and offspring's drinking, and this becomes profoundly visible when it involves children of alcoholics (King et al., 2009). Although these explanations seem clear and several longitudinal studies have found parental drinking to predict children's alcohol use (Ary et al., 1993; Ellickson and Hays, 1991; Engels et al., 1999; Kandel and Andrews, 1987; Poelen et al., 2007; Seljamo et al., 2006; White et al., 2000), other longitudinal studies did not find such an association between parental and adolescent drinking (Peterson et al., 1994; Power et al., 2005; Reifman et al., 1998).

Different explanations for these contrasting findings have been suggested[1]. First, they might be explained by varying measures used to operationalize parental drinking in the particular studies. For example, adolescent drinking was not affected by parental household alcohol problems (Sieving et al., 2000) but was affected indeed by parental drinking frequency (Kandel and Andrews, 1987). Although a variety of measures, such as parental problem drinking (Latendresse et al., 2008; Sieving et al., 2000; Van der Zwaluw et al., 2008) and weekly and daily drinking (Poelen et al, 2007; 2009) have been used, most scholars examined parental drinking by estimating the number of drinks a week (Otten et al., 2008; Peterson et al., 1994; White et al., 2000). Yet, the average number of drinks a week might conceal different drinking patterns, which may also differ in their impact on adolescent behavior. For example, an equal number of drinks (e.g. 10 drinks a week) might be consumed both by daily light drinkers (1-2 glasses daily) and by

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1   In the following overview of longitudinal studies we only refer to 'normative' levels of parental drinking (excluding alcoholism), as the association between parent alcoholism and adolescent drinking involves different mechanisms.

heavy episodic drinkers (e.g. 10 glasses each Saturday night). As no former stud-
ies tried to unravel these patterns, it is unclear which specific parental drinking
patterns are most harmful.

Second, the role of parental gender is still inconclusive. A number of studies
found especially paternal drinking to predict adolescent drinking (Poelen et al.,
2009; Seljamo et al., 2006), whereas others emphasized the particular influence
of maternal drinking (Otten et al., 2008; Poelen et al., 2007; Reifman et al., 1998).
A third category of studies suggests the strongest influence between same-sex
dyads (father-son, mother-daughter; Wickrama et al., 1999). Less is known
about the combined influence of paternal and maternal drinking patterns. The
existing studies, comparing families with none, one or two drinking parents,
report that adolescents are at particular risk when both parents drink (Green et
al., 1991; Hung et al., 2009). Hall et al. (1983) studied different combinations of
paternal and maternal drinking patterns. Problem drinking fathers usually had
wives who were no problem drinkers while problem drinking mothers often had
husbands who were (Hall et al., 1983). However, combinations of paternal and
maternal drinking patterns within a family have not been analyzed in relation
to child drinking.

Third, parental drinking might play differential roles at specific stages of ado-
lescent drinking (Power et al., 2005). Reifman et al. (1998) found maternal drink-
ing to affect adolescent heavy drinking but not initiation. Other studies found
the frequency of parental drinking to remain influential throughout adolescence
(Poelen et al., 2007; 2009). Additional studies report parental drinking to affect
initiation more than transition to regular or problem drinking (Power et al., 2005)
and the impact to decline when adolescents grow older (Van der Zwaluw et al.,
2008). Hence, the particular influence of parental drinking across different stages
of adolescent alcohol use is still unclear.

Fourth, parental drinking is associated with parents' strictness towards their
children's alcohol use (Peterson et al., 1994; Van der Vorst et al., 2006). Accord-
ingly, the direct impact of parental drinking on adolescent alcohol use may de-
crease when parental rules about alcohol are taken into account (Van de Vorst et
al., 2006). The same may apply to drinking of parents in the presence of the child.
For example, Peterson et al. (1994) reported the, significant, influence of parental
drinking frequency on adolescent drinking to disappear after controlling for
parents' permissiveness concerning adolescent drinking. Hence, contrasting
findings on the impact of parental drinking in particular studies may also be
explained by inclusion of confounders, such as parental rules about alcohol.

Last, the influence of parental drinking on adolescents may vary as specific groups might be more susceptible to parental drinking. That is, the impact of parental drinking may differ for boys and girls and across different socio-economic groups (Green et al., 1991; Wickrama et al., 1999).

The present study

This study is innovative in examining the impact of specific patterns of paternal and maternal drinking on the initiation and development of adolescent drinking over four years using a large sample (N = 2319) of parent-child dyads. First, we will identify specific paternal and maternal drinking patterns and examine the influence of detailed combinations of these drinking patterns on early drinking and the development of adolescent alcohol use. Second, we will investigate whether the influence of parental drinking patterns on adolescent drinking remains significant when controlling for parental rules about alcohol. Third, we will examine whether the influence of parental drinking patterns on adolescent drinking differs between 1) boys and girls and 2) low and high SES adolescents.

Method

Procedure

The data used in the current study are part of a longitudinal randomized controlled trial (RCT) called "Prevention of Alcohol use in Students" (PAS: Koning et al., 2009). Current analyses were based on results from the four measurements, while controlling for the intervention conditions. A randomly selected sample of 80 secondary schools in the Netherlands was invited (by letter) to participate in the study. A total of 19 secondary schools from different regions in the Netherlands were willing to participate with a total of 3490 first year adolescents. The study included both the adolescents and one of their parents.

Data were collected in September/October 2006 (T1), 8 months later in May/June 2007 (T2), again in May/June 2008 (T3) and in May/June 2009 (T4). Adolescent data were collected in their classrooms through questionnaires, available on a secured web site. All questions needed to be answered, resulting in zero non-response on item-level. Research assistants were trained to administer the survey. Parental data were collected by written questionnaires that were sent to their home addresses in a school envelope along with a letter of consent. This letter gave parents the opportunity to refuse participation of their child (0.01% refusal). Parents could decide themselves whether the father or mother filled in the questionnaire. The questionnaire was followed by a written reminder three

weeks later to parents who had not yet responded. Another two weeks later, non-responding parents were called by phone.

Participants

Nineteen schools, including 3490 adolescents were selected to participate in the study. Due to initial non-response (adolescents: N = 122, due to their parents' refusal or their absence from school on the day the questionnaire was administered; parents: N = 643) and exclusion of single-parent families (N = 266, single parents were excluded as we were particularly interested in combinations of paternal and maternal drinking patterns) or parents with incomplete data (N = 140), 2319 parent-child dyads were eligible for analyses.

The adolescent sample had a mean age of 12.2 (SD = 0.5), including 52% boys, 51% in lower secondary vocational education (low education) and 49% in higher general secondary and pre-university education (high education). Most of the responding parents were female (80.2%). Two thirds of the mothers (72.7%) and fathers (63.5%) had low educational levels (only vocational training).

Attrition analyses

A total of 2196 adolescents (94.7%) at T2, 2055 adolescents (88.6%) at T3, and 2038 (87.9%) adolescents at T4 completed the follow-up assessments after 8, 20 and 32 months respectively. Attrition analyses on demographic variables and alcohol use indicated that responding adolescents were more likely to be younger, more often in lower education and drank a lower average number of alcohol beverages per week at baseline. No follow-up data from parent reports are used in the current study.

Measures

Parental alcohol use

Parental alcohol use at T1 was measured using a Quantity-Frequency scale (Knibbe et al., 1991; Koning et al., 2010; Monshouwer et al., 2008). Because the majority of the responding parents were mothers (80%), paternal alcohol use was generally reported by them. Cross-reports between partners have found to be fairly reliable (correlation .65 - .73) (Connors and Maisto, 2003). The alcohol use measures were adapted according to the gender of the responding parents. We used each of the quantity-frequency items separately to detect drinking patterns. This resulted in the following four items measured for mothers and fathers individually; (1) *number of drinking days during the week* (Monday to Thursday), (2)

number of usual drinks on a weekday, (3) *number of drinking days during the weekend* (Friday to Sunday), and (4) *number of usual drinks on a weekend day*.

Drinking in the presence of the child was measured at T1 by asking the adolescent how often his/her parents drink alcohol in their presence (range: 1-5; 1=never; 5=very often) (Verdurmen et al., 2008).

An additional measure of parental drinking was examined to portray the observed latent classes. *Parental problem drinking* was measured at T1 with a short version of the problem drinking list (Cornel et al., 1994). The scale consisted of six items asking whether the respondent e.g. "has tried to stop drinking" and "drank alcohol to forget my worries" in the past twelve months. Severity of problem drinking was reflected by the sum score. The respondent who filled in the questionnaire also answered the items for his/her partner. Cronbach's alphas were .64 and .76 for mothers and fathers respectively.

Adolescents' alcohol use

Adolescents' alcohol use was measured at T1-T4 by using the same Quantity-Frequency Scale as described above for parental alcohol use. The Quantity-Frequency measure represented the average weekly alcohol use. Quantity-frequency was computed by calculating the products of the number of days and the number of glasses and then summing the two products for weekdays and weekend days. The quantity-frequency of one or more indicated that the respondent drinks at least one day a week, one glass of alcohol. For those who indicated no alcohol use last month, the quantity-frequency was adjusted to zero.

Rules about alcohol

Rules about alcohol measured the degree of rule-setting perceived by the adolescent at T1. This scale was developed by Van der Vorst et al. (2005). Items included "I am allowed to have one glass of alcohol when my parents are at home" and "I am allowed to drink alcohol at a party with my friends." The scale consisted of the mean of ten items rated on a 5-point scale from 1 "*never*" to 5 "*always*" reversely scored, i.e. higher scores indicate more rule-setting behavior. Cronbach's alpha was .90.

Educational level

In the Netherlands, from the first year of secondary school, when pupils are 12–13 years of age, the educational system is already highly differentiated. Depending on their teacher's advice and the results of a test in the last year of

primary education pupils enter different types of secondary education. Educational level was included as a dichotomous variable. Low education included: pre-vocational education and low general secondary education; higher education included: upper general secondary education and pre-university secondary education (Koning et al., 2009; Smit et al., 2002). Educational level is a good proxy of adolescents' own current level of SES (Rahkonen et al., 1995; Richter and Leppin, 2007). Furthermore, studying the potential differences of parental drinking on adolescent alcohol use across educational levels is recommended in the light of prevention efforts, since 1) effective family programs are targeting parents via schools (Koning et al., 2009; Mares et al., 2012b); 2) family programs are differentially effective across educational levels (Verdurmen et al., under review) and 3) adolescent drinking is heavier at lower educational levels (Smit et al., 2002).

Strategy for Analyses

Latent Class Analysis

Drinking patterns among parents were identified by applying latent class analysis (LCA) in Mplus5.0 (Muthén and Muthén, 2007) to the list of four alcohol items (number of drinking days during the week; number of usual drinks on a weekday; number of drinking days during the weekend and number of usual drinks on a weekend day) for both mothers and fathers separately. LCA assumes that the association among the observed alcohol items is due to an underlying class structure. The goal of LCA is to identify the smallest number of latent classes that adequately describes the associations among the observed items. We started with the most parsimonious 1-class model and fitted successive models with increasing numbers of classes. Goodness-of-fit statistics were used to select the optimal model. We compared successive models by the Bayesian information criterion (BIC), the entropy and the Vuong Lo-Mendell-Rubin Likelihood Ratio Test (LMR-LRT). The model with the lowest BIC, the highest entropy and a significant LMR-LRT criterion, was considered to be the optimal model.

One-way ANOVA was carried out to examine whether parent and adolescent characteristics were significantly different between the classes. Bonferroni's correction was used to adjust for multiple comparison. Adolescents who are at higher risk for alcohol use are, amongst others, boys (Epstein et al., 1998), the lower educated (Kostelecky, 2005) and older adolescents (Van der Vorst et al., 2005). Therefore, we controlled for gender, educational level and age in further

analyses. Additionally, the data were collected as part of a RCT, so we controlled for the intervention conditions in all analyses.

Latent growth model

A latent growth curve (LGC) modeling approach was used to examine the development of adolescent weekly drinking over time and to investigate the influence of parental drinking patterns on initiation and development of adolescent weekly drinking.

First, different latent growth models (LGM) were estimated to examine which model described the growth of adolescent alcohol use over a four-year period (T1-T4) best. A two-factor latent growth model was used, including intercept and slope. The intercept represents information in the sample concerning the mean and variance of the adolescent alcohol level at T1. The second factor, the slope has the mean and variance of the total sample, and describes the individuals' change of alcohol use over time. Slope parameters represent years 1, 2, 3 and 4 respectively. The residual variances of the outcome variables were estimated and allowed to be different across time. To examine whether the data are best described by linear or nonlinear growth, two models were tested. In the linear model, factor loadings for slope were fixed at values corresponding to a linear time scale (0, 1, 2.5 and 4). In the nonlinear model, constraints on linear growth were relaxed. For identification of the model, at least two factor loadings on the slope factor must be fixed to two different values (Meredith and Tisak, 1990). The first three factor loadings were fixed at 0, 1 and 2.5, whereas the fourth factor loading was allowed to be freely estimated.

Second, the relative influence of parental drinking patterns (dummy classes) on adolescents' growth trajectories was estimated using path modeling. As multinomial regression requires a reference group, classes one to six were chosen as the reference group, successively. In this way all possible combinations of two classes were examined. All analyses were conducted in Mplus (5.0; Muthén and Muthén, 2007) using a maximum likelihood estimator (ML), the default in Mplus5.0. Model fit was assessed using the Chi-square goodness of fit test, comparative fit index (CFI; Bentler, 1990) and root mean square error of approximation (RMSEA; Browne and Cudeck, 1993). Consequently, two different models were run, 1) a model which controlled only for demographic variables (age, gender and educational level) and 2) a model which additionally controlled for "rules about alcohol" to test the relative influence of parental drinking pat-

terns on adolescent growth trajectories when controlling for parental rules about alcohol.

Third, we tested whether there were interaction effects between parental drinking patterns and gender and educational level on adolescent alcohol use (intercept and slope). All variables were centered or dichotomized before the interaction terms of gender and educational level were computed (Aiken and West, 1991).

As data are retrieved from a cluster randomized trial, design effects were estimated to decide on accounting for non-independence due to cluster sampling. As the design effect (based on possible cluster effects at the classroom level which is more conservative than at the school level), was lower than two, accounting for cluster-sampling was not imperative (Kish, 1965, Muthén and Satorra, 1995).

Complete parent-child dyads were selected in this study, without missing data on the independent variable, measured at baseline. No missing data appeared on confounders due to zero non-response on item-level for the adolescents. Missing data on the dependent variables were handled using full estimation maximum likelihood (Muthén and Muthén, 2007). Accordingly, all eligible parent-child dyads were used in the analyses (N = 2319).

Results

Latent class analysis of parental drinking patterns

Parental drinking patterns at T1 were identified using latent class analyses (LCA). The results of the several criteria and measures to decide for the number of classes are given in Table 1. LCA identified a six-class solution to fit the data the best, according to the LMR-LRT (six classes: $p < .001$, seven classes: $p = .803$). The average class probabilities were high (.91-.98), which indicated that the par-

Table 1: Criteria for deciding the number of classes (N=2319)

No. of classes	H	BIC	LMR- LRT statistic	LMR- LRT p-value
2	0.94	58829	5828	0.000
3	0.91	57057	1816	0.000
4	0.95	54741	1780	0.000
5	0.93	54378	1776	0.002
6	**0.94**	**53817**	**1801**	**0.000**
7	0.93	53303	575	0.803

H = entropy measure; BIC = Bayesian information criterion; LMR-LRT = Vuong Lo–Mendell–Rubin Likelihood Ratio Test. Bold numbers indicate the optimal model based on high entropy, low BIC and a significant LMR-LRT.

ticipants were properly classified to their latent class. The six parental drinking patterns that were identified by LCA are described in Table 2. Class 1 contained parents who drank 1-2 glasses 0-1 days a week (*non/incidental drinkers*). Parents in the second class drank 1-2 glasses 2-4 days a week (*regular light drinkers*). Class 3 consisted of families where mothers drank incidentally and fathers drank 2-3 glasses daily (*mother incidental, father daily drinker*). Class 4 contained families where both father and mother drank 2-3 glasses daily (*both parents daily drinkers*). Class 5 contained families where mothers drank incidentally and fathers drank 6-9 glasses 4 days a week (*mother incidental, father heavy drinker*). Finally, class 6 consisted of parents who incidentally drank on weekdays, yet an average of 8-9 glasses 1-2 days during the weekend (*heavy weekend drinkers*).

Table 2: Six latent classes of parental drinking patterns, based on fathers' and mothers' quantity and frequency of drinking on weekdays and weekend days (N=2319).

| Groups | N (%) | Mother | | | | Father | | | |
| | | Week | | Weekend | | Week | | Weekend | |
		Days [a]	Drinks [b]	Days [c]	Drinks [d]	Days [a]	Drinks [b]	Days [c]	Drinks [d]
1: Non/ incidental	965 (42)	.05	.06	.53	.93	.28	.39	.91	2.02
2: Regular light	494 (21)	1.56	1.43	1.78	2.19	1.19	1.34	1.63	2.40
3: MO incidental, FA daily	343 (15)	.15	.16	.66	.89	3.28	2.17	2.53	3.26
4: MO and FA daily	432 (19)	3.28	1.80	2.63	2.53	3.48	2.15	2.74	3.12
5: MO incidental; FA heavy	51 (2)	.38	.42	.79	1.88	2.32	6.31	2.00	8.74
6: MO and FA heavy weekend drinkers	34 (1)	1.03	2.53	1.38	8.28	1.22	2.65	1.40	9.44

MO= mother; FA= father; [a] Number of drinking days during the week (Monday to Thursday); [b] Number of usual drinks on a weekday; [c] Number of drinking days during the weekend (Friday to Sunday); [d] Number of usual drinks on a weekend day.

Characteristics of each of the latent classes are presented in Table 3. The mean age, the percentage of boys and adolescent alcohol use at T1 were consistent across classes. Adolescent alcohol use at T4 (age 15) was significantly higher among adolescents with heavy drinking fathers (class 5). Class 4 (daily drinkers) contained fewer adolescents attending lower education compared to other classes. Drinking in the presence of the child was significantly lower in class 1 (nondrinking or incidental drinking parents) compared to other classes. Maternal problem drinking was higher among classes 4 and 6 (both parents daily or heavy drinkers respectively) compared to other classes. Paternal problem drink-

ing was higher among classes 3 to 6 (one or both parents daily or heavy drinkers) compared to class 1 and 2 (nondrinkers or light drinkers). Membership in classes 5 (heavy drinking fathers) and 6 (heavy weekend drinking parents) was associated with significantly less parental rules about alcohol at T4 compared to other classes.

Table 3: Descriptive statistics (mean/ percentage) of adolescents and parents within families with differential parental drinking patterns (N=2319).

	Total	1: Non/ incidental	2: Regular light	3: MO incidental, FA daily	4: MO and FA daily	5: MO incidental; FA heavy	6: Both heavy weekend drinkers
N (%)	2319	965 (42)	494 (21)	343 (15)	432 (19)	51 (2)	34 (1)
Adolescent characteristics							
Gender (% boys)	52.2	53.2 [1]	52.6 [1]	52.5 [1]	49.1 [1]	49.0 [1]	61.8 [1]
Mean age	12.2	12.2 [1]	12.1 [1]	12.1 [1]	12.1 [1]	12.1 [1]	12.2 [1]
Education (% lower)	51.4	56.4 [1]	49.2 [1,2]	51.3 [1]	40.0 [2]	64.7 [1]	67.6 [1]
Adolescent weekly drinking (T1)[a]	.4	.4 [1]	.3 [1]	.3 [1]	.3 [1]	.6 [1]	.5 [1]
Adolescent weekly drinking (T4)[a]	3.9	3.6 [1]	3.3 [1]	3.9 [1]	4.4 [1]	11.2 [2]	8.3 [1,2]
Parent characteristics							
Weekly drinking mother (T1)[a]	4.7	1.1 [1]	6.1 [2]	1.2 [1]	12.6 [3]	3.1 [4]	15.9 [5]
Weekly drinking father (T1)[a]	9.1	3.1 [1]	6.2 [2]	15.4 [3]	16.2 [3]	34.0 [4]	19.9 [5]
Problem drinking mother (T1)[b]	.4	.1 [1]	.6 [2]	.2 [1]	1.0 [3]	.4 [1,2]	1.3 [3]
Problem drinking father (T1)[b]	.7	.3 [1]	.6 [2]	1.0 [3]	1.1 [3]	2.0 [4]	1.4 [3,4]
Drinking in presence of child (T1)[c]	2.3	2.3 [1]	2.9 [2]	3.2 [3]	3.6 [4]	3.3 [2,3,4]	3.1 [2,3,4]
Parental rules about alcohol (T1)[d]	4.6	4.6 [1]	4.5 [1]	4.5 [1]	4.6 [1]	4.4 [1]	4.4 [1]
Parental rules about alcohol (T4)[d]	4.2	4.2 [1]	4.2 [1]	4.2 [1]	4.2 [1]	3.7 [2]	3.5 [2]

Means compared by ANOVAS using Bonferroni's correction to adjust for multiple comparisons. MO= mother; FA= father; Means that do not share superscripts (1, 2, 3, 4, 5) are significantly different (p<.05). [a] Average number of glasses a week. [b] Severity of problem drinking is reflected by the aggregated score of 6 items (range: 0-6). [c] Means of drinking in the presence of the child, measured on a 5-point scale ranging from never (1) to very often (5). [d] Strictness of parental rules is measured by the mean score of 10 items (range: 1-5).

Latent growth model of adolescent drinking

Model fit

Two latent growth models (LGM) were estimated to examine which model described the intercept and slope of adolescent alcohol use over a four-year period (T1-T4) best. The linear growth model where time points for alcohol use were fixed, described the growth trajectory for adolescent alcohol use over time not very well (χ^2 (5) = 112.3 (p < .001); CFI = .90; RMSEA = .10). As the non-linear

model showed acceptable fit (χ^2 (5) = 48.5 (p < .001); CFI = .96; RMSEA = .07), this model was used for all further analyses. Unstandardized means (*SE*) for intercept and slope of adolescent drinking were .41 (.04) and .54 (.03) respectively.

Regression analyses

Table 4 shows the results of the regression models, all including six dummies of parental drinking patterns representing six classes of parental drinking. Successively, classes one to six were chosen as the reference group. As results above and below the diagonal corresponded, only results below the diagonal were reported.

   First, a model was run controlling for age, gender and education (Model 1: χ^2 (26) = 92.2, p < .001; CFI = .95; RMSEA = .03). An association was identified for membership in class 6 and the intercept of adolescent drinking, compared to class 1 to 4 (βs ranging from -.20 to -.27, p < .05). Class 5 and class 6 were associated with the slope of adolescent drinking, compared to classes 1 to 4 (βs ranging from -.33 to -.48, p < .001 and from -.22 to -.34, p < .05 respectively). That is, within families where both parents tend to drink heavy during weekends (class 6), adolescents drank significantly more at the age of 12 (T1) when compared with adolescents whose parent(s) abstained or drank limited amounts regularly or daily (class 1 to 4). Moreover, adolescents with either a heavy drinking father (class 5) or two parents who tend to drink heavy during weekends (class 6) showed a stronger increase in drinking compared with adolescents having other parental drinking classes. Apart from classes 5 and 6, no direct associations were observed between parental drinking patterns on one hand and intercept or slope of adolescent drinking on the other.

   Second, parental rules about alcohol was added to the model (Model 2: χ^2 (28) = 106.5, p < .001; CFI = .95; RMSEA = .04). Like model 1, significant associations were identified for membership in class 6 with the intercept compared to classes 1 to 3 (βs ranging from -.19 to -.22, p < .05), yet borderline significant compared to class 4 (β = -.16, p = .05). Also similar to model 1, class 5 was associated with the slope of adolescent drinking compared to classes 1 to 4 (βs ranging from -.29 to -.42, p < .001). Class 6 was associated with the slope of adolescent drinking compared to classes 1 to 3 (βs ranging from -.20 to -.26, p < .05, respectively), but not significantly compared with class 4 (β = -.16, p = .08). Hence, when parental rules about alcohol were taken into account, the observed associations between parental heavy (episodic) drinking (class 5 and 6) and the intercept and slope of

Table 4: Regression analysis of background variables and parental drinking patterns on intercept and slope of adolescent weekly drinking (standardized estimates (β))[a].

[b]	Regular light drinkers (class 2)		Mother incidental, father daily drinker (class 3)		Both parents daily drinkers (class 4)		Mother incidental, father heavy drinker (class 5)		Both parents heavy weekend drinkers (class 6)	
	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope
Model 1[c]										
Gender	.07**	.09**								
Age	.10**	.09**								
Education	.11***	.07*								
Class 1	.02	.01	.03	-.002	-.02	-.06	-.08	-.48***	-.27*	-.34**
Class 2			.01	-.01	-.04	-.06	-.08	-.41***	-.25*	-.29**
Class 3					-.04	-.04	-.08	-.34***	-.22*	-.24**
Class 4							-.04	-.33***	-.20*	-.22*
Class 5									-.06	.04
R^2	.05***	.07***								
Model 2[d]										
Parental rules	-.52***	-.29***								
Class 1	.05	.03	.05	.01	-.003	-.05	.008	-.42***	-.21*	-.26*
Class 2			.004	-.01	-.04	-.07	-.03	-.37***	-.22*	-.24*
Class 3					-.04	-.05	-.03	-.31***	-.19*	-.20*
Class 4							.009	-.29***	-.16	-.16
Class 5									-.07	.05
R^2	.31***	.15***								

* p <.05; ** p <.01; *** p <.001. [a]Class 1: Both parents non/ incidental drinkers; class 2: Both parents regular light drinkers; class 3: Mother incidental, father daily drinker; class 4: Both parents daily drinkers; class 5: Mother incidental, father heavy drinker; class 6: Both parents heavy weekend drinkers. [b] Parental drinking patterns in this row are the reference classes. [c] Model 1: Controlled for intervention condition (3 dummies) and demographics (age, gender and educational level). Model fit: χ^2 (26) = 92.2, p <.001; CFI = .95; RMSEA = .03). [d] Model 2: Model 1 + parental rules about alcohol. Model fit: χ^2 (28) = 106.5, p <.001; CFI= .95; RMSEA=.04.

adolescent weekly drinking remained significant and consistent compared with less severe drinking patterns.

An association between "drinking in the presence of the child" and the intercept of adolescent drinking was observed ($\beta = .13$, $p < .001$), which disappeared when control for parents rules about alcohol ($\beta = .05$, $p > .05$) was applied. No significant associations were found between "drinking in the presence of the child" and the slope of adolescent drinking.

Interaction analyses

Interaction analyses were performed to observe whether parental drinking might influence adolescent early drinking (intercept) or drinking development (slope) differently in high-risk groups.

Gender

First, to establish whether the relation between parental drinking and adolescent drinking differs across gender, interaction terms (Gender X Parental Drinking
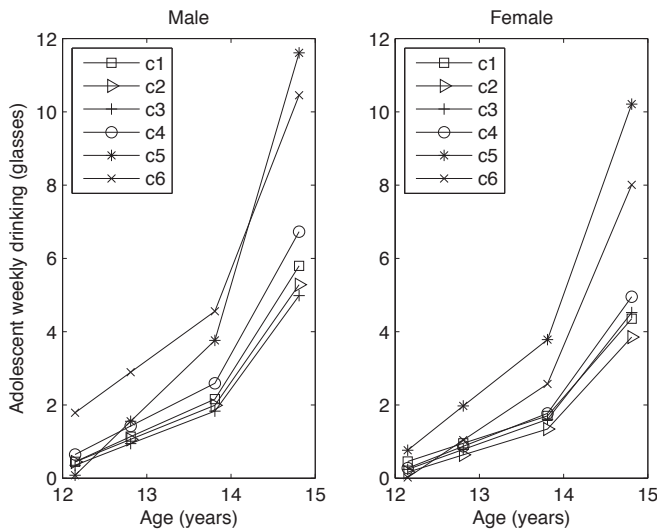
Fig. 1. The relationship between parental drinking patterns and adolescent weekly drinking is moderated by adolescent gender (unstandardized effects). c1 = non/incidental drinkers; c2 = regular light drinkers; c3 = mother incidental, father daily drinker; c4 = both parents daily drinkers; c5 = mother incidental, father heavy drinker; c6 = both parents heavy weekend drinkers.

Classes) were added to the model (model 3: χ^2 (38) = 120.1, p < .001; CFI = .95; RMSEA = .03). Differences between boys and girls existed for the relationship between class 4 (compared with class1; β = -.11, p <.05), class 5 (compared with class 2 and class 4; βs are .22, p <.05) and class 6 (compared with class 1-5; βs ranging from -.18 to -.52, p <.05) and the intercept of adolescent drinking (Fig. 1). Fig. 1 shows that, at the age of 12 the influence of a heavy drinking father (class 5) is especially strong among girls, whereas the influence of both parents daily drinking (class 4) and heavy weekend drinking (class 6) affects boys more strongly. No significant interaction effects were found for the slope of adolescent drinking. Still, Fig. 1 reveals that boys in class 5 'catch up' to boys in class 6 by the time they are 15, indicating that the father's influence is also important to boys, but perhaps somewhat delayed. Though, for girls, the influence of the father's heavy drinking (class 5) remains stronger throughout.

Level of education

Second, interaction analyses were performed to establish whether the relation between parental drinking and adolescent drinking differs across educational levels (low versus high). The model revealed good model fit (model 4: χ^2 (38) =

Fig. 2. The relationship between parental drinking patterns and adolescent weekly drinking is moderated by adolescent education (unstandardized effects). c1 = non/incidental drinkers; c2 = regular light drinkers; c3 = mother incidental, father daily drink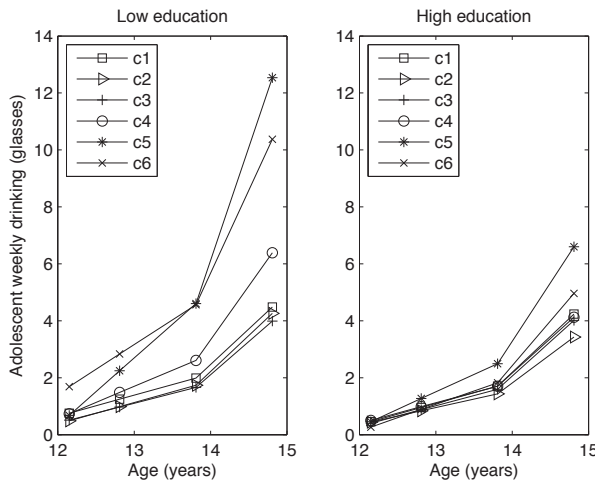er; c4 = both parents daily drinkers; c5 = mother incidental, father heavy drinker; c6 = both parents heavy weekend drinkers.

113.3, $p < .001$; CFI = .96; RMSEA = .03). Differences between educational levels existed for the relationship of class 6 (compared with class 2; β = -.30, $p < .05$ and class 3; β = -.25, $p < .05$) and the intercept of adolescent drinking and for the relationship between class 4 (compared with class 1; β = -.13, $p < .05$) and class 5 (compared with class 1; β = -.36, $p < .05$, and class 3; β = -.23, $p < .05$) and the slope of adolescent drinking (Fig. 2). Separate analyses for educational levels revealed that the influence of parental heavy weekend drinking (class 6) more strongly affects 12 year olds attending lower education compared with their higher educated peers. Furthermore, membership in class 4 (both parents daily drinkers) and class 5 (father heavy drinker) was associated with a stronger increase in drinking among adolescents attending low education compared to high education. Consequently, when parents were in classes 4, 5 and 6 (drinking both daily or heavily) alcohol consumption among adolescents in lower educational levels was 1.5 to 2 times higher compared to their higher educated peers (Fig. 2).

Discussion

This study is the first to investigate the combined influence of particular paternal and maternal drinking patterns on early drinking and the development of adolescent drinking over four years using a large sample of parent-child dyads. In general, two parental drinking patterns constituted a particular risk for adolescent drinking. That is, 1) adolescents from families with an incidentally drinking mother and a heavy drinking father were at higher risk for a stronger increase in drinking throughout adolescence, and 2) adolescents from families with two heavy episodic drinking parents were at higher risk of both early drinking and for a stronger increase in drinking. Thus, parental heavy (episodic) drinking, and not so much the frequency of drinking, seems to be the most harmful to their offspring.

When controlled for parental rules about alcohol and for the impact of several background factors (e.g., adolescent age, gender and educational level), these findings remained significant and consistent. In addition, known risk groups of adolescent drinking (e.g., boys and lower SES adolescents) are affected more strongly by specific parental drinking patterns, such as daily and heavy drinking.

Notably, in general only two out of six parental drinking patterns were related to the initiation or development of adolescent drinking. This finding underlines the importance of studying specific patterns of parental drinking. That is, parents who drink 30 glasses throughout the week (6-9 glasses per day) (class5) or 10-15 glasses during weekends (6-10 glasses per day) (class 6) constitute a higher

risk for adolescent drinking compared with parents who drink 10-15 glasses throughout the week (2-3 glasses per day) (class 4). Our findings seem to contrast the results of Poelen et al. (2007; 2009) who found parental weekly drinking to predict offspring's drinking. However, Poelen et al. (2009) (peculiarly) found adolescent drinking to be predicted longitudinally by fathers who drink a few times a week but not by fathers' daily drinking. This unexpected finding might be explained by the fact that they studied only the frequency and not the intensity of parental drinking. In line with previous studies investigating heavy parental drinking patterns such as the intensity of weekly drinking and problem drinking (Otten et al., 2008; Seljamo et al., 2006; Van der Zwaluw et al., 2008), we observed that parents who regularly drink (moderately) do not expose their children to the same risk as parents who drink heavily (either regularly or solely during weekends). In short, particularly father's heavy drinking and parental heavy episodic drinking seem to harm adolescents, placing them at greater risk for increased drinking during adolescence.

No significant associations with adolescent drinking were observed for "drinking in the presence of the child", when controlled for parents rules about alcohol. Possibly, apart from the aforementioned mechanisms, underlying drinking expectancies or drinking motives may explain why adolescent alcohol use is predicted by heavy parental drinking but not by other drinking patterns. For example, heavy drinking parents may drink to enhance a positive mood or to cope with stress (Cooper et al., 1992; Engels et al., 2005) whereas daily (moderate) drinking parents might drink for different reasons. Possibly, parental drinking motives and expectancies may predict adolescent drinking.

Furthermore, heavy parental drinking was found to predict not only early drinking but also a stronger increase in adolescent drinking between 12-15 year olds. This is in contrast with theoretical models reporting parental drinking to affect early drinking more than the transition to regular or problem drinking (Simons et al., 1988). Parental modeling, for example, is suggested to play a stronger role at a younger age because most adolescents start to drink with the family at home (Van der Vorst et al., 2010). However, apart from parental modelling, the persistent role of parental drinking throughout adolescence may be explained by additional mechanisms. Rose and Dick (2005) report environmental factors, like parental modelling, to greatly influence the initiation of drinking, while genetic influences become of increasing importance once drinking has been initiated. Hence, parental modelling and genetic factors might explain the observed impact of parental heavy drinking on both early drinking and development of adolescent drinking.

After controlling for some socio-demographics, such as gender, age and educational level, and parental rules about alcohol, the observed associations between parental heavy drinking and adolescent initiation and development of drinking remained significant and consistent. This finding is in contrast with the finding of Peterson et al. (1994) but in line with those of other studies (Latendresse et al., 2008; Van der Zwaluw et al., 2008) showing that parental drinking directly affects their offspring's alcohol use.

Moderation analyses revealed the influence of parental drinking to differ across groups of adolescents. With respect to gender, positive as well as negative interactions were observed with the intercept of adolescent drinking. That is, 12 year old girls are affected more strongly by their fathers' heavy drinking, while same-age boys are more influenced by fathers' and mothers' heavy episodic drinking (Fig. 1). These findings are in contrast with that of Wickrama et al. (1999) who found transmission of parental health behaviors, including extensive drinking, to be strongest along the same gender lines, but are in line with that of Andrews et al. (1997) in showing that the impact of father's drinking in early adolescence is stronger for girls. Possibly, boys may relate to weekend drinking at an earlier age than girls, as drinking among men is still more normative, whereas they may not relate to their fathers heavy drinking at the age of 12. Although, the literature is still inconclusive, more insight into the transmission of parental drinking to their offspring's early alcohol use may be of particular importance as the age of first alcohol use predicts alcohol problems later in life (DeWit et al., 2000). Therefore, studying the effect of parental drinking patterns on boys' and girls' alcohol use in early adolescence is recommended.

Differences between educational levels are more profound. When both parents drank daily, heavy episodically or when fathers drank heavily (class 4, 5 and 6), adolescent weekly alcohol consumption in lower educational levels was 1.5 to 2 times higher at the age of 15 compared with that of their higher educated peers (Fig. 2). These findings are in line with those of Spijkerman et al. (2008) who found adolescents from low SES families with heavy drinking parents to be at particular risk for excessive alcohol use. Possibly, adolescents in low SES groups are more sensitive to parental modeling effects, compared to their better-off peers (Spijkerman et al., 2008), resulting in earlier and heavier drinking.

Despite the strengths of this study, some limitations need to be mentioned. First, parental drinking, parental rules about alcohol and the intercept of adolescent drinking were measured on the same time, thus outcomes related to the intercept of drinking should be interpreted as cross-sectional associations. Ac-

cordingly, conclusions about causality can only be drawn for the outcomes on the slope of adolescent drinking.

Second, the data of this study are retrieved from a RCT, testing the effectiveness of a parent and student intervention, offered separately and jointly, in postponing adolescent drinking. As (only) the combined intervention was effective in postponing adolescent drinking (Koning et al., 2009, 2011) it could be argued that the relationship between parental drinking patterns and adolescent alcohol use might differ for the dyads that received the combined intervention. Post-hoc analyses revealed a significant difference for the combined intervention in the influence of class 5 on the slope of adolescent drinking ($p < .01$). The fathers' heavy drinking impacts the slope of adolescent drinking for the non-effective and control conditions (class 5 compared with classes 1-4; βs ranging from -.33 to -49; $p < .001$), whereas this was not observed for the combined intervention (βs ranging from 06 to .15; $p < .05$). Thus, the observed relation between the fathers' heavy drinking (class 5) and the slope of adolescent drinking may disappear due to the intervention. Consequently, findings were observed, not because but, despite of the intervention. All other findings did not differ across intervention conditions. Accordingly, the impact of parental heavy episodic drinking (class 6) on the intercept and slope of adolescent drinking did not differ across RCT conditions.

Third, apart from parental drinking, peer drinking is also an important predictor of adolescent alcohol use which was not included in the current analyses (Scholte et al., 2008). Combining peer and parent drinking in a single model is suggested to get a better understanding of the development of adolescent alcohol use (Reifman et al., 1998).

Fourth, parental drinking in our study population seems lower compared to other studies investigating same-aged Dutch adults (of whom approximately 10 percent are heavy drinkers; Van Laar et al., 2010). Possibly, parental non-response in the study is higher among heavy drinkers. Our study population (two-parent families) may give an additional explanation, as heavy drinking is lower in two-parent families compared to adults without children (Van Dijk et al., 2004) and single parents (Weitoft et al., 2003). To identify combinations of paternal and maternal drinking patterns, single-parent families were excluded from analyses. As both parental drinking and parenting behavior in single parents differ from this sample (Pettersson et al., 2009; Weitoft et al., 2003), the conclusions might differ as well. In sum, as heavy drinking parents are probably underrepresented in this study of two-parent families, replication of these analyses among single parents is suggested.

In conclusion, parental heavy (episodic) drinking, and not so much the frequency of drinking, predicts earlier drinking and a stronger increase in drinking among 12-15 year olds. These findings remained consistent and significant when controlled for demographics and parental strictness towards adolescent drinking. Interaction analyses revealed that, adolescents in lower education may be particularly susceptible to parental heavy drinking. Parents and professionals must be aware that parental heavy drinking may increase underage drinking in their offspring, especially among adolescents with lower SES, resulting in earlier and heavier drinking among this high-risk group.

3

TRENDS IN ALCOHOL-SPECIFIC PARENTING PRACTICES AND ADOLESCENT ALCOHOL USE BETWEEN 2007 AND 2011 IN THE NETHERLANDS

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Abstract

Following increased research and policy attention on the harmful effects of alcohol use among adolescents and the implementation of prevention programs aimed at reducing adolescent alcohol use, this study examined whether alcohol-specific parenting practices have become stricter and whether adolescent alcohol use has declined between 2007 and 2011 in the Netherlands. Data were derived from three nationally representative cross-sectional studies of 12- to 16-year old adolescents - the Dutch National School Survey on Substance Use (2007 and 2011), and the Health Behavior in School-aged Children study (2009). These data were obtained using of self-report questionnaires in the classroom (adolescents, M_{age} = 13.8 years, SD=0.04) and at home (parents). Between 2007 and 2011, Dutch parents increasingly adopted strict alcohol-specific practices, except for parents of 16-year old adolescents. Furthermore, adolescent reports of lifetime and last month alcohol use decreased, except for 16-year olds. The quantity of alcohol consumed by adolescents did not change between 2007 and 2011. Alcohol-specific parenting practices were associated with lower adolescent alcohol use. These associations were generally stable over time. Our findings are consistent with the recent increased awareness in research, policy and the media about the harmful effects of alcohol on young people. Specifically, they are consistent with the focus of recent prevention efforts aimed at parents to postpone the alcohol use of their child at least until the age of 16. Future prevention programs should also target older age groups (i.e., age 16 years and older) and address the quantity of alcohol consumed by adolescents when they drink.

Introduction

Adolescence is a peak period for the initiation and use of substances, and many adolescents experiment with or consume alcohol regularly. Although some experimentation is normative (Engels and Ter Bogt, 2001), prevention of early and excessive alcohol use among adolescents is important, particularly because it is associated with adverse psychological, social and physical health consequences, including brain damage, academic failure, violence, injuries, and unprotected sexual intercourse (Gmel et al., 2003; Perkins, 2002).

Parents are important socialization agents when it comes to whether and how adolescents start or develop their alcohol use. Besides general parenting practices, such as providing support and control (for a review see Ryan et al., 2010), alcohol-specific parenting practices have shown to be important deterrents of adolescents' drinking behaviors. Specifically, parental attitudes (i.e., disapproval of alcohol use among adolescents) have been related to later initiation of adolescent alcohol use (Koning et al., 2010) and lower levels of adolescent alcohol use (Bahr et al., 2005; Koning et al., 2010; 2012; Ryan et al., 2010). In addition, the quality of alcohol-specific communication (i.e., conversations about alcohol between parents and children in which parents can express their thoughts, rules and concerns about alcohol to their children) has been found to correlate with reduced prevalence and intensity of adolescent alcohol use (Miller-Day and Kam, 2010; Spijkerman et al., 2008; Van der Vorst et al., 2010). Finally, alcohol-specific rules, which entail parents imposing rules on their children regarding their alcohol use inside and outside the house, have been found to be one of the strongest parenting practices associated with later initiation (Van der Vorst et al., 2007) and a lower intensity of adolescent alcohol use (Mares et al., 2012a).

Until 2005/06, the Netherlands was among the European countries with the highest percentage of alcohol-using adolescents (Currie et al., 2008; Hibell et al., 2009). In the 1990s and early 2000s, adolescent alcohol use increased substantially, especially among younger age groups (12-14 years old) and girls (Geels et al., 2011; Monshouwer, 2008; Poelen et al., 2005). At that time, alcohol-specific parenting practices were, overall, lenient among many Dutch parents (Monshouwer, 2008). Partly, these attitudes have been explained by the fact that the generation of parents whose children were adolescents in the 1990s and early 2000s was among the first generations raised during a period of growing alcohol consumption and a relatively liberal (national) alcohol policy (Van Laar et al., 2005).

Since 2005/06, a socio-cultural change seems to have taken place with respect to adult attitudes towards adolescent alcohol use. As scientific knowledge of the potentially hazardous effects of early alcohol use has accumulated (i.e., early alcohol use has been found to be associated with abnormal brain functioning and development, and related learning, retention, and attention difficulties; Hiller-Sturmhöfel and Swartzwelder, 2004; Tapert et al., 2002), concerns were raised about the high rates of alcohol use among Dutch adolescents. As a result, the reduction of adolescent alcohol use became a priority in Dutch social policy (Klink et al., 2007). A number of mass media campaigns and prevention programs aimed at reducing alcohol use among adolescents were developed and implemented. Since the scientific literature showed a strong link between alcohol-specific parenting and adolescent alcohol use (Van der Vorst, 2007), and since family interventions were shown to be effective in delaying adolescent drinking (Koning et al., 2011a; Koutakis et al., 2008; see review: Smit et al., 2008), these campaigns and programs targeted parents, with the aim of influencing alcohol-specific parenting practices.

In the first few years (2006-2009), mass media campaigns focused on raising awareness among parents about the harms of early drinking and the importance of strict rule setting. In subsequent years (2009-2012), messages about more complex alcohol-specific parenting practices, including supportive parent-child communication skills around alcohol, were added to those on strict rule setting. Parents were advised to postpone alcohol use of their child for as long as possible, at least until the age of 16 years, the legal age limit for the purchase of alcohol at that time. These prevention messages reached many parents, as they were disseminated via national and regional media, including television, radio, print media, and school prevention programs (Dienst Publiek en Communicatie, 2007-2009, 2010-2011). Since combined prevention efforts (in multiple settings) have been found to be effective in reducing adolescent substance use (Carson et al., 2011; Foxcroft and Tsertsvadze, 2011; Koning et al., 2011a), it was expected that the campaigns and programs would be successful in increasing alcohol-specific parenting and in turn decreasing adolescent alcohol use.

In this study, we examined changes over time in alcohol-specific parenting practices and adolescent drinking behaviors between 2007 and 2011 in the Netherlands. Specifically, we investigated whether there were any changes in adolescent alcohol use and parenting practices as they relate to the contemporaneous mass media campaigns. We further tested whether these changes differed across demographic subgroups, such as gender, age, and educational track (vocational versus academic).

We aimed to answer the following research questions:

1. Have alcohol-specific parenting practices changed between 2007 and 2011 and are these changes similar for parents of adolescents from different socio-demographic groups (adolescent gender, age, educational track)?
2. Have adolescent drinking behaviors changed between 2007 and 2011 and are the changes similar for different socio-demographic groups?
3. Are alcohol-specific parenting practices associated with adolescent drinking behaviors and are the associations similar for different socio-demographic groups?
4. Are the associations between alcohol-specific parenting practices and adolescent alcohol use stable over time?

We expected that, compared to 2007, parents in 2009 and 2011 would be more likely to perceive alcohol use as harmful for adolescents, report high-quality alcohol-specific communication with their child, and set rules with respect to their child's alcohol use. We also expected a decrease in adolescent alcohol use during this period. Prevention programs after 2006 targeted parents of adolescents under the age of 16, so it was expected that parents of 12- to 15-year olds would become stricter and that alcohol use would decrease more in this age group, compared to 16-year olds. We did not have a hypothesis on the moderating effect of gender or educational track. With respect to the association between alcohol-specific parenting practices and adolescent drinking behaviors, we expected a negative association, which was equally strong across adolescent demographic groups and stable across survey years.

Method

Study procedures

Data were derived from the Dutch National School Survey on Substance Use in 2007 and 2011 and from the Health Behavior in School-aged Children study in 2009. The sampling and survey procedures for the different surveys were identical and the present examination had a repeated cross-sectional design. The study included data from adolescents aged 12 to 16 attending the first four classes of general secondary education and one of their parents.

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 was 57% (2007), 48% (2009) and 48% (2011). The reasons for non-response were mainly related to (being approached for) participation in other research.

Research assistants administered self-complete questionnaires in the classroom (lasting approximately 50 min) in October and 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 (7%), mainly because of illness.

Parental data were also collected using paper questionnaires in October and November of the corresponding year. During data-collection at the schools, adolescents were given a sealed envelope with the 'parent-questionnaire' and an accompanying letter. The students were instructed to hand over the envelope to one of their parents the same afternoon. Three weeks later, a written reminder was sent. The adolescent and parent questionnaires were linked by means of a bar code. To prevent matching errors, we further checked whether gender and birth date of the adolescent on the parent and adolescent questionnaire corresponded. Incentives were used to promote parent response (e.g., ten 100 euro's vouchers were raffled in 2011), resulting in response rates of 55% (2007), 52% (2009) and 49% (2011).

Study sample

In total, we received 3615 (2007), 2953 (2009) and 3229 (2011) questionnaires from both adolescents and their parents. Demographics of the total sample of adolescents and of those with a responding parent are presented in Table 1. Compared to non-responding parents, parents who returned the questionnaire had adolescents who were younger (mean age 13.7 versus 14.0, ts = -8.53 to -4.59, ps < 0.001); more often in academic tracks, χ^2 = 51.1-238.0, ps < 0.01, less likely to have an ethnic minority background, χ^2 = 251.7-360.6, ps < 0.001, and more likely to live with both biological parents, χ^2 = 41.2-80.3, ps< 0.001. No differences were found with respect to adolescent gender. Finally, adolescent alcohol use was generally lower among adolescents of responding parents, compared to non-responding parents. With respect to the lifetime and last month prevalence of alcohol use, this effect emerged in 2007 and 2011, χ^2 = 16.3-68.6, ps < 0.01, but

not in 2009. For the number of drinks during weekends, this effect emerged in all three survey years, ts=-6.31 to -4.51, ps < 0.001.

To control for the selective response, and to make it possible to generalize the results to the Dutch school going population aged 12-16, a weighting procedure was applied to all three datasets. As statistics on parental demographics were not available, both adolescent and parent data were weighted using adolescent demographics. Post-stratification weights were calculated by comparing the joint sample distributions and known population distributions of the child's school type, grade, gender, and level of urbanization of the corresponding year (national statistics were obtained from Statistics Netherlands, CBS).

Table 1: Basic characteristics of the adolescent and parent samples (weighted %)

Sample	All participating adolescents						Adolescents with parent report [b]					
Survey year	2007		2009		2011		2007		2009		2011	
	N	%	N	%	N	%	N	%	N	%	N	%
Total	6524	100.0	5626	100.0	6624	100.0	3615	100.0	2953	100.0	3229	100.0
Gender												
Boy	3376	51.8	2866	50.9	3433	51.8	1895	52.4	1510	51.1	1681	52.1
Educational track												
Academic	2816	43.2	2649	47.1	3029	45.9	1635	45.2	1533	51.9	1595	49.5
Vocational	3708	56.8	2977	52.9	3572	54.1	1980	54.8	1420	48.1	1629	50.5
Age												
12	1041	16.0	992	17.6	1153	17.4	609	16.8	556	18.8	598	18.5
13	1681	25.8	1414	25.1	1662	25.1	952	26.3	751	25.4	816	25.3
14	1579	24.2	1280	22.8	1594	24.1	869	24.0	666	22.6	784	24.3
15	1501	23.0	1354	24.1	1498	22.6	839	23.2	722	24.5	725	22.4
16	722	11.1	586	10.4	717	10.8	347	9.6	258	8.7	306	9.5
Ethnicity												
Minority background	799	13.1	870	16.2	864	13.9	250	7.4	256	9.0	213	7.0
Family structure												
Incomplete family [a]	1305	20.2	1137	20.2	1623	24.6	604	16.8	520	17.6	647	20.1
Lifetime-prevalence alcohol	4929	76.1	3655	65.7	4253	64.4	2704	75.3	1991	68.1	2037	63.2
Last month alcohol use	2781	44.6	2059	37.4	2253	35.1	1459	42.1	1080	37.3	1030	32.7
Number of glasses during weekends (M, SE)	3.39	.24	2.26	.20	2.81	.23	2.86	.25	1.85	.22	2.41	.23

[a] Not living with both biological parents; [b] All analyses were based on this sample

Measures

In the three study waves, identical questions on alcohol-specific parenting were posed to parents, and identical questions on alcohol use and background characteristics were posed to adolescents.

Alcohol-specific parenting: Parent report

Perceived harmfulness of drinking. The degree of perceived harm of alcohol use was measured by a scale representing the mean of three items: "How harmful (physically or in other ways) do you think it is for adolescents under 16 (the legal age of drinking in the Netherlands) to drink 1) one or two glasses every weekend; 2) one or two glasses every day; and 3) five or more glasses every weekend". Response categories ranged from 1 = *not harmful* to 4 = *very harmful*. Cronbach's alphas were .75, .67, and .71 for 2007, 2009, and 2011, respectively.

   Perceived quality of alcohol-specific communication. Parents were asked about the quality of communication about alcohol with their child using three items: 1) "My child and I talk easily about our opinions regarding drinking"; 2) "When my child and I talk about drinking, we both feel comfortable"; 3) "When my child and I talk about drinking, he or she feels taken seriously/understood" (Spijkerman et al., 2008). Response categories ranged from 1 = *completely untrue* to 5 = *completely true*. A high mean score reflected a high-perceived quality of parent-adolescent communication about alcohol. Cronbach's alphas were .84, .92, and .91 for 2007, 2009, and 2011, respectively.

   Alcohol-specific rules. Parent reports on parental rule-setting regarding alcohol use of the adolescent were measured using four items, two of them referring to alcohol use while parents or supervisors are present and the other two referring to alcohol use while parents or supervisors are absent. The items were: "Would you allow/Is your child allowed to drink: 1) one glass of alcohol at home with parent(s); 2) several glasses at home with parent(s); 3) alcohol at a party with friends; and 4) alcohol during weekends (based on the scale developed by Van der Vorst et al., 2005). Adolescent alcohol use during weekends typically occurs on a Friday or Saturday night in a bar or pub with friends. Response categories ranged from 1 = *definitely not* to 5 = *definitely*. Responses were reverse scored so that a higher mean on this scale reflected more restrictive alcohol-specific rules. Cronbach's alphas were .88, .91, and .92 for 2007, 2009, and 2011, respectively.

Adolescent alcohol use: Adolescent report

Lifetime prevalence of adolescent alcohol use was measured by asking adolescents how often they had drunk alcohol in their lifetime. Response categories ranged from 0 to 40 or more times on a 14-point scale (O'Malley et al., 1983). In order to establish lifetime prevalence the answers were re-coded into 0 and 1 (answers 1 – 40 or more).

Last month prevalence of adolescent alcohol use was measured by asking adolescents how often they had drunk alcohol during the last four weeks using the aforementioned 14-point scale. Answers were re-coded likewise into 0 and 1 (answers 1 – 40 or more).

*Number of glasses consumed during a weekend (*quantity of drinking) was measured using a Quantity-Frequency Scale (Knibbe et al., 1991; Koning et al., 2010). This scale measures the average number of alcoholic drinks consumed during a weekend. Quantity–frequency was computed by multiplying the number of drinking days during the weekend (Friday to Sunday) and the number of usual drinks on a weekend day. We chose to measure quantity-frequency during a weekend, as adolescents generally drink during the weekends, rather than on weekdays.

Covariates

All analyses controlled for gender (boy vs. girl), age (ranging from 12 to 16), ethnicity (ethnic minority vs. native Dutch background), family structure (living with both biological parents or not) and educational track (vocational vs. academic).

Strategy for analyses

The analyses considered two characteristics of the data. 1) Students from the same class 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 the statistic software package Stata-V12 (Stata Corp., College Station, TX).

To answer research questions 1 and 2, the weighted (raw) prevalence estimates for alcohol-specific parenting and adolescent alcohol use in 2007, 2009 and 2011 were calculated for the total sample. Multivariate (logistic) regression analyses were performed to test the significance of the time trends. Survey year,

the predictor of interest, was included as a dummy variable, using the year 2007 as the reference year. To test for linear trends, we repeated this analysis with time as a continuous variable. To correct for possible differences in the demographic composition across the waves, demographic covariates (gender, age, ethnicity, family structure and educational track) were also included in these analyses.

To test whether the time-trends in both alcohol-specific parenting and adolescent drinking differ across demographic groups (adolescent gender, age and educational track), prevalence estimates for alcohol-specific parenting and adolescent alcohol use were calculated separately for different subgroups. Per subgroup, multivariate (logistic) regression analyses were performed to test the significance of the time trends. In addition, interaction analyses were performed to test whether differences between groups were statistically significant. The interaction term (demographic factor x survey year) was added to the regression analyses.

To investigate the association between alcohol-specific parenting and adolescent drinking (research questions 3 and 4), four multiple (logistic) regression analyses predicting adolescent alcohol use (controlled for demographic factors) were performed. In the first model, time was entered as a dummy variable. In Model 2, alcohol-specific parenting practices were added. In Model 3, interactions between demographic subgroup and alcohol-specific parenting practices were added to Model 2 consecutively. Finally, in Model 4, interactions between survey year and alcohol-specific parenting practices were entered consecutively.

To correct for the large datasets and the large amount of tests we conducted, associations and interaction effects were considered significant if $p < 0.01$. Interaction effects were interpreted based on post hoc graphical (margin) plots.

Results

Trends in alcohol-specific parenting practices between 2007 and 2011

Table 2 presents changes in parental perceptions of the harmfulness of adolescent alcohol use, the quality of alcohol-specific communication, and parental rule setting between 2007 and 2011. For conceptual reasons, perceived harmfulness of adolescent alcohol use under the age of 16 was reported only for parents whose child had not yet reached the age of 16. Besides the raw means across different (adolescent) demographic groups, the results of the regression analyses that controlled for demographic background characteristics are also presented. The ps for trend (testing linear trends) are reported in a footnote below the table. They confirm the results of the main analysis.

Table 2: Trends in alcohol-specific parenting practices between 2007 and 2011 (N = 3615 for 2007, N = 2953 for 2009, N = 3229 for 2011)

	Perceived harmfulness of drinking [a]					Quality of alcohol-specific communication [b]					Alcohol-specific rules [b]				
	M [c]			Adjusted B [d]		M [c]			Adjusted B [d]		M [c]			Adjusted B [d]	
Survey year	2007	2009	2011	2009	2011	2007	2009	2011	2009	2011	2007	2009	2011	2009	2011
Total	3.33	3.54	3.47	.21**	.15**	4.00	4.29	4.38	.28**	.37**	4.25	4.39	4.42	.12*	.16**
Gender															
Girls	3.34	3.52	3.46	.18**	.11**	4.01	4.32	4.42	.31**	.41**	4.28	4.34	4.43	.07	.14**
Boys	3.31	3.57	3.49	.25**	.18**	4.00	4.26	4.34	.25**	.33**	4.21	4.43	4.42	.15**	.18**
Age															
12-13	3.42	3.56	3.53	.14**	.12**	4.04	4.35	4.46	.31**	.43**	4.66	4.73	4.76	.07*	.11**
14-15	3.22	3.50	3.39	.28**	.18**	3.98	4.25	4.33	.26**	.34**	4.10	4.29	4.39	.18*	.29**
16	-a	-a	-a	-a	-a	3.96	4.19	4.21	.24*	.23**	3.09	3.18	3.00	-.03	-.13
Educational track															
Academic	3.37	3.56	3.51	.19**	.13**	4.06	4.35	4.42	.29**	.36**	4.27	4.45	4.50	.11	.19**
Vocational	3.29	3.52	3.44	.24**	.16**	3.96	4.22	4.34	.27**	.38**	4.22	4.32	4.34	.13*	.14**

p for trend analysis: significant for all parenting practices for all groups (*p* < .001), except for alcohol-specific rules for 16-year olds (*p* = .18). To ensure that trend patterns with respect to the parenting scales were not driven by single items, we repeated all analyses with the single items. The trend patterns of the single items were, overall, identical to the trend patterns of the corresponding scales. *p* < .01; **p* < .001. [a] Parents were asked about the harmfulness of drinking under the age of 16 (legal drinking age in the Netherlands). Only parents of adolescents under the age of 16 are included in these analyses (scale range: 1-4); [b] Scale range: 1-5; [c] *M* = raw mean; [d] B = unstandardized result of multivariate regression analysis adjusted for gender, age, educational level, ethnicity, and family structure (ref. 2007).

Perceived harmfulness of adolescent drinking increased among parents in all subgroups. In 2007, parents scored 3.33 on average on the scale (1-4). This increased to 3.54 in 2009 and stabilized at 3.47 in 2011. The increase was not equally strong across adolescent age groups. Among parents of 14-15 year olds, the increase between 2007 and 2009 was stronger compared to parents of 12-13 year olds ($B = 0.14$, $p < 0.001$). There were no other significant interactions.

The perceived quality of alcohol-specific communication also increased among parents in all subgroups. In 2007, parents scored 4.00 on average on the 5-point scale. In 2009, they scored 4.29 and in 2011 4.38. A significant interaction effect between age and survey year was identified. The increase across years was stronger among parents of 12-13 year olds compared to parents of 16-year olds (2011 vs. 2007; $B = -0.19$, $p = 0.004$). There were no other significant interactions.

Finally, parent reports of alcohol-specific restrictive rule setting increased from 2007 to 2011. In 2007, parents scored 4.25 on average on the 5-point scale. In 2009, they scored 4.39 and in 2011, they scored 4.42. One exception involved parents of 16-year olds (compared to adolescents of younger age groups) who did

not report more rule-setting over time. Further, when comparing 12-13 year olds with 14-15 year olds, the increase in alcohol-specific rules was stronger among the latter group (2011 vs. 2007). This resulted in a significant interaction effect (2011 vs. 2007: $B = 0.18$, $p < 0.001$). There were no other significant interactions.

Trends in adolescent alcohol use between 2007 and 2011

Time trends in adolescent lifetime and last month alcohol use are presented in Table 3. In 2007, 75.3% of the adolescents reported having ever drunk alcohol. In 2009, this percentage decreased to 68.1% and in 2011, 63.2% of the adolescents reported having ever drunk alcohol. However, lifetime prevalence among 16 year olds did not decrease, but this did not result in any significant interaction effects.

The prevalence of last month alcohol use also decreased, from 42.1% in 2007 to 32.7% in 2011. These decreases occurred to a similar degree in all subgroups of adolescents, except for the 16-year olds. Among 16-year olds, the prevalence of last month alcohol use did not decrease. Accordingly, significant interaction effects of age group (12-13-year olds versus 16-year olds) and survey year were identified ($OR = 2.35$, $p = 0.004$ in 2009; $OR = 3.41$, $p < 0.001$ in 2011).

Table 3 presents time trends concerning the average number of glasses of alcohol that adolescents reported drinking during a weekend. Overall, in 2007, adolescents reported drinking an average of 2.86 glasses on weekends. In 2009, this number decreased to 1.85. In 2011, however, it increased again to 2.41 glasses per weekend. The trends were similar for boys and girls and for adolescents in different educational tracks. With respect to age group, one significant interaction effect was identified. In 2009, compared to 2007, the decrease in the number of glasses was stronger among 14-15-year olds compared to 12-13 year olds ($B = -1.06$, $p = 0.008$).

In an additional analysis, we repeated the trend analyses concerning the average number of glasses consumed on the weekend for drinkers (i.e., adolescents who reported to have drunk alcohol in the past month) only. Overall, drinkers reported consuming an average of 6.58 glasses on weekends in the 2007 survey, 4.89 glasses on weekends in the 2009 survey, and 7.56 glasses on weekends in the 2011 survey. Thus, among drinkers the number of glasses consumed decreased between 2007 and 2009 ($p = .004$). but increased between 2009 and 2011 ($p < 0.001$). The increase between 2007 and 2011 was not significant ($p = 0.09$).

Table 3: Trends in adolescent alcohol use between 2007 and 2011 (N = 3615 for 2007, N = 2953 for 2009, N = 3229 for 2011)

	Lifetime-prevalence of alcohol use					Last month prevalence of alcohol use					Number of glasses during a weekend				
	% [a]			Adjusted OR [b]		% [a]			Adjusted OR [b]		M [c]			Adjusted B [d]	
Survey year	2007	2009	2011	2009	2011	2007	2009	2011	2009	2011	2007	2009	2011	2009	2011
Total	75.3	68.1	63.2	.72**	.51**	42.1	37.3	32.7	.84	.62**	2.86	1.85	2.41	-.85*	-.26
Gender															
Girls	72.8	66.4	58.9	.72*	.47**	40.6	37.4	31.9	.82	.62**	2.44	1.69	1.99	-.80*	-.35
Boys	77.6	69.7	67.2	.71*	.55**	43.6	37.3	33.5	.86	.61**	3.24	2.01	2.79	-.81	-.18
Age															
12-13	61.0	50.4	43.4	.69**	.48**	20.7	14.5	11.2	.71*	.47**	.61	.20	.28	-.35**	-.30*
14-15	84.7	79.9	75.8	.73	.54**	54.6	50.6	42.9	.87	.62**	3.74	2.36	2.87	-1.33**	-.78
16	93.3	94.2	92.2	1.34	.83	75.7	80.5	82.3	1.83	1.68	8.61	7.31	10.2	.04	2.21
Educational track															
Academic	73.7	64.7	58.4	.70*	.46**	40.0	32.2	30.4	.78	.63**	2.24	1.34	2.02	-.62	-.02
Vocational	76.6	71.8	67.9	.76	.58**	43.9	42.9	35.0	.92	.60**	3.37	2.41	2.80	-1.09*	-.49

p for trend analysis: for lifetime and last month prevalence of alcohol use, *p* for trend was significant for all groups (*p* < .001), except for 16-year olds. For the number of glasses during a weekend, *p* for trend was not significant, except for 12-13-year olds (*p* < .01). * *p* < .01; ** *p* < .001. [a] % = raw percentage; [b] OR = Odds ratio; result of multivariate logistic regression analysis adjusted for gender, age, educational level, ethnicity, and family structure (ref. 2007); [c] *M* = raw mean; [d] B = unstandardized result of multivariate regression analysis adjusted for gender, age, educational level, ethnicity, and family structure (ref. 2007).

Are alcohol-specific parenting practices associated with adolescent alcohol use?

Table 4 presents the results of the multiple (logistic) regression analyses predicting adolescent alcohol use. In accordance with the aforementioned results, significant time effects were observed for all three alcohol outcomes (Model 1).

The results of Model 2 show that perceived harmfulness was negatively related to last month alcohol use, but not to lifetime alcohol use (although *p* = 0.01) and the quantity of alcohol consumed. Quality of alcohol-specific communication and alcohol-specific rule setting were negatively associated with all three outcomes of adolescent alcohol use. In Model 2, the association between survey year and adolescent alcohol use generally decreased in strength due to the addition of the alcohol-specific parenting variables. This may indicate that increasing trends in alcohol-specific parenting practices may in part account for the decreasing trends in adolescent alcohol use.

The results of Model 3a reveal that the associations between alcohol-specific parenting and adolescent alcohol use were similar for boys and girls, with one exception: the association between alcohol-specific rules and the number of glasses consumed was stronger for boys than for girls. Model 3b shows that

Table 4: Results of multiple (logistic) regression analysis examining alcohol-specific parenting, time, and their interaction as possible determinants of adolescent alcohol use (N = 3615 for 2007, N = 2953 for 2009, N = 3229 for 2011)

		Lifetime alcohol use	Last month alcohol use	Number of glasses consumed
		OR (CI 95%)	OR (CI 95%)	B (SE)
Model 1: Time	Time			
	2009 (ref 2007)	0.72**(0.61-0.85)	0.84 (0.70-1.01)	-0.85*(0.24)
	2011 (ref 2007)	0.51**(0.44-0.59)	0.62**(0.52-0.73)	-0.26 (0.23)
Model 2: + alcohol-specific parenting [a]	Time			
	2009 (ref 2007)	0.83 (0.70-0.97)	1.03 (0.85-1.24)	-0.35*(0.22)
	2011 (ref 2007)	0.60**(0.52-0.70)	0.78*(0.65-0.92)	-0.42 (0.22)
	Perceived harmfulness	0.88 (0.80-0.97)	0.84*(0.76-0.93)	-0.13 (0.16)
	Quality of alcohol-specific communication	0.80*(0.73-0.88)	0.72**(0.66-0.78)	-0.95**(0.13)
	Alcohol-specific rules	0.67**(0.61-0.73)	0.62**(0.57-0.67)	-1.75**(0.15)
Model 3a: + interactions alcohol-specific parenting x gender	Perceived harmfulness x male gender	0.99 (0.82-1.21)	1.05 (0.86-1.27)	-0.30 (0.20)
	Alcohol-specific communication x male gender	0.99 (0.82-1.21)	0.94 (0.81-1.11)	-0.33 (0.23)
	Alcohol-specific rules x male gender	1.17 (1.00-1.37)	1.04 (0.92-1.19)	-1.35**(0.26)
Model 3b: + interactions alcohol-specific parenting x age group	Perceived harmfulness x 14-15-year olds	0.80 (0.64-1.00)	0.95 (0.76-1.18)	-1.13**(0.18)
	Perceived harmfulness x 16-year olds	-	-	-
	Alcohol-specific communication x 14-15-year olds	1.05 (0.87-1.26)	1.10 (0.94-1.30)	-1.09**(0.20)
	Alcohol-specific communication x 16-year olds	0.86 (0.50-1.48)	0.86 (0.64-1.15)	-2.37**(0.67)
	Alcohol-specific rules x 14-15-year olds	0.72**(0.61-0.84)	0.75**(0.64-0.88)	-1.60**(0.18)
	Alcohol-specific rules x 16-year olds	0.33*(0.22-0.49)	0.59**(0.45-0.78)	-4.02**(0.45)

Table 4: Results of multiple (logistic) regression analysis examining alcohol-specific parenting, time, and their interaction as possible determinants of adolescent alcohol use (N = 3615 for 2007, N = 2953 for 2009, N = 3229 for 2011) (continued)

	Lifetime alcohol use	Last month alcohol use	Number of glasses consumed
	OR (CI 95%)	OR (CI 95%)	B (SE)
Model 3c alcohol-specific parenting × educational track			
Perceived harmfulness x vocational track	0.94 (0.76-1.16)	0.92 (0.76-1.11)	-0.39 (0.23)
Alcohol-specific communication x vocational track	1.11 (0.91-1.35)	1.12 (0.94-1.33)	-0.24 (0.25)
Alcohol-specific rules x vocational track	0.99 (0.84-1.17)	1.03 (0.90-1.18)	-0.41 (0.32)
Model 4: + interactions alcohol-specific parenting × time			
Perceived harmfulness x 2009	0.98 (0.75-1.29)	0.87 (0.69-1.10)	-0.15 (0.32)
Perceived harmfulness x 2011	1.05 (0.83-1.32)	0.87 (0.67-1.12)	0.09 (0.27)
Alcohol-specific communication x 2009	0.68** (0.55-0.83)	0.80 (0.65-0.99)	-0.01 (0.31)
Alcohol-specific communication x 2011	0.66** (0.55-0.80)	0.79 (0.65-0.96)	-0.14 (0.34)
Alcohol-specific rules x 2009	0.97 (0.78-1.19)	0.96 (0.81-1.15)	0.59 (0.38)
Alcohol-specific rules x 2011	1.12 (0.91-1.37)	1.01 (0.85-1.21)	-0.31 (0.39)

All models adjusted for gender, age, educational level, ethnicity, and family structure. In model 2 all parenting variables were entered simultaneously. In models 3 and 4 all interactions were entered separately. In models 3 and 4 interaction terms including "perceived harmfulness of drinking under the age of 16" were analyzed including only parents of adolescents under the age of 16. * $p < .01$; ** $p < .001$. [a] (Changed) estimates for the time trends in Model 2 give insight into the potential influence of trends in alcohol-specific parenting on trends in adolescent alcohol use.

the strength of associations between alcohol-specific parenting and adolescent alcohol use in some instances differed across age group. First, the association between perceived harmfulness and the number of glasses consumed was stronger for 14-15-year olds, compared to 12-13-year olds. Second, the association between parental perceptions of the quality of alcohol-specific communication and the number of glasses consumed by adolescents was stronger for older age groups (14-15 and 16-year olds) compared to the youngest age group (12-13-year olds). Finally, the association between alcohol-specific rules and adolescent alcohol use (lifetime and last month alcohol use and the number of glasses consumed) was also stronger for older age groups. Model 3c showed that associations between alcohol-specific parenting practices and adolescent alcohol use were similar for adolescents attending vocational and academic educational tracks.

Model 4 revealed no significant interactions of survey year by alcohol-specific parenting practices on adolescent alcohol use, implying that these associations are stable over time. There was one exception: the association between the parental perceptions of the quality of alcohol-specific communication and adolescent lifetime alcohol use changed over time in that the association was not significant in 2007, but it was significant and negative in 2009 and 2011.

Discussion

This study aimed to identify trends in alcohol-specific parenting practices and adolescent alcohol use between 2007 and 2011. We had three main findings. First, compared to 2007, parents in 2009 reported greater awareness of the harm of alcohol use by their children, better quality of communication with their child about alcohol use, and increased likelihood of setting rules with respect to their child's alcohol use. These increases stabilized or continued in 2011. The only exception was that parents of 16-year olds did not report increasing their rule setting about alcohol use. Second, adolescent reports of both lifetime and last month prevalence of alcohol consumption decreased considerably between 2007 and 2011, while the reports of the number of glasses consumed during a weekend fluctuated. Reports of alcohol use did not decrease among 16-year olds. Third, alcohol-specific parental attitudes and practices were negatively associated with adolescent alcohol use. Associations tended to be stronger for older age groups and were generally stable across survey waves.

The increased prevalence rates of strict alcohol-specific parenting practices and the decrease in lifetime and last month alcohol use among adolescents suggest a decreased risk of experiencing the negative effects of alcohol use among

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Dutch adolescents, especially those in the younger age groups. It is noteworthy that these developments occurred in all age, gender and educational subgroups (except for the 16-year olds). This may reflect the fact that national prevention efforts aimed at postponing alcohol use at least until the age of 16 have been successful. Yet, while our results are compelling and consistent with an effect of the mass media campaigns, it needs to be noted that similar changes in adolescent alcohol use have also been observed in other European countries, meaning that the observed decrease in alcohol use among Dutch adolescents may have derived from other, more general cultural shifts in Europe. The prevention programs targeting alcohol-specific parenting practices and their potential effects on adolescent alcohol use should be interpreted in the context of these changing cultural and societal developments.

There were two main exceptions to the general increase in alcohol-specific parenting and the decrease in adolescent alcohol use. First, the number of glasses of alcohol consumed during a weekend was the only alcohol use outcome that did not decrease from 2007 to 2011. Second, the results for 16-year olds indicated a lack of an increase in parental rule setting and a lack of a decrease in adolescent alcohol use. The average number of glasses reported as being consumed on a weekend by 16-year olds remained high, dramatically higher than younger age groups. These two exceptions may possibly reflect the messages conveyed in Dutch prevention programs from 2006 onwards. Specifically, parents were advised to postpone their children's alcohol use at least until they reached the age of 16. Although prevention programs also stressed the harmful effects of alcohol on young people in general (including adolescents aged 16 and over) and underlined that *if* adolescents drink, they should drink limited amounts of alcohol, the straightforward message of 'no drinking before the age of 16' may have been picked up by most parents. Parents may have found it difficult to continue their practices after their child turned 16, as they had already communicated the message that their child would have more freedom with respect to drinking from age 16 onwards. Furthermore, parents may have focused more on the *moment* at which their adolescent started drinking rather than the *quantity* they drank.

As expected, overall, alcohol-specific parenting practices and adolescent alcohol use were negatively associated. However, perceived harmfulness was related neither to lifetime alcohol use nor to the quantity (number of glasses) consumed. While the results revealed no direct association, parental perceived harmfulness may be a condition for the adoption of strict and effective parenting practices that reduce the amount of alcohol consumed by adolescents. It is important to note that different alcohol-specific parenting practices can increase

each other's effectiveness (Stigler et al., 2006). Parent-based alcohol interventions should therefore not be limited to encouraging single parenting practices; they should aim for simultaneous improvement of various components within the parenting context (Koning et al., 2012).

The associations between alcohol-specific parenting and adolescent alcohol use were stronger for older age groups (14-16 year olds) compared to younger age groups (12-13-year olds). This may reflect the fact that alcohol use among younger adolescents is infrequent, which makes it more difficult to identify a strong association between alcohol use and parenting behaviors in these age groups. Our findings imply that while parents of older adolescents may believe that they have less influence on their child's behavior compared to parents of younger adolescents, their influence may be just as substantial. This entails an important prevention message for future years, suggesting that it may be fruitful to concentrate on parents of older adolescents by stressing their continued influence on their children's drinking behaviors.

The associations between adolescent alcohol use and alcohol-specific parenting practices were stable over time, except for the association between the parental perceptions of the quality of alcohol-specific communication and lifetime alcohol use. This association became stronger over time. This may be explained by the fact that prevention programs in 2009 explicitly educated parents about how to communicate effectively with their adolescents about alcohol. As a result, parental definitions of high-quality alcohol-specific communication may have changed over time. For example, parents may have increasingly conceptualized high-quality communication as communication in which they can be strict about what is allowed and not allowed while initially believing that a more lenient approach is the best.

Strengths and limitations

This study has a number of strengths, such as the use of large datasets, a standard protocol for the data collection across the three study waves, and a semi-experimental design. However, it is limited by its use of repeated cross-sectional surveys, meaning that causality cannot be inferred. While the increase in alcohol-specific parenting practices coincided with a decrease in adolescent alcohol use, and the parenting practices related negatively with adolescent alcohol use, this is not sufficient evidence to conclude that the decrease in adolescent alcohol use was *caused* by an increase in alcohol-specific parenting practices. To make such a conclusion, future longitudinal and experimental research should investigate

whether adolescent alcohol use increases less over time if their parents adopt stricter alcohol-specific parenting practices.

A second limitation is that the observed increases in alcohol-specific parenting practices are relatively small. This is likely to reflect a ceiling effect, as the initial (2007) scores were already high (i.e., 3.33 out of 4; 4.00 out of 5; and 4.25 out of 5). The high initial scores in 2007 may be explained by the fact that prevention programs aimed at reducing adolescent alcohol use started in 2006 already, which may have influenced parents in 2007. Our finding that all of the three parenting scales showed a significant increase from 2007 to 2011 suggests that the increases, albeit small, are meaningful and important.

A third limitation is the selective response of parents. For each study wave, about 50% of the parents who were approached responded to our invitation to participate in the study. As a result, adolescents in our sample were younger, more often enrolled in academic tracks, less likely to have an ethnic minority background, more likely to live with both biological parents, and less likely to drink alcohol. We corrected for this selective response by weighting our data for adolescents' educational track, grade, gender, and level of urbanization. However, as weighting procedures cannot completely compensate for non-response biases, the effect sizes in our study may be slightly inflated.

Fourth, we used self-report data on alcohol-specific parenting practices (parent report) and adolescent alcohol use (adolescent report), which entails the risk of socially desirable answers. Parent and adolescent perceptions of alcohol-specific rules differ considerably, with parents reporting stricter rules compared to adolescents (Dorsselaer van et al., 2010; Verdurmen et al., 2008; 2012). Our parent data may thus be biased towards higher scores (reporter bias). Further, adolescent perceptions are stronger predictors of their own alcohol use compared to parent perceptions (Koning et al., 2011a). Our estimates of the associations between alcohol-specific parenting practices and adolescent alcohol use should therefore be considered conservative. To ensure that adolescents would complete our questionnaire honestly, research assistants stressed anonymity before administering the questionnaires.

Finally, in this study, we did not investigate several possible determinants of adolescent alcohol use, including personality factors, such as sensation seeking and disinhibition, family factors, such as birth order and behaviors of older siblings, and biological or genetic markers. Although we included an important set of social and individual factors as confounders in our models, a more elaborate model of alcohol use should include additional personality, family, and biological factors, as well as their interactions.

Implications

This study shows that the recent change in social policy and in societal perspectives on adolescent alcohol use may have resulted in stricter alcohol-specific parenting practices and a decrease in adolescent alcohol use in the Netherlands. This study can be perceived as a test case for countries that recently experienced similar socio-cultural changes. Our findings are consistent with the national policy on adolescent alcohol use in the Netherlands between 2007 and 2011. As alcohol use among 16-year olds and the quantity of alcohol consumed did *not* show a decrease over time, future policy efforts might pay more attention to the quantity of alcohol consumed by adolescents and to alcohol prevention among adolescents aged 16 years and over. The large quantities of alcohol consumed by 16-year olds are especially worrisome and deserve more attention.

4 | FAMILY INTERVENTIONS AND THEIR EFFECT ON ADOLESCENT ALCOHOL USE IN GENERAL POPULATIONS; A META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

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Abstract

In order to quantify the effectiveness of family interventions in preventing and reducing adolescent drinking, we conducted a meta-analysis of randomized controlled trials. We searched the Cochrane Database of Systematic Reviews, ERIC (Educational Research Information Center), Medline and PsycInfo for studies published between 1995 and September 2006. Summary estimates (OR and Cohen's *d*) were derived from the difference in changed alcohol consumption between family intervention and control group. Random effect models were used to estimate the overall effect and heterogeneity among studies. Eighteen papers describing nine independent trials were eligible for inclusion in this meta-analysis. The overall effect of family interventions in reducing alcohol initiation (OR: 0.71; 95% CI: 0.54, 0.94) and frequency of alcohol use (*d*: -0.25; 95% CI: -0.37, -0.12) show the success of these programs. There was heterogeneity between studies reporting on alcohol initiation (*p*-heterogeneity: <0.001; I^2: 78.6%). Yet, the most successful interventions continued to be effective in reducing alcohol initiation even at 48 months follow-up (Pooled estimate (OR): 0.53; 95% CI: 0.38, 0.75). The results from this meta-analysis suggest that the overall effect of family interventions on adolescent alcohol use is small, yet consistent and effective even at 48 months.

Introduction

Underage drinking is a major public health problem in Western Society. In 2003 18% of the 12-14 year old students in the US reported binge drinking, where 'binge drinking' is defined as taking at least five drinks (each of 10 mg pure ethanol) on a single occasion (Miller et al., 2007). In 2006, 73% of 16 year old US students reported any alcohol use and 56% reported having been drunk at some point in their lives (Johnston et al., 2007). In Northern Europe these numbers are even higher; nearly all 15-16 year old students (>90%) have drunk alcohol at some point in their lives, on average beginning at age 12, and getting drunk at age 14 (Anderson and Baumberg, 2006).

Several studies indicate that alcohol use and misuse among children under 16 is associated with elevated risks of a physical and a social nature (Bonomo et al., 2001; Hingson et al., 2000; Verdurmen et al., 2005). Moreover, in young people it may permanently disturb the development of the brain (Hiller-Sturmhöfel and Swartzwelder, 2004; Tapert et al., 2002) and create alcohol-related problems later in life (DeWit et al., 2000; Grant et al., 2006; Hawkins et al., 1997). Therefore, delaying the onset of drinking is an important goal for prevention efforts (Pitkänen et al., 2005).

Parents play an important part in the initiation of alcohol use. The example set by parents with their own drinking has been shown to affect their children's alcohol use (White et al., 2000). Adolescents model their behavior after their parents' patterns, contexts, attitudes and expectancies of consumption. The family's structure and aspects of the parent-child relationship (parenting style, attachment, nurturance, abuse, conflict, discipline and monitoring) have also been linked to young people's alcohol use (Andrews et al., 1993; Ary et al., 1993; Kandel, 1980; White et al., 2000). In addition, alcohol specific parenting, such as setting clear rules on drinking, prevented adolescents from starting to consume alcohol heavily and frequently (Van der Vorst et al., 2005).

Several interventions have been developed for parents and families in order to prevent or reduce substance use and abuse in children. Most studies targeted high-risk families (Paglia and Room, 1999). A recent review of both experimental and naturalistic follow-up studies concludes that most studies demonstrated positive effects of family-based interventions in reducing youth substance use and other high-risk behaviors (Thompson et al., 2005). Kumpfer et al. (2003) reviewed family-based intervention studies and found evidence of effectiveness for outcome types like bonding, communication, aggression and substance use in high-risk families. These authors stated that family-based interventions

have effect sizes 2-9 times greater than approaches that are solely child focused. Bolier and Cuijpers (2000) conducted a systematic literature review of controlled studies, describing seven family-based substance use prevention programs. The authors reported some evidence that family-based prevention programs may reduce alcohol use, in general populations.

In conclusion, earlier reviews describe a number of family interventions that are effective in reducing alcohol use among adolescents, yet, to our knowledge, a meta-analytic evaluation of the association between adolescent alcohol use and family interventions in general populations has never been conducted. We carried out a meta-analysis, restricted to randomized controlled trials, as naturalistic follow-up studies are more prone to confounding, thus introducing uncertainty about causality. As alcohol is used by the majority of the adolescent population (at age 15-16), we are interested in the effectiveness of a "whole group" approach of prevention, therefore including only family programs in general populations. The aim of this meta-analysis is to quantify the overall effect of family-interventions in reducing adolescent drinking (i.e., initiation, alcohol use in the last month, and frequency of drinking in the last month). In addition we performed stratified analyses for ethnicity, intervention type, randomization level (i.e., individual versus group) and publication year to get a clearer understanding of the different interventions and their respective effectiveness.

Method

Identification of studies

A search strategy was designed to identify studies reporting on a family intervention aimed at reducing alcohol use in adolescents aged under 16. We identified studies from four electronic databases: the Cochrane Database of Systematic Reviews, Educational Research Information Center (ERIC), MEDLINE and PsycInfo (including Dissertation Abstracts). We included studies published between 1995 and September 2006. Subsequently, references of included articles and earlier reviews and meta-analyses were used to search for additional studies.

Alcohol-related search terms included 'alcohol', 'alcohol use', 'drink', 'drinking', 'alcohol drinking patterns' and 'alcohol drinking attitudes'. The intervention-related search terms included 'mother', 'father', 'maternal', 'paternal', 'family', 'parent', 'parenting', 'parental characteristics', 'parent child relations', 'mother child relations', 'parental attitudes', 'parenting style' and 'parenting skills'. Pertinent (mesh) terms were adapted for use in the different databases by an information specialist. All Dutch and English full-text articles of random-

ized controlled trials that reported on adolescents or school age children were included in the search strategy.

Published articles as well as (possibly unpublished) dissertations were included when, 1) targeting parents with children <16 years of age, 2) describing a family intervention (at least half of the program had to be targeting parents directly), 3) all types of learning media were included e.g. group sessions, skills training, booklets and CD-ROM programs, 4) the intervention was carried out in a general population and 5) reporting on the effectiveness of the study. Articles were excluded when, 1) the intervention was designed to manage at-risk groups, like juvenile offenders or children of alcoholics, 2) interventions were part of a multi-component intervention and no separate analyses were performed for family interventions, 3) the outcome was not actual alcohol use, e.g. intention to drink and 4) the subjects were not randomly assigned to the intervention or control condition.

All possibly relevant papers were selected by one reviewer according to a two-step procedure: where possible, the decision to exclude studies was based on the abstract. When articles could not be excluded on this basis, the decision for inclusion was based on the full paper.

Data extraction

Data-extraction was performed independently by two reviewers. Differences between reviewers were discussed and resolved by consensus. For each selected article, information was extracted about the characteristics of the publication, population, study design, intervention, analysis and the follow-up times at which the end points were measured. Furthermore, outcome specific information was collected, such as outcome type (e.g. alcohol initiation) and effect sizes (e.g. odds ratio (OR) or Cohen's *d*). When an article reported data comparing two or more types of treatment, data were reported separately for each treatment condition relative to the control group. When a study included a 'school-based intervention group', a 'school-based plus a parent intervention group' and a 'minimal intervention control group', the school-based intervention group was used as the comparison group, since we were interested in the unique effect of family interventions.

Data analysis

We conducted separate analyses for three different outcome types (alcohol initiation, last month alcohol use and frequency of alcohol use), as more than two

independent estimates were eligible for analyses of these outcome types. Papers were included in the alcohol initiation analysis when they reported on lifetime (ever/never) alcohol use. Recent alcohol use included ever/never use in the last 30 days or past month. Frequency of alcohol use included 'average number of drinking occasions in the past month', 'quantity and frequency of beer, wine and liquor consumption over the past year', '30 and 7 day frequency of alcohol use' and 'frequency of beer or alcohol consumption in the past month'.

In addition, analyses were conducted separately for the two different estimates of effect (OR and Cohen's *d*). Estimates were suitable for meta-analysis when either OR and confidence interval (CI) or standard error (SE) were given or could be obtained, or when number of subjects, means and standard deviations (SD) were given or could be obtained both for the intervention and control group. When alcohol use was reported at pretest as well as at follow-up measures, we calculated the effect-size correcting for the pretest alcohol use.

We had a particular interest in long-term effects of the interventions; yet, follow-up times were not similar in all studies. To minimize the differences in follow-up times between studies, we used the most frequently cited follow-up time (either 24 or 30 months) when a study reported outcomes on different follow-up times and discarded the other time points. When a single study reported on two different populations, we used both estimates separately in the analyses. Hence, one study can have multiple effect sizes.

Random effect models were used for all analyses. We examined the occurrence of heterogeneity between studies using Q-statistic (which is χ^2 distributed); however, as the Q-statistic is not very sensitive when the number of studies is small, we also quantified the amount of heterogeneity between studies using I^2 (Higgins et al., 2003), which yields the percentage of variance between the individual studies' effect sizes that cannot be accounted for by chance (sample error). To gain insight into possible sources of heterogeneity, stratified analyses were carried out on subgroups, e.g. ethnicity (>50% Caucasian versus African-American); intervention type (parent-child versus parent targeted intervention; a parent-child intervention was defined as an intervention that targets not only parents but also actively involves the child in a substantial part of the intervention (at least half of the meetings, sessions or booklets was attended by the child separately or together with his/her parent). All other interventions were classified "parent intervention" as (most of) the intervention components were directed to parents only.); randomization level (group versus individual level; a group level intervention was defined as an intervention where all families in the group (mainly schools) received the same intervention, as opposed to random-

ization at the individual level targeting randomly selected families) and year of publication (articles published up to 2000 versus articles published since 2001). We did not perform stratified analyses by other intervention characteristics, as the interventions differed too much to permit categorization. We also conducted meta-regression analyses to investigate whether these study characteristics could affect results between studies. Meta-regression analyses provide outcomes in the form of a regression coefficient and confidence intervals. This regression coefficient represents the difference in effect between trials rated on the two levels of categorical variables (such as 'parent' and 'parent-child' interventions). The natural logarithm of the odds ratio was the outcome (dependent) variable, and the study characteristics (like intervention type) were explanatory variables. We followed a backward elimination procedure, first including all study char-acteristics in the model and step-wise excluding the non-significant ones. The meta-regression techniques described are analogous to logistic-regression. We performed sensitivity analyses by identifying and excluding possible outliers. A study was considered an outlier when the 95% CI of a single study did not overlap with the 95% CI of the pooled estimate.

We created funnel plots, and used the Begg's (Begg and Mazumdar, 1994) and Egger's (Egger and Smith, 1997) test to detect possible publication bias.

The statistical analyses were carried out using the statistic software package STATA-V9 (Stata Corp., College Station, TX). p Values that were less than 0.05 were considered statistically significant. All statistical tests were two-sided. One study reported a 95% lower limit based on a one-sided test (Bauman et al., 2000). We recalculated a 95% CI based on a two-sided test, and used the corresponding SE in the meta-analysis.

Results

We identified 113 articles from our database search. After reading abstracts and when necessary full texts, we included 13 articles. Most articles were excluded as they were not randomized controlled trials. About a third of the articles were excluded as the subjects were from a high risk population (e.g. juvenile offend-ers or adolescents with substance use disorders) or the outcome was not actual alcohol use, but e.g. parenting practices or likeliness to drink (including the "Keep a Clear Mind program" (Brody et al., 2004), "Parent Management Train-ing" (Young et al., 1996; Martinez and Eddy, 2005) and "Adolescent Transition Program") (Dishion et al., 2002). A small number of excluded articles described

school or community interventions (Komro et al., 2006; Williams et al., 1999) instead of family interventions (e.g. Project Northland) (Komro et al., 2006).

Five additional articles were included after a reference search of the above 13 articles. In the 18 articles (Bauman et al., 2000; Bauman et al., 2001a,b, 2002; Brody et al., 2006; Gerrard et al., 2006; Guyll et al., 2004; Loveland-Cherry et al., 1999; Park et al., 2000; Schinke et al., 2004; Spoth et al., 1999a,b, 2001, 2002, 2005; Stevens et al., 2002; Werch et al., 1998, 2003) (Tables 1 and 2) nine randomized trials were described.

Table 1: Intervention characteristics of 18 publications of randomized controlled trials describing nine interventions focusing on parents (and their children), with the intention to reduce or delay alcohol consumption of adolescents.

Author, year	Intervention name (type)	Intervention characteristics	Control group
Loveland-Cherry et al. (1999)	CAPR (family)	Children and Parent Relations (CAPR); Three home-based intervention sessions at fourth grade, family meetings afterwards and follow-up telephone calls. All proposed to maximize protective factors and minimize parent/family risk factors and build competencies. Booster sessions between 36 and 48 months of follow-up.	The control condition was not described in the article.
Schinke et al. (2004)	CD-ROM + parent-intervention; (parent)	Thirty minute videotape and print materials to demonstrate how parents could help their children to avoid problems with alcohol. Furthermore, the value of family rituals, rules and bonding in the context of alcohol use prevention was explained. Between follow-up measures were booster sessions.	Child CD-ROM prevention program of 10 sessions covering issues like peer pressure, refusal skills and effective communication. Between follow-up measures were booster sessions.
Stevens et al. (2002)	Dartmouth prevention project; (family)	Clinician messages to encourage family communication and rule setting about alcohol and tobacco onset. Both child and parent received quarterly newsletters to reinforce the clinician messages. The intervention continued for 36 months, follow-up measurements were performed during the intervention.	The control group received an intervention focused on gun safety, bicycle helmet and seatbelt use.
Bauman et al. (2000, 2001a[a]; 2001b[a], 2002)	Family matters; (parent)	Four booklets and child-parent activities covering general parenting like supervision, support, communication skills, attachment, time spent together; alcohol specific parenting such as rules related to alcohol use; and non-family influences that matter.	The control condition was not described in the article.

Table 1: Intervention characteristics of 18 publications of randomized controlled trials describing nine interventions focusing on parents (and their children), with the intention to reduce or delay alcohol consumption of adolescents. (continued)

Author, year	Intervention name (type)	Intervention characteristics	Control group
Spoth et al. (1999a, 1999b [a], 2001); Guyll et al. (2004)[a]	ISFP; (family)	Iowa's Strengthening Families Program (ISFP) (adjusted from the SFP); Seven two hour sessions for children and parents and one hour together and one hour separately; training of parenting, norm setting and communication skills of parents; skills training for children focusing on communication, management of stress, conflict, emotions and resistance.	Minimal contact control condition (four mailed leaflets describing different aspects of adolescent development).
Brody et al. (2006); Gerrard et al. (2006)[a]	SAAF; (family)	The Strong African American Families Program (SAAF) (adjusted from SFP); similar to ISFP yet adjusted for the specific rural African-American population. Community liaisons were African American community members, selected on the basis of their social contacts and standing in the community.	Minimal intervention control: three leaflets via postal mail, describing adolescent development, exercise encouragement and stress management
Spoth et al. (2002, 2005[a])	SFP10-14; (family)	The intervention group received both Strengthening Families Program (SFP10-14) + Life Skills Training (LST, see control group); SFP program contains seven two hour sessions for children and parents, one hour together and one hour separately; aimed at reducing youth substance use and other problem behavior; intermediate goals include the enhancement of parental skills in nurturing, limit setting, and communication, as well as youth pro-social and peer resistance skills. Four booster sessions 18 months after pretest.	LST: a 15 session school based prevention program aimed at promoting skills development (e.g. social resistance, self-management and general social skills) and to provide knowledge encouraging the avoidance of substance use. Five booster sessions 18 months after pretest.
Park et al. (2000); Spoth et al. (1999b, 2001); Guyll et al. (2004)[a]	PDFY; (parent)	Preparing for the Drug Free Years (PDFY); Four sessions attended by parents only, focusing on identifying risk factors, effective rearing strategies and conflict management. One session for both child and parent together focusing on peer resistance skills.	Minimal contact control condition (four mailed leaflets describing different aspects of adolescent development).
Werch et al. (1998[a]; 2003)	STARS for families; (family)	Start Taking Alcohol Risks Seriously (STARS) for families; A 2 year preventive intervention consisting of two nurse consultations, a series of postcards mailed to parents and up to nine family take-home lessons providing activities to enhance parent-child communication regarding prevention skills and knowledge. All intervention components were matched to the specific stage status and risk factors of individual youth, based on pre-intervention data.	Minimal intervention control

[a] Results from these papers were not included in the analyses.

Table 2: Study characteristics of randomized controlled trials on family intervention and alcohol use

Intervention definition	Reference (subgroup)	Outcome	N (intervention/control)	Follow-up time (Months)	Intervention type	Randomization level	Ethnicity child (majority of the population) (%)	Age (Mean age at pretest (age range/SD or SE))	Adjustments for confounders
Family matters	Bauman et al. (2002)	Alcohol initiation	531/604	23-26	P	Individual	Non-Hispanic white (73.4)	13.9 (SD=0.9)	Baseline use [a]
	Bauman et al. (2000) (baseline drinkers)	Last month drinking	99/104	23-26	P	Individual	Non-Hispanic white (73.4)	13.9 (SD=0.9)	[a]
SFP10-14	Spoth et al. (2002)	Alcohol initiation	453/503	18	PC	School	Caucasian (96)	12	
SAAF	Brody et al. (2006)	Alcohol initiation	172/133	29	PC	Community	African-American	11.2	Per capita income [b]
ISFP	Spoth et al. (1999a)	Alcohol initiation	153/141	30	PC	School	Caucasian (98)	11	
	Spoth et al. (2001)	Frequency last month	151/151	48	PC	School	Caucasian (99)	11.3 (SE=0.03)	
PDFY	Spoth et al. (2001)	Frequency last month	142/151	48	P	School	Caucasian (99)	11.3 (SE=0.03)	
	Park et al. (2000)	Last month drinking	144/151	48	P	School	Caucasian (99)	11.3	
	Spoth et al. (1999b)	Alcohol initiation	101/137	30	P	School	Caucasian (99)	11.0	
STARS for families	Werch et al. (2003) (magnet school)	Alcohol initiation	100/107	30	PC	Individual	African-American (58)	11.4 (SD=0.71)	Motivation to avoid drinking [c]
	Werch et al. (2003) (neighborhood school)	Alcohol initiation	150/150	30					

Table 2: Study characteristics of randomized controlled trials on family intervention and alcohol use (continued)

Intervention definition	Reference (subgroup)	Outcome	N (intervention/ control)	Follow-up time (Months)	Intervention type	Randomization level	Ethnicity child (majority of the population) (%)	Age (Mean age at pretest (age range/ SD or SE))	Adjustments for confounders
	Werch et al. (2003) (magnet school)	Last month drinking	100/107	30					
	Werch et al. (2003) (neighborhood school)	Last month drinking	150/150	30					
	Werch et al. (2003) (magnet school)	Frequency	141/142	30					
	Werch et al. (2003) (neighborhood school)	Frequency	83/93	30					
Cd-rom + parent intervention	Schinke et al. (2004)	Frequency last month	142/175	36	P	Community	54% black	11.5 (10-12)	
CAPR	Loveland-Cherry et al. (1999)	Quantity and frequency last year	90/338	48	PC	Individual	86% Caucasian	9	
Dartmouth prevention project	Stevens et al. (2002)	Alcohol initiation	-	24	PC	Pediatric practices	-	11 (10-12)	Clinic pair[d]

P = Parent intervention; PC = parent-child intervention; SD= Standard Deviation; SE = Standard Error

[a] Also adjusted for: ethnicity, age, gender, mother's education, number of parents living in the home

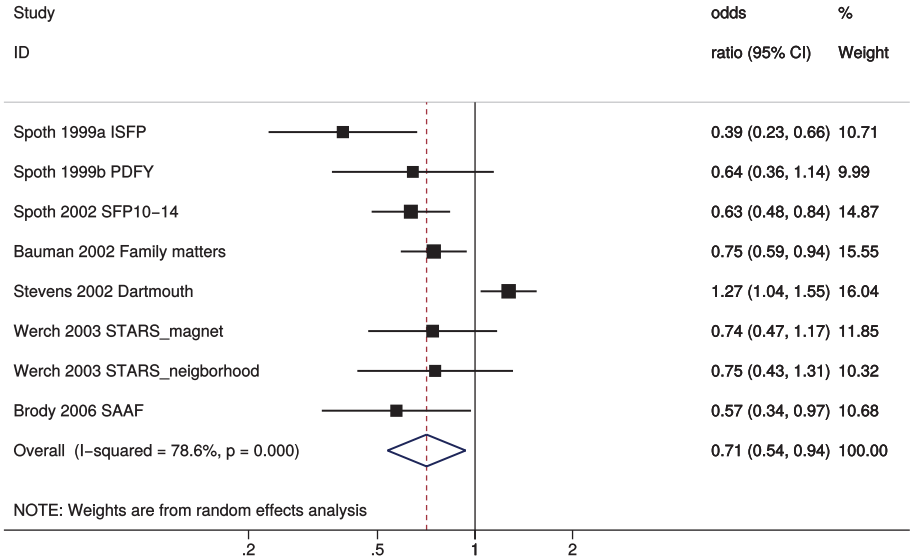[b] Also adjusted for: mother's education, mother's age, number of children in household

[c] Also adjusted for: expectancy beliefs, peer prevalence, influence ability, total risk factors for alcohol use

[d] Also adjusted for: baseline characteristics: age, parents' education, family income, gender, marital status of the parent, child's friends drinking, parents' self-esteem, parent with drinking problem.

4

Alcohol initiation

Eleven articles, describing seven independent studies, reported on alcohol initiation over the next 18–30 months. As one study reported on two separate population subgroups, eight estimates were eligible for analysis. All but one (Stevens et al., 2002) reported an OR below one (range: 0.39-0.75), suggesting a reduced likelihood of initiating alcohol use, due to the intervention. All but three estimates (Spoth et al., 1999b; Werch et al., 2003) had confidence intervals not including 1.0. Yet, the summary OR (95% CI) of the eight estimates was 0.71 (0.54, 0.94), implying a lower alcohol initiation level among the intervention group compared to the control group (Fig. 1).

Study ID	odds ratio (95% CI)	% Weight
Spoth 1999a ISFP	0.39 (0.23, 0.66)	10.71
Spoth 1999b PDFY	0.64 (0.36, 1.14)	9.99
Spoth 2002 SFP10–14	0.63 (0.48, 0.84)	14.87
Bauman 2002 Family matters	0.75 (0.59, 0.94)	15.55
Stevens 2002 Dartmouth	1.27 (1.04, 1.55)	16.04
Werch 2003 STARS_magnet	0.74 (0.47, 1.17)	11.85
Werch 2003 STARS_neigborhood	0.75 (0.43, 1.31)	10.32
Brody 2006 SAAF	0.57 (0.34, 0.97)	10.68
Overall (I–squared = 78.6%, p = 0.000)	0.71 (0.54, 0.94)	100.00

NOTE: Weights are from random effects analysis

Fig. 1: Forest plot for family intervention and alcohol initiation, considering eight independent estimates from seven randomized controlled trials, using a random effect model.

Testing for heterogeneity provided clear evidence to suggest heterogeneity between studies. About 78.6% (I^2) of the total variation was attributable to systemic variation across studies (Q=32.7; df=7; p<0.001). The 'Dartmouth prevention project study' (Stevens et al., 2002) was identified as an outlier, as the CI of this single study did not overlap the CI of the pooled estimate (Fig. 1, Table

3). When excluding this study from the analysis, heterogeneity between studies decreased substantially (Q=5.65; df=6; p=0.464; I^2: 0.0%). After excluding the outlier there remained a decreased risk of alcohol initiation in the intervention group (OR: 0.66; 95% CI: 0.57, 0.76). The outlier was excluded from additional analyses (Table 3), as this estimate might distort e.g. stratified analyses. Begg's and Egger's tests were performed to test for publication bias. There was no clear evidence to suggest publication bias (t= -2.16; df=7; p=0.074).

Table 3: Overall, stratified, and sensitivity analyses for the effect of family interventions on alcohol initiation, any use last month and frequency of alcohol use, using random effect models.

	No. of Studies (no. of estimates)		OR/d	95% CI (lower, upper limit)	Q for heterogeneity (df)	p for heterogeneity (I^2 (%))
Alcohol initiation	7	(8)	0.71 (OR)	0.54, 0.94	32.7 (7)	< 0.001 (78.6)
Sensitivity analysis outlier						
Dartmouth prevention project (outlier*)	1	(1)	1.27	1.04, 1.55		
All except Dartmouth	6	(7)	0.66	0.57, 0.76	5.65 (6)	0.464 (<0.1)
Ethnicity						
Caucasian	4	(4)	0.63	0.50, 0.79	4.91 (3)	0.179 (38.9)
African American	2	(3)	0.69	0.51, 0.92	0.67 (2)	0.717 (<0.1)
Intervention type						
Parent	2	(2)	0.73	0.59, 0.91	0.22 (1)	0.639 (<0.1)
Parent-child	4	(5)	0.62	0.51, 0.75	4.09 (4)	0.394 (2.1)
Randomization level						
Group	4	(4)	0.58	0.47, 0.71	2.66 (3)	0.447 (<0.1)
Individual	2	(3)	0.75	0.61, 0.91	0.00 (2)	0.999 (<0.1)
Year of publication						
Published up to 2000	2	(2)	0.49	0.30, 0.80	1.56 (1)	0.212 (35.9)
Published since 2001	4	(5)	0.69	0.60, 0.81	1.44 (4)	0.837 (<0.1)
Any use last month	3	(4)	0.70 (OR)	0.46, 1.05	5.03 (3)	0.170 (40.4)
Ethnicity						
Caucasian	2	(2)	0.75	0.31, 1.82	4.88 (1)	0.027 (79.5)
African American	1	(2)	0.65	0.39, 1.10	0.12 (1)	0.726 (<0.1)
Intervention type						
Parent	2	(2)	0.75	0.31, 1.82	4.88 (1)	0.027 (79.5)
Parent-child	1	(2)	0.65	0.39, 1.10	0.12 (1)	0.726 (<0.1)

Table 3: Overall, stratified, and sensitivity analyses for the effect of family interventions on alcohol initiation, any use last month and frequency of alcohol use, using random effect models. (continued)

	No. of Studies (no. of estimates)		OR/d	95% CI (lower, upper limit)	Q for heterogeneity (df)	p for heterogeneity (I^2 (%))
Randomization level						
Group	1	(1)	0.49	0.30, 0.80		
Individual	2	(3)	0.83	0.54, 1.28	2.28 (2)	0.320 (12.3)
Year of publication						
Published up to 2000	1	(1)	0.49	0.30, 0.80		
Published since 2001	2	(3)	0.83	0.54, 1.28	2.28 (2)	0.320 (12.3)
Sensitivity analysis						
Family matters	1	(1)	1.21	0.64, 2.26		
All except Family matters	2	(3)	0.56	0.39, 0.80	0.78 (2)	0.678 (<0.1)
Frequency of alcohol use	5	(6)	-0.25 (d)	-0.37, -0.12	8.23 (5)	0.144 (39.2)
Ethnicity						
Caucasian	3	(3)	-0.23	-0.37, -0.10	0.54 (2)	0.763 (<0.1)
African American	2	(3)	-0.25	-0.53, 0.03	7.53 (2)	0.023 (73.4)
Intervention type						
Parent	2	(2)	-0.40	-0.63, -0.17	2.04 (1)	0.153 (51)
Parent-child	3	(4)	-0.17	-0.29, -0.05	1.07 (3)	0.785 (<0.1)
Randomization level						
Group	3	(3)	-0.35	-0.51, -0.19	3.10 (2)	0.212 (35.5)
Individual	2	(3)	-0.13	-0.28, 0.01	0.27 (2)	0.874 (<0.1)
Year of publication						
Published up to 2000	1	(1)	-0.16	-0.40, 0.07		
Published since 2001	4	(5)	-0.26	-0.41, -0.12	7.55 (4)	0.109 (47)

[*] The estimate was identified as an outlier (see results section) and therefore not included in the further (stratified) analyses.

Last month alcohol use

Four articles (Bauman et al., 2000; Park et al., 2000; Werch et al., 1998, 2003) describing three independent studies, reported on 'any alcohol use last month'. As one study (Werch et al., 2003) reported on two separate population subgroups, four estimates were eligible for analysis. Three estimates provided an OR smaller than one (range= 0.49-0.74), suggesting a lower chance of last month alcohol use, due to the intervention. The summary OR (95% CI) was 0.70 (0.46, 1.05) at

follow-up (24-48 months following pretest), indicating a non-significant effect of family interventions in reducing last month alcohol use (Fig. 2).

The *Q*-statistic provided no evidence to suggest heterogeneity across studies ($Q= 5.03$; df= 3; $p= 0.17$), yet the corresponding I^2 test suggested that 40.4% of the total variation was attributable to systemic effects, but this may be over-estimated due to a lack of power (Higgins et al., 2003).

We did not perform any sensitivity analyses, as CIs of the included studies overlapped the CI of the pooled estimate. Also the number of studies was too small to perform sensitivity analyses or meta-regression analyses.

Begg's and Egger's tests revealed no evidence to suggest publication bias ($t=0.75$; df=3; $p=0.534$).

4

Study ID		odds ratio (95% CI)	% Weight
Park 2000 PDFY		0.49 (0.30, 0.80)	32.67
Bauman 2002 Family matters		1.21 (0.64, 2.26)	25.48
Werch 2003 STARS_neigborhood		0.74 (0.32, 1.72)	17.33
Werch 2003 STARS_magnet		0.61 (0.32, 1.17)	24.52
Overall (I–squared = 40.4%, p = 0.169)		0.70 (0.46, 1.05)	100.00

NOTE: Weights are from random effects analysis
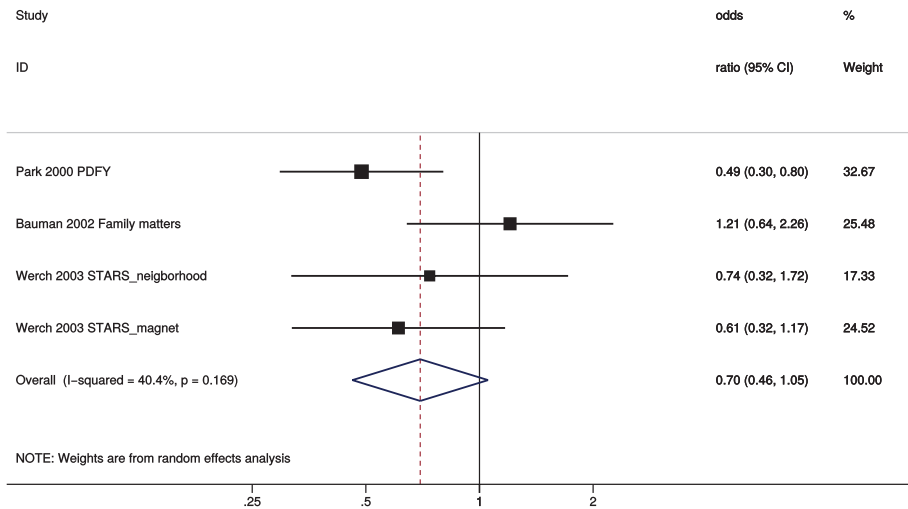
Fig. 2: Forest plot for family intervention and 'any alcohol use last month', considering four independent estimates from three randomized controlled trials, using a random effect model.

Frequency of alcohol use

Five articles (Loveland-Cherry et al., 1999; Schinke et al., 2004; Spoth et al., 2001; Werch et al., 1998, 2003) describing five independent studies, reported on '(quantity and) frequency of alcohol use' in the last month or last year. As one

study (Werch et al., 2003) reported on two separate population subgroups, six estimates were eligible for analysis. These yielded a significant effect of family interventions on frequency of alcohol use (Fig. 3). Cohen's ds were negative for all six estimates (range -0.52, -0.07), suggesting that the frequency of alcohol use was lower in the intervention compared to the control group. The summary estimate (95% CI) for frequency of alcohol use was -0.25 (-0.37, -0.12) at follow-up (36-48 months following pretest).

The I^2 test indicates that 39.2% (Q=8.23; df=5; p=0.144) of the total variation was attributable to variation across studies. We found no outlier, as the CIs of all included studies overlapped the CI of the pooled estimate. Also the number of studies was too small to perform a meaningful sensitivity analysis. Yet we observed that most of the variance between studies could be explained by excluding the 'CD-Rom + parent' study (Schinke et al., 2004). When excluding the 'CD-ROM + parent' study from the analysis, there was no evidence to suggest heterogeneity between studies (Q=1.79; df=4; p=0.775; I^2: <0.1%).

Begg's and Egger's tests did not reveal any evidence to suggest publication bias (t=1.37; df=5; p=0.243).
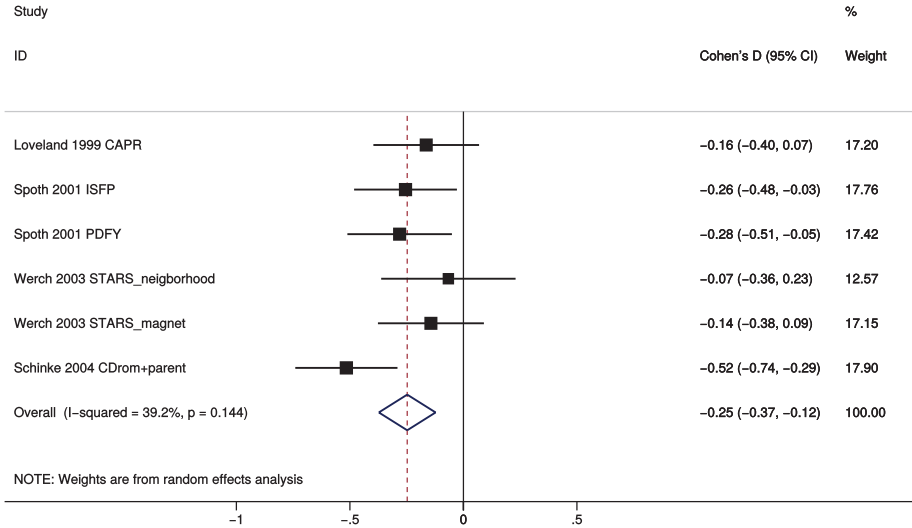

Fig. 3: Forest plot for family intervention and 'frequency of alcohol use', considering six independent estimates from five randomized controlled trials, using a random effect model.

Stratified analyses and meta-regression analyses

Stratified analyses were carried out for year of publication, intervention type, randomization level and ethnicity (Table 3). We did not observe any significant differences between strata, as the 95% CIs of the strata overlapped. Nevertheless, studies targeting all families within a group (mainly schools) showed a somewhat stronger effect, as compared to interventions targeting families independently, for all three outcome types: alcohol initiation (OR; 95% CI: 0.58; (0.47, 0.71)) (Brody et al., 2006; Spoth et al., 1999a,b, 2002) versus 0.75; (0.61, 0.91) (Bauman et al., 2002; Werch et al., 2003), any use last month (0.49; (0.30, 0.80)) (Park et al., 2000) versus 0.83; (0.54, 1.28) (Bauman et al., 2002; Werch et al., 2003) and frequency of alcohol use (d; 95% CI: -0.35; (-0.51, 0.19)) (Schinke et al., 2004; Spoth et al., 2001) versus -0.13; (-0.29, 0.01) (Loveland-Cherry et al., 1999; Werch et al., 2003). Meta-regression analyses for alcohol initiation revealed no significant effect for any study characteristic. Meta-regression of the frequency of alcohol (expressed as a standardized mean difference score) on group-level intervention (predictor, coded yes/no), showed a significant effect (b-coefficient: -0.219; SE: 0.099; p=0.027; 95% CI: -0.41; -0.024) indicating that interventions targeting all families within a group are significantly more effective in curbing alcohol use among adolescents than interventions not offered at group level.

Analyses over follow-up times

We performed additional analyses for different follow-up times to gain under-standing about changes of effect over time. Three studies (Park et al., 2000; Spoth et al., 1999a,b, 2001; Stevens et al., 2002) reported results on alcohol initiation over three follow-up measurements after pretest. The summary ORs (95% CI) at the first (12-18 months) second (24-30 months) and third (36-48 months) follow-up measurement were 1.00 (0.69, 1.45), 0.70 (0.33, 1.53) and 0.73 (0.74-1.48), respec-tively. As the Dartmouth prevention project (Stevens et al., 2002) was identified as an outlier on the overall analysis, we chose to exclude this study from the longitudinal analysis. The Iowa's Strengthening Families Program (ISFP) and the Preparing for the Drug Free Years program (PDFY) (Park et al., 2000; Spoth et al., 1999a,b, 2001) both seemed to show the strongest reduction at 30 months after pretest. Yet at 48 months the reduction was considerable, compared to the control group. The overall estimates (OR; 95% CI) of the ISFP and PDFY at the first (18 months), second (30 months) and third (48 months) follow-up measure-ments were 0.71 (0.25, 2.01), 0.49 (0.30, 0.80) and 0.53 (0.38, 0.75) respectively.

We did not perform additional analyses over follow-up times concerning last month alcohol use and frequency of alcohol use, as no more than two studies (Loveland-Cherry et al., 1999; Schinke et al., 2004) reported on more than one follow-up measurement.

Discussion

Main findings

Just nine randomized controlled trials were found studying the effect of family intervention on adolescent alcohol use in general populations. The main findings from this meta-analysis consistently point to a favorable effect of family interventions on alcohol initiation and frequency of alcohol use in adolescents. These results imply that family interventions, as described in the included studies, are effective in delaying alcohol initiation and reducing frequency of alcohol consumption among young people. The effects were maintained over time.

A general challenge of family interventions is the difficulty of attracting and retaining high-risk families. As loss to follow-up probably is selective, thus higher among high-risk families, the effectiveness of the studies might be overestimated when analyses did not follow the intent-to-treat procedure. Included studies were effective in both delaying and reducing alcohol use, regardless of parents' actual attendance of the intervention programs. Yet, we found that the included studies based the results only on adolescents who completed the follow-up measurements, not accounting for families that were lost to follow-up, hence these are not intent-to-treat analyses in the strict sense. There is a need for future research on strict intent-to-treat analyses, to show the effectiveness of family interventions in a general population.

As for prevention practice, we are interested in the effectiveness of specific intervention and study characteristics. Hence, we performed stratified analyses and meta-regression analyses for year of publication, ethnicity, randomization level and intervention type (Table 3). Meta-regression analyses revealed stronger effects for interventions which randomized at group level (mainly schools), compared to studies which randomized at individual level. This difference might be explained by the way the impact of the intervention is amplified in the school-setting, when adolescents' attitudes and behavior are influenced by school-wide changes and peer influences (Flay, 2000).

Sensitivity analyses, excluding outliers from the analysis, also shed light on the effectiveness of the different studies. The Dartmouth prevention program (Stevens et al., 2002) was the only study reporting a higher probability for alco-

hol initiation in the prevention group compared to the control group. A possible explanation for the absence of a positive effect might be the negligible contrast between both conditions: the intervention group received an intervention aimed at reducing alcohol use and the control group received an intervention focused on safety behaviors. As both interventions were based on promoting parent-child communication, both groups could behave similarly and have attained equivalent rates of alcohol use and safety behaviors. In contrast with the other eligible studies, the 'Family matters' study (Bauman et al., 2000) reported a higher probability of last month alcohol consumption for the intervention group compared to the control group. Only baseline drinkers were included in the analysis, which may explain part of the anomalous results. Baseline age might be another explanation for the divergent results of the 'Family matters' study. The mean age at baseline of the 'Family matters' study was 13.9, and the mean age of the other studies included in the analysis ranged from 11.0 to 11.4. The intervention may trigger negative responses when the adolescents are at a later age or when the proportion of drinkers at baseline is already high (Dielman, 1994; Van der Vorst et al., 2006).

The results need to be interpreted in the context of the limitations of both our meta-analyses and of the primary studies.

Limitations

First, it was our aim to include all randomized controlled trials. Although we searched for peer reviewed articles and possibly unpublished dissertations in four different databases and performed additional reference searches, we may have missed unpublished articles and abstract-only publications. This might lead to small study bias: not only inferior studies, but also well performed small studies which report small effects or contradict current opinions, are more frequently rejected by journals or are not submitted for publication by the author. Although, the results of Begg's and Egger's tests suggest no clear evidence for small study bias, the possibility of publication bias cannot be excluded with this small amount of included studies.

Second, not all included studies could be combined in a single meta-analysis as different outcome types for alcohol use as well as different risk estimates were used in the included studies, resulting in a small number of estimates being available for the different meta-analyses.

Third, one may feel reluctant to combine results from different studies, conducted with different methods in different populations. Therefore, we used

random effect models for all analyses. These models do not assume that the primary studies are exact replicas of each other and, as a rule, they give broader confidence intervals for the meta-analytically pooled estimate of the effect size. Methodological limitations of the primary studies concern the alcohol measurement methods of the various studies included. We did not attempt to stratify studies by type of questionnaire or by their psychometric characteristics, because the information given in the papers was often insufficient. Test-retest reliability and Cronbach's α of alcohol consumption questionnaires, cited in the articles, range from 0.79 to 0.99 and 0.55 to 0.84, respectively. We are not overly concerned about the effect of measurement error in our meta-analyses, because this sort of error will attenuate the observed effects (in the ORs and ds), thus strengthening the null hypothesis of no effect. In other words, the effects that we report exist not because of, but in spite of random measurement error.

Conclusion

The results of this meta-analysis suggest family interventions to be effective in reducing adolescent alcohol consumption, even at 48 months. However, only a small number of studies reported the effect of family interventions on alcohol consumption of adolescents, in general populations. Moreover, just three studies reported the long-term effect of the intervention and all studies were conducted in the US. We underline the need to strengthen the evidence-base with more trials, longer follow-ups, strict intent-to-treat analyses and more studies conducted in countries other than the US. We feel that strengthening the evidence-base may be well worth the effort. Given the public health significance of adolescent drinking and all its due consequences it is also recommended that this type of intervention be implemented more broadly. After all, our meta-analysis showed that family interventions are likely to be effective in delaying the age of alcohol initiation and in curbing risky drinking behaviors in young people. Thus, we now begin to see the emergence of converging evidence of the effectiveness of this type of interventions.

5

Mediation and moderation effects of an in-home family intervention: The "In control: No alcohol!" Pilot Study

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Abstract

The aim of this study was to examine the effect of a theory-based in-home family intervention (In control: No alcohol!) on adolescent alcohol cognitions via its putative mediators using a randomized controlled design. In the South Holland region of the Netherlands, a total of 213 children (11-12 years) and their mothers were randomly assigned to the prevention program (108 dyads) and the control condition (105 dyads). Mediation effects were analyzed using pre-test and two follow-up measurements (5 and 12 months after baseline). A path model was estimated (using Mplus) to examine the effect of the intervention on the putative mediators (frequency- and quality of mother-child communication, rules about alcohol, establishing a non-drinking agreement and parental monitoring of the child's whereabouts). Outcomes were adolescents' perceived harmfulness of drinking and intention to drink. Multi-group analyses were performed to examine potential differences across gender. The program led to an increase in frequency of alcohol-specific communication, non-drinking agreements and parental monitoring. Moreover, adolescents in the experimental condition perceived drinking to be more harmful and had less intention to drink compared to adolescents in the control condition. The effect of the program on adolescent alcohol cognitions was significantly mediated through having more frequent conversations about alcohol, yet only among boys. Although results on actual drinking need to be added, findings indicate that this relatively inexpensive, easy-to-administer home intervention is promising.

Introduction

As in other European countries, underage drinking in the Netherlands is common practice (Hibell et al., 2009). In the last year of elementary school, 29 % has had their first drink and 5 % drank alcohol recently (Dorsselaer van et al., 2010). After the transition to secondary education (average age of 12), the prevalence of recent drinking has doubled. Underage drinking has been clearly related to an elevated risk at physical and social problems and may permanently affect the development of the brain and predicts alcohol problems later in life (Bonomo et al., 2001; DeWit et al., 2000; Tapert et al., 2002).

Social cognitive theory states that parents are the main socialization agents in their child's development (Bandura 1986). In accordance, in trying to delay or reduce adolescent drinking, family-based programs have effect sizes that are two to nine times greater than programs that are only child focused (Kumpfer et al., 2003; Velleman, 2009). In addition, there is emerging evidence that family interventions, targeting both parent and child, have a higher efficacy than programs that are solely parent focused (Koning et al., 2009; Velleman, 2009). Thus, targeting both parent and child may be crucial to the success of alcohol prevention.

Another crucial factor is the time to intervene. In specific, family programs may be less effective when children are at an older age or already drink at baseline (Loveland-Cherry et al., 1999; Van der Vorst et al., 2006). Petrie et al. (2007) report "the transition from primary to secondary school" to be an effective time to intervene. Thus, targeting families before the transition to secondary school may be promising in preventing early drinking.

Despite the growing evidence of efficacy of family interventions in preventing underage drinking, the active ingredients have rarely been studied. Most commonly, family programs target general parenting practices, like attachment, conflict management, discipline and monitoring (Hawkins et al., 1997; White et al., 2000). Although family programs have been reported to significantly increase, e.g. parental monitoring (Kumpfer et al., 2010; Spoth et al., 1998), to our knowledge, universal family interventions aimed to prevent underage drinking have never demonstrated significant mediation through general parenting practices.

Recent longitudinal studies have shown that alcohol specific parenting behaviors are at least as important predictors of underage drinking as general parenting practices. For example, providing restrictive rules about alcohol use appears to be effective in delaying and reducing adolescent drinking (Van der Vorst et al., 2006; Yu 2003). Although parents express these rules via alcohol-

specific conversations (Ennett et al., 2001a), the findings concerning alcohol-specific parent–child communication are not as unambiguous. While some studies show frequent alcohol-specific communication to reduce early drinking (Martyn et al., 2009; Pasch et al., 2010), others do not find an association (Eijnden van den et al., 2011) or even suggest frequent alcohol-related conversations to increase alcohol use among early drinkers (Ennett et al., 2001a; Van der Vorst et al., 2010). Possibly, the frequency of conversations does not inform us about the exact content (e.g. which rules) or the quality of the communication (e.g., the level of respect). Indeed, several studies showed that instead of frequent talks about alcohol, a few solid conversations about alcohol are more effective in preventing adolescent drinking (Miller-Day and Kam 2010; Spijkerman et al., 2008). Though the evidence of efficacy on early drinking varies between alcohol-specific parenting factors, family programs are found to improve alcohol-specific parenting, like norms on drinking (Spoth et al., 1998), rules about alcohol (Ennett et al., 2001b; Koning et al., 2011a), nondrinking agreements, and communication about alcohol (Mares et al., 2012b). Yet, the small number of studies that tested mediation show inconsistent findings: altered alcohol-specific parenting, like more strict rules about alcohol explained part of the success of a family program (Koning et al., 2011a), while the effect of another did not (Ennett et al., 2001b). Still, it is unclear whether and which parenting factors account for the efficacy of family programs in reducing early drinking.

Gender differences

Parent-child relations differ for boys and girls, e.g., girls generally talk more to their mothers than boys do (Noller and Callan 1990). Yet, mothers ask their sons more questions about alcohol (Boone and Lefkowitz 2007) and are more permissive towards their daughters (Reimuller et al., 2011). In accord, parenting behavior may impact boys and girls differently (Kumpfer et al., 2008). Still, the efficacy of family programs in preventing early drinking across gender is unclear. A few studies testing the efficacy of family programs in preventing substance use across gender showed mixed results (Jones et al., 2005; Pilgrim et al., 1998; Trudeau et al., 2007). Though inconclusive, they may indicate the existence of diverging efficacy of family programs across gender. In accord, analyses across gender are suggested when studying programs that intend to be universally effective (Kumpfer et al., 2008).

The current study

"In control: No alcohol!" is a recently developed universal family program aimed to prevent alcohol use among elementary school children (11 years old) right before they transit to secondary education. This in-home program targets both mother and child individually and together. The program is derived from two theories: Social Cognitive Theory (Bandura 1986) and the Elaboration Likelihood Model (Petty and Cacioppo 1986). Fundamentals of child socialization consisted of how children learn from their environment (i.e., their parents and their behaviors; Bandura 1986). The Elaboration Likelihood Model of persuasion states that dyads can differ in the degree to which they experience the program to be relevant or salient, e.g., some parents will engage in argument-based processing, where message content most affects parental response to program recommendations, while others' may be most affected by peripheral cues such as print design. Both content and layout are taken into account while structuring program information. Additionally, recent studies have indicated interpersonal communication as a possible mediator between public health messages and substance use (Southwell and Yzer 2007; Van den Putte et al., 2011). In accord, this program is designed to stimulate mother-child interpersonal communication about alcohol.

In an earlier report on the post-test outcomes (Mares et al., 2012b), this pilot randomized controlled trial (RCT) has been shown effective in altering a number of general and alcohol-related parenting behaviors: parental monitoring, alcohol-specific communication and the establishment of a non-drinking agreement. The present study evaluates the 1-year follow-up effects of this intervention on parenting behaviors as well as on adolescent alcohol cognitions. As drinking in this sample is still rather scarce, adolescents' alcohol cognitions are included as expressed in adolescents' perceived harmfulness of drinking and their intention to drink, as these are known predictors of adolescent drinking (Hawkins et al., 1997; Marcoux and Shope 1997). The main aim is to study whether the intervention changes adolescents' alcohol cognitions and whether the program-induced parenting factors are accountable for the expected change. Next, we explore gender differences in program effects and mediation paths. To our knowledge, this is the first in-home family intervention aimed to prevent early drinking among primary school children in the Netherlands which effect is tested on parent and child factors using an RCT design.

Method

Design and procedure

In May 2009, we randomly selected 60 schools from a list of primary schools in the South Holland region of the Netherlands. Thirty-three schools were willing to distribute recruitment materials to a total of 892 fifth graders. Materials included
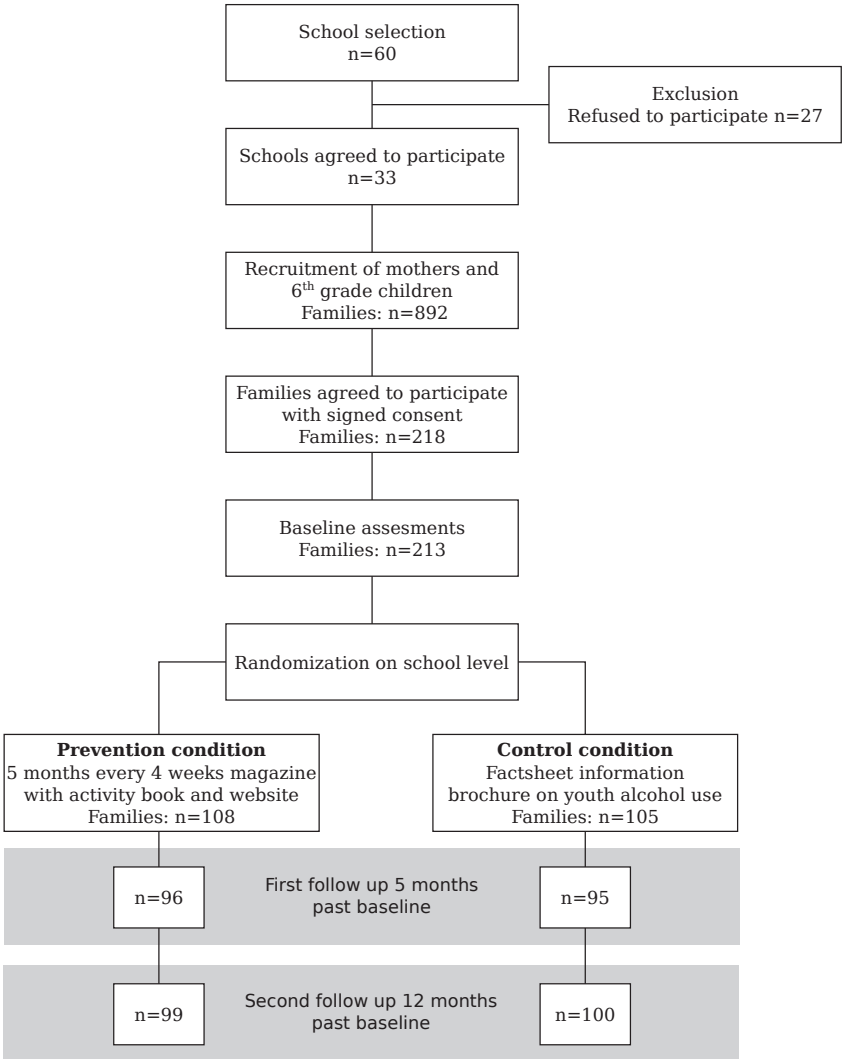

Fig. 1: Flow of participants through the trial

an information letter about the program and research project and an application form including signed consent, which 218 mothers sent back. We randomly assigned these families to either the intervention or the control condition. More detailed information on the randomization is reported by Mares et al. (2012). Mothers and children completed an online questionnaire at home on a secured webpage, which was sent to them separately by e-mail. The first questionnaire was sent in November 2009 (T0), the second (T1) in April 2010 after program completion, and again in November 2010 (T2; Fig. 1).

Participants

At the start of the program 105 families in the control group and 108 families in the program group still agreed to participate. The majority of participating families were of Dutch origin (> 95%). Child's gender was almost equally divided (50.7% girls). Child's mean age was 11.3 (*SD* = .52; range 10-13) and mothers' mean age was 41.6 (*SD* = 4.4; Table 1).

Table 1: Baseline characteristics of adolescents and mothers (Independent Samples *T* and χ^2 tests)

Variable	Total Sample		Experimental Group		Control Group		T/χ^2
	(*N*=213)		(*N*=108)		(*N*=105)		
Child characteristics							
Gender: *n* (%) boys	105	(49.3)	54	(50.0)	51	(48.6)	0.04
Age: mean (SD)	11.3	(0.52)	11.3	(0.52)	11.3	(0.53)	0.14
Maternal characteristics							
Age: mean (SD)	41.6	(4.4)	41.7	(4.1)	41.4	(4.6)	-0.49
Low education [a]: *n* (%)	97	(49.5)	45	(45.9)	51	(53.1)	6.93
Single parent family; *n* (%)	29	(13.7)	17	(15.7)	12	(11.5)	0.79
Model variables: mean (SD)							
Frequency of alcohol-specific communication	2.14	(0.89)	2.09	(0.85)	2.19	(0.91)	0.89
Quality of alcohol-specific communication	3.97	(0.68)	3.94	(0.71)	4.00	(0.65)	0.54
Alcohol-specific rules	4.84	(0.23)	4.82	(0.25)	4.86	(0.20)	1.20
Non-drinking contract	0.48	(0.50)	0.44	(0.50)	0.51	(0.50)	0.90
Monitoring	4.43	(0.65)	4.43	(0.63)	4.44	(0.68)	0.15
Perceived harm of drinking	3.30	(0.50)	3.30	(0.48)	3.30	(0.51)	0.12
Intention to drink	2.09	(0.66)	2.14	(0.68)	2.05	(0.64)	-1.00

The numbers of observations are less than the total numbers of observations for some variables because of missing data.
SD: standard deviation. [a] Elementary school or a low educational level of Dutch secondary school

Loss to follow-up

A total of 191 adolescents (89.7%) and their mothers at T1 and 199 (93.4%) at T2 stayed in the program and completed the follow-up assessments after 5 and 12 months, respectively (Fig. 1). No differences between completers and dropouts were observed for adolescents' age, gender and living situation, mothers' alcohol use (numbers of glasses per week) and mothers' education. Children who did not participate in the first follow-up differed from completers in having more alcohol-specific conversations with their mothers (T0: $t = 3.18$, $p = 0.002$). No differences in frequency of communication were found between completers and dropouts at the second follow-up. Also, no differences between completers and dropouts were observed for all other model variables (putative mediators and outcome variables) as assessed at baseline.

The intervention

This recently developed alcohol prevention program is based on the principles of a smoking prevention program called "Smoke-free Kids" (Jackson and Dickinson 2003). The focus of that program is on enabling parents to prevent their children from smoking. It has been shown to be effective in a sample of US families (Jackson and Dickinson 2006) and is currently being tested in a sample of Dutch families (Hiemstra et al., 2009). While designing the alcohol prevention program, adjustments have been made based on recent evidence on alcohol-specific socialization, e.g., setting strict rules about alcohol, communicating constructively about alcohol issues, and monitoring daily activities (Koning et al., 2010; 2012; Van der Vorst et al., 2005; 2006; Yu 2003).

The intervention consisted of five magazines, eight pages each, which were mailed to the homes of families in the intervention condition with an interval of 4 weeks starting in December 2009. Each of the five magazines includes information for mothers and games and assignments for mothers and children to complete together addressing different important issues regarding youth alcohol use and child socialization. The program is relatively inexpensive as parent-child dyads independently work through the program and no teachers or trainers are required. The main approaches of alcohol-specific socialization addressed are communication, rule setting, and monitoring. Magazine 1 consists of general information about alcohol, alcohol use among children, and the importance of parenting behavior such as anti-alcohol norms and parental supervision. Magazine 2 addresses the risks of alcohol use, especially among children, and parental attitudes towards early drinking. Magazine 3 focuses on

parental modeling of alcohol use and the efficacy of setting clear rules about alcohol. Magazine 4 is aimed at increasing awareness about peer influence and increasing the ability to handle peer pressure, while magazine 5 discusses the impact of alcohol-related media and again stresses the value of setting strict rules. In addition, each magazine contains general information and practical tips on high-quality communication. A website and accompanying logbook provided additional information, games and assignments for the adolescent to complete every month. Seventy-five percent of the dyads reported they took part in at least three of five magazines, suggesting successful implementation (Mares et al., 2012b).

Participating families in the control condition received a single brochure about alcohol and parenting once in January 2010. This brochure is the standard parent alcohol brochure at "the Netherlands Institute of Mental Health and Addiction" (treatment as usual).

Measures

Child's reports of both mediators (parenting behaviors) and outcomes variables (child behaviors) were assessed at baseline (T0), at the first (T1) and the second follow-up (T2).

Frequency of alcohol-specific communication. A Dutch translation of the alcohol-specific communication scale of Ennett et al. (2001a) was used to assess eight specific domains of parent-child communication on alcohol (Van der Vorst et al., 2005). Domains include negative consequences of use, peer pressure resistance, media portrayal of alcohol, and rules about alcohol use. Children reported how many times they talked about these topics with their mothers in the last twelve months on a Likert scale ranging from 1 (*never)* to 5 (*very often)*. Cronbach's alpha ranged from 0.90 to 0.91.

Quality of alcohol-specific communication. Children were asked about the quality of maternal communication about alcohol with six items, such as "My mother and I are interested in each other's opinion about alcohol" (Spijkerman et al., 2008). Response categories ranged from 1 (*completely untrue)* to 5 (*completely true)*, of which mean scores were computed. A high mean on this score reflected a high quality of communication about alcohol. Cronbach's alphas were respectively 0.78, 0.82, and 0.79 for the three waves.

Alcohol-specific rules. A 10-item scale (Van der Vorst et al., 2005) was adjusted for elementary school children (resulting in 11 items) and used to assess children's view on parental alcohol-specific rule setting. An example item is "are you

allowed to drink a nip of alcohol in the absence of your parents?" with response categories ranging from 1 (*definitely not)* to 5 (*definitely).* Responses were reverse scored, i.e., a higher mean reflects more restrictive alcohol-specific rules. Alphas were 0.74, 0.83, and 0.90, respectively.

Nondrinking agreement. Children were asked "Do you have an agreement with your parents that you will not drink until a certain age?" Response categories were "no" and "yes, I am not allowed to drink until I am…years old" (Mares et al., 2012b).

Monitoring. Three items were used to ask children whether their parents solicited information on the child's whereabouts and whether the child needed parental permission to go out (Kerr and Stattin 2000). Response categories ranged from 1 = *never* to 5 = *always* with higher means reflecting more parental monitoring. Alphas were 0.65, 0.75, and 0.67, respectively.

Perceived harm of drinking. Children were asked "How harmful (physically or in other ways) do you think it is for adolescents under 16 (the legal age of drinking in the Netherlands) to drink 1) occasionally, 2) one or two glasses every day, and 3) five or more glasses every weekend". Response categories ranged from 1 (*not harmful)* to 4 (*very harmful).* Alphas were 0.65, 0.70, and 0.71, respectively.

Intention to drink. At the first and second wave (T0 and T1) adolescents were asked two questions about their intention to drink beer or wine, e.g., "Do you think you would drink beer when you're a grown-up?" Response categories were 1 (*no)*, 2 (*maybe)*, 3 (*yes).* At the third wave (T2), a single question was used to ask adolescents whether they intended to drink alcohol in the next year. Response categories ranged from 1 (*absolutely)* to 4 (*absolutely not).* Responses were reverse scored, i.e., higher scores indicate a stronger intention to drink.

Strategy of analysis

Means and standard deviations of demographic variables of adolescents and mothers at baseline were computed per condition to check whether randomization resulted in an even distribution across conditions (Table 1). Correlations between intervention-targeted behaviors were estimated (Table 2).

To examine the effect of the program at the second follow-up, Structural Equation Modeling was conducted using Mplus 5.0 (Muthén and Muthén 2007). In addition to Mares et al. (2012) who examined the effects on parent factors at the first follow-up, we estimated the program effects at the second follow-up (12 months past baseline; T2) on both parent and adolescent factors. No missing data on item-level appeared due to zero nonresponse on item level. Missing data due

Table 2: Correlations between the intervention targeted parent and adolescent behaviors

Variables	1	2	3	4	5	6
1. Frequency of alcohol-specific communication (T1)	-					
2. Quality of alcohol-specific communication (T1)	0.27***	-				
3. Alcohol-specific rules (T1)	0.11	0.22**	-			
4. Nondrinking agreement (T1)	0.26**	0.10	0.01	-		
5. Monitoring (T1)	0.10	0.33***	0.23**	-0.06	-	
6. Perceived harm of drinking (T2)	0.16*	0.18*	0.23**	-0.04	0.14	-
7. Intention to drink (T2)	-0.11	-0.22**	-0.30***	-0.03	-0.19*	-0.18

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

to loss-to-follow up were handled using full information maximum likelihood (Muthén and Muthén 2007). Consequently, in accord with the intent-to-treat principle, all families that were randomized were included in the analyses.

The mediating effects of the program-induced adolescent and parent behaviors were analyzed using path modeling. First, it was tested whether the program had an effect on parent factors (putative mediators). Second, the effect of the putative mediators on the outcome variables was analyzed. Finally, it was tested whether the size of the mediation paths (indirect intervention effect) were statistically significant (Bryan et al., 2007). We measured mediators at the first follow-up (T1) and outcome variables at the second follow-up (T2), so that actual change over time and mediation could be measured. Pretreatment scores (T0) for the putative mediations were included in the model as control variables so that post-test scores result in a residual change variable (Cole and Maxwell 2003). Outcomes were allowed to correlate. Mediation was tested using bias-corrected bootstrapped confidence intervals as these provide the most accurate type I and II error rates (MacKinnon et al., 2004).

To examine whether mediation paths are equal among genders multi-group analyses were run for boys and girls. We tested whether paths significantly differed across gender using chi-square (Wald) tests. Although an earlier study found no effect on some of the parent factors at T1, we decided to keep all parenting factors into the mediation model for moderation purposes. That is, despite the lack of an overall effect on these parenting factors, the intervention may influence these parenting factors in a subgroup of the population.

All models controlled for child gender, age, and living situation at baseline (Mares et al., 2012b). Design effects were estimated to decide on accounting for non-independence due to cluster sampling. As design effects for both outcome measures were small (< 2), accounting for cluster sampling was not imperative

(Kish 1965; Muthén and Satorra 1995). To evaluate the model fit, we used the comparative fit index (CFI) and the root mean square error of approximation (RMSEA). Chi-square values, degrees of freedom and p values are reported but are less suitable to assess the model fit.

Results

At baseline, no significant differences were observed between the experimental and the control group for all model variables as well as on all demographics (Table 1). Table 2 reports the inter-correlations among mediators and outcome variables. Apart from nondrinking agreement, all putative mediators (parenting behaviors) correlated with one or both outcome measures (adolescent alcohol cognitions).

Follow-up effects (T2) on parent and adolescent targeted behaviors

As reported earlier (Mares et al., 2012b) three out of five parent-targeted behaviors (T1) altered significantly due to the intervention. That is, children in the intervention condition reported to have alcohol-related conversations more often, to have a nondrinking agreement more often, and reported more parental monitoring compared to controls. Longer-term follow-up effects (T2) indicated that the intervention induced increase in alcohol-specific communication ($b = 0.20$, $p = 0.001$) and non-drinking agreement ($b = 0.21$, $p = 0.001$) remained at T2 (Table 3). The effect of the program on parental monitoring was not significant

Table 3: Intervention effects at 5 months and 12 months following baseline (standardized estimates of the models) ($n = 213$)

|	Follow-up (T1) (5 months)	Follow-up (T2) (12 months)
Parenting behaviors (mediators)		
Frequency of alcohol-specific communication	0.31***	0.20**
Quality of alcohol-specific communication	0.02	0.04
Alcohol-specific rules	0.01	0.00
Nondrinking agreement	0.26***	0.21***
Monitoring	0.13*	0.08
Child behaviors (outcomes)		
Perceived harm of drinking	0.15*	0.19**
Intention to drink in the next year	0.01	-0.19**

Univariate models are all saturated and thus have perfect model fit
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

at T2 (b = 0.08, p = 0.21). Next, the program had no effect on quality of alcohol-related communication (b = 0.04, p = 0.50) and alcohol-specific rules (b = -0.004, p = 0.96) at T2. Moreover, results revealed that children in the program condition perceived drinking to be more harmful (b = 0.19, p = 0.004) and had less intention to drink (b = -0.19, p = 0.006) at T2 compared to controls. (Table 3)

Mediation model

Figure 2 reveals the results of the mediation model (model fit, χ^2 = 66.8(57), p = 0.18; CFI = 0.98; RMSEA (90% CI) = 0.03 (0.00, 0.05)). In consistence with the simple models (Table 3), the program significantly predicted frequency of alcohol-specific communication (b = 0.32, p < 0.001), nondrinking agreement (b = 0.25, p < 0.001) and monitoring (b = 0.14, p = 0.03) at T1. In turn, nondrinking
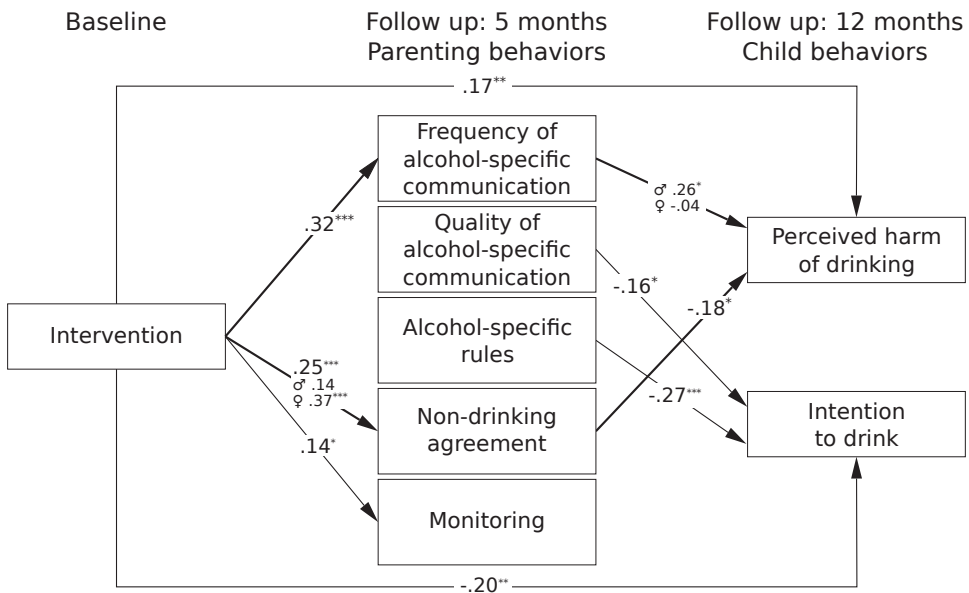
Fig. 2: Intervention effects (treatment versus control group) on child behaviors through the intervention targeted parenting behaviors (mediation). Standardized path coefficients for the total group and for the multi-group analyses across gender.

Model 1 (total group), model fit: χ^2 = 66.8 (57), p =.18; comparative fit index (CFI) = .98; root mean square error of approximation (RMSEA) (90% CI) = .03 (.00, .05). Significant indirect effect on perceived harmfulness through non-drinking agreement: unstandardized b = -.05 (bias corrected 95% CI = -.10, -.01). Model 2 (moderation for gender), model fit: χ^2 = 158.4 (110), p = .002; CFI = .91; RMSEA (90% CI) = .06 (.04, .09). Significant indirect effect for boys on perceived harmfulness through frequency of communication: unstandardized b = .08 (bias corrected 95% CI = .01, .19). Outcomes were allowed to correlate. Both models controlled for child gender, age, living situation, parenting behaviors and child behaviors at baseline. Paths are only depicted when significant for the total group or when significant differences existed across gender. *Bold arrows* indicate significant mediation.

agreement predicted perceived harm of drinking negatively (b = -0.18, p = 0.008). The (negative) indirect effect of the program through nondrinking agreements was significant (unstandardized b = -0.05, bias-corrected 95% CI = -0.10, -0.01). That is, the program predicted nondrinking agreements whereas such an agreement was associated with less perceived harm of drinking (the opposite of what was intended). Besides, children's intention to drink at T2 was predicted by quality of communication (b = -0.16, p = 0.02) and alcohol-specific rules (b = -0.27, p < 0.001) at T1. Direct effects of the program on perceived harm of drinking (b = 0.17, p = 0.009) as well as children's intention to drink (b = -0.20, p = 0.004) remained, i.e., due to the program, children perceived drinking as more harmful and had less intention to drink, which could not be explained by the program-induced parenting factors.

Multi-group analyses

We performed multi-group analyses to examine whether mediation paths differed across gender. The constrained model showed a significantly worse fit than a model in which paths were freed to vary across groups ($\Delta\chi2$ = 102.8, Δdf = 70, p = 0.007), which suggests significant differences in magnitudes of path coefficients across gender. Similarities as well as differences between boys and girls were observed in the mediation part of the model. Both boys and girls had more frequent conversations with their mother about drinking due to the intervention (boys: b = 0.30, p = 0.001; girls: b = 0.32, p < 0.001; Wald test = 0.15 (1), p = 0.70). Besides, having frequent conversations about alcohol was associated with more perceived harm of drinking among boys (b = 0.26, p = 0.01), but not among girls (b = -0.04, p = 0.68), a difference that is statistically significant (Wald test = 4.59 (1), p = 0.03; Fig. 2). Hence, among boys, a significant indirect program effect on perceived harm of drinking was observed through frequent conversations about alcohol (indirect effect: unstandardized b = 0.08, bias corrected 95% CI = 0.01, 0.19). Differences across gender were also observed for nondrinking agreements. That is, girls in the intervention group settled a nondrinking agreement with their mothers more often than girls in the control group (b = 0.37, p < 0.001), while boys did not (b = 0.14, p = 0.15; Wald test = 3.99 (1), p < 0.05; Fig. 2). Still, having such an agreement was associated with less perceived harm of drinking; an association that did not significantly differ across gender (Wald test = 0.75 (1), p = 0.39). The program effect on monitoring did not significantly differ between boys and girls (Wald test = 0.83 (1), p = 0.36). Last, in agreement with findings for the total group, the intervention had no effect on quality of communication and

alcohol specific rules. Still, quality of communication and rules about alcohol were associated with less intention to drink; associations which did not differ across gender (Wald test = 2.61 (1), p = 0.11 and 2.15 (1), p = 0.14, respectively; Fig. 2)

Direct intervention effects on adolescent alcohol cognitions did not significantly differ across gender (perceived harm of drinking: Wald test = 0.99 (1), p = 0.32; intention to drink: Wald test = 0.58 (1), p = 0.45).

In sum, direct intervention effects on adolescent alcohol cognitions did not significantly differ across gender, whereas only among boys a significant indirect effect was observed through having frequent conversations about drinking.

Discussion

Main findings

This study is the first to investigate the effects of the "In control: No alcohol!" family program on both mother and child outcomes. Notably, children perceive alcohol to be more harmful and have less intention to drink, due to this inexpensive, easy-to-administer in-home family program. In addition, mother-child dyads more often settled a nondrinking agreement (which appeared to be negatively related to adolescents' perceived harm of drinking) and increased their alcohol-related conversations compared to their control dyads. The efficacy of the program on adolescent alcohol cognitions did not differ across gender. Still, mother-daughter dyads (counterproductively) established a nondrinking agreement more often than control dyads. Moreover, the raise in alcohol-related conversations among mother-son dyads explained part of the increase in perceived harm of drinking among boys, yet not among girls.

Notably, this easy-to-administer in-home family program resulted in more aversive alcohol cognitions. Moreover, these effects are stronger at T2 compared to T1. This finding is in line with a meta-analysis (Smit et al., 2008) and two recent RCTs (Koning et al., 2011b; Spoth et al., 2011) who found program effects on adolescent drinking to become stronger over time. The longer-term effects of the "In control: No alcohol!" intervention are promising, especially taking into account that at T2, children have moved to secondary education, when their cognitions may become increasingly positive towards drinking. Since program effects become stronger over time, the change in alcohol cognitions due to the "In control: No alcohol!" program might be an important step in delaying adolescent actual drinking later on.

In line with our hypothesis, mother-child dyads increased their alcohol-related conversations compared to controls. Moreover, among boys, the increase in conversations about alcohol with their mothers resulted in more perceived harm of drinking. Hence, an indirect effect (mediation) was observed through mother-child conversations about alcohol, yet only among boys. Van der Vorst et al. (2010) also observed gender differences in the impact of frequent alcohol conversations on adolescent drinking. Still, the authors found that frequent parental communication did not result in positive outcomes among heavy drinking boys, possibly due to an unconstructive way of discussing drinking. In contrast, our results show that more frequent communication leads to more positive outcomes among 12-year-old boys. Possibly, the "In control: No alcohol!" program realizes more constructive alcohol-related conversations among mother-son dyads, which in turn brings about more aversive alcohol cognitions. Still, this study does not tell us why frequent conversations about alcohol differently affect boys' and girls' alcohol cognitions. Various explanations may be mentioned. First, boys may benefit more from programs shortly after implementation, whereas profits for girls may emerge later and are longer lasting (SAMHSA 2002; Trudeau et al., 2007). Second, our sample might have been too small to detect significant mediation paths among girls. Third, the mechanism through which parents impact adolescent alcohol cognitions may differ across gender. Longitudinal studies found parenting factors that predict adolescent drinking, to vary in the strength of their influence on boys and girls (Danielsson et al., 2011; Kelly et al., 2011; Kumpfer et al., 2008). In specific, alcohol-specific parenting (e.g., parental disapproval), might play a stronger role in preventing alcohol use among boys, whereas general parenting (e.g., family bonding) may be more effective among girls (Kumpfer et al., 2008). Our findings suggest that, apart from the aforementioned parenting practices, alcohol-related conversations may vary in the strength of their impact on boys and girls. More research, using longer term follow-up assessments and larger samples, is needed 1) to clarify how parent-child conversations impact alcohol use throughout adolescence as well as 2) to confirm whether the impact of general and alcohol-specific parenting on early drinking differs across gender.

Remarkably, a significant (negative) indirect effect was observed through the settling of a nondrinking agreement. As expected, mother-child dyads in the program condition more often than controls settled a nondrinking agreement. Yet, settling a nondrinking agreement predicted less perceived harm of drinking, while an increase was expected. Although settling a nondrinking agreement is common in the Netherlands (Dorsselaer van et al., 2010), no longitudinal

studies have examined its relation with underage drinking. Possibly, settling a nondrinking agreement may be a relatively simple tool to prevent early drinking, whereas the current literature underlines the need of "a more detailed and complex parent-child communication" to prevent early drinking (Miller-Day and Kam 2010). Besides, parents may (unintended) give a permissive instead of an anti-alcohol message (Reimuller et al., 2011). Next, adolescents may internalize parental messages differently depending on their drinking experience and their preexisting beliefs about, e.g., the harm of drinking (Ennett et al., 2001a; Reimuller et al., 2011). Longer-term results on actual drinking may clarify the impact of this program component.

Far more clear is the evidence from longitudinal studies on the efficacy of quality of alcohol-specific communication and alcohol-specific rules in preventing early drinking (Koning et al., 2012; Van der Vorst et al., 2006; Yu 2003). In accord, we observed these parenting behaviors to predict children's intention to drink. Still, in contrast to other studies (Koning et al., 2009; Kosterman et al., 2001), program participation did not alter these factors. Possibly, an alternative sequence (e.g., handling rules earlier in the program) or alternative formats (e.g., video examples of good quality communication or feedback on communication and rule setting) may improve their efficacy. Moreover, the ability of assessing improvement in quality of communication and alcohol-specific rules was impaired as baseline reports were very high and showed little variation at the age of 11 (mean (SD) are respectively 3.97 (0.68) and 4.84 (0.23) on a five point scale; ceiling-effect). As parenting factors, like alcohol rules (Van der Vorst et al., 2005), show more variation when adolescents are older, parents remaining high quality conversations and strict rules about alcohol might be important program successes which may not be ruled out on the longer term.

In line with our hypothesis, the improved alcohol cognitions could be explained by program-targeted parenting factors, like alcohol-related conversations, yet only in part. In addition, the improved alcohol cognitions may be due to unmeasured program successes, like improved family bonding, mothers' self-efficacy and adolescents' knowledge about drinking.

Limitations

Some limitations need to be mentioned. First, our sample size is relatively small, resulting in little power to detect potential differences especially among subgroups. Still, the aim of this pilot RCT was to test the effects of the program on the proposed mediators and alcohol cognitions in children, for which we did

not need a larger sample. Also, studying gender differences using a relatively small sample is suggested for meta-analytic purposes (Oesterle et al., 2010). Second, causal interpretation of the observed mediation effects should be made with caution, keeping in mind that even in an RCT randomization on the level of the mediators cannot be performed. Hence, mediators and outcomes may be confounded which could violate the assumption under which causality can be claimed (MacKinnon and MacKinnon 2008). Third, intention to drink alcohol at T2 was measured differently from T0 and T1. Fourth, long-term follow-up assessments are needed to investigate whether the intervention 1) delays adolescent actual drinking, 2) improves parenting factors with ceiling effects, and 3) is equally effective across gender. Fifth, replication of this study in other countries is warranted to ensure the generalizability of the present findings.

Conclusion

This family-based program was the first theory-based home intervention aimed to prevent adolescent drinking among elementary school children in the Netherlands. This relatively inexpensive, easy-to-administer program was completed by mothers and children in their home environment at a time of their choice. This created the opportunity to reach a wide array of families and made the program easily accessible. In conclusion, the present study showed that due to the "In control: No alcohol!" program, adolescents perceived alcohol to be more harmful and had less intention to drink and these effects became stronger over time. Although results on actual drinking need to be added, these findings are promising. Among boys, part of the altered perception of the harm of drinking could be explained by having more alcohol-related conversations with their mothers. As parenting practices may influence early drinking differently across gender, more research is needed to probe into the mechanism through which family programs are effective in preventing early drinking across gender.

PART II

THE ROLE OF PARENTS IN PREVENTING ADOLESCENT CANNABIS USE
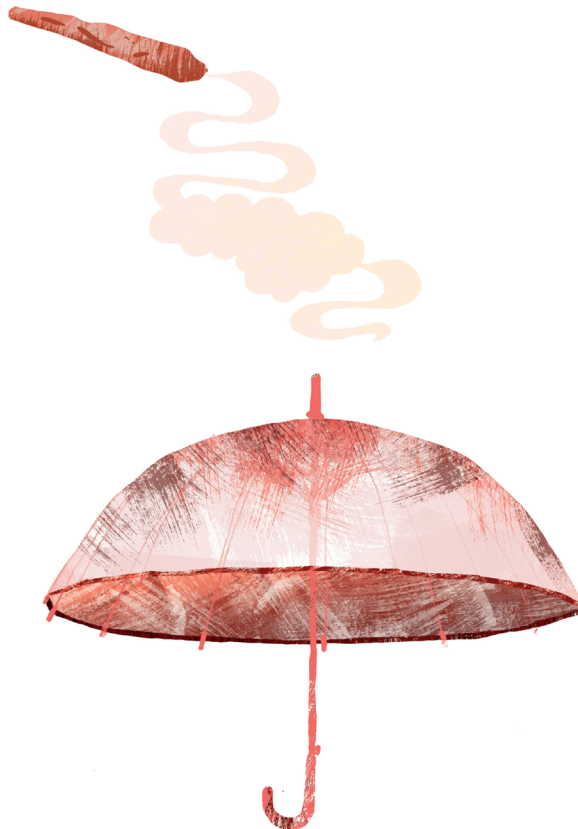
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THE ROLE OF GENERAL PARENTING AND CANNABIS-SPECIFIC PARENTING PRACTICES IN ADOLESCENT CANNABIS AND OTHER ILLICIT DRUG USE

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Wilma Vollebergh

Abstract

This study aimed to investigate general and cannabis-specific parenting practices in relation to adolescent cannabis and hard drug use. Data were derived from the Dutch National School Survey on Substance Use among students (N = 3209; aged 12-16 years) and one of their parents in 2011. Logistic regression analyses revealed that 1) parental cannabis use was significantly related to more adolescent lifetime and recent cannabis use, and 2) restrictive cannabis-specific parental rules were associated with less adolescent recent cannabis and lifetime hard drug use, even when controlled for socio-demographic factors, general parenting, adolescent tobacco use, and tobacco-specific parenting. Furthermore, no significant interaction was observed between parental cannabis use and cannabis-specific rules in their relation to adolescent cannabis and hard drug use, indicating that cannabis rules are evenly associated with adolescent drug use for families with and without parental cannabis experience. In conclusion, in addition to general parenting practices, restrictive cannabis-specific rules are related to lower adolescent cannabis and hard drug rates. Parents who ever used cannabis have children with a higher prevalence of cannabis use. However, their restrictive cannabis-specific rules are equally related to a lower chance of adolescent cannabis use.

Introduction

While cannabis use is common among Western youth, early onset and frequent use are associated with increased risks of low school performance (Fergusson et al., 2007) and mental problems, e.g. depression (Graaf de et al., 2010) and psychosis (Schubart et al., 2010). Approximately 30 percent of Dutch adolescents have used cannabis at the age of 16 (Verdurmen et al., 2012), which is comparable to the average of European 15-16 year olds (29%) (Hibell et al., 2012).

Parents are assumed to play an important part in adolescent cannabis use in different ways. In general, an authoritative parenting style, combining support and control, has been found to reduce the risk of adolescent cannabis use (Becoña et al., 2012; Spooner, 1999). Additionally, high parental monitoring of the child's whereabouts in early adolescence has been longitudinally related to low cannabis initiation (Bohnert et al., 2012; Chilcoat and Anthony, 1996; Ryzin van et al., 2012).

Many studies have reported on the relation between alcohol-specific parenting practices and adolescent alcohol use. That is, in addition to general parenting practices, like support and monitoring, alcohol-specific parenting, e.g. rules on drinking, are found to be of particular importance to delay adolescent drinking (Zundert et al., 2006). Likewise, cannabis-specific parenting practices may discourage adolescent cannabis use. However, little is known about whether parents may influence adolescent cannabis use by cannabis-specific parenting. That may be a major omission, as its impact may be substantial.

On the basis of what is known, we may hypothesize in different directions. First, it may be suggested that, in contrast to adolescent alcohol use, parents may have little direct influence on adolescent cannabis use, as it is illegal and mostly used without parents' awareness and approval. Accordingly, we may hypothesize that parents role in preventing cannabis use may primary be indirect, e.g. through their general parenting practices. Second, the few studies that investigated cannabis-specific parenting suggest more direct practices, including parental attitudes towards cannabis use (Bahr et al., 2005; Oesterle et al., 2012; Olsson et al., 2003) and parents' anger in response to drug use (Parsai et al., 2009). Moreover, Miller-Day (Miller-Day, 2008) found that, after identifying seven parental strategies to deal with substance use, setting a "no tolerance rule" was the only effective strategy associated with less cannabis use among university students.

Apart from these parenting practices, parents own experience with cannabis use has been related to adolescent cannabis use. Both cross-sectional and lon-

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gitudinal studies have shown that parental cannabis use is (weakly) positively associated with adolescent cannabis use in general populations (Bares et al., 2011; Hops et al., 1996; Newcomb et al., 1983). This association may be explained by different mechanisms, like role modelling, access to drug use, genetic vulnerability and indirectly through parenting practices. In sum, it is unclear whether cannabis-specific practices, like cannabis rules and parent's own cannabis use, are related to adolescent cannabis use in the way alcohol-specific practices are related to alcohol, or whether parents' role is more indirect through general parenting practices.

It is known that parent and child perceptions of general and substance-specific parenting behaviors differ, and may predict adolescent substance use differently (Harakeh et al., 2005; Sessa et al., 2001; Van der Vorst et al., 2005). For instance, parents report to be stricter than adolescents perceive them to be (Van der Vorst et al., 2005). As this study includes both parents' and children's reports, examination of differences between respondents is possible.

To our knowledge, apart from parental norms on cannabis, concrete cannabis-specific parenting practices, like cannabis rules, have never been studied among young and middle adolescents using a multivariate design that allows examination of the additional effect of cannabis-specific parenting on top of general parenting. This study adds to the current literature by examining the role of general parenting, cannabis-specific rules and parental cannabis use in adolescent drug use. As these associations may vary across levels of drug use, three outcomes will be used including lifetime and recent cannabis use, and lifetime hard drug use. As co-occurrence rates of tobacco and cannabis use are high (Brook et al., 2012) and tolerant tobacco rules and maternal tobacco use are found to be associated with higher levels of adolescent cannabis use (Brook et al., 2012; Looze de et al., 2012a), adolescent and parent tobacco use and tobacco rules are taken into account in multivariate models. A nationally representative sample of parent-child dyads will be used ($N = 3209$), which allows examination of whether the perception of adolescent and parenting practices differ between respondents.

Method

Study procedures

Data were derived from the Dutch National School Survey on Substance Use among students aged 12-16 in the first four classes of general secondary education and one of their parents in 2011.

The sample was obtained using a two-stage random sampling procedure. First, schools were stratified according to level of urbanization and drawn proportionally to their number. Second, within each school two to three 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 was 48%. Reasons for non-response were mainly related to (being approached for) participation in other research.

Research assistants administered self-complete questionnaires in the classroom during a lesson (usually 50 minutes) in October/ November 2011. 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 (7%), mainly because of illness.

Parental data were also collected by written questionnaires. During the data-collection at the schools, adolescents were given a sealed envelope with the 'parent-questionnaire' and an accompanying letter. Students were instructed to hand over the envelope to one of their parents the same afternoon. Three weeks later a written reminder was sent. The adolescent and parent questionnaire were linked by means of a bar code. To prevent incorrect matching, we checked whether gender and birth date of the adolescent on the parent and adolescent questionnaire corresponded. Incentives were used to promote parental response (ten 100 euro's vouchers were raffled), resulting in a response rate of 49%.

Study sample

In total, we received 6,624 adolescent and 3209 parent questionnaires. Compared to non-responding parents, parents who returned the questionnaire (81% mothers) had adolescents who were: younger (mean age: 13.7 versus 14.0, t = -8.53, p < .001); more often into higher educational levels (χ^2 = 74.3; p < .001); less likely to have an ethnic minority background (χ^2 = 252.9; p < .001); and more likely to live with both biological parents (χ^2 = 72.6; p < .001). With respect to child's gender no differences between non-responding and responding parents were found. Finally, adolescents' drug use was lower among adolescents of responding parents, compared to non-responding parents (lifetime cannabis (χ^2 = 84.3; p < .001), last month cannabis (χ^2 = 72.0; p < .001) and lifetime hard drugs (χ^2 = 22.6; p < .001).

To control for the selective response and to enable to generalize the results to Dutch secondary school children aged 12 to 16, a weighting procedure was applied. As national statistics on parental demographics were not available, both adolescent and parent data were weighted using adolescent demographics. Post-stratification weights were calculated by comparing the joint sample distributions and known population distributions of the child's school type, grade, gender, and level of urbanization (national statistics were obtained from Statistics Netherlands, CBS).

Measures

Exact questions, items, alphas (for multi-item scales), answer categories, and references of the measures are provided in appendix 1.

Adolescent substance use

Lifetime prevalence of cannabis use was measured by asking adolescents and their parents how often they/ their child had used cannabis in their/his life (O'Malley et al., 1983). Answers were recoded into 'never' (0) and 'at least once' (1).

Last month cannabis use was measured by asking adolescents how often they had used cannabis during the last four weeks. Answers were re-coded likewise into 0 and 1.

Lifetime prevalence of any hard drugs was measured by asking adolescents and their parents whether they/ their child had used XTC, cocaine or amphetamine use during their/his life. Answers were recoded to establish lifetime prevalence of any of these three drugs.

Adolescent daily smoking was measured by asking adolescent and their parents whether they/ their child ever smoked a cigarette or shag.' Answers were re-coded into 'no daily smoking' (0) and 'daily smoking' (1).

Parental substance use

Parental cannabis use Parents were asked whether they themselves and/or their partner ever used cannabis. Answers were recoded into 'both parents never used cannabis' (0) and 'one or both parents ever used cannabis' (1).

Parental smoking Parents were asked how often they themselves and/ or their partner smoke at present. Answer categories were recoded into 'both parents do not smoke (anymore)' (0) and 'one or both parents smoke at present' (1).

General parenting

Parental support was based on six items on emotional support as part of a larger relational support scale (Scholte et al., 2001). Higher means reflect more parental support.

Parental monitoring Three items were used to ask children and their parents whether their parents/they solicited information on the child's whereabouts and whether the child needed parental permission to go out (Kerr and Stattin, 2000; Looze de et al., 2012a).

Parental knowledge A four-item scale was used to measure adolescents' and parents' perception of parental knowledge on his/their friends, activities and whereabouts (Looze de et al., 2012b).

Substance -specific parenting

Tobacco-specific rules. A three item scale was used (Looze de et al., 2012a) to measure adolescents' and parents' perceptions of parental tobacco-specific rules.

Cannabis-specific rules. A three item scale was developed based on the above-mentioned tobacco-specific rules scale.

Covariates

All analyses controlled for adolescents' gender, age, family structure (living with both biological parents or not) and educational track (vocational vs. academic).

Strategy for analyses

In the analyses two characteristics of the data were taken into account. First, students from the same school were drawn as a single cluster and weights were applied to obtain representativeness of Dutch secondary school students. All analyses were performed using Stata-V12 (Stata Corp., College Station, TX).

First, the weighted prevalence estimates for adolescent drug use and parenting practices were calculated. Differences in child and parent reports were examined (χ^2/t-test), when both reports were available. Likewise, differences between families with or without parental experience with cannabis use were examined.

Second, to investigate whether general- and cannabis-specific parenting are associated with adolescent drug use, a univariate and a multivariate logistic regression model were performed for the three outcome types (lifetime and recent cannabis use and lifetime hard drug use).

Results

Descriptives (Table 1)

2.1% of the 3209 adolescents reported to have used any hard drugs during their lives, whereas only 0.1% of their parents thought they had. 3.9% of the adolescents reported to have used cannabis during the last month (parent report not available). 10.2% of the adolescents reported to have used cannabis at least once, compared to 2.1% of their parents (n = 3209). 4.2% of the adolescents reported to be daily tobacco smokers, whereas only 2.2% of their parents thought they were. 23.6% of the parents reported that one or both parents had used cannabis at least once and 28.9% of the parents reported one or both parents to be current tobacco smokers.

Parent and adolescent reports on general parenting practices differed significantly from each other. Parents reported to be more supportive, to monitor their children more closely, and to know more of their child's whereabouts than their children reported. Both adolescent and parent reports on cannabis-specific rules (mean of 4.89-4.91 on a five-point scale) and, to a lesser extent, on tobacco-specific rules (mean of 4.5-4.7) were very strict, indicating a ceiling effect. Still, parents believed that they imposed (somewhat) stricter rules on tobacco and cannabis use compared to their children's perception.

The prevalence of cannabis was much higher among adolescents from families where one or both parents ever used cannabis compared to adolescents with parents who had no cannabis experience. Furthermore, cannabis-specific rules (particularly on experimental use) and tobacco-specific rules were less strict among families where one or both parents ever used cannabis.

Table 2 shows Pearson's correlations between model variables.

Logistic regression analyses

Table 3 shows the results of the logistic regression analyses (child perception). The univariate model shows that all model variables were significantly associated with adolescent lifetime and recent cannabis use (except for educational level and family structure). Likewise, all model variables were associated with adolescent hard drug use, except for parental tobacco and cannabis use.

The multivariate model revealed four main findings. First, adolescent tobacco use was highly associated with adolescent ever and recent cannabis use and ever hard drug use (ORs are 14.9, 18.0, and 9.4 respectively). Second, with respect to general parenting practices, medium to large effect sizes were found for the negative association between parental knowledge of the child's whereabouts

Table 1: Comparison of model variables between adolescent and parent reports, and between parents with or without lifetime cannabis use (χ^2 and paired t-tests)

	Adolescent report	Parent report	Adolescent report		Parent report	
	Total (N = 3209)		No parental lifetime cannabis use [e] (N = 2430)	Parental lifetime cannabis use [f] (N =761)	No parental lifetime cannabis use [e] (N = 2430)	Parental lifetime cannabis use [f] (N =761)
Adolescent drug use (% (95% CI))						
Lifetime prevalence of cannabis	10.2 (8.4- 12.2)	2.1*** (1.5- 2.9)	8.1 (6.6-9.9)	16.9*** (13.2-21.3)	1.2 (0.7-1.9)	5.0*** (3.2-7.7)
Last month prevalence of cannabis	3.9 (3.0- 5.1)	–	3.3 (2.4-4.6)	5.8* (4.0-8.4)		
Lifetime prevalence of hard drug use [a]	2.1 (1.5-2.8)	0.1*** (0.05-0.3)	1.9 (1.3-2.6)	2.6 (1.6-4.1)	0.1 (0.0-0.3)	0.4* (0.1-1.1)
General parenting practices (mean (SE))						
Support [1-5(=high)]	4.25 (.01)	4.57** (.01)	4.24 (.01)	4.25 (.02)	4.58 (.01)	4.57 (.02)
Monitoring [1-5(= high)]	3.98 (.02)	4.79*** (.01)	3.98 (.03)	3.96 (.03)	4.79 (.01)	4.78 (.01)
Parental knowledge [b 1-3 (= high)]	2.83 (.01)	2.95*** (.01)	2.83 (.01)	2.83 (.01)	2.95 (.01)	2.94** (.01)
Cannabis -specific parenting						
Cannabis-specific rules (mean (SE)) [1-5(= strict)] (scale)	4.89 (.01)	4.91* (.01)	4.91 (.01)	4.82* (.02)	4.94 (.01)	4.81*** (.02)
Single items of the cannabis-specific rules scale:						
Not allowed to try out smoking a joint	4.85 (.01)	4.83 (.01)	4.88 (.01)	4.77 (.03)***	4.89 (.01)	4.65 (.04)***
Not allowed to smoke a joint now and then	4.89 (.01)	4.93 (.01)***	4.91 (.01)	4.83 (.03)**	4.96 (.01)	4.85 (.02)***
Not allowed to smoke a joint regularly	4.93 (.01)	4.97 (.01)***	4.93 (.01)	4.91 (.02)	4.98 (.01)	4.93 (.01)**
Lifetime prevalence of cannabis [c] (parents) (%)	–	23.6 (20.8- 26.8)	–	–	0	100
Adolescent smoking (% (95% CI))						
Daily smoking	4.2 (3.3- 5.3)	2.2** (1.5- 3.1)	3.8 (2.9-4.9)	5.5 (3.5-8.7)	1.8 (1.2-2.7)	3.4* (2.0-5.8)
Tobacco-specific parenting						
Tobacco-specific rules (mean (SE)) [1-5(=strict)]	4.52 (.03)	4.67** (.02)	4.55 (.03)	4.41* (.06)	4.71 (.02)	4.56** (.04)
Parental current smoking [d] (% (95% CI))	–	28.9 (26.9- 31.0)	–	–	25.1 (23.0-27.3)	41.2*** (36.8-45.7)

Significant difference between child and parent report; and between families with and without parental lifetime cannabis use * $p < 0.05$; ** $p < 0.01$; *** $p < .001$); – : Data are not available; [a] Lifetime prevalence of any hard drugs, including XTC, Cocaine and Amphetamines; [b] Parental knowledge of the child's whereabouts; [c] Percentage of families with at least one parent ever using cannabis; [d] Percentage of families with at least one currently smoking parent; [e] Both parents never used cannabis; [f] One or both parents ever used cannabis.

Table 2: Correlations between model variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Gender																					
2. Age	0.027																				
3. Educational level	-0.020	0.026																			
4. Family structure	-0.031	0.020	0.101																		
5. Adolescent lifetime cannabis use (A)	0.070	0.285	0.006	0.042																	
6. Adolescent lifetime cannabis use (P)	0.042	0.172	0.019	0.056	0.393																
7. Adolescent last month cannabis use (A)	0.052	0.200	0.002	0.041	0.613	0.318															
8. Adolescent lifetime hard drug use [a] (A)	0.037	0.089	0.003	0.053	0.316	0.143	0.352														
9. Adolescent lifetime hard drug use [a] (P)	0.008	0.005	-0.009	0.039	0.072	0.185	0.080	0.109													
10. Support (A)	-0.058	-0.081	-0.077	-0.064	-0.127	-0.053	-0.106	-0.126	-0.085												
11. Support (P)	-0.056	-0.058	-0.081	0.009	-0.082	-0.042	-0.050	-0.047	-0.021	0.275											
12. Monitoring (A)	-0.243	-0.131	-0.119	-0.050	-0.113	-0.083	-0.092	-0.068	0.003	0.239	0.107										
13. Monitoring (P)	-0.076	-0.168	-0.048	-0.007	-0.097	-0.078	-0.084	-0.049	-0.007	0.046	0.188	0.169									
14. Parental knowledge (A)	-0.101	-0.004	-0.094	-0.124	-0.151	-0.079	-0.149	-0.116	-0.034	0.381	0.177	0.238	0.059								
15. Parental knowledge (P)	-0.079	-0.067	-0.043	-0.076	-0.152	-0.153	-0.121	-0.070	-0.016	0.149	0.229	0.110	0.154	0.223							
16. Cannabis-specific rules (A)	-0.061	-0.148	0.026	-0.018	-0.223	-0.205	-0.238	-0.199	-0.062	0.116	0.044	0.169	0.086	0.101	0.066						
17. Cannabis-specific rules (P)	-0.003	-0.094	0.017	-0.025	-0.086	-0.123	-0.092	-0.010	-0.031	0.035	0.076	0.034	0.121	-0.009	0.035	0.152					
18. Parental cannabis use [b] (P)	-0.015	0.029	-0.088	0.090	0.117	0.106	0.066	0.024	0.034	0.010	-0.017	-0.007	-0.011	-0.008	-0.053	-0.082	-0.167				
19. Adolescent daily tobacco smoking (A)	0.026	0.196	0.065	0.055	0.447	0.323	0.424	0.220	-0.008	-0.085	-0.051	-0.111	-0.054	-0.101	-0.108	-0.148	-0.052	0.032			
20. Tobacco-specific rules (A)	-0.010	-0.287	-0.068	-0.047	-0.333	-0.261	-0.259	-0.158	-0.022	0.125	0.077	0.203	0.112	0.082	0.065	0.474	0.128	-0.054	-0.458		
21. Tobacco-specific rules (P)	0.042	-0.182	-0.070	-0.039	-0.167	-0.188	-0.097	-0.059	-0.005	0.020	0.058	0.068	0.147	-0.019	0.056	0.113	0.319	-0.069	-0.308	0.381	
22. Parental tobacco smoking [c] (P)	-0.007	-0.026	0.153	0.124	0.058	0.041	0.017	0.028	-0.026	-0.021	-0.006	-0.047	0.010	-0.039	-0.028	-0.013	-0.005	0.149	0.076	-0.118	-0.096

P = parent report; A = adolescent report; [a] Lifetime prevalence of any hard drugs, including XTC, Cocaine and Amphetamines; [b] Parent report of ever cannabis use by one or both parents; [c] Parent report of current tobacco use by one or both parents.

Table 3: Logistic regression analyses of general parenting practices, cannabis-specific and tobacco-specific parenting practices on adolescent lifetime and last month cannabis use and lifetime hard drug use (child report of a univariate and a multivariate model) (OR (95% CI))

	Lifetime prevalence cannabis		Last month prevalence cannabis		Lifetime prevalence of any hard drug use (XTC, Cocaine or Amphetamines)	
	Univariate	Multivariate [c]	Univariate	Multivariate [c]	Univariate	Multivariate [c]
Demographic factors						
Gender (boys)	1.65** (1.23-2.21)	1.71* (1.14-2.57)	2.02** (1.31-3.11)	2.13* (1.20-3.78)	1.76* (1.01-3.05)	1.37 (0.76-2.45)
Age	2.55*** (2.24-2.90)	2.34*** (2.00-2.74)	2.71*** (2.21-3.31)	2.27** (1.78-2.90)	1.68*** (1.32-2.12)	1.26 (0.98-1.62)
Educational level (low)	0.93 (0.61-1.41)	0.73 (0.49-1.10)	0.93 (0.56-1.56)	0.78 (0.45-1.35)	0.98 (0.53-1.81)	0.71 (0.35-1.45)
Family structure (not living with both biological parents)	1.38* (1.03-1.85)	1.02 (0.68-1.54)	1.49 (0.97-2.30)	1.12 (0.62-2.03)	2.32* (1.33-4.04)	1.79 (0.94-3.41)
General parenting practices						
Support	0.56*** (0.46-0.67)	0.72* (0.54-0.95)	0.46*** (0.35-0.59)	0.68* (0.47-0.99)	0.32*** (0.25-0.74)	0.41*** (0.27-0.61)
Monitoring	0.69*** (0.60-0.79)	1.11 (0.92-1.35)	0.62*** (0.50-0.75)	1.12 (0.84-1.49)	0.61*** (0.48-0.77)	1.11 (0.85-1.45)
Parental knowledge	0.28*** (0.20-0.40)	0.27*** (0.16-0.45)	0.19*** (0.12-0.28)	0.21*** (0.11-0.39)	0.20*** (0.11-0.36)	0.45 (0.19-1.04)
Cannabis-specific parenting practices						
Cannabis-specific rules	0.39*** (0.31-0.49)	0.78 (0.57-1.07)	0.37*** (0.30-0.45)	0.60** (0.43-0.82)	0.38*** (0.28-0.50)	0.57* (0.37-0.89)
Parental cannabis use [a]	2.31*** (1.72-3.11)	2.56*** (1.88-3.49)	1.80* (1.09-2.97)	2.06* (1.18-3.61)	1.40 (0.79-2.50)	1.36 (0.65-2.87)
Adolescent tobacco smoking						
Daily tobacco smoking	39.8*** (23.9-66.4)	14.9*** (7.88-28.2)	34.3*** (20.0-58.7)	18.0*** (8.36-36.6)	15.8*** (8.7-28.6)	9.40*** (3.49-25.4)
Smoking-specific parenting						
Tobacco-specific rules	0.46*** (0.41-0.52)	0.78* (0.64-0.94)	0.46*** (0.40-0.53)	0.93 (0.70-1.22)	0.51*** (0.43-0.60)	0.93 (0.69-1.27)
Parental tobacco smoking [b]	1.49** (1.13-1.96)	1.17 (0.83-1.64)	1.10 (0.69-1.73)	0.62 (0.31-1.23)	1.43 (0.78-2.62)	1.09 (0.56-2.12)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. [a] Parent report of lifetime cannabis use by one or both parents; [b] Parent report of current tobacco use by one or both parents; [c] As for comparability with the parent report of the multivariate model, the child report of the multivariate model also included parent report of parental cannabis use and parental tobacco smoking; Significant results remained when only mother reports (81.1%; $N = 2602$) were included in the analyses for all outcomes, except for "support" in the multivariate model of lifetime cannabis use and for cannabis rules in the univariate model in relation to lifetime hard drug use in that ORs were no longer significant (p- values are 0.06 and 0.07, respectively).

and adolescent lifetime and recent cannabis use and between parental support and adolescent hard drug use. Third, tobacco-specific rules were significantly related to a lower chance of adolescent lifetime cannabis use (OR (95% CI) = 0.78 (0.64 - 0.94), whereas cannabis-rules were clearly associated with less adolescent recent cannabis use and lifetime hard drug use (ORs (95% CI) are 0.60 (0.43 - 0.82) and 0.57 (0.37 - 0.89), respectively). Fourth, adolescents with at least one parent who ever used cannabis during his or her life were more likely to have used cannabis themselves ever (OR (95% CI) = 2.56 (1.88 - 3.49)), and recently (OR (95% CI) = 2.06 (1.18 - 3.61), but not to have ever used hard drugs (OR (95% CI) = 1.36 (0.65-2.87)).

Additional analyses revealed that: 1) in consistence with adolescents' reports (Table 3), parents' reports of parenting practices (Table 4) were negatively related to adolescent cannabis use. Yet, associations were less strong and parents' reports of none of the included parenting practices were significantly associated with adolescent hard drug use. In contrast to adolescents' perceptions and parents' perceptions in the univariate model, parents' perception of their tobacco-specific rules were positively related with adolescent recent cannabis use. 2) Findings were no different when only mothers' reports (81.1% of the data) were included (see footnotes at Table 3 and 4). 3) Significant results of the multivariate model remained when alcohol-specific rules and parental drinking (Verdurmen et al., 2012) were added to the models, for all three outcome measures. 4) No significant interaction effects were observed between cannabis-specific rules and parental cannabis use for all three outcome measures (ORs (95% CI) are 1.06 (0.59-1.90); 0.94 (0.58-1.54); 1.18 (0.65-2.14), respectively). That is, cannabis rules are associated to adolescent cannabis and hard drug use in the same way for parents who did and parents who never used cannabis themselves. 5) Parental current cannabis use was assessed only through the adolescents' questionnaire. As only 36 adolescents (1.1%) report that their parents currently use cannabis, this measure was not included in the analyses. Still, this prevalence rate indicates that parental lifetime cannabis use may mainly reflect cannabis use in the past.

Discussion

General conclusion

The aim of the current study was to investigate general and cannabis-specific parenting practices in their relation with adolescent drug use. The main findings indicate that parental cannabis use is significantly related to more adolescent lifetime and recent cannabis use, and cannabis-specific parental rules are associ-

Table 4: Logistic regression analyses of general parenting practices, cannabis-specific and tobacco-specific parenting practices on adolescent lifetime and last month cannabis use and lifetime hard drug use (parent report of a univariate and a multivariate model) (OR (95% CI))

	Parent report					
	Lifetime prevalence cannabis		Last month prevalence		Lifetime prevalence of any hard drug use (XTC, Cocaine or Amphetamines)	
	Univariate	Multivariate [c]	Univariate	Multivariate [c]	Univariate	Multivariate [c]
Demographic factors						
Gender (boys)	1.65** (1.23-2.21)	1.60* (1.11-2.33)	2.02** (1.31-3.11)	2.01* (1.17-3.47)	1.76* (1.01-3.05)	1.39 (0.77-2.48)
Age	2.55*** (2.24-2.90)	2.28*** (1.99-2.62)	2.71*** (2.21-3.31)	2.18*** (1.75-2.72)	1.68*** (1.32-2.12)	1.29* (1.01-1.65)
Educational level (low)	.93 (0.61-1.41)	.75 (0.51-1.12)	.93 (0.55-1.56)	.77 (0.43-1.38)	0.98 (0.53-1.81)	0.83 (0.42-1.65)
Family structure (not living with both biological parents)	1.38* (1.03-1.85)	1.08 (0.72-1.61)	1.49 (0.97-2.30)	1.20 (0.65-2.24)	2.32* (1.33-4.04)	1.88 (1.00-3.56)
General parenting practices						
Support	0.52*** (0.39-0.71)	0.71 (0.47-1.06)	0.54** (0.34-0.85)	0.73 (0.38-1.40)	0.43** (0.25-0.74)	0.57 (0.28-1.16)
Monitoring	0.50** (0.38-0.66)	0.77 (0.53-1.10)	0.45*** (0.31-0.67)	0.69 (0.39-1.23)	0.51** (0.32-0.83)	0.69 (0.39-1.24)
Parental knowledge	0.07*** (0.04-0.12)	0.11*** (0.05-0.28)	0.06*** (0.03-0.13)	0.24 (0.04-1.37)	0.11*** (0.04-0.35)	0.54 (0.08-3.48)
Cannabis-specific parenting practices						
Cannabis-specific rules	0.48*** (0.36-0.64)	0.70 (0.48-1.02)	0.43*** (0.31-0.61)	0.50** (0.30-0.84)	0.82 (0.42-1.61)	1.14 (0.44-2.96)
Parental cannabis use [a]	2.31*** (1.72-3.11)	2.38*** (1.74-3.26)	1.80* (1.09-2.97)	1.65 (0.85-3.18)	1.40 (0.79-2.50)	1.10 (0.54-2.20)
Adolescent tobacco smoking						
Daily tobacco smoking	39.8*** (23.9-66.4)	25.5*** (13.2-49.3)	34.3*** (20.0-58.7)	24.9*** (11.7-52.8)	15.8** (8.7-28.6)	11.2** (4.82-26.0)
Tobacco-specific parenting						
Tobacco-specific rules	0.58*** (0.51-0.66)	1.07 (0.87-1.31)	0.62*** (0.52-0.75)	1.33* (1.01-1.76)	0.69** (0.53-0.90)	1.12 (0.82-1.53)
Parental tobacco smoking [b]	1.49** (1.13-1.96)	1.33 (0.94-1.87)	1.10 (0.69-1.73)	0.89 (0.54-1.48)	1.43 (0.78-2.62)	1.36 (0.69-2.68)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. [a] Parent report of lifetime cannabis use by one or both parents; [b] Parent report of current tobacco use by one or both parents; [c] As for comparability with the child report of the multivariate model, the parent report of the multivariate model also included child report of demographic factors and adolescent daily tobacco smoking; Significant results remained when only mother reports (81.1%; $N = 2602$) were included in the analyses for all outcomes, except for parental current smoking in the univariate model in relation to lifetime cannabis use (p-value < 0.08).

ated with less adolescent recent cannabis and lifetime hard drug use, even when controlled for general and tobacco-specific parenting and adolescent tobacco use. In addition, cannabis rules are equally associated with adolescent cannabis use among families with and without parental cannabis experience.

Cannabis-specific parenting practices

This study is one of the first examining concrete cannabis-specific parenting practices in relation to adolescent cannabis use. Notably, we found that cannabis-specific rules are related to adolescent recent cannabis use and lifetime hard drug use, even when controlled for general and tobacco-specific parenting practices, and adolescent tobacco use. Our findings are in line with earlier studies on alcohol-specific and tobacco-specific parenting, which underline the importance of restrictive parental rules in relation to adolescent substance use (Van der Vorst et al., 2006; Looze de et al., 2012a). Still, this similarity is quite remarkable, as adolescent cannabis use differs from tobacco and alcohol use in several ways. First, cannabis use is less common. Second, cannabis use is less socially accepted and parental awareness of adolescent cannabis use is much lower (adolescent versus parent report: 10% vs. 2%, Table 1) than of alcohol (63 vs. 57%) and tobacco use (71 vs. 56%). Moreover, it is interesting to see that we have found significant associations for parental rules on cannabis while the mean level of cannabis rules was very strict (indicating a ceiling effect) and the variance was low (mean (SE) = 4.89 (0.01) on a five point scale), compared to alcohol-specific (4.03 (0.06)) and tobacco-specific rules (4.52 (0.03)). Possibly just a hint of parental tolerance regarding cannabis use is related to actual use by their children. This is in consistence with findings from Miller-Day (Miller-Day, 2008), who found that 'no-tolerance rules' are negatively related to adolescent cannabis use among university students. Apart from existing differences between substances similarities among these substances may not be discarded, e.g. settings and motivations for use may be similar and co-occurrence is common (Brook et al., 2012). The abovementioned differences and similarities may explain why tobacco- and alcohol specific rules may be insufficient in explaining adolescent drug use, while cannabis-rules are related to cannabis in a comparable way.

Parental cannabis use

Our finding that parental cannabis use is associated with adolescent lifetime and recent cannabis use is in line with earlier studies (Bares et al., 2011; Hops et al., 1996; Newcomb et al., 1983). Although we found no association between

parental cannabis use and adolescent hard drug use, we may not discard the risk of parental current cannabis use on adolescent hard drug use (Castro et al., 2006). Different mechanisms might play a role among past and current users. Perceivably, genetic vulnerability, modelling, drug availability at home and drug use with the child (Agrawal and Lynskey, 2006; Spooner, 1999; Castro et al., 2006) may be main risk factors for children with currently using parents, whereas more tolerant attitudes and behaviors might explain cannabis use among adolescents with parents who were past users.

General parenting practices

Notably, in contrast to earlier studies (Bohnert et al., 2012) no distinct association was observed between parental monitoring and adolescent drug use for all three outcomes in multivariate models, whereas consistent associations were found between parental knowledge of the child whereabouts and adolescent cannabis use. Possibly, parental active solicitation and control of free time (monitoring) may be less important in relation to adolescent cannabis use, when controlled for concrete cannabis rules. Still, spending less time at home and more time with peers, which probably will result in less parental knowledge of the child's whereabouts, may explain the increased risk of cannabis use.

Medium effect sizes were found for the negative association between parental support and adolescent drug use (cannabis and hard drugs), even in multivariate models. A recent review (Becoña et al., 2012) shows that, particularly, a neglectful parenting style (lack of both limits and support) increased the risk of adolescent drug use, whilst an authoritative style (limits and support) is found to protect against drug use. Future studies are needed to confirm whether combining concrete parental rules on cannabis use with general parenting practices like support are effective in preventing adolescent cannabis use.

Parent and child reports

Reports of cannabis use and cannabis-specific parenting practices significantly differed between dyads (child and parents reports). In line with studies on smoking and smoking-specific parenting (Harakeh et al., 2005; Mahabee-Gittens et al., 2010), and alcohol use and alcohol-specific parenting (Van der Vorst et al., 2005; Verdurmen et al., 2012), we found that parents strongly underestimated adolescent cannabis use. Parents are far less aware of adolescent cannabis use, compared to e.g. alcohol use. Thus, even in the Netherlands with its relatively lenient drug culture, adolescent cannabis use is less common and accepted

compared to drinking. Additionally, adolescents reported parenting practices to be less constructive (strict or supportive) compared to their parents. Possibly, parents report more socially desirable on parenting practices.

Limitations

Although this study is one of the first to examine cannabis-specific parenting and has several strengths, like a large nationally representative sample of parent-child dyads, limitations exist. First, due to the cross-sectional design of the study no interferences about causality can be made. Longitudinal studies are needed to investigate whether parents can prevent their child from drug use. Second, we may have missed important parenting factors in our model, for instance parental abuse and parental mental health might play a role in adolescent cannabis use (Spooner, 1999). Moreover, apart from cannabis-specific rules, also other cannabis-specific parenting practices, e.g. parent-child conversations about cannabis and parental reactions to cannabis use, may be important. Third, in addition to parent factors also peer and personality factors are known to be associated to adolescent cannabis use (Spooner, 1999). Fourth, internal reliability of the parental monitoring and parental knowledge scales were low, especially for parent reports. Fifth, replication of this study in other countries is recommended to examine the generalizability of its findings beyond the, tolerant, Dutch culture.

Conclusion

Parental cannabis use is significantly related to adolescent lifetime and recent cannabis use, and cannabis-specific parental rules are clearly associated with adolescent recent cannabis use and lifetime hard drug use, even when controlled for general parenting, adolescent tobacco use, and tobacco-specific parenting. Furthermore, cannabis rules are equally associated with cannabis use among families with and without parental cannabis experience. Longitudinal studies are recommended to confirm and extend these preliminary findings. Still, our results indicate that, apart from general parenting practices, parents may need to be advised to set strict cannabis rules in order to prevent their child from using cannabis and hard drugs.

Appendix 1: Description of measures.

	Questions	Alpha adolescent/parent report	Original answer categories	Recoded answer categories	Reporter	Reference
Adolescent substance use						
Lifetime prevalence of cannabis use	How often did you use weed (marijuana) or hash during your life?	-	0-14 (never - 40 times or more)	0 = 'never', 1 = 'at least once'.	A, P	(O'Malley, Bachman, & Johnston, 1983)
Last month cannabis use	How often did you use weed (marijuana) or hash during the last four weeks?	-	0-14 (never - 40 times or more)	0 = 'never', 1 = 'at least once'.	A	(O'Malley et al., 1983)
Lifetime prevalence of any hard drugs	How often did you use XTC during your life? How often did you use cocaine during your life? How often did you use amphetamines during your life?	-	0-14 (never - 40 times or more)	0 = 'never', 1 = 'ever use of any hard drugs at least once'.	A	(O'Malley et al., 1983)
	Did your child ever use XTC? Did your child ever use cocaine? Did your child ever use amphetamines?		0-2 (never, more than once)	0 = 'never', 1 = 'ever use of any hard drugs at least once'.	P	
Adolescent daily smoking	Did you ever smoke a cigarette or shag?	-	0-3 (never – daily)	0 = 'no daily smoking', 1 = 'daily smoking'.	A, P	
Parental substance use						
Parental cannabis use	Did you ever use weed (marijuana) or hash during your life? Did your partner ever use weed (marijuana) or hash during his/her life?	-	0-2 (never – regularly)	0 = 'both parents never used cannabis' 1 = 'one or both parents ever used cannabis'	P	
Parental smoking	How often do you smoke at present? How often does your partner smoke at present?	-	0-3 (I do not smoke (anymore) - every day)	0 = 'both parents do not smoke (anymore)' 1 = 'one or both parents smoke at present'	P	

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Appendix 1: Description of measures. (continued)

	Questions	Alpha adolescent/ parent report	Original answer categories	Recoded answer categories	Reporter	Reference
General parenting						
Parental support	1) My parents show me that they admire me; 2) In my parents' eyes, I do everything wrong*; 3) My parents show me that they love me; 4) My parents often make me look ridiculous*; 5) My parents support me in my activities; 6) My parents treat me aggressively*	0.81/ 0.75	1-5 (definitely true - definitely not true)	1-5 (definitely true - definitely not true)*	A, P	Adapted from Scholte et al., 2001
Parental monitoring	1) Before you leave the house, do your parents want to know with whom or where you are going?; 2) Do you need your parents' permission to go out at night?; 3) If you go out at night, do your parents want to know afterward with whom or where you were?	0.74/ 0.57	1-5 (never – always)	1-5 (never – always)	A, P	Adapted from Kerr and Stattin 2000
Parental knowledge	How well do your parents know: 1) Who your friends are?; 2) How you spend your money?; 3) Where you go after school?; 4) How you spend your free time?	0.66/ 0.53	1-3 (they know nothing - they know much)	1-3 (they know nothing - they know much)	A, P	Adapted from Looze de et al., 2012b
Substance -specific parenting						
Tobacco-specific rules	1) I am allowed to try out smoking a cigarette*; 2) I am allowed to smoke now and then;* 3) I am allowed to smoke regularly.*	0.93/ 0.89	1-5 (definitely not- definitely)	1-5 (definitely not- definitely)*	A, P	Looze de et al., 2012a
Cannabis-specific rules	1) I am allowed to try out smoking a joint*; 2) I am allowed to smoke a joint now and then;* 3) I am allowed to smoke a joint regularly.*	0.89/ 0.77	1-5 (definitely not- definitely)	1-5 (definitely not- definitely)*	A, P	Adapted from Looze de et al., 2012a

A = Adolescent report; P = Parent report; *Negative items were reverse scored so that higher scores indicate higher levels of support/ more restrictive parenting.

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FAMILY INTERVENTIONS AND THEIR EFFECT ON ADOLESCENT ILLICIT DRUG USE; A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

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Abstract

In order to quantify the effectiveness of family interventions in preventing and reducing adolescent illicit drug use, we conducted a systematic review and meta-analysis of randomized controlled trials. We searched the Cochrane Database of Systematic Reviews, Educational Research Information Centre (ERIC), Medline, Embase and PsycInfo (including dissertation abstracts) for studies published between 1995 and 2013. Meta-analyses were performed on marijuana and other illicit drug initiation in universal samples, using random effect models. Pooling results was considered inappropriate for frequency of illicit drug use (universal, selective and indicated) and recent illicit drug use (selective), as outcome measures, follow-up times and sample populations were too diverse; thus we provided narrative reviews. 39 papers describing 22 RCTs were eligible for inclusion. Universal family interventions targeting parent-child dyads are likely to be effective in preventing (OR = 0.72; 95% CI = 0.56, 0.94) and reducing adolescent marijuana use, but not to prevent other illicit drugs (OR = 0.90; 95% CI = 0.60, 1.34). Among high-risk groups, there is no clear evidence for the effectiveness of family interventions in preventing and reducing illicit drug use and drug disorders. The three small RCTs among substance (ab)using adolescents gave some indication that programs might reduce frequency of illicit drug use. Family interventions targeting parent-child dyads are likely to be effective in preventing and reducing adolescent marijuana use in general populations, but no evidence for other illicit drug use was found. We underline the need to strengthen the evidence-base with more trials, especially among at-risk populations.

Introduction

Adolescent illicit drug use is common in Western society, while early initiation and frequent use are associated with increased risks of academic failure (Fergusson et al., 2007) and mental health problems, e.g. depression (Graaf de et al., 2010) and psychosis (Henquet et al., 2005; Schubart et al., 2010; Smit et al., 2004; Os van et al., 2002). At the age of 16, 30 percent of Dutch adolescents have used cannabis (Verdurmen et al., 2012a), which is comparable to the average of European 15-16 year olds (29%) (Hibell et al., 2012). More than 40% of Dutch adolescents have used some kind of illicit drug at the age of 18 (e.g. marijuana, cocaine or XTC) and about a third of 17-18 year old boys used any illicit drug during the past month (Monshouwer et al., 2008).

The existing evidence for developmental harm caused by early illicit drug use highlights the need of preventive interventions, especially among high-risk adolescents such as adolescents at lower educational levels, drop-outs and juvenile offenders (Kepper et al., 2011; Monshouwer et al., 2008; Van Laar et al., 2010). However, little is known concerning the evidence of illicit drug prevention among adolescents. There is some evidence for school-based interventions in preventing adolescent alcohol and illicit drug use (Faggiano et al., 2005; Foxcroft and Tsetsvadze 2012; Komro and Toomey 2002). Moreover, interventions aimed at reducing adolescent alcohol use show 2-9 times greater effects when targeting families, compared to interventions targeting the child solely, such as school interventions (Kumpfer et al., 2003). As comparable family factors (like an authoritative parenting style, parental monitoring and parental rules) are associated with both adolescent alcohol and illicit drug use (Bahr et al., 2005; Baumrind 1991; Calafat et al., 2014; Hawkins et al., 1992; Kelly et al., 2002; Vermeulen-Smit et al., submitted), we might expect family interventions to be effective in preventing adolescent illicit drug use as well. The evidence from RCTs, however, has not confirmed this hypothesis. Recent reviews (Hyshka 2013; Jackson et al., 2012) found that there is some evidence that addressing multiple domains of influence is most effective to prevent cannabis and other risk behaviors in young people. Gates et al. (2006) could not be conclusive concerning the particular effectiveness of family interventions in preventing adolescent illicit drug use, due to the small number of family interventions (published up to 2004) that reported on the effectiveness of illicit drug prevention. However, the last decade a number of randomized controlled trials have been published regarding this topic. Therefore, in the present study we will give an update of the existing

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evidence concerning the effectiveness of family interventions in delaying and reducing adolescent illicit drug use.

The present study

We carried out a meta-analysis, restricted to randomized controlled trials, to quantify the overall effect of family-interventions in preventing adolescent illicit drug use. As illicit drug use is common among youth, yet more frequently used in specific risk groups, we were interested in three types of interventions[2] 1) the effectiveness of a "whole group" approach of prevention, therefore including family programs in general populations 2) the effectiveness of interventions in selective populations of at-risk adolescents, such as juvenile offenders or children of substance abusing parents and 3) the effectiveness of interventions in preventing and reducing heavier use among young illicit drug users. The aim of this meta-analysis is to quantify the overall effect of family-interventions in preventing adolescent illicit drug use (i.e., marijuana initiation, initiation of other illicit drugs, and the frequency of illicit drug use in the last month).

Method

Identification of studies

A search strategy was designed to identify studies reporting on a family intervention aimed at preventing illicit drug use in adolescents aged under 22. We identified studies from five electronic databases: the Cochrane Database of Systematic Reviews, Educational Research Information Center (ERIC), MEDLINE, EMBASE and PsycInfo (including Dissertation Abstracts). We included studies published between 1995 and 2013. In addition, references of included articles and earlier reviews and meta-analyses were used to search for additional studies.

Illicit drug-related search terms included 'drug use', 'drug abuse', 'substance abuse', 'marijuana usage', 'drug abuse prevention', and 'drug education'. The intervention-related search terms included 'family', 'parent', 'family attitudes', 'family programs', 'family therapy', 'family intervention', 'parent child relationship' and 'child rearing'. Pertinent (mesh) terms were adapted for use in the different databases by an information specialist. Full-text articles of randomized

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2   Interventions can be ordered in three types: 1) universal preventive interventions are intended for all members of a general population; 2) selective interventions are intended for higher risk population subgroups, and 3) indicated interventions are intended for members of populations that have been individually identified as being at high risk, and show early signs of being on the trajectory towards a specific disorder, in this case drug abuse.

controlled trials, in all languages, that reported on children, adolescents or students were included in the search strategy.

Published articles as well as (possibly unpublished) dissertations were included when describing, 1) a family intervention (at least half of the program had to be targeting parents directly), 2) any type of learning media e.g. group sessions, skills training, booklets and computer-delivered programs, 3) any type of intervention (universal, selective and indicated prevention (Mrazek and Haggerty 1994)) and accordingly interventions in any type of population (general populations, youth at-risk for illicit drug use e.g. juvenile offenders or children of illicit drug users, and youth already using illicit drugs) and 4) the effectiveness of the program. Articles were excluded when 1) interventions were part of a multi-component intervention and no separate analyses were performed for family interventions, 2) the outcome was not actual illicit drug use, e.g. intention to use or any substance use (including tobacco or alcohol use) and 3) the subjects were not randomly assigned to the intervention or control condition.

All possibly relevant papers were selected according to a two-step procedure: where possible, the decision to exclude studies was based on the abstract. When articles could not be excluded on this basis, the decision for inclusion was based on the full paper.

Data extraction

Data extraction was carried out by the first author. Uncertainties were resolved through discussion with the second author. For each selected article, information was extracted about the characteristics of the publication, population, study design, intervention, analysis and the follow-up times at which the end points were measured. Furthermore, outcome specific information was collected, such as outcome type (e.g. marijuana initiation) and effect sizes (e.g. odds ratio (OR) or Cohen's d). When an article reported data comparing two or more types of intervention, data were reported separately for each intervention condition relative to the control group. When a study included a 'school-based intervention group', a 'school-based plus a parent intervention group' and a 'minimal intervention control group', the school-based intervention group was used as the comparison group, since we were interested in the unique effect of family interventions.

Data analysis

We conducted separate analyses for two different outcome types ("marijuana initiation" and "initiation of other illicit drugs", as more than two independent estimates were eligible for analyses of these outcome types. Papers were included in the marijuana initiation analysis when they reported on lifetime (ever/ never) marijuana use. Initiation of other illicit drugs included lifetime (ever/ never) use of 'cocaine/ crack', 'illicit drug initiation', 'illegal drug initiation' and 'inhalants'. Estimates were suitable for meta-analysis when either the number of users and non-users were given or could be obtained, or when number of subjects, means and standard deviations (SD) were given or could be obtained both for the intervention and control group. When illicit drug use was reported at pretest as well as at follow-up measures, we calculated the effect-size correcting for the pretest use. The number of studies reporting on the effectiveness of reducing the frequency of illicit drug use in universal samples and the number of studies reporting on selective and indicated samples were small and diverse; therefore a narrative review was provided describing these results.

We had a particular interest in long-term effects of the interventions; yet, follow-up times were not similar in all studies. To minimize the differences in times of follow-up between studies, we used the most frequently cited follow-up assessment when a study reported outcomes on different follow-up times and discarded the other time points. When a single study reported on two or more populations, we used all estimates separately in the analyses. Hence, one study can have multiple effect sizes.

Random effect models were used for all analyses. We examined the occurrence of heterogeneity between studies using Q-statistic (which is χ^2 distributed); however, as the Q-statistic is not very sensitive when the number of studies is small, we also quantified the amount of heterogeneity between studies using I^2 (Higgins et al., 2003), which yields the percentage of variance between the individual studies' effect sizes that cannot be accounted for by chance (sample error).

The statistical analyses were carried out using the statistic software package STATA-V11 (Stata Corp., College Station, TX). P values that were less than 0.05 were considered statistically significant. All statistical tests were two-sided.

Results

We identified 532 articles from our database search. After reading abstracts and when necessary full texts (153), we included 39 articles. Most articles were

excluded as they were no randomized controlled trials or as the subjects were in treatment for substance use dependence. About a quarter of the studies were excluded as the outcome was not actual illicit drug use, but e.g. parenting practices (e.g. Preparing for the Drug Free Years (PDFY), Kosterman et al., 2001), problem behavior (SFP in special populations, Kumpfer et al., 1996), expectancy to use illicit drugs (including the "Family Advocacy Network", St. Pierre 1997) and "Keeping A Clear Mind", Young et al., 1996)), substance use (initiation of either tobacco, alcohol or marijuana (Coping Power, Lochman and Wells 2002; PDFY, Mason et al., 2007) or alcohol use (Family Matters, Bauman et al., 2001b). A small number of excluded articles described school or community interventions, without separate analyses for family interventions (e.g. Keepin' It real, Kulis et al., 2007; Midwestern prevention program, Riggs et al., 2009; Project Northland, Perry et al., 2007; Preventive Treatment Program (Montreal), Tremblay et al., 1996 and Utrecht Coping Power Program, Zonnevylle-Bender et al., 2007).

In the 39 articles, eight universal (9 RCTs), eight selective (10 RCTs) and two indicated (3 RCTs) family programs were described. Table 1 gives an overview of the intervention characteristics of the 18 family programs (as a number of programs are examined before and after adaptation or with different control groups, 21 programs are described separately in table 1). Study characteristics, like outcome type, follow-up time, adolescent age and ethnicity are described in Table 2 (universal programs) and Table 3 (selective and indicated programs).

Design

According to our inclusion criteria all studies were randomized controlled trials. Yet, only two trials reported that research staff (and trainers or recruitment staff) was blinded to treatment condition (Fang et al., 2013; McGillicuddy et al., 2001). Six other trials reported that (at least 96% of) assessment (and recruitment) staff was blinded to treatment conditions (Connell et al., 2007; DeGarmo et al., 2009; Milburn et al., 2012; Winters and Leitten 2007; Winters et al., 2012; Wolchik et al., 2013).

Most studies used intent-to-treat analyses (table 2 and 3), i.e. including all adolescents assigned to the intervention in the analyses regardless of their parents actual program attendance. More recent studies performed intent-to-treat analyses in the strict sense, i.e. including all randomized participants in the analyses regardless of completion of follow-up measurements (DeGarmo et al., 2009; Fang et al., 2013; Haggerty et al., 2008; Milburn et al., 2012; Prado et al., 2012; Rotheram-Borus et al., 2012; Wolchik et al., 2013).

Table 1: Intervention characteristics of 39 publications of randomized controlled trials describing universal (8), selective (8) and indicated (2) interventions focusing on parents (and their children) with the intention to delay or reduce illicit drug use among adolescents.

Program (type) (Subgroups)	Reference	Intervention characteristics	Control group
Universal			
Familias Unidas (Universal)	Prado et al. 2007	Familias Unidas + PATH (Parent- Preadolescent Training for HIV Prevention). Familias Unidas is a parent-centered intervention aimed to improve family functioning, addressing issues like parental involvement, positive parenting, parent-adolescent communication and family support. PATH focuses specifically on increasing parent-child communication about unsafe sex and HIV-risks.	Attention control: 1) ESOL (English for Speakers of Other Languages) + PATH or 2) ESOL + HEART (HeartPower! for Hispanics))
FSP (Universal)	Furr-Holden et al. 2004	FSP (Family-school partnership); 1) Training for teachers / school mental health professionals and other relevant school staff in parent-school communication and partnership building, 2) weekly home-school learning and communication activities, 3) nine workshops (7 + 2 boosters) for parents led by the first grade teacher and the school psychologist or social worker	Standard care
Home based parent alcohol intervention (Universal)	Grossbard et al. 2010	Home based family alcohol intervention (combined with BASICS) (for BASICS, see control condition); 35 page handbook to discuss with their teen before matriculation to college including facts about college drinking, strategies and techniques for communication with teens, tips to help teens develop assertiveness and resist peer pressure and information about how alcohol works in their body.	Waitlist control or BASICS (computer generated personalized feedback concerning alcohol use at baseline)
ImPACT (Universal)	Wu et al. 2003; Stanton et al. 2000[a]; 2004[a]	ImPACT (Informed Parents And Children Together) + Focus on Kids (FoK, see control group); 20 minute video plus two instructor led vignettes, delivered in homes. Topics included monitoring child whereabouts and communication about adolescent risk behaviour	Parental attention control (video about career + discussion with instructor + text) + FoK: eight groups sessions including education, games and videos. Topics included: decision making, goal setting, communication, negotiating skills and info about safe sex, alcohol and illicit drugs.
Parents Who Care (Universal)	Haggerty et al. 2007	PA: parent and adolescent administered format: Seven (2-2,5 hour) parent-child group sessions universal substance abuse and problem behaviour preventive intervention for families (including at least one parent and their teen together) including parenting, youth and family components. Based on social development model. SA: self-administered with weekly telephone support format: video and workbook and 62 activities to complete as a family)	No treatment control

Table 1: Intervention characteristics of 39 publications of randomized controlled trials describing universal (8), selective (8) and indicated (2) interventions focusing on parents (and their children) with the intention to delay or reduce illicit drug use among adolescents. (continued)

Program (type) (Subgroups)	Reference	Intervention characteristics	Control group
PDFY; (Universal)	Spoth et al. 1999; 2001; 2009b[a]	Preparing for the Drug Free Years (PDFY); Four sessions attended by parents only, focusing on identifying risk factors, effective rearing strategies and conflict management. One session for both child and parent together focusing on peer resistance skills.	Minimal contact control condition (four mailed leaflets describing different aspects of adolescent development).
SFP; (Universal)	Spoth et al. 1999; 2001; 2004[a]; 2006[a]; 2008[a]; 2009a[a]; 2009b[a]; 2012[a]	Iowa's Strengthening Families Program (ISFP) (adjusted from the SFP); Seven two hour sessions for children and parents, one hour together and one hour separately; training of parenting, norm setting and communication skills of parents; skills training for children focusing on communication, management of stress, conflict, emotions and resistance.	Minimal contact control condition (four mailed leaflets describing different aspects of adolescent development).
SFP10-14; (Universal)	Spoth et al. 2002	The intervention group received both Strengthening Families Program (SFP10-14) + Life Skills Training (LST, see control group) SFP program contains seven two hour sessions for children and parents, one hour together and one hour separately; aimed at reducing youth substance use and other problem behaviour; intermediate goals include the enhancement of parental skills in nurturing, limit setting, and communication, as well as youth pro-social and peer resistance skills. (Four booster sessions 18 months after pretest).	LST: a 15 session school based prevention program aimed at promoting skills development (e.g. social resistance, self-management and general social skills) and to provide knowledge encouraging the avoidance of substance use. Five booster sessions 18 months after pretest.
SODAS-City Computer-delivered mother-daughter intervention (Universal) (Girls)	Schinke 2009a; 2009b; 2011a; Fang et al. 2010[a]; 2013	Nine/ten session computer-delivered (cd-rom or internet) substance use prevention program including narration, skills demonstration and interactive exercises for mothers and daughters to complete together. Topics included communication, rules, monitoring, self-image and peer pressure.	No-treatment control

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Table 1: Intervention characteristics of 39 publications of randomized controlled trials describing universal (8), selective (8) and indicated (2) interventions focusing on parents (and their children) with the intention to delay or reduce illicit drug use among adolescents. (continued)

Program (type) (Subgroups)	Reference	Intervention characteristics	Control group
Selective			
Familias Unidas (Selective: delinquent youth)	Prado et al. 2012	Familias Unidas; A parent-centered intervention aimed to improve family functioning, addressing issues like parental involvement, positive parenting, parent-adolescent communication and family support. Familias Unidas included 8 2-hour parent group sessions, and 4 1-hour family visits.	Community Practice. Standard care services are made available to families in the control condition, including referrals to community-based organizations that offer several therapeutic modalities, like individual and family therapy aimed to address multi problem behaviours e.g. alcohol and drug problems.
Family Check-up (Selective: youth at risk for substance use)	Connell et al. 2007	The Family Check-up (FCU) is part of a multilevel intervention: Adolescent Transition Program (ATP). The first level of the programs is a universal program that established a Family Resource Center in schools plus six in-class sessions for adolescents referred to as the SHAPe Curriculum. The selected intervention was the FCU which was specifically offered to the families of high-risk youth. FCU consisted of three sessions: initial interview, an assessment session and a feedback session based on motivational interviewing. During the assessment session the family was videotaped in the home while engaging in a variety of tasks that would help evaluate parent-child interactions.	Adolescents in the intervention condition (FCU) were compared with high-risk adolescents using Complier Average Causal Effects (CACE)-modeling to assess the effect of a selective intervention as part of multilevel intervention.
Family Check-up (Selective: youth at risk for substance use)	Fosco et al. 2013; Stormshak and Dishion 2009[a]; Stormshak et al. 2011	The Family Check-up (FCU) is part of a multilevel intervention: EcoFIT. The first level of the programs is a universal program that established a Family Resource Center in schools, offering diverse, flexible services and service delivery options. The selected intervention was the FCU which was specifically offered to the families of high-risk youth. FCU consisted of three sessions: initial interview, an assessment session and a feedback session based on motivational interviewing. During the assessment session the family was videotaped in the home while engaging in a variety of tasks that would help evaluate parent-child interactions.	Adolescents in the intervention condition (FCU) were compared with high-risk adolescents using Complier Average Causal Effects (CACE)-modeling to assess the effect of a selective intervention as part of multilevel intervention.

Table 1: Intervention characteristics of 39 publications of randomized controlled trials describing universal (8), selective (8) and indicated (2) interventions focusing on parents (and their children) with the intention to delay or reduce illicit drug use among adolescents. (continued)

Program (type) (Subgroups)	Reference	Intervention characteristics	Control group
Family Empowerment Intervention (FEI) (Selective: juvenile offenders)	Dembo et al. 2000	Family Empowerment Intervention. Home visits to youth and family from study field consultants. Parenting and family functioning education.	Extended Services Intervention. Monthly telephone contact from study research assistant.
Focus on Families (Selective: methadone-treated parents)	Catalano et al. 1999; Haggerty et al. 2008	Methadon treatment + parenting program consisting of 33 sessions of family training based on social development model (5 hour family retreat and 32 90 min parent sessions (12 together with children), including motivation, discussion, modeling, guided practice, independent practice and generalization (skills training included relapse prevention and coping, anger management, child development and communication skills, holding family meetings, setting clear expectations of children and use of appropriate rewards and disciplinary consequences. Parents are instructed in teaching their child refusal skills, problem solving and strategies for succeeding in school. Nine months of home-based case management aimed to generalize and maintain the trained skills.	Methadon treatment alone (methadone dispensing and some individual and group counseling).
LIFT (Selective; schools in high-risk neigbourhoods)	DeGarmo et al. 2009	LIFT (Linking the interests of families and teachers); Parent management training, child social and problem solving skills training, school recess intervention (a version of good behaviour game). Encouragement of parent and teacher communication.	Services as usual
New beginnings program (Selective: Children and their recently divorced custodial parent).	Soper et al. 2010[a]; Wolchik et al. 2002; 2013	Mother Plus Child Program (MPCP) consisted of 11 group sessions of 1.75 hours led by clinicians focusing on effective coping, reducing negative thoughts about divorce stressors, improving mother-child relationship quality. Mother Program (MP) consisted of 11 group sessions of 1.75 hours led by clinicians plus 2 individual 1-hour sessions. The intervention aimed to improve mother-child relationship quality and effective discipline, increasing fathers' access to child and reducing inter-parental conflict.	Self-study. Mothers and children received 3 books, at 3 weeks interval.
Strive (Selective: newly homeless youth)	Milburn et al. 2012	Strive (Support to Reunite, Involve and Value Each other). The Strive intervention consisted of five sessions administered to youth and parents together based on cognitive-behavioural theories aimed to improve families' problem-solving, conflict resolution skills, positive family climate, improving family functioning and providing role clarity.	Standard Care including appropriate referrals based on their needs.

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Table 1: Intervention characteristics of 39 publications of randomized controlled trials describing universal (8), selective (8) and indicated (2) interventions focusing on parents (and their children) with the intention to delay or reduce illicit drug use among adolescents. (continued)

Program (type) (Subgroups)	Reference	Intervention characteristics	Control group
TALC (Selective: children of parents with HIV)	Rotheram-Borus et al. 2004; Rotheram-Borus et al. 2006[a]	Project TALC (Project Teens and Adults Learning to Communicate) A coping skills intervention based on social learning theory and cognitive-behavioural principles and delivered in three modules addressing either parental or adolescent tasks related to the parents' phase of illness. Module one consisted of eight parent sessions. Module two consisted of 16 sessions for the parent and adolescent separately or together, including avoiding high-risk behaviours, like substance use. If their parents died adolescents were invited to attend 16 sessions in module three focusing on a positive youth-guardian relationship and setting new life goals.	Families in the control condition were given access to a broad range of services based on need to parents with HIV and their children, including rent subsidies, home care, child care, food banks, mental health services, and medical care. Each parent with HIV was assigned to a social worker who functioned as a case manager.
TALC (adapted) (Selective: children of parents with HIV)	Rotheram-Borus et al. 2012	A shortened version of the abovementioned TALC intervention including a total of 16 sessions and elimination of focus on post death family adjustment.	Waiting list control group
Indicated			
Brief intervention	Winters and Leitten 2007; Winters et al. 2012	One hour-session parent component based on motivational interviewing focused on improving parental monitoring and increasing parent caring behaviours.	Two one-hour sessions of brief interventions based on motivational interviewing with the adolescent only in a school-setting.
Parent coping skills training	McGillicuddy et al. 2001	Parent coping skills training aimed at enabling parents to respond more effectively to their adolescents' substance use. The program is based on a behavioural – analytical model of skill training, and consists of eight weekly 2-hour sessions to teach 'more effective' coping skills in responding to their adolescents' substance use (not in treatment). The training uses group discussion and role-play around a standard set of frequently encountered situations.	Waitlist control

[a] Results from these papers were not included as outcome measures did not allow inclusion in the meta-analyses (e.g. due to growth curve modelling) or narrative review (e.g. due to combining marijuana and alcohol measures). AA = African American; EA = European American; PA = Parent and adolescent; SA = Self-Administered format

Table 2: Study characteristics of eight universal family interventions (9 RCTs). *

Program	Reference (subgroup)	Outcome	N (intervention/ control groups)	Study quality	Randomization level	Population (child) Ethnicity; (majority of the population) (%); Age (Mean age at pretest (age range/ SD)); Gender
Familias Unidas	Prado et al. 2007	Freq. of illicit drug use in the past 90 days	91/84	Blinding: Raters who assessed adherence to modules Intent-to-treat Follow-up: 36 m Attrition: 20%	Individual	Eth: Hispanics (100) Age: 13.4 (.7) Gender: mixed
FSP	Furr-Holden et al. 2004	Marijuana initiation Other illicit drugs	196/178 196/178	Blinding: n/a Intent-to-treat Follow-up: 7 y Attrition: 16%	School	Eth: AA (85-90) Age: 6.2 Gender: mixed
Home based family alcohol intervention	Grossbard et al. 2010	Freq. of marijuana use last month Freq. of LSD use last month Freq. of hallucinogens use last month Freq. of amphetamine use last month Freq. of steroid use last month	342/277 342/277 342/277 342/277 342/277	Blinding: n/a Intent-to-treat Follow-up: 10 m Attrition: 14%	College	Eth: Caucasian (80%) Age: 17.9 (.39) Gender: mixed
ImPACT	Wu et al. 2003	Marijuana initiation Lifetime crack/ cocaine use	344/239 362/241	Blinding: n/a Intent-to-treat: n/a Follow-up: 6 m, 12 m Attrition: 33%	Community	Eth: Black (100) Age: 14 (13-16) Gender: mixed
Parents Who Care	Haggerty et al. 2007 (PA, AA) (SA, AA) (PA, EA) (SA, EA)	Marijuana initiation Marijuana initiation Marijuana initiation Marijuana initiation	42/37 32/37 42/42 41/42	Blinding: n/a Intent-to-treat Follow-up: 24 m Attrition: 8%	Individual	Eth: AA (100) Age: 13.7 Gender: Mixed EA (100) EA

Table 2: Study characteristics of eight universal family interventions (9 RCTs).* (continued)

Program	Reference (subgroup)	Outcome	N (intervention/ control groups)	Study quality	Randomization level	Population (child) Ethnicity; (majority of the population) (%); Age (Mean age at pretest (age range/ SD)); Gender
	(PA, AA)	Other illegal drug use initiation	42/37			AA
	(SA, AA)	Other illegal drug use initiation	32/37			AA
	(PA, EA)	Other illegal drug use initiation	42/42			EA
	(SA, EA)	Other illegal drug use initiation	41/42			EA
PDFY	Spoth et al. 2001 Spoth et al. 1999	Marijuana initiation Inhalant initiation	143/151 143/151	Blinding: n/a Intent-to-treat Follow-up: 48 m Attrition: 33%	School	Eth: Caucasian (99) Age: 11.3 (SE=0.03) Gender: mixed
SFP	Spoth et al. 2001 Spoth et al. 1999	Marijuana initiation Lifetime inhalant use	150/151 151/151	Blinding: n/a Intent-to-treat Follow-up: 48 m Attrition: 33%	School	Eth: Caucasian (99) Age: 11.3 (SE=0.03) Gender: mixed
SFP10-14	Spoth et al. 2002	Marijuana initiation	453/503	Blinding: n/a Intent-to-treat: n/a Follow-up: 12 m (posttest assessment is used as baseline) Attrition: n/a	School	Eth: Caucasian (96) Age: 12 (10-14) Gender: mixed
SODAS City Computer-delivered intervention	Schinke et al. 2009a; 2009b (girls)	Marijuana freq. last month Prescription drug freq. last month Inhalant freq. last month	205/327; 415/413	Blinding: n/a Intent-to-treat: no Follow-up: 12 m, 24 m Attrition: 9.6%	Individual	Eth: Black (49) Age: 12.7 (11-13) Gender: girls
SODAS City Computer-delivered intervention	Fang et al. 2013 (girls)	Marijuana freq. last month Prescription drug freq. last month	56/52	Blinding: Investigators & recruitment staff Intent-to-treat Follow-up: 12 m, 24 m Attrition: 13.9%	Individual	Eth: Asian American Age: 13.1 (SD = 0.96) Gender: girls

* PA = Parent and adolescent- Administered format; AA = African American; SA = Self- Administered format; EA = European American; freq. = frequency; Eth = ethnicity[a]
Longer-term follow-up assessment (24 months vs. 12 months) include more children as data from different publications were used with different, yet overlapping, samples.

Table 3: Study characteristics of selective (8) and indicated (2) family interventions (13 RCTs).

Program	Reference	Outcome	N (intervention/ control)	Study quality	Randomization level	Population (child): Ethnicity (majority of the population) (%); Age (Mean at pretest (age range/ SD)); Gender
Selective						
Familias Unidas	Prado et al. 2012	Illicit drug use in the past 90 days; Marijuana dependence	120/122	Blinding: n/a; Intent-to-treat; Follow-up: 12 m; Attrition: 5%	Individual	Eth: Hispanic or Latino (100); Age: 14.7 (12-17); Gender: mixed
Family Check-Up (selective program as part of a multilevel program: ATP)	Connell et al. 2007	Frequency of marijuana use last month	500/498 (115 engagers; 385 non engagers)	Blinding: Assessment staff; Intent-to-treat: No (CACE Model); Follow-up: 5,5 y; Attrition: 20.5%	Individual	Eth: Caucasian (42.3); Age: 11; Gender: mixed
Family Check-Up (selective program as part of a multilevel program: EcoFIT)	Fosco et al. 2013; Stormshak et al. 2011	Frequency of marijuana use last month	386/207 (163 engagers; 223 non engagers)	Blinding: n/a; Intent-to-treat: No (CACE Model); Follow-up: 36 m; Attrition: n/a	Individual	Eth: EA (36); Age: 6th graders; Gender: mixed
Family Empowerment Intervention (FEI)	Dembo et al. 2000	Marijuana use last year	81/82	Blinding: n/a; Intent-to-treat: n/a; Follow-up: 12 m; Attrition: 16%	Individual	Eth: n/a; Age: n/a; Gender: mixed
Focus on Families	Catalano et al. 1999; Haggerty et al. 2008	Marijuana use last month; Marijuana use disorder	6-12 m.: 58/ 46 12-15 y: 82/69 (> 1 child/ family); 71/55 (one random child/ family) [a]	Blinding: n/a; Intent-to-treat; Follow-up: 6 m, 12 m, 12-15 y; Attrition: 10%, 17%	Individual	Eth: White (77); Age: 10.4 (6-14); Gender: mixed

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Table 3: Study characteristics of selective (8) and indicated (2) family interventions (13 RCTs). (continued)

Program	Reference	Outcome	N (intervention/ control)	Study quality	Randomization level	Population (child) Ethnicity (majority of the population) (%); Age (Mean at pretest (age range/ SD)); Gender
LIFT	DeGarmo et al. 2009	Illicit drug use in the last 6 months; Frequency of illicit drug use in the last 6 months (growth rate over 7 years)	Total: 348	Blinding: Assessment staff; Intent-to-treat; Follow-up: 7 y; Attrition: 4%	School	Eth: EA (85); Age: 5th graders; Gender: mixed
New beginnings program	Wolchik et al. 2002; 2013	Frequency of marijuana use last year and last month; Frequency of other illicit drug use last year; Illicit drug abuse; Illicit drug dependence	6 y follow-up: Mother-child: 73; Mother-only:77; Control: 68; 15 y follow-up: Mother-child + mother-only:164 Control76	Blinding: Assessment staff (>96%); Intent-to-treat; Follow-up: 6 y, 15 y; Attrition: 9.2%; 10.4%	Individual	Eth: White; Age: 10.7 (9-12); Gender: mixed
Strive	Milburn et al. 2012	Marijuana or hard drug use in the past 3 months; Frequency of marijuana use in the past 3 months; Frequency of hard drug use in the past 3 months	68/83	Blinding: Recruitment & assessment staff; Intent-to-treat; Follow-up: 12 m; Attrition: 54%	Individual	Eth: Hispanic (62); Age: 14.8 (12-17); Gender: mixed
TALC	Rotheram-Borus et al. 2004	Marijuana use yes/no (time period unspecified)	156/161	Blinding: n/a; Intent-to-treat; Follow-up: 6 y; Attrition: 19.7%	Individual	Eth: Latino (51.4); Age: 14.8 (11-21); Gender: mixed
TALC (adapted version)	Rotheram-Borus et al. 2012	Marijuana use in the past 6 months; Hard drug use in the past 6 months; No. of marijuana use days in the past 90 days; No. of hard drug use days in the past 90 days	172/167	Blinding: n/a; Intent-to-treat; Follow-up: 18 m; Attrition: 29%	Individual	Eth: Latino (63); Age: 14.9 (2.4); Gender: mixed

Table 3: Study characteristics of selective (8) and indicated (2) family interventions (13 RCTs). (continued)

Program	Reference	Outcome	N (intervention/ control)	Study quality	Randomization level	Population (child) Ethnicity (majority of the population) (%); Age (Mean at pretest (age range/ SD)); Gender
Indicated						
Brief intervention	Winters and Leitten 2007	No. of illicit drug use days	Parent + adolescent: 26; Adolescent-only: 26; Control: 27	Blinding: Assessment staff; Intent-to-treat: n/a; Follow-up: 6 m; Attrition: 0.01%	Individual	Eth: White (81) Age: 15.6 (14-17) Gender: mixed
Brief intervention	Winters et al. 2012	No. of cannabis use days; No. of cannabis abuse symptoms; No. of cannabis dependence symptoms	123/136 Parent + adolescent: 123; Adolescent-only: 136; Control: 56	Blinding: Assessment staff; Intent-to-treat: n/a; Follow-up: 6 m; Attrition: 0.01%	Day/ evening group	Eth: White (58.9) Age: 16.3 (12-18/1.4) Gender: mixed
Parent coping skills training	McGillicuddy et al. 2001	No. of marijuana use days (parent report of adolescent use)	14/8	Blinding: Treatment & research staff; Intent-to-treat; Follow-up: 2 m; Attrition: 0%	Individual	Eth: White (91) Age: 16.2 (12-21) Gender: mixed

S=Selective; I=Indicated; n/a: No information provided; Eth = ethnicity; CACE = Complier Average Causal Effects-modeling to assess the effect of a selective intervention as part of multilevel intervention; [a] As children below the age of 11 were not assessed, long-term follow-up assessment (12-15 years post baseline) include more children than short term (6 and 12 months) follow-up assessments.

All trials were from the US.

Intervention duration ranged from a single one hour session (Winters and Leitten 2007; Winters et al., 2012) to over 30 sessions (Catalano et al., 1999; Rotheram-Borus et al., 2004; 2012) and boosters were added between follow-up measures in a number of studies (Fang et al., 2013; Furr-Holden et al., 2004; Spoth et al., 2002).

Follow-up times ranged from 2 months (McGillicuddy et al., 2001) to 15 years (Haggerty et al., 2008; Wolchik et al., 2013). Attrition ranged from zero (McGillicuddy et al., 2001) to 54% (Milburn et al., 2012).

Five family programs were tested (after adaptation) in multiple (two) trials, i.e.: Strengthening Families Program (SFP, Spoth et al., 1999b; 2001 versus SFP10-14, Spoth et al., 2002); Family Check-up (FCU as part of ATP, Connell et al., 2007 versus FCU as part of EcoFIT, Fosco et al., 2013; Stormshak et al., 2011); TALC (TALC, Rotheram-Borus et al., 2004 versus TALC adapted, Rotheram-Borus 2012); SODAS- City (10-session version, Schinke et al., 2009a; 2009b versus 9-session version, Fang et al., 2010; 2013) and a brief indicated program (pilot, Winters and Leitten 2007 versus larger RCT, Winters et al., 2012).

One study provided separate outcomes for different formats (self-administered and family group-sessions), and ethnic groups (European-Americans versus African-Americans) (Haggerty et al., 2007). The two trials in which SODAS-city was examined were performed among different ethnic groups (mixed ethnicity and Asian Americans). Moreover, SODAS-city was specifically designed for and examined among mother-girl dyads. All other studies examined mixed gender populations and moderation analyses on gender were performed only by five studies (DeGarmo et al., 2009; Grossbard et al., 2010; Haggerty et al., 2008; Winters et al., 2012; Wolchik et al., 2013). One family program (Familias Unidas) was examined both in a universal (Prado et al., 2007) as well as a high-risk sample (delinquent youth, Prado et al., 2012).

Two programs (three RCTs), targeting children of parents with HIV or in methadone treatment, included more than one child per family in the analyses (Haggerty et al., 2008; Rotheram-Borus et al., 2004; 2012). Haggerty et al. (2008) found equivalent results when one random child per family was included.
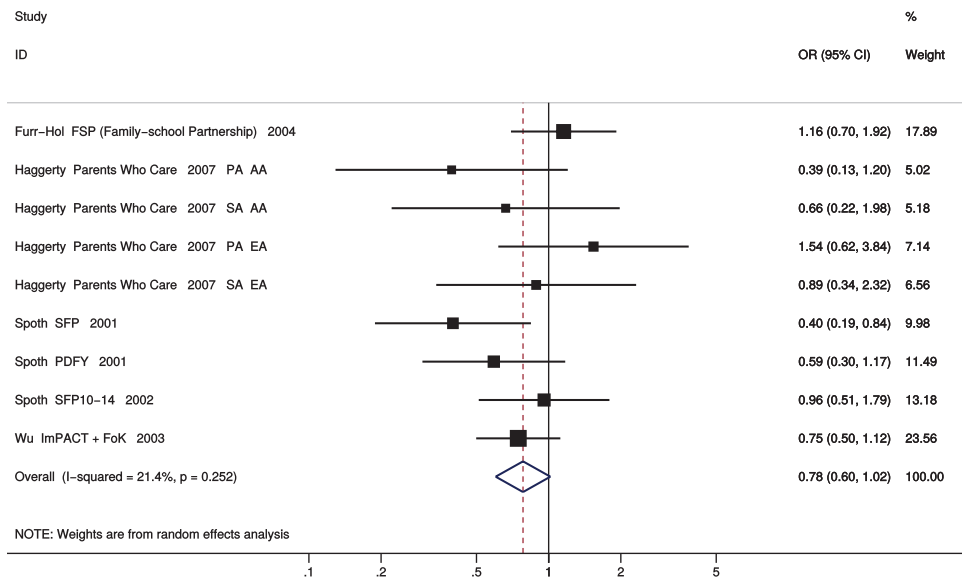
The effectiveness of universal family programs

Marijuana initiation

Five articles, describing six independent studies, reported on marijuana initiation over the next 12 – 48 months (Furr-Holden et al., 2004; Haggerty et al., 2007;

Spoth et al., 2001; 2002; Wu et al., 2003) (Table 1 and 2). As one study reported on four separate population subgroups, nine estimates were eligible for analysis. All but two (Furr-Holden et al., 2004; Haggerty et al., 2007, one of four subgroups) reported an OR below one (range: 0.39- 0.96), suggesting a reduced likelihood of initiating marijuana use, due to the intervention. Only the strengthening families program, a 7-session skills-training intervention among 11-year olds and their parents, significantly reduced the likelihood of lifetime marijuana use among adolescents four years later (OR = .40; 95% CI: .19 - .84) (Spoth et al., 2001). The summary OR (95% CI) of the nine estimates was 0.78 (0.60, 1.02), implying a non-significant reduction in marijuana initiation level due to the interventions (Figure 1). Testing for heterogeneity provided no clear evidence to suggest heterogeneity between studies ($\chi^2 = 10.2$ (8); $p = 0.25$). Still 21.4% (I^2) of the total variation was attributable to systematic variation across studies.

Study ID	OR (95% CI)	% Weight
Furr–Hol FSP (Family–school Partnership) 2004	1.16 (0.70, 1.92)	17.89
Haggerty Parents Who Care 2007 PA AA	0.39 (0.13, 1.20)	5.02
Haggerty Parents Who Care 2007 SA AA	0.66 (0.22, 1.98)	5.18
Haggerty Parents Who Care 2007 PA EA	1.54 (0.62, 3.84)	7.14
Haggerty Parents Who Care 2007 SA EA	0.89 (0.34, 2.32)	6.56
Spoth SFP 2001	0.40 (0.19, 0.84)	9.98
Spoth PDFY 2001	0.59 (0.30, 1.17)	11.49
Spoth SFP10–14 2002	0.96 (0.51, 1.79)	13.18
Wu ImPACT + FoK 2003	0.75 (0.50, 1.12)	23.56
Overall (I–squared = 21.4%, p = 0.252)	0.78 (0.60, 1.02)	100.00

NOTE: Weights are from random effects analysis

Fig. 1: Forest plot for effects of universal family intervention on marijuana initiation, considering nine independent estimates from six family programs (5 RCTs), using a random effect model.

Sensitivity analysis

The overall estimate of marijuana initiation is strongly influenced by a single study (FSP, Furr-Holden et al., 2004) which differed from the other studies in two ways. I.e. FSP targeted *only parents* when adolescents were 6 years old, while the other studies 1) combined child and parent approaches and 2) were delivered when adolescents were 10-14 years old. When excluding this estimate from the meta-analysis, the pooled estimate was significant (OR (95% CI) = .72 (.56- .94) and heterogeneity among studies decreased (χ^2 = 7.51 (7), p = 0.378, I^2 = 6.8%).

Initiation of other illicit drugs

Four articles, describing five independent studies, reported on initiation of other illicit drugs over the next 12 – 48 months (Furr-Holden et al., 2004; Haggerty et al., 2007; Spoth et al., 1999b; Wu et al., 2003). As one study reported on four separate population subgroups, eight estimates were eligible for analysis. All but three (Haggerty et al., 2007, one of four subgroups; Spoth et al., 1999b; Wu et al., 2003) reported an OR below one (range: 0.39- 0.88), suggesting a reduced likelihood of initiating other illicit drugs, due to the intervention. Yet, all estimates had confidence intervals including 1.0. The summary OR (95% CI) of the eight estimates was 0.90 (0.60, 1.34), implying no significant reduction in initiation of other illicit drugs due to the interventions (Figure 2). Testing for heterogeneity provided no evidence to suggest heterogeneity between studies (χ^2 = 5.42 (7); *p* = 0.61; I^2 = 0.0%).

Frequency of illicit drug use past month

Six articles describing three universal intervention programs (4 RCTs) reported on the frequency of marijuana, illicit drug use or both (Grossbard et al., 2010; Prado et al., 2007; Schinke et al., 2009a, 2009b; 2011; Fang et al., 2010; 2013). As the outcome measures and follow-up times were diverse, and we did not succeed in getting additional information from the authors in order to calculate Cohen's ds on all studies, we chose to provide a narrative review.

   Grossbard et al. (2010) reported a home-based family alcohol intervention combined with a child intervention to be effective in reducing the frequency of marijuana use 10 months post baseline compared to the child intervention alone (N = 619; d = -0.23, z = 2.82, p < 0.01). Yet, effects on other drugs (LSD, Hallucinogens, Amphetamines and Steroids) were not significant. No significant moderation effects were found by gender or baseline drinking for all outcomes.
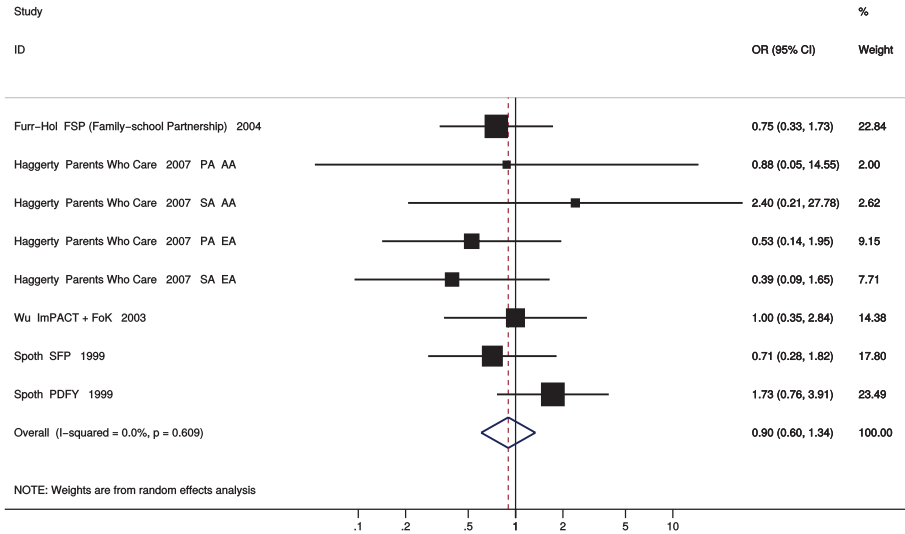
Fig. 2: Forest plot for effects of universal family intervention on initiation of hard drugs (illicit drugs other than marijuana), considering eight independent estimates from five family programs (4 RCTs), using a random effect model (follow-times varying from 12-48 months). PA = Parent and adolescent- Administered format; AA = African American; SA = Self- Administered format; EA = European American.

Schinke et al. (2009a) found a 10-session computerized mother-daughter program to be effective in reducing last month frequency of marijuana use ($\chi^2 =$ 6.75, p < 0.01) and the frequency of prescriptions for nonmedical purposes ($\chi^2 =$ 12.45, p < 0.0001) at one-year follow-up. At two-year follow-up reductions were observed for occasions of marijuana use (F = 4.12, p = 0.02), use of prescriptions for nonmedical purposes (F = 3.58, p = 0.03) and inhalant use (F = 3.72, p = 0.02), compared to the control condition (Schinke et al., 2009b). Especially, mother-daughter engagement in activities to build their relationship was expected to explain the success of this family intervention. Parenting characteristics, like monitoring, communication and rules on substance use, as well as adolescent characteristics, like refusal skills improved due to the intervention and were accordingly expected to explain the decrease in illicit drug use.

In an additional RCT, Fang et al. (2010; 2013) found a 9-session version of the abovementioned computerized mother-daughter program to be effective among

Asian-American girls (N = 108) in reducing adolescent marijuana use over a 2 year follow-up period (F = 3.24, p = 0.04) as well as the use of prescriptions for nonmedical use over a 2 year follow-up period (F = 3.15, p = 0.047).

Familias Unidas (Prado et al., 2007) + PATH (Parent- Preadolescent Training for HIV Prevention) was effective, compared to the attention control (ESOL (English for Speakers of Other Languages) + HEART (HeartPower! for Hispanics)) in reducing illicit drug use 36 months post baseline (d =0.58, z = 2.02, p < 0.05), yet not compared to ESOL + PATH (d = 0.05, z = 1.07, p = 0.28). The effects of Familias Unidas + PATH were found to be mediated by improvements in family functioning, especially positive parenting and parent-adolescent communication. Therefore, the authors suggest strengthening the family system to be most effective in preventing illicit drug use (amongst others) (Prado et al., 2007).

In conclusion, the evidence for the effectiveness of family interventions in reducing the frequency of adolescent illicit drug use is based on four RCTs with varying sizes, outcome measures and follow-up times. Still, this small body of knowledge is generally encouraging.

The effectiveness of selective family programs

Sixteen articles describing eight independent family programs (10 RCTs) reported on the impact of family interventions on marijuana or other illicit drug use in high-risk populations (Table 1 and 2). As the outcome measures, follow-up times and, especially, populations (including e.g. children of recently divorced parents, newly homeless youth, and children of methadone-treated parents) were diverse, we chose to provide a narrative review.

Recent illicit drug use

Six articles reported on the effects of five family interventions in preventing adolescent illicit drug use among high-risk populations.

Rotheram-Borus et al. (2004) described a family intervention aimed at children of parents with HIV. Compared to controls, who were provided access to a broad range of services and assignment to a case-manager, the family intervention TALC (Table 1 and 2) did not significantly prevent marijuana use or other illicit drug use 6 years post baseline. Additionally, Rotheram-Borus et al. (2012) compared an adapted version of TALC to a waiting list control group. Rates of marijuana and hard drug use remained similar after 18 months.

Catalano et al. (1999) examined a family intervention focusing on children of parents in methadone treatment called Focus on the Family (FoF). Short term re-

sults (6 to 12 months post baseline) indicated no effects on adolescent marijuana initiation.

Milburn et al. (2012) described the results of a family intervention aimed to reduce sexual risk taking, substance use and delinquency among newly homeless youth. No significant effect for lifetime marijuana or harddrugs was found after 12 months (no effect sizes reported).

Linking the Interests of Families and Teachers (LIFT), a school-based intervention in high-risk neighborhoods had a marginal effect on the intercept of illicit drug use initiation (β = -.09, p <.10) (DeGarmo et al., 2009).

Familias Unidas, a family intervention aimed at delinquent youth and their parents was efficacious in reducing the chance of illicit drug use in the past 90 days (29.1% vs. 22.5%), compared to controls (23.1 vs. 31.3%) 12 months post baseline (b = -0.72, p = 0.04, δ = 0.79) (Prado et al., 2012). This effect was moderated by parental stress (Familias Unidas reduced the change of recent drug use in families with high parental stress, but not significantly among those with no parental stress). No significant moderation effects were observed for social support for parents.

Five out of six RCTs reported no significant effect (p < 0.05) of selective family interventions in preventing adolescent illicit drug use among high-risk populations, indicating no clear evidence for the success of these programs.

Frequency of illicit drug use

Nine articles reported on the effectiveness of six family programs (7 RCTs) among high-risk populations in reducing the frequency of adolescent illicit drug use.

An adapted version of TALC, a family intervention aimed at children of parents with HIV (Table 1), increased the frequency of marijuana use compared to a waiting list control group (t = 5.97, df = 256, p < 0.01), whereas hard drug use decreased significantly more in the intervention condition (t = -3.46, df = 256, p < 0.01) after 18 months (Rotheram-Borus et al., 2012).

Adolescents receiving the STRIVE intervention, a family intervention aimed to reduce sexual risk taking, substance use and delinquency among newly homeless youth, increased the frequency of marijuana use during the past 90 days (9 to 12 times) compared to a decrease in the control condition (12 to 6 times), p < 0.001). Still, the frequency of hard drug use decreased in both intervention groups, especially in the STRIVE condition (2.8 to 0.3, vs. 2.7 to 1.2, p < 0.001) 12 months post baseline (Milburn et al., 2012)

Linking the Interests of Families and Teachers (LIFT), a school-based intervention in high-risk neighborhoods had a significant effect on illicit drug use frequency over 7 years (slope, β = -.12, p <.05) (DeGarmo et al., 2009) This effect was not mediated by family problem-solving outcomes. Girls in the sample showed higher illicit drug use rates at baseline and greater benefits in growth rates of illicit drug use.

The New Beginnings Program (NBP) (Wolchik et al., 2002; 2013) targeted children aged 9-12 and their recently divorced custodial parent. The mother-program resulted in a lower frequency of adolescent marijuana use last year compared to the control condition at six years follow-up. At 15 years follow-up both intervention conditions (Mother-Child Program and Mother Program) together were compared to the self-study control condition. For last month marijuana frequency a significant reduction was not observed, and for past year frequency of other illicit drugs only among males (d= 0.61).

Dembo et al. (2000) described the results of the one-year follow-up of a family intervention among juvenile offenders. Although the effect size was not reported, the authors found a significant reduction of the frequency of marijuana use in the last year.

Last, the Family Check-Up (FCU) was examined as part of a multi-level intervention called Adolescent Transitions Program (ATP) (Connell et al., 2007). Due to the design of the study, CACE (Complier Average Causal Effect) -modeling (see Imbens and Rubin 1997) was used showing the frequency of marijuana use past month to be 5-7 times smaller. In a second trial FCU was investigated as part of a multilevel intervention called EcoFIT. CACE-modeling revealed a significant intervention effect on the growth of adolescent marijuana use frequency (risk estimate (SE) = -1.13 (0.21), d = 1.10, p < 0.05) during middle school years (Stormshak et al., 2011). An effect that was mediated through adolescent self-regulation at two-year follow-up (Fosco et al., 2013).

The included selective family interventions aimed to reduce the frequency of adolescent illicit drug use strongly varied in content, follow-up times, outcome measures, targeted populations and results. Three family programs (4 RCTs) resulted in a reduced marijuana use frequency. Two other family programs showed an increase in marijuana use, yet a reduction in hard drug use. Still another study found a reduced frequency of marijuana use after 6 years, which did not hold until 15 years post baseline, while a reduction in harddrugs use was observed only among males. Due to the heterogeneity across studies and small sample sizes we cannot conclude that there is evidence of family programs to be

effective among high-risk adolescents in general nor among a particular group of high-risk adolescents.

Drug disorders

Four studies were found that reported on the effect of selective family interventions on adolescent drug disorders. First, Familias Unidas, aimed at delinquent youth and their parents, was found to have a non-significant effect on the growth of marijuana dependence favoring the intervention condition (b = -0.49, p = 0.15, δ = 0.93) (Prado et al., 2012). No significant moderation effects were observed for either social support for parents or parent stress. Second, the FoF intervention, which focused on children of methadone-treated parents, was found to decrease the risk of a marijuana disorder on the longer term (12-15 years post baseline when children were 15-29 years old; Haggerty et al., 2008) among boys, yet not among girls. No significant moderation was observed by adolescent's age. Third, the New Beginnings Program (NBP) (Wolchik et al., 2002; 2013) targeted children aged 9-12 and their recently divorced custodial parent. Results showed no significant differences between Mother-Child Program, Mother Program and self-study control group on adolescent drug abuse and dependence six years post baseline. Fourth, results from the Family-Check-up trial revealed no significant difference for marijuana abuse/dependence (χ^2(1, N= 998) = 0.74, ns; Connell et al., 2007). Thus, Focus on Families (FoF) was the only study that reduced the risk of marijuana disorder. This effect was found only among boys, at 12-15 years post baseline when children were 15-29 years old.

The effectiveness of indicated family programs

Only three studies reported on the effectiveness of two family interventions in reducing illicit drug use among adolescents already using illicit drugs, who were not dependent or in treatment (indicated prevention).

In a pilot study (N = 79), Winters and Leitten (2007) reported that a one-hour parent session, aimed to promote parental monitoring and parent caring behavior, added to two one-hour sessions for adolescents, decreased the number of days adolescents used illicit drugs in the last six months significantly more than the assessment only group (d = -0.91, z = 3.14, p = 0.02), but not more than those receiving only the adolescent intervention (d = -0.30, z = 1.06, p = 0.29). An additional RCT (N = 315) revealed that the effect of a one-hour parent session in addition to two adolescent-only sessions decreased the number of cannabis use days, the number of cannabis abuse symptoms and the number of cannabis

dependence symptoms in the last 6 months significantly more than the assessment only group; and decreased the number of cannabis use days significantly more than the adolescent only intervention (Winters et al., 2012). The decrease in number of cannabis use days due to the intervention was not significantly mediated through parenting practices, yet through increased use of community services. No significant moderation was observed by adolescent's gender, age, race, therapist or baseline drug use.

McGillicuddy et al. (2001) reported on an intervention consisting of eight weekly 2-hour sessions to teach parents more effective coping skills in responding to their adolescents' substance use. The small randomized trial (N =22) showed greater improvement in parental coping skills, parents' own functioning, family communication and the number of marijuana use days (parent report) in the last 50 days in the intervention group compared to the waiting list control group (effect size = 0.08).

Thus, three RCTs showed positive outcomes of family interventions in reducing the number of days adolescents used illicit drugs. Larger studies with longer-term follow-up assessments by independent evaluators are necessary to confirm these promising findings.

Discussion

Main findings

Only nine randomized controlled trials were found examining the effect of family interventions on illicit drug use in general populations. Overall, universal family programs targeting adolescents (aged 10-14) as well as their parents seem to have a small favorable effect on the initiation of marijuana use. Still, there is no clear evidence of the efficacy of family interventions in preventing adolescent initiation of illicit drug use other than marijuana. Findings on the effectiveness of universal family interventions in reducing the frequency of adolescent illicit drug use are encouraging (4 RCTs). Among high-risk groups (selective prevention), there is no clear evidence of the effectiveness of family interventions on 1) illicit drug initiation (6 RCTs), 2) the frequency of illicit drug use (7 RCTs), and 3) drug disorders (3 RCTs). Three small RCTs point towards a favorable effect of family interventions in reducing the frequency of illicit drug use among substance (ab)using adolescents (indicated prevention).

Universal family programs

Overall universal family programs, targeting parent-child dyads, are likely to be effective in preventing marijuana and reducing marijuana use among adolescents. This finding is in line with recent reviews (Hyshka 2013; Jackson et al., 2012) which reported some evidence that addressing multiple domains of influence is most effective to prevent cannabis and other risk behaviors in young people. Still, only half of the individual studies showed significant results. Furthermore, the overall effect on illicit drug other than marijuana was not significant. Different explanations have been suggested that might clarify why half of the included programs do not seem to prevent illicit drug use among adolescents, while the others do (with respect to marijuana).

First, in line with family interventions aimed to prevent adolescent alcohol use (Kumpfer et al., 2003; Koning et al., 2009), the combination of parent and adolescent approaches may be essential in preventing adolescent illicit drug use. For instance, we found that the overall estimate of marijuana initiation was significant, when excluding a single study (FSP, Furr-Holden et al., 2004) which targeted only parents, while the other studies combined child and parent approaches. In accordance, the three studies reporting on the frequency of illicit drug use all targeted both parent and adolescent separately or together and were able to reduce the frequency of illicit drug use among adolescents. The success of combining parent and child approaches may be explained through 1) parent-child interaction as an essential element for family interventions to be successful (Petrie et al., 2007; Foxcroft et al., 2003), and 2) the combination of essential parenting and adolescent directed topics (Petrie et al., 2007). I.e. programs that included general parenting, substance-specific parenting and adolescent self-control/ peer resistance skills significantly prevented adolescent marijuana use (Spoth et al., 2001; Schinke et al., 2009a; 2009b; Grossbard et al., 2010). Just one universal program (Prado et al., 2007) performed mediation analyses and found family functioning (particularly positive parenting and parent-adolescent communication) to (partially) mediate the effect of Familias Unidas + PATH on adolescent illicit drug use. Mediation analyses in RCTs are recommended to gain more insight into effective program elements.

Second, program effectiveness may be related to type of learning media used in the programs (e.g. group sessions, home based, computer delivered). Haggerty et al (2007; Parents Who Care), compared formats and found no differences between the group administered format and the self-administered with weekly telephone support format group. Use of modern media like internet and

computer-based interventions (Tait et al., 2013) may need to be compared with face-to-face interventions, as active parental involvement (face-to-face or by telephone) has been suggested to explain (part of) the success of the most effective interventions aimed to reduce adolescent substance use (Petrie et al., 2007).

Third, the optimal age of the child during the intervention has been suggested to be of importance (Petrie et al., 2007). For example, the FSP program, involving parents of 6-year olds in school-programs, did not result in a reduced risk of marijuana use seven years later, while those aimed at 10-14 year olds did. Accordingly, the time of follow-up assessments may explain differential outcomes between and within programs. Possibly, the intervention effect of the FSP-program does not last seven years and may be faded out when adolescents are 13. Additionally, 13 years of age may still be too early to be able to detect differences in illicit drug use between intervention and control group.

Fourth, it is unclear whether family programs are differentially effective across gender and ethnicity groups. One study compared program effectiveness across gender (Grossbard et al., 2010) and two did so across ethnicity groups (SODAS, Schinke et al., 2009a; 2009b; Fang 2013; and Haggerty et al., 2007). Moderation analyses across population subgroups are recommended to investigate whether programs are, as they intend to be, universally effective.

Fifth, program intensity is likely to explain the success of the most effective universal interventions aimed to prevent adolescent substance use (Petrie et al., 2007). E.g. SFP consists of seven two-hour sessions plus transportation to the program location and supplying meals. In accordance, booster sessions may explain the longer term efficacy (effect remains after 2-4 years for SODAS and SFP (Fang et al., 2013; Spoth et al., 2002).

Sixth, differential effectiveness across programs may be due to methodological differences, like program attendance, attrition from follow-up assessments, intention to treat analyses and blinding of researchers (table 2).

Last, as marijuana may be used as a gateway drug and other illicit drugs may be used at a later age, we may hypothesize that parental influence on adolescent marijuana versus other illicit drug may differ in strength and nature (Vermeulen-Smit et al., submitted). More research is needed on the role of parenting practices in relation to marijuana and other illicit drugs.

Selective and indicated family programs

The few studies that tested the efficacy of selective and indicated family programs in preventing or reducing illicit drug use were very heterogeneous, and

often counterproductive or without significant effect. Still, the included studies give rise to hypothesize on ways to improve research and development of family programs among these young people that are at particular risk of (problematic) drug use.

First, the effective elements of family programs aimed at high-risk families may differ from those in general populations. That is, high-risk and substance using adolescents may demonstrate a variety of problem behaviors, which may need a different content and a more intensive and multifaceted approach. Mediation analyses were performed in three studies among high-risk adolescents. DeGarmo et al. (2009) found that a decrease in illicit drug use frequency could not be explained through family problem solving. Second, the significant effect of the Family Check-Up on reducing the growth of adolescent marijuana use frequency (Stormshak et al., 2011) was mediated through adolescent self-regulation (Fosco et al., 2013). Among substance using adolescents, Winters et al. (2012) found that a brief intervention decreased the number of cannabis use days, an effect that was not significantly mediated through parenting practices, yet through increased use of community services. On the one hand, a one-hour session was insufficient to improve parenting practices. On the other hand, the importance of increased use of community services might explain why other family programs did not show program success when compared to controls "who were given access to a broad range of services" (e.g. Rotheram-Borus et al., 2004).

Second, in contrast to universal programs, programs aimed at high-risk adolescents (selective prevention) and programs aimed to prevent more problematic use (indicated prevention) mostly start when adolescents are 15-16 years old. Possibly, among high-risk adolescents like newly homeless and children of parents with HIV the age of 15 may be too late to address marijuana use, and programs might be more successful when addressing problematic use instead of abstinence (Hopson and Steiker 2010).

In addition to adolescent age, program effectiveness may differ across adolescent gender. Moderation analyses on gender were performed by four studies, showing either girls (DeGarmo et al., 2009), boys (Haggerty et al., 2008; Wolchik et al., 2013), or both (Winters et al., 2012) to benefit from the intervention. More research is needed to investigate whether a differential approach to drug use prevention is needed for at-risk boys and girls.

Last, high-risk groups may benefit from more intensive and targeted programs combined with universal programs (which may alter their social-environment by e.g. decreasing peer substance use) (Lochman and Van den Steenhoven 2002). Moreover, embedding more intensive programs within universal interventions

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may become more prominent as the difficulty of attracting and retaining high-risk families is a general challenge of family interventions (Cuijpers 2003; Gates et al., 2006). The Family Check-Up (Stormshak and Dishion 2009; Connell et al., 2007) is a promising example of a selective family intervention that has been examined as part of a universal school program and showed large reductions in marijuana use among adolescents. Still, rigorous effectiveness trials - in different populations and by independent evaluators - are needed to confirm the effectiveness of multi-level programs.

Apart from the Family Check-Up, a small number of promising programs may be worthwhile mentioning. First, Focus on Families (FoF) was the only study that reduced the risk of marijuana disorder. This effect was found only among boys, when studying a small sample, yet at 12-15 years post baseline when children were 15-29 years old. Second, two small RCTs point towards a favorable effect of a one hour family intervention based on motivational interviewing in reducing the frequency of illicit drug use among substance (ab)using adolescents.

In the light of the observed effectiveness of family programs in adolescent alcohol prevention (Smit et al., 2008) and drug *treatment* (Rowe 2012), parents are expected to be important in preventing and reducing adolescent drug use, yet the evidence from current family programs is small, and among high-risk samples insufficient. More research is needed to identify the key elements, optimal age and strategies to attract and attain high-risk youth and their parents in these programs, in order to investigate whether and how family interventions can prevent at-risk boys and girls from early and problematic illicit drug use.

Limitations

These findings need to be interpreted in the light of the limitations of both our systematic review and meta-analyses, and those of the primary studies. First, it was our aim to include all randomized controlled trials. Although we searched for peer reviewed articles and possibly unpublished dissertations in five different databases and performed additional reference searches, we may have missed unpublished articles and abstract-only publications. This might lead to small study bias: not only inferior studies, but also well performed small studies which report small effects or contradict current opinions, are more frequently rejected by journals or are not submitted for publication by the author.

Second, our inclusion criteria for family programs to "target at least half of the program to parents", might have been to strict. For instance, an adapted version of SFP in Sweden had been excluded from our study (Skärstrand et al., 2013)

as after the adaptation process to the Swedish populations the parent part of the program had become too small for inclusion in our review. On the one hand, the decrease in parent involvement in the intervention might explain why no significant effect on drug use was observed in Sweden. On the other hand, a small parent component may be an essential addition to adolescent only interventions in preventing adolescent substance use (Koning et al., 2009). Future studies need to unveil essential components of family programs to maintain their effectiveness when adapting and implementing them in other countries or settings.

Third, not all included studies could be combined in a single meta-analysis as different outcome types for illicit drug use were used in the included studies, resulting in a small number of estimates being available for the different meta-analyses. Furthermore, we included only the most frequently cited follow-up times in our meta-analyses and discarded other time points, which included exceptionally long follow-up effects, like the 10-year follow-up effects of SFP (Spoth et al., 2012).

Fourth, one may feel reluctant to combine results from different studies, conducted with different methods in different populations. Therefore, we used random effect models for all analyses. These models do not assume that the primary studies are exact replicas of each other and, as a rule, they give broader confidence intervals for the meta-analytically pooled estimate of the effect size.

Limitations concerning many of the included primary studies include: methodological shortcomings (self-reports of illicit drug use without validation with biomarkers, no strict intent-to-treat analyses, i.e. including all randomized dyads in the analyses; no blinding to randomization of research staff; and the use of monetary incentives for assessments as well as participation in program activities) and lack of replications by independent evaluators.

Conclusion

The results of this systematic review and meta-analysis suggest family interventions targeting parent-child dyads to show a small favorable effect on initiation and frequency of marijuana use, yet no clear evidence on initiation of illicit drugs other than marijuana. However, only a small number of studies reported the effect of family interventions on marijuana and other illicit drug use of adolescents in universal populations. Furthermore, just ten RCTs examined on family interventions aimed to prevent illicit drug use among, a broad range of, at-risk adolescents, showing no clear evidence of their effectiveness. Three RCTs among substance (ab)using adolescents show promising findings. We underline the need

to strengthen the evidence-base with rigorous trials, especially among at-risk populations and more studies conducted in countries other than the US. In sum, this systematic review showed that family interventions are likely to be effective in preventing and reducing adolescent marijuana use in general populations.

8 | GENERAL DISCUSSION

Main findings

Findings from this thesis underline the importance of parents in adolescent alcohol and cannabis use (Table 1).

Parental heavy drinking, and not so much the frequency of drinking, was associated with early juvenile drinking and with a stronger increase in drinking throughout adolescence. That is, adolescents with a heavy drinking father or two heavy episodic drinking parents drink earlier and heavier than those with non or incidentally drinking parents, especially among adolescents attending vocational education. (chapter 2)

Alcohol-specific parenting practices, e.g. high quality of alcohol-specific communication and strict alcohol-specific rules were consistently related to lower rates and a smaller quantity of adolescent alcohol use in large national samples. Dutch parents, in general, increasingly adopted strict alcohol-specific practices between 2007 and 2011, which might explain the decreasing trends among Dutch early adolescent drinking in recent years. Still, among 16 year olds, parents did not exert stricter alcohol-specific rules in recent years, and rates and quantity of drinking did not decrease in this age group. While adolescent drinking becomes more prevalent and heavier throughout adolescence, alcohol-specific rules are more strongly associated with less adolescent drinking among older, compared to younger adolescents. Besides, alcohol-specific parenting is equally associated with adolescent drinking across gender and educational tracks. (chapter 3)

In addition, a meta-analysis of randomized controlled trials revealed small, yet consistent, effects of universal family interventions in delaying and reducing adolescent drinking. Still, all included studies were performed in the US. (chapter 4)

In the Netherlands, we examined a home-based family program, called 'In control: No alcohol!', using a RCT design, which resulted in more perceived harmfulness of drinking and less intention to drink among adolescents. The (small) effect of the 'In control: No alcohol!' program on perceived harm of drinking, could be partially explained by an increase in alcohol-related conversations, yet only among boys. (chapter 5)

In line with the role of parents in adolescent alcohol use, parental cannabis use is significantly related to adolescent lifetime and recent cannabis use, and cannabis-specific parental rules are clearly associated with adolescent recent cannabis use and lifetime hard drug use, even when controlled for general parenting, adolescent tobacco use, and tobacco-specific parenting. Furthermore,

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Table 8. Summary of the main findings.

Alcohol		Main findings	Chapter
Parental drinking	-	Parental heavy (episodic) drinking, and not so much the frequency of drinking was found to be the most harmful to their offspring. When controlled for parental rules about alcohol these (moderate) effects remained significant and consistent.	2
Alcohol-specific parenting	-	Between 2007 and 2011, Dutch parents increasingly adopted strict alcohol-specific practices, while adolescent lifetime and last month alcohol use decreased.	3
	-	Alcohol-specific parenting practices, e.g. high quality of alcohol-specific communication and strict alcohol-specific rules were weakly, yet consistently, related to lower rates and a smaller quantity of adolescent alcohol use.	
Moderating factors in the role of parents in adolescent drinking			
Developmental stage	-	Parental heavy drinking constitutes a higher risk of drinking initiation at the age of 12, as well as on the development of drinking throughout adolescence.	2, 3
	-	Between 2007 and 2011, Dutch parents increasingly adopted strict alcohol-specific practices, except for parents of 16-year old adolescents. Furthermore, adolescent lifetime and last month alcohol use decreased, except for 16 year olds.	
	-	The associations between alcohol-specific parenting and adolescent alcohol use are found to differ across age groups, with stronger associations for older age groups (14-16 year olds), compared to younger age groups (12-13-year olds).	
Gender	-	Small differences are found in the influence of parental drinking patterns on adolescent drinking between boys and girls at the age of 12.	2, 3
	-	The trends in alcohol-specific parenting and adolescent alcohol use were similar for boys and girls.	
	-	The associations between alcohol-specific parenting and adolescent alcohol use were similar across gender, with the exception of the association between alcohol-specific rules and the number of glasses consumed, which was stronger for boys.	
Educational track	-	When both parents drank daily, heavy episodically or when fathers drank heavily, adolescent weekly alcohol consumption at the age of 15 was 1.5 to 2 times higher among those attending vocational education compared to their peers in academic education.	2, 3
	-	The trends in alcohol-specific parenting and adolescent alcohol use were similar for adolescents in different educational tracks.	
	-	Associations between alcohol-specific parenting practices and adolescent alcohol use (lifetime, last month and number of glasses during a weekend) were similar for adolescents attending vocational and academic tracks.	

Family interventions	-	The overall effect of family interventions in general populations on adolescent alcohol use is small, yet consistent and effective even at 48 months.	4, 5
	-	Due to the 'In control: No alcohol!' pilot study children perceived drinking as more harmful and had less intention to drink. The (small) effect of the 'In control: No alcohol!' program on perceived harm of drinking, could be partially explained by an increase in alcohol-related conversations, yet only among boys.	
Cannabis			
Parental cannabis use	-	Parental cannabis experience is significantly (weak to moderately) related to more adolescent lifetime and recent cannabis use, even when controlled for general and tobacco-specific parenting and adolescent tobacco use.	6
Cannabis-specific parenting	-	Cannabis-specific parental rules are moderately associated with less adolescent recent cannabis and lifetime hard drug use, even (weak to moderately) when controlled for general and tobacco-specific parenting and adolescent tobacco use.	6
	-	Cannabis-specific parental rules are equally associated with adolescent cannabis use among families with and without parental cannabis experience.	
Family interventions	-	Family interventions targeting parent-child dyads are likely to be effective (small effect) in preventing and reducing adolescent cannabis use in general populations.	7
	-	Insufficient evidence exists on the effectiveness of family programs in preventing adolescent illicit drug use other than cannabis, and for programs targeting high-risk and substance (ab)using adolescents.	

cannabis rules are equally associated with adolescent cannabis use among families with and without parental cannabis experience. (chapter 6)

Furthermore, family interventions are likely to be effective in preventing and reducing adolescent cannabis use in general populations. Insufficient evidence exists on the effectiveness of family programs in preventing adolescent illicit drug use other than cannabis, and for programs targeting high-risk and substance (ab)using adolescents. (chapter 7)

Reflections on the role of parents in adolescent alcohol use

Results indicate that parental drinking as well as alcohol-specific parenting were associated with adolescent drinking throughout adolescence. Chapter 2 indicates that two out of six parental drinking patterns constituted a particular risk for adolescent drinking. That is, 1) adolescents from families with an incidentally drinking mother and a heavy drinking father were at higher risk for a stronger increase in drinking throughout adolescence, and 2) adolescents from families with two heavy episodic drinking parents were at higher risk of

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both early drinking and for a stronger increase in drinking. Thus, parental heavy (episodic) drinking, and not so much the frequency of drinking, predicts the initiation and development of alcohol consumption in their offspring. These associations remained significant and consistent when controlled for parental rules about alcohol. Although, parental heavy (episodic) drinking is relatively uncommon in our sample of two-parent families (3%), these findings have clear and important implications for prevention practice.

While particular parental drinking patterns explain the heavier drinking among children of heavy (episodically) drinking parents, alcohol-specific parenting practices play a more general role in the initiation and quantity of alcohol use among secondary school students. That is, alcohol-specific parenting practices, and especially restrictive rules about alcohol, are consistently related to different stages of adolescent drinking in longitudinal studies (Koning et al., 2012; Mares et al., 2013; Van der Vorst, 2007). Still, these studies have been performed among relatively small samples, which did not fully represent Dutch secondary school students, as studies were mainly based on a sample of adolescents living with both biological parents (Mares et al., 2013; Van der Vorst, 2007). In addition to these studies, this thesis (chapter 3) shows that constructive and strict alcohol-specific practices (parent perception) were associated with less adolescent lifetime and last month alcohol use and with a lower number of glasses consumed during a weekend in three large nationally representative samples. Additionally, chapter 3 revealed that between 2007 and 2011, adolescent lifetime and last month alcohol use decreased considerably, while, in the same period, parents reported greater awareness of the harm of their children's alcohol use, better quality of alcohol-related communication and increased likelihood of setting rules with respect to their child's alcohol use. These findings are consistent with the recent increased awareness in research, policy and the media about the harmful effects of alcohol on young people. Specifically, they are consistent with the focus of recent national and local prevention efforts aimed at parents to postpone the alcohol use of their child. Furthermore, as our findings are based on large nationally representative samples, we were able to investigate the stability of associations throughout the developmental stage of adolescence and across adolescent gender and educational track.

Moderating factor: The impact of parents on adolescent drinking may depend upon the developmental stage of adolescents.

Chapter 2 revealed that heavy parental drinking was found to predict not only early drinking but also a stronger increase in adolescent drinking between 12-15 year olds. This is in contrast with theoretical models reporting parental drinking to affect early drinking more than the transition to regular or problem drinking (Simons et al., 1988). Parental modelling, for example, is suggested to play a stronger role at a younger age because most adolescents start to drink with the family at home (Van der Vorst et al., 2010). However, apart from parental modelling, the remaining influence of parental drinking throughout adolescence may be explained by additional mechanisms. Rose and Dick (2005) report environmental factors, like parental modelling, to greatly influence the initiation of drinking, while genetic influences become of increasing importance once drinking has been initiated. Hence, parental modelling and genetic factors might explain the observed impact of parental heavy drinking on both early drinking and the development of adolescent drinking.

While adolescent drinking becomes more prevalent and heavier throughout adolescence, alcohol-specific parenting is found to be more strongly associated with less adolescent drinking among older (14-16 year olds), compared to younger adolescents (12-13 year olds) (chapter 3). Furthermore, during a period (2007-2011) wherein national and local policy and media messages underlined the need to postpone adolescent drinking, at least till the age of 16, adolescent drinking declined among 12-15 year olds, but not among 16 year olds. Meanwhile, parental restrictive alcohol-related rules became stricter among 12-15 year olds, but not among 16 year olds.

Thus, not so much, or at least not only, the declining influence of parenting practices, but the lack of e.g. restrictive rules on drinking might explain (part of) the heavier alcohol use among older adolescents. This finding needs to be interpreted in the light of earlier studies. On the one hand, throughout adolescence the parent-child relation changes, i.e. adolescents spend less time with their parents and adolescents' identity becomes more articulate (Larson et al., 1996; Meeus et al., 2005). On the other hand, parent's support as well as their behavioral control (discussing the boundaries of acceptable behavior) have been found to remain important for their developing children (Beyers and Goossens, 2008). Also with respect to adolescent drinking, the influence of parents has been found to remain important during adolescence (Wood et al., 2004). Parental rules on alcohol, for instance, have recently been found to affect adolescent drinking, even into

early adulthood (Abar et al., 2009; Mares et al., 2013). More specifically, a recent longitudinal study found that, although parental rule setting became less strict throughout adolescence and adolescent drinking concurrently increases, still parental rules on alcohol were found to affect adolescent drinking a year later, even when adolescents were 19-21 years old (Mares et al., 2013). As adolescent drinking at the age of 16 remained high in the two last decades (lifetime prevalence was 86.2% and 89.7% in 1992 and 2011, respectively) and the quantity of drinking remained high (among 16 year olds, last month drunkenness was 27.3% and 46.6% in 1992 and 2011, respectively; Verdurmen et al., 2012a), while parental restrictive rules are still related to less adolescent drinking, parents should be highly aware of their remaining influence on adolescent drinking throughout adolescence and maintain strict rules in order to prevent their children from (heavy) drinking. Chapter 3 highlights the importance for future policy efforts to pay more attention to the quantity of alcohol consumed by adolescents and to alcohol prevention among adolescents aged 16 years and over. Meanwhile, since 2014, the legal age of drinking in the Netherlands has been increased from 16 to 18 year olds. National monitoring studies still need to show the effectiveness of this adjusted national policy on alcohol-related parenting practices and, especially, on adolescent early and heavy drinking throughout adolescence.

Moderating factor: The impact of parents on adolescent drinking may differ across gender.

Chapter 3 revealed that trends in alcohol-specific parenting and adolescent alcohol use were similar for boys and girls. This may indicate the general effectiveness of prevention messages across gender. In accordance, the associations between alcohol-specific parenting and adolescent alcohol use were similar for boys and girls. However, there was one exception. That is, the association between alcohol-specific rules and the number of glasses consumed, was stronger for boys. This finding is in line with longitudinal studies, which found parenting factors that predict adolescent drinking, to vary in the strength of their influence on boys and girls (Danielsson et al., 2011; Kelly et al., 2011; Kumpfer et al., 2008). In specific, alcohol-specific parenting (e.g. parental disapproval), might play a stronger role in preventing alcohol use among boys, whereas general parenting (e.g. family bonding) may be more effective among girls (Kumpfer et al., 2008). In accordance, small differences are found in the influence of parental drinking patterns on adolescent drinking between boys and girls at the age of 12 (chapter 2). More research, using longer term follow-up assessments, is needed to clarify

whether the impact of parental drinking patterns and general- and alcohol-specific parenting on adolescent drinking differs across gender.

Moderating factor: The impact of parents on adolescent drinking may differ across educational tracks.

In the Netherlands, from the first year of secondary school, when pupils are 12–13 years of age, the educational system is already highly differentiated. Depending on their teacher's advice and the results of a test in the last year of primary education pupils enter different types of secondary education. Studying the potential differences of parental drinking and parenting practices on adolescent alcohol use across educational levels is recommended in the light of prevention efforts, since 1) family programs are often targeting parents via schools (Koning et al., 2009; Mares et al., 2012b); 2) family programs seem to be differentially effective across educational levels (Verdurmen et al., 2014) and 3) adolescent drinking is heavier at lower educational levels (Dorsselaer van et al., 2010; Verdurmen et al., 2012a).

We found that parental drinking patterns affected adolescent drinking differently across educational tracks (Chapter 2). That is, in families where both parents drank daily, heavy episodically or when fathers drank heavily, adolescent weekly alcohol consumption in lower educational levels was 1.5 to 2 times higher at the age of 15 compared with that of their higher educated peers. As educational level is a good proxy of adolescents' own current level of socio-economic status (SES; Rahkonen et al., 1995; Richter and Leppin, 2007), these findings are in line with those of Spijkerman et al. (2008) who found adolescents from low SES families with heavy drinking parents to be at particular risk for excessive alcohol use. Possibly, adolescents in low SES groups are more sensitive to parental modelling effects, compared to their better-off peers (Spijkerman et al., 2008), resulting in heavier drinking. As the (moderate to large) influence of parental heavy drinking remains significant and consistent when controlling for parental rules on alcohol, parents from adolescents attending vocational tracks that are heavy (episodic) drinkers may need to be aware that their heavy drinking may particularly harm adolescents, placing them at greater risk for increased drinking during adolescence.

While adolescent heavy drinking is more prevalent among adolescents in vocational versus academic education, alcohol-specific parenting is equally associated with adolescent drinking across educational tracks (chapter 3). In accordance, between 2007 and 2011 trends in alcohol-specific parenting and

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adolescent alcohol use were similar for adolescents in different educational tracks (chapter 3). This may reflect the fact that national prevention efforts aimed at postponing alcohol use through parents' involvement have been successful across educational levels.

Reflections on the effectiveness of family interventions in preventing adolescent alcohol use

In order to get an overview of the effectiveness of family interventions in preventing and reducing adolescent drinking in general populations, we conducted a meta-analysis of randomized controlled trials (chapter 4). The overall effect of family interventions in delaying and reducing adolescent drinking is found to be small, yet consistent and effective even at 48 months. Still, there was heterogeneity between studies reporting on alcohol initiation (p-heterogeneity: <0.001; I^2: 78.6%). Furthermore, we investigated the effectiveness of a recently developed family program called 'In control: No alcohol!' using a randomized controlled trial (RCT) design (chapter 5). Results from this pilot program indicated more aversive adolescent alcohol cognitions. Furthermore, the effect of the 'In control: No alcohol!' program on perceived harm of drinking, could be partially explained by an increase in alcohol-related conversations, yet only among boys. After the pilot study a larger RCT on the 'In control: No alcohol!' program was carried out examining its effect on actual alcohol use and the potential mediators. In contrast to the results of the pilot study (chapter 5), results of the larger RCT did not show any significant program effects, neither on actual alcohol use, nor on its potential mediators (Mares et al., 2014). Both the heterogeneity between studies in our meta-analysis and the contrasting findings between the pilot and the larger RCT on the 'In control: No alcohol!' program may be explained by different sources of variation in program effects, as described by Weiss et al. (2013). That is, variation in program effects may be due to differences in 1) context, 2) content, 3) contrast, and 4) client characteristics.

Sources of variation in our meta-analysis

First, the included studies in our meta-analysis vary in **context**, or environment, in which the families receive the intervention. For instance, some of the included studies were cluster-randomized trials, i.e. randomization took place at group level instead of individual level. We performed stratified analyses and meta-regression analyses to investigate whether e.g. randomization level could affect results between studies (chapter 4). Studies targeting all families within a group

(mainly schools) showed a somewhat stronger effect, as compared to interventions targeting families independently, for all three outcome types: alcohol initiation, any use last month and frequency of alcohol use. Meta-regression analyses for alcohol initiation revealed no significant effect, while for the frequency of alcohol use meta-regression revealed that interventions targeting all families within a group (e.g. a school) are significantly more effective in curbing alcohol use frequency among adolescents than interventions targeting families independently. This may indicate that interventions targeting all families within a group (e.g. a school) are significantly more effective in curbing alcohol use among adolescents than interventions offered to independent families. Still, clustering should be taken into account in the analyses of the primary studies, as one of the studies did (Spoth et al., 2002), but others did not (Spoth et al., 1999a, b), or was found not imperative due to no significant cluster effects (Brody et al., 2006), thus the observed differences favoring interventions randomized at group level may be slightly biased.

Second, the included studies differed in program **content**. We did not perform stratified analyses by e.g. prevention message, format or program intensity as the interventions differed too much to permit categorization. Still, a number of effective family programs aimed to improve alcohol-specific parenting, like restrictive rules on alcohol use, and/or adolescent self-control (Bauman et al., 2002; Schinke et al., 2004; Spoth et al., 2001; 2002), which have recently been found to mediate program effects of family intervention on adolescent drinking (Koning et al., 2011a). That is, Koning et al. (2011a) observed significant reductions in adolescent drinking when combining a school prevention program with three annual parent meetings at school and found that these effects were attributable to parental restrictive rules on drinking, parental attitudes towards adolescent drinking and adolescent self-control. Future mediation analyses are needed to confirm and extend these findings in order to understand which elements are essential in explaining the effectiveness of universal family programs in preventing adolescent drinking.

Third, **contrast** between intervention and control group varied across studies. E.g. the Dartmouth prevention program (Stevens et al., 2002) was the only study in our meta-analysis reporting a higher probability for alcohol initiation in the prevention group compared to the control group. A possible explanation for the absence of a positive effect might be the negligible contrast between both conditions: the intervention group received an intervention aimed at reducing alcohol use and the control group received an intervention focused on safety behaviors. As both interventions were based on promoting parent-child communication,

both groups could behave similarly and have attained equivalent rates of alcohol use and safety behaviors.

Fourth, **client characteristics** might explain heterogeneity among the studies in our meta-analysis. For instance, the included studies in our meta-analysis did not differentiate between program effectiveness across gender, while, in line with Kumpfer et al. (2008), results from the 'In control: No alcohol!' pilot study indicate that different mechanisms might explain the differential effectiveness of family interventions between boys and girls. More research is needed to investigate whether and how effective elements of family programs differ across parent and adolescent gender.

Apart from this variation across studies, all included studies were performed in the US. Recently, a number of family programs have been investigated in Europe (e.g. Coombes et al., 2009; Koning et al., 2009; Mares et al., 2012b) and others are currently being investigated in Europe (e.g. Bodin and Strandberg, 2011; Bröning et al., 2014; Okulicz-Kozaryn et al., 2012; Segrott et al., 2014). An update of our systematic review and meta-analysis may reveal whether the effectiveness of universal family programs on adolescent drinking in the US can be generalized towards the European context.

Sources of variation between RCTs studying the "In control: No alcohol!" family program

As the abovementioned sources of variation might explain differences across family programs, these factors may also explain the contrasting outcomes of two different RCTs that studied the effectiveness of the 'In control: No alcohol!' program.

First, the **context** in which the two RCTs were carried out might have been different. While both RCTs were cluster-randomized trials, the pilot study (chapter 5) did not account for non-independence of observations due to cluster-sampling, while the larger RCT did (Mares et al., 2014). Still, in the pilot study design-effects for both outcome measures were small (< 2), thus accounting for cluster-sampling was not imperative (Kish 1965; Muthén and Satorra 1995). Furthermore, the pilot study was carried out during winter, while the larger RCT was carried out during summer, when Dutch adolescents have an eight week holiday-period before the transition to secondary education. The transition to secondary education has been suggested to be a good time to intervene (Petrie et al., 2007). Yet, the timing of a home-based intervention during summer holidays

might explain the lower program exposure compared to the pilot study, which in turn might explain the diverging results across the two RCTs.

Variations between our meta-analysis and the 'In Control: No alcohol!' program may also be due to diverging contexts. First, the 'In control: No alcohol!' program was targeting adolescents and their mother at the transition from primary to secondary education, while this might be too early to address this topic, now that adolescent drinking in the Netherlands has been delayed in recent years (chapter 3). Thus prevention programs may need to be adapted to target adolescents, and their parents, at a latter age. Second, while all family programs included in the meta-analysis were performed in the US, the 'In control: No alcohol!' program was carried out in the Netherlands, which differs from the US in drinking culture and governmental policies regarding adolescent drinking. Still, Koning et al. (2009) showed the possibility of program effectiveness in the Netherlands on adolescent actual drinking, even at 4 years follow-up. Differential findings across the 'In control: No alcohol!' program and the 'Prevention of Alcohol use in Students intervention (PAS; Koning et al., 2009), which were both performed in the Netherlands and were both based on recent evidence on alcohol-specific parenting may also be due to diverging contexts. For instance, changes in adolescent drinking might have been easier to detect in the PAS intervention as adolescents were older, and dyads might have been a better representation of the general population compared to the 'In control: No alcohol!' samples, which probably included more motivated parents among whom differences are more difficult to detect due to ceiling effects.

Second, the **content** of the program might explain differences between studies, as well as the lack of a positive result on actual drinking. First, although the actual program did not differ between the two studies, participants in the pilot study had more contact with the researchers, as compared to participants in the larger RCT. E.g. part of the participants in the pilot study took part in a process-evaluation of the program performed by telephone. As active parental involvement (face-to-face or by telephone) has been suggested to explain (part of) the success of the most effective interventions aimed to reduce adolescent substance use (Petrie et al., 2007), the effects of the pilot study on adolescent alcohol cognitions, may be due to these telephone calls. Second, mediation analysis revealed that girls in the 'In control: No alcohol!' program settled a non-drinking agreement more often than dyads in the control group, while such an agreement was associated with less perceived harm of drinking, i.e. the opposite of what was intended. Although the 'In control: No alcohol!' program was based on recent literature on alcohol-specific parenting, little is known concerning the longitu-

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dinal association between a non-drinking agreement and adolescent drinking. Possibly, settling a nondrinking agreement may be a relatively simple tool to prevent early drinking, whereas the current literature underlines the need of "a more detailed and complex parent-child communication" (Miller-Day and Kam 2010), and to combine restrictive rules with good quality conversations (Koning et al., 2012) to prevent early drinking. Further, agreement across parents from adolescents in the same class on a set of shared rules (Koning et al., 2009), may be more effective than parent-child dyads settling a non-drinking agreement.

Third, apart from the abovementioned telephone calls, **contrast** between intervention and control group did not differ across the two RCTs studying the effects of the 'In control: No alcohol!' program. Still, the contrast between this program and the 'placebo' might explain the lack of consistent effects on the 'In control: No alcohol!' program. That is, the contrast between the program, consisting of booklets for parents and adolescents to discuss together, and the 'placebo', consisting of an information brochure including information on the harmful effects of adolescent drinking, as well as on alcohol-specific parenting, might have been too small to observe significant differences between conditions. Furthermore, the recent awareness in research, policy and the media about the harmful effects of alcohol on young people and the focus of recent national and local prevention efforts aimed at parents to postpone the alcohol use of their child may have influenced program effectiveness due to a reduced contrast between program and control dyads.

Fourth, **client characteristics** might explain the differential effectiveness of the two studies, as they were performed in different parts of the Netherlands, where drinking cultures and parent-child communication styles may differ. Furthermore, client characteristics might explain different outcomes across our meta-analysis and the 'In control: No alcohol!' program. For instance, the 'In control: No alcohol!' program only included mothers, whereas targeting both parents might be important to realize e.g. consistent rules on drinking within a family.

Apart from these sources of variation that have been indicated by Weiss et al. (2013), diverging methodology might explain differential effectiveness across studies. For instance, researchers in the larger RCT were blinded to randomization and were not part of the research institute (Trimbos Institute) that developed the 'In control: No alcohol!' program. Furthermore, outcome measures varied between studies. In particular, positive outcomes on alcohol cognitions were observed in the pilot RCT, whereas in both studies no effects on actual drinking were observed.

An integrated approach to substance use prevention

Since 2010, the prevention and research program that this thesis is based upon (Alcohol and Parenting), altered into a broader program including parenting in relation to adolescent tobacco, alcohol and cannabis use. Reasons to combine prevention strategies of multiple substances are twofold. First, co-occurrence rates of tobacco, alcohol and illicit drugs are high. Second, combining tobacco, alcohol and illicit drug prevention has potential benefits like being more cost-effective and lowering the burden for youth and their parents (Looze de et al., 2012a).

In order to come to an evidence-based integrative approach of substance use prevention, the first steps have been undertaken. That is, the role of parents in adolescent smoking, drinking and drug use has been investigated by means of an expert-meeting and an additional literature review (Vermeulen-Smit et al., 2010). As little evidence was found in the existing literature on the role of cannabis-specific parenting in adolescent illicit drug use, this topic was investigated (chapter 6). Next, we examined the current evidence on the effectiveness of family programs in preventing adolescent illicit drug use (chapter 7).

Reflections on the role of parents in adolescent cannabis use

As we mentioned above, many studies have reported on the relation between parental drinking and alcohol-specific parenting practices on the one hand and adolescent alcohol use on the other. Likewise, parental cannabis use and cannabis-specific parenting practices may discourage adolescent cannabis use.

Chapter 6 revealed that parental cannabis experience is significantly (weak to moderately) related to more adolescent lifetime and recent cannabis use. These findings are in line with both cross-sectional and longitudinal studies which have shown that parental cannabis use is (weakly) positively associated with adolescent cannabis use in general populations (Bares et al., 2011; Hops et al., 1996; Newcomb et al., 1983). Furthermore, no association was found between parental cannabis use and adolescent hard drug use. Possibly, parents who have experimented with cannabis themselves are more tolerant towards children's cannabis experience, while they are strict towards hard drug use. Although we found that parental experience with cannabis was not associated with adolescent hard drug use in a general population, we may not discard the risk of parents' current cannabis use on adolescent hard drug use (Castro et al., 2006). In contrast to earlier studies, we examined the influence of parental past cannabis experience in a general population. As the prevalence of parental actual cannabis use is low,

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parental past cannabis experience is more common and may be an important predictor of adolescent cannabis use in general populations. In this sense, the influence of parental cannabis use on adolescent cannabis use may differ from the influence of parental alcohol use on adolescent drinking, as we revealed in chapter 2 that especially father's heavy drinking and heavy episodic drinking by both parents, ways of drinking that exist only among 3% of Dutch families, influences adolescent drinking.

Second, chapter 6 showed cannabis-specific parental rules to be associated with less adolescent recent cannabis and lifetime hard drug use, even when controlled for general and tobacco-specific parenting and adolescent tobacco use. Furthermore, cannabis-specific parental rules are found to be equally associated with adolescent cannabis use among families with and without parental cannabis experience. These findings are in line 1) with earlier studies on alcohol-specific and tobacco-specific parenting, which underline the importance of restrictive parental rules in relation to adolescent substance use (Looze de et al., 2012; Van der Vorst et al., 2006), and 2) with findings from Miller-Day (Miller-Day, 2008), who found that 'no-tolerance rules' are negatively related to adolescent cannabis use among university students. The similarity with alcohol-specific and tobacco-specific parenting practices is quite remarkable, as adolescent cannabis use differs from tobacco and alcohol use in several ways, like prevalence and acceptance. Apart from existing differences between substances, similarities among these substances may not be discarded, e.g. settings and motivations for use may be similar and co-occurrence is common (Brook et al., 2012). The abovementioned differences and similarities may explain why tobacco- and alcohol specific rules may be insufficient in explaining adolescent drug use, while cannabis-rules are related to cannabis in a comparable way. Still, longitudinal studies are recommended to confirm and extend these preliminary findings.

In addition to cannabis-specific parenting, general parenting practices were associated with adolescent cannabis use. In contrast to earlier studies (Bohnert et al., 2012; Chilcoat and Anthony, 1996; Ryzin van et al., 2012), no significant associations were found between parental monitoring and adolescent cannabis use in multivariate models. Still, parental knowledge of the child's whereabouts showed moderate to strong associations with a higher chance of adolescent cannabis use. Furthermore, medium effect sizes were found for the negative association between parental support and adolescent drug use (cannabis and hard drugs), even in multivariate models. Two recent studies (Becoña et al., 2012; Calafat et al., 2014) investigated the influence of general parenting practices on adolescent drug use. In line with our finding on cannabis-specific rules and pa-

rental support, Becoña et al. (2012) showed that particularly a neglectful parenting style (lack of both limits and support) increased the risk of adolescent drug use, whilst an authoritative style (limits and support) protects against drug use. Calafat et al. (2014) found an authoritative parenting style (limits and support) and an indulgent parenting style (support without limit setting) to be equally protective against drug use, underlining the particular protective effect of parental warmth and support in preventing adolescent drug use in six European countries (not including the Netherlands). With respect to adolescent alcohol use, the influence of parental support was found to be less clear in the Netherlands compared to other countries (Van der Vorst, 2007; Engels et al., 2013). More specifically, in the Netherlands, parental support was not found to be significantly related to adolescent drinking (Van Zundert et al., 2006; Verdurmen et al., 2012b). This might be due to a lack of variance, as 98% of Dutch parents report themselves that they provide 'much' support to their children and this percentage does not decline throughout adolescence, indicating a ceiling effect (Dorsselaer van, et al., 2010). Adolescent perception of parental support may be a better indicator of parental support. Still, also 86-92% of Dutch 12-16 year olds report that their parents provide 'much' support (Dorsselaer van et al., 2010). Future studies on parental support may need to involve multiple respondents, like adolescents and teachers and should investigate the protective role of parental support across substances. Additionally, future studies are needed to confirm whether and which combinations of concrete parental rules on cannabis use and general parenting practices, like support and monitoring, are associated with less adolescent cannabis use. Studying parenting profiles including substance-specific parenting practices are uncommon (Koning et al., 2012), but may give more insight into the role of parents in preventing adolescent cannabis use.

Reflections on the effectiveness of family interventions in preventing adolescent cannabis use

The effectiveness of family programs in preventing adolescent cannabis use

In order to get an overview of the effectiveness of family interventions in preventing and reducing adolescent illicit drug use, we conducted a systematic review and meta-analysis of randomized controlled trials. Cannabis use is relatively common in the general population (approximately 30% of Dutch adolescents, as well as European adolescents in general, have used cannabis at the age of 16), yet more frequently used among high-risk adolescents such as adolescents attend-

ing vocational education, special education and juvenile offenders (Kepper et al., 2009, 2011; Monshouwer et al., 2008; Van Laar et al., 2010). Therefore, we were interested in three types of interventions, including those in general populations (universal prevention), among at-risk adolescents (selective prevention), and among illicit drug(ab)using adolescents (indicated prevention).

39 papers describing 22 RCTs, all performed in the US, were eligible for inclusion. Only nine randomized controlled trials were found examining the effect of family interventions on illicit drug use in general populations. Overall, universal family programs targeting adolescents (aged 10-14) as well as their parents seem to have a small favorable effect on the initiation of marijuana use. Still, there is no clear evidence of the efficacy of family interventions in preventing adolescent initiation of illicit drug use other than marijuana. Findings on the effectiveness of universal family interventions in reducing the frequency of adolescent illicit drug use are encouraging (4 RCTs). Among high-risk groups (selective prevention), there is no clear evidence of the effectiveness of family interventions on 1) illicit drug initiation (6 RCTs), 2) the frequency of illicit drug use (7 RCTs), and 3) drug disorders (3 RCTs). Three small RCTs point towards a favorable effect of family interventions in reducing the frequency of illicit drug use among substance (ab)using adolescents (indicated prevention). We underline the need to strengthen the evidence-base with rigorous trials, especially among at-risk populations and more studies conducted in countries other than the US.

Studying the effectiveness of family programs in preventing multiple substances

As co-occurrence rates of tobacco, alcohol and illicit drugs are high, intervention programs are often designed to prevent multiple substances (combining tobacco, alcohol and illicit drug prevention) (Brody et al., 2012; Mason et al., 2012), which has potential benefits like being more cost-effective and lowering the burden for youth and their parents (Looze de et al., 2012a; Jackson et al., 2012). Furthermore, a family program that aimed to prevent adolescent drinking has been shown effective in reducing the frequency of adolescent marijuana use (chapter 7; Grossbard et al., 2010). A number of studies have investigated program effects on the so-called substance use index, i.e. initiation of either tobacco, alcohol or cannabis, as substance use among early adolescents is generally low and changes over time might be difficult to detect on their own. One study was included in both our meta-analyses (chapter 4 and 7) as results on alcohol and cannabis use were reported separately (Spoth et al., 1999b; 2001; 2002). The pos-

sibility of publication bias does not rule out the chance of diverging effectiveness across substances for programs that aimed to prevent multiple substances. That is, not only inferior studies, but also well-performed studies which report small effects or contradict current opinions, are more frequently rejected by journals or are not submitted for publication by the author(s). Possibly, family programs aimed to prevent multiple substances may be successful in preventing alcohol use, while counterproductive effects on cannabis might be found. Still, these counterproductive effects may not be reported or published, unless favorable effects are found on other outcomes. Likewise, programs that reduced the frequency of adolescent hard drug use were found to, unintendedly, increase adolescent cannabis use (Milburn et al., 2012; Rotheram-Borus et al., 2012). Additionally, a Dutch school program that aimed to reduce adolescent smoking, alcohol and cannabis use, had a small iatrogenic effect on adolescent cannabis use (Cuijpers et al., 2002). Furthermore, family programs may trigger negative responses on drinking when the adolescents are e.g. at a later age or when the proportion of users at baseline is already high (Dielman, 1994; Van der Vorst et al., 2006). Thus, combining the prevention of multiple substances does not rule out the possibility of diverging effectiveness for different substances –including counterproductive effects– as e.g. effective elements and time-to-intervene may vary across substances (Vermeulen-Smit et al., 2010). More research is needed to understand how and when substance-specific messages are warranted in order to effectively combine the prevention of multiple substances. In sum, combining the prevention of multiple substances may have many potential benefits, yet does not rule out the possibility and importance to include both general and substance-specific messages, and may not discard the need to evaluate the effectiveness of prevention programs and mediation pathways for different substances separately.

Limitations

This thesis has a number of strengths like the use of large datasets of parent-child dyads and strong designs, including longitudinal analyses, systematic reviews, meta-analyses, and a randomized controlled trial. Still, some limitations need to be discussed.

First, two chapters are limited by the cross-sectional design of the studies, thus causality cannot be inferred (chapters 3 and 6).

A second limitation is the selective response of parents in chapter 3 and 6. In the different samples, about 50% of the parents who were approached responded

to our invitation to participate in the study. As a result, adolescents in our sample were younger, more often enrolled in academic tracks, less likely to have an ethnic minority background, more likely to live with both biological parents, and less likely to drink alcohol and use cannabis. We corrected for this selective response by weighting our data for adolescents' educational track, grade, gender, and level of urbanization. As weighting procedures cannot completely compensate for non-response biases, the effect sizes in our study may be slightly inflated.

Third, as socio-demographic factors were related to both parenting practices and adolescent alcohol and cannabis use, we controlled for adolescent age, gender and educational level when studying the role of parenting practices on adolescent alcohol or cannabis use (chapter 2, 3 and 6). In chapter 5, we controlled for adolescent age and gender, but not for educational level as adolescents were still in primary school at baseline. As the number of adolescents from ethnic minorities was small in the datasets used in chapter 2 and chapter 5 we did not control for ethnicity in these analyses. Family structure, i.e., living with both biological parents or not, was controlled for in chapter 3, 5 and 6. In chapter 2, as to identify combinations of paternal and maternal drinking patterns, single-parent families were excluded from analyses. Therefore, findings from chapter 2 are restricted to two-partner families.

Fourth, in chapter 3 alcohol-specific parenting practices were analyzed as reported by one of the parents, while adolescents' report of alcohol-specific parenting has been found to be less strict, i.e. showing more variation, and to be more strongly related to adolescent drinking (Van der Vorst, 2007; Koning, 2011). This might explain the relatively weak associations between alcohol-specific parenting and adolescent drinking in chapter 3, compared to earlier studies (Van der Vorst, 2007). Still, significant associations between different alcohol-specific practices and different levels of adolescent drinking in three consecutive national samples are consistently observed despite the fact that we used parents' reports of parenting behavior.

Fifth, with regard to adolescent cannabis use, in addition to cannabis-specific rules, other cannabis-specific parenting practices may need to be included in future studies, like availability of cannabis at home and quality of communication about cannabis. Furthermore, future studies are needed to confirm whether and which combinations of cannabis-specific practices and general parenting practices, like support and monitoring, are effective in preventing adolescent cannabis use. Studying parenting profiles including substance-specific parenting

practices are uncommon (Koning et al., 2012), but may give more insight into the role of parents in preventing adolescent cannabis use.

Sixth, although this thesis focused on the role of parents in adolescent alcohol and cannabis use, these associations may be better understood using an environmental approach additionally including e.g. individual and peer factors. That is, we did not investigate several possible types of determinants of adolescent alcohol use, including personality factors, such as sensation seeking, family factors, such as parental abuse and parental mental problems, peer factors, such as time spent with friends and peer substance use and genetic markers. Although we included an important set of social and individual factors as confounders in our models, a more elaborate model of alcohol and cannabis use should include additional personality, family factors, peer factors, and genetic factors, as well as their interactions.

Seventh, the quantitative nature of this thesis did not intend to reflect and identify differences across individual families, but rather to observe general phenomena in a universal population. That is, although we tried to disseminate across sociodemographic groups, general behavior patterns were identified, which may not necessarily exist and apply to each and every family. Furthermore, different measures of parenting behaviors have been studied on their own, while actual parenting is a more complex phenomenon. That is, although we used multivariate models, i.e. controlling for general and substance-specific parenting practices in our models, and some interactions were examined, other methods may be better to understand more complex behaviors. For instance, identifying parenting profiles may enable to identify existing combinations of parenting practices in general populations (Koning et al., 2012), and observational studies may help to understand the multifaceted nature of parent-child communication.

Last, although two chapters in this thesis were systematic reviews of the international literature, included studies in both reviews were restricted to the US. Findings from the remaining chapters may be somewhat restricted to the Dutch culture with its (currently) changing drinking culture. To ensure the generalizability of the present findings, 1) independent evaluations of family programs aimed to prevent adolescent alcohol and cannabis use outside the US and, 2) replication of analyses concerning the role of parents on adolescent alcohol and cannabis use in other countries are warranted.

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Future research

This thesis, and in particular the abovementioned limitations, indicate a number of fields that need further study.

First, longitudinal studies are needed to confirm the results from cross-sectional studies, as described in chapter 3 and 6. Although the effect of restrictive parental rules on lower drinking levels has been consistently confirmed by longitudinal studies, it is unclear from longitudinal studies whether these associations differ across educational levels. Furthermore, the preliminary finding, that, -like alcohol-specific rules are related to lower alcohol rates-, restrictive cannabis-specific rules are related to lower adolescent cannabis and hard drug rates, needs to be confirmed by longitudinal research.

Second, the role of parents in adolescent alcohol and cannabis use may be better understood using an environmental approach additionally including e.g. individual and peer factors, as the role of parents in adolescent substance use may not stand on its own but may interact with e.g. adolescents' personality and peer behavior. Future studies may need to study a more elaborate and complex model of alcohol and cannabis use, additionally including personality, family factors, peer factors, and genetic factors, as well as their interactions.

Third, general, and alcohol- and cannabis-specific parenting practices may need to be studied more comprehensively. With respect to alcohol-specific parenting, more detailed questionnaires on the multidimensional nature of parent-child communication about alcohol, including rule setting behavior, may enable to formulate more detailed prevention messages towards parents and professionals concerning 'what parents can tell adolescents exactly' (Kam and Middleton, 2013; Reimuller et al., 2011). The prevention message to delay adolescent drinking, at least until a certain age, may be totally straightforward, yet it remains unclear what parents can be advised to tell their children once they have started drinking. For instance, conditional permissiveness of drinking and strategies focusing on harm reduction may be unclear and inconsistent to adolescents and may unintendedly lead to heavier drinking. While the impact of parental rules on drinking has been found to remain significant until early adulthood (Mares et al., 2013) and current quantities of alcohol consumed by 16-year olds are worrisome (Looze de et al., 2014; Verdurmen et al., 2012a), future studies are needed to further understand what parents can do to prevent adolescent heavy drinking. In specific, a qualitative approach, like more detailed or open-ended questionnaires and observational studies may be needed to be able to advise parents more clearly.

With regard to adolescent cannabis use, in addition to cannabis-specific rules, other cannabis-specific parenting practices may need to be included in future studies, like availability of cannabis at home and quality of communication about cannabis. Furthermore, future studies are needed to confirm whether and which combinations of cannabis-specific practices and general parenting practices, like support and monitoring, are effective in preventing adolescent cannabis use. Studying parenting profiles including substance-specific parenting practices are uncommon (Koning et al., 2012), but may give more insight into the role of parents in preventing adolescent cannabis use.

Fourth, as all included studies in our systematic reviews were performed in the US, studies in other countries are needed to confirm the generalizability of its findings. An update of our systematic review and meta-analysis (chapter 4) may reveal whether the effectiveness of universal family programs on adolescent drinking in the US can be generalized towards the European context. Extending such an update to family interventions aimed to prevent heavy drinking among older adolescents and among high-risk populations may be important. Furthermore, we underline the need to strengthen the evidence-base of family interventions with more trials, particularly those that aim to reduce the quantity of adolescent drinking, and those that aim to reduce adolescent cannabis use, in general as well as among high-risk populations.

Fifth, more research is needed to understand the higher substance use among diverging risk groups, as risk and protective factors may entirely differ from those in universal samples. While a tolerant and permissive drinking culture might have explained the increase in adolescent drinking in the general population that was observed around 2003, drinking among at-risk adolescents may, for instance, be a way to cope with family or other problems. The same may apply for adolescent cannabis use. That is, in addition to the aforementioned longitudinal studies that are needed to confirm the role of cannabis-specific parenting practices on lower rates of adolescent cannabis use, well-designed experimental trials are needed to strengthen the evidence-base in general populations, but especially among at-risk adolescents whose cannabis rates are much higher (Kepper et al., 2011). In sum, both empirical and experimental studies are needed to understand the preventive role of parents in adolescent alcohol and cannabis use among high-risk adolescents.

Sixth, combining the prevention of multiple substances needs further study in order to be successful in delaying and reducing the use of all targeted substances. Empirical research may gain further understanding in when and which substance-specific parental messages are warranted. Experimental studies, that

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aim to combine the prevention of multiple substances, may need to evaluate the effectiveness of prevention programs and mediation pathways for different substances separately. Separate analyses are of particular importance to identify and explain the existence of possible iatrogenic effects, as observed in some of the earlier studies (Cuijpers et al., 2002; Milburn et al., 2012; Rotheram-Borus et al., 2012).

Practical implications

The abovementioned findings have a number of implications for prevention practice.

First, parents and professionals must be aware that parental heavy drinking affects their offspring, resulting in earlier and heavier drinking.

Second, the co-occurring decline in adolescent drinking and the increase in several alcohol related parenting practices among 12-15 year olds are consistent with the focus of recent prevention efforts aimed at parents to postpone the alcohol use of their child at least until the age of 16. As alcohol use among 16-year olds and the quantity of alcohol consumed did *not* show a decrease over time, these findings suggest that future policy and prevention efforts should pay more attention to the quantity of alcohol consumed by adolescents and to alcohol prevention among adolescents aged 16 years and over.

Third, in line with the role of parents in adolescent drinking, restrictive cannabis-specific rules are related to lower adolescent cannabis rates. Thus, parents may need to be advised to set strict cannabis rules in order to prevent their child from using cannabis.

Fourth, since 2014, the legal age of drinking in the Netherlands has been altered from 16 to 18 year olds. National monitoring studies still need to show the effectiveness of this adjusted national policy on alcohol-related parenting practices and, especially, on adolescent early and heavy drinking throughout adolescence. It is unclear whether the recent change in social policy is sufficient to delay adolescent drinking until the age of 18. Furthermore, it is uncertain whether the altered legal drinking age will realize a decrease in the quantity of adolescent drinking once drinking commences. This thesis revealed that 1) the overall effect of universal family interventions is small, yet consistent, in reducing initiation as well as frequency of adolescent alcohol use, and 2) strict parental rules about alcohol are found to be more strongly related to less adolescent drinking among 16 year olds, compared to younger adolescents. Therefore, new prevention efforts with an important focus on parents are needed, in order

to successfully reduce the large quantities of alcohol consumed by adolescents aged 16 and over, which are especially worrisome and deserve more attention.

Fifth, now that reductions in adolescent early drinking have been accomplished at a universal level, and existing family programs have been found effective in preventing early adolescent alcohol use and likely to be effective in preventing adolescent cannabis use, it may be time to shift research and prevention efforts towards at-risk adolescents. In particular, among at-risk adolescents, like delinquent youth and those attending special education for youth with behavioral problems, substance use is particularly high (Kepper et al., 2009; 2011; Van Laar et al., 2010), whereas the available prevention efforts are sparse and evidence of its effectiveness insufficient (chapter 7; Vermeulen-Smit et al., 2014).

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SUMMARY

Summary

In 2004, the Dutch National School Survey on Substance Use (DNSSU) reported a strong increase in alcohol use from 66% to 84% between 1992 and 2003 among 12-16 year olds. At the same time, the ESPAD study (European School Survey Project on Alcohol and Other Drugs), comparing adolescent substance use internationally, found Dutch adolescents to be the heaviest drinkers in Europe. During these years, there was a growing awareness of the hazardous effects of early drinking. Meanwhile, longitudinal studies showed the important role of parents in adolescent drinking. In particular, setting strict rules on alcohol was found to delay adolescent drinking. These developments provoked the start of a national prevention and accompanying research program that started in the Netherlands in 2006 called "Alcohol and Parenting". This program aimed to delay adolescent drinking at least until the age of 16 (the legal age for selling alcoholic beverages in the Netherlands at the time) through improving alcohol-specific parenting, e.g. by raising parents awareness of the harmfulness of adolescent drinking, and the need to set rules on drinking. This thesis is primarily based on the research part of the "Alcohol and Parenting" program, which was designed to investigate the role of parents in adolescent drinking, in order to improve prevention practice. Along the years, the program (Alcohol and Parenting) altered into a broader program including parenting in relation to adolescent tobacco and cannabis use, which was called "Tobacco, Alcohol, Cannabis and Parenting" from 2010 onwards. As little is known from earlier studies on 1) the relation between cannabis-specific parenting practices and adolescent cannabis and other drug use, and 2) the effectiveness of family interventions on adolescent cannabis and other drug use, these topics were additionally studied in this program and accordingly became part of this thesis.

Part I: The role of parents in preventing adolescent alcohol use

The first part of this thesis addressed the role of parental drinking patterns and alcohol-specific parenting practices on adolescent drinking in the general population, and the universality of associations: 1) throughout the developmental stage of adolescence and 2) across adolescent gender and educational track. Furthermore, we answered the question whether adolescent drinking and alcohol-specific parenting behavior can be influenced by family programs in general, and, more specifically, in the Netherlands.

First, we investigated the association of specific paternal and maternal drinking patterns with both initiation and development of 12-15 year olds' drinking (chapter 2). Only two out of six parental drinking patterns are found to be related to adolescent drinking. That is, having a heavy drinking father or two heavy episodic drinking parents particularly predicted early and heavier adolescent drinking even when controlled for socio-demographic factors and parental rules about alcohol. The influence of parental heavy (episodic) drinking differs across gender and is especially strong among adolescents attending vocational education. In addition to parental drinking patterns, alcohol-related parenting practices are found to be associated with adolescent drinking. For instance, chapter 3 shows that adolescents are less likely to drink alcohol when parents set strict rules about alcohol, when they have pleasant conversations with their parents about alcohol and when parents are aware of the potential harmfulness of adolescent drinking. These associations were generally stable over time in three waves between 2007 and 2011, and are similar for boys and girls, and for adolescents attending different educational tracks, yet these associations were stronger for older, compared to younger adolescents. In addition, chapter 3 revealed that between 2007 and 2011, Dutch parents increasingly adopted strict alcohol-specific practices, with the exception of parents of 16-year old adolescents. Furthermore, adolescent reports of lifetime and last month alcohol use decreased, except for 16-year olds. The quantity of alcohol consumed by adolescents did not change between 2007 and 2011.

In addition to the consistent role of parenting practices in adolescent drinking, chapter 4 revealed that family programs can be effective in delaying and reducing adolescent drinking. More specifically, in order to quantify the effectiveness of family interventions in preventing and reducing adolescent drinking, we conducted a meta-analysis of randomized controlled trials. Eighteen papers describing nine independent trials were eligible for inclusion in this meta-analysis. The overall effect of family interventions in reducing alcohol initiation and the frequency of alcohol use show the success of these programs. There was heterogeneity between studies reporting on alcohol initiation. Yet, the most successful interventions continued to be effective in reducing alcohol initiation even at 48 months follow-up. The results from this meta-analysis suggest that the overall effect of family interventions on adolescent alcohol use is small, yet consistent and effective even at 48 months. Still, this evidence is solely based on studies performed in the US.

Chapter 5 examined the effect of an in-home family intervention (In control: No alcohol!), which stressed alcohol-specific practices, like parent-child commu-

nication about alcohol and rules on drinking. In the region South-Holland of the Netherlands a total of 213 children (11-12 years) and their mothers were randomly assigned to the prevention program and the control condition. The intervention consisted of five magazines, eight pages each, which were mailed monthly to the homes of families in the intervention condition. Each of the five magazines includes information for mothers and games and assignments for mothers and children to complete together addressing different important issues regarding youth alcohol use and child socialization. A website and accompanying logbook provided additional information, games and assignments for the adolescent to complete every month. Participating families in the control condition received a single brochure about alcohol and parenting once. This brochure is the standard parent alcohol brochure at "the Netherlands Institute of Mental Health and Addiction" (treatment as usual). Mediation effects were analyzed using pretest and two follow-up measurements (5 and 12 months after baseline). We examined the effect of the intervention on adolescent alcohol cognitions via its putative mediators (frequency- and quality of mother-child communication, rules about alcohol, establishing a non-drinking agreement and parental monitoring of the child's whereabouts). The program led to an increase in frequency of alcohol-specific communication, non-drinking agreements and parental monitoring. Moreover, adolescents in the experimental condition perceived drinking to be more harmful and had less intention to drink compared to adolescents in the control condition. The effect of the program on adolescent alcohol cognitions was significantly mediated through having more frequent conversations about alcohol, yet only among boys. Although findings indicate that this relatively inexpensive, easy-to-administer home intervention is promising, an additional RCT could not replicate its findings and did not show significant improvements on actual drinking. Sources of variation that might explain differential outcomes across RCTs are discussed.

Part II: The role of parents in preventing adolescent cannabis use

Little is known about the role of cannabis-specific parenting in adolescent cannabis use. We hypothesized that, in contrast to adolescent alcohol use, parents may have little direct influence on adolescent cannabis use, as it is illegal and mostly used without parents' awareness and approval. Thus, their influence may primary be indirect, e.g. through their general parenting practices. Still, in accord with the relation between alcohol-specific parenting and adolescent drinking, also cannabis-specific parenting practices may discourage adolescent cannabis

use. Additionally, parents own experience with cannabis use might play a role in cannabis-specific parenting and adolescent cannabis use. Therefore, we investigated general and cannabis-specific parenting practices in relation to adolescent cannabis and other illicit drug use (chapter 6). Results showed that 1) parental cannabis use experience was significantly related to more adolescent lifetime and recent cannabis use, and 2) restrictive cannabis-specific parental rules were associated with less adolescent recent cannabis and lifetime use of other illicit drugs, even when controlled for socio-demographic factors, general parenting, adolescent smoking, and smoking-specific parenting. In addition, no significant interaction was observed between parental cannabis use and cannabis-specific rules in their relation to adolescent cannabis and other illicit drug use, indicating that cannabis rules are evenly associated with adolescent illicit drug use for families with and without parental cannabis experience.

In addition to these preliminary findings on the relation between cannabis-specific parenting and adolescent cannabis use, we investigated the effect of family programs in preventing adolescent cannabis and other illicit drug use (chapter 7). More specifically, we conducted a systematic review and meta-analysis of randomized controlled trials. Cannabis use is relatively common in the general population, yet more frequently used among high-risk adolescents. Therefore, we were interested in three types of interventions, including those in general populations (universal prevention), among at-risk adolescents (selective prevention), and among illicit drug (ab)using adolescents (indicated prevention). 39 papers describing 22 RCTs were eligible for inclusion. Universal family interventions targeting parent-child dyads are likely to be effective in preventing and reducing adolescent cannabis use, but not to prevent other illicit drugs. Among high-risk groups, there is no clear evidence for the effectiveness of family interventions in preventing and reducing illicit drug use and drug disorders. The three small RCTs among substance (ab)using adolescents gave some indication that programs might reduce frequency of illicit drug use.

The abovementioned findings have a number of implications for future research and prevention practice. First, parents and professionals must be aware that parental heavy drinking affects their offspring, resulting in earlier and heavier drinking.

Second, the co-occurring decline in adolescent drinking and the increase in several alcohol related parenting practices among 12-15 year olds are consistent with the focus of recent prevention efforts aimed at parents to postpone the alcohol use of their child at least until the age of 16. As alcohol use among 16-year olds and the quantity of alcohol consumed did *not* show a decrease over time,

these findings suggest that future policy and prevention efforts should pay more attention to the quantity of alcohol consumed by adolescents and to alcohol prevention among adolescents aged 16 years and over.

Third, reductions in adolescent early drinking have been accomplished at a universal level, and existing family programs have been found effective in preventing early adolescent alcohol use and likely to be effective in preventing adolescent cannabis use. Therefore, it may be time to shift research and prevention efforts towards at-risk adolescents, whose substance use is particularly high, whereas the available prevention efforts are sparse and evidence of its effectiveness insufficient.

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SAMENVATTING (SUMMARY IN DUTCH)

Samenvatting (Summary in Dutch)

In 2004 bleek uit cijfers van het Peilstationsonderzoek Scholieren een sterke toename in het alcoholgebruik onder Nederlandse 12-16 jarigen van 66% in 1992 naar 84% in 2003. Tegelijkertijd bleek uit een studie waarin het middelengebruik van jongeren internationaal vergeleken werd (European School Survey Project on Alcohol and Other Drugs) dat Nederlandse jongeren de zwaarste drinkers van Europa waren. In dezelfde periode was er een groeiend bewustzijn van de schadelijke gevolgen van vroegtijdig drinken. Tevens lieten longitudinale studies zien dat ouders een belangrijke rol spelen in het alcoholgebruik van adolescenten. Met name het stellen van regels bleek van belang om alcoholgebruik van jongeren uit te stellen. Deze ontwikkelingen leidden tot de aftrap van een nationaal preventie en onderzoeksprogramma in 2006, genaamd 'Alcohol en Opvoeding'. Dit programma beoogde het alcoholgebruik van adolescenten uit te stellen tot tenminste de leeftijd van 16 jaar (destijds de wettelijke leeftijd voor het verkopen van alcohol in Nederland). Dit gebeurde door het verbeteren van de alcohol-specifieke opvoeding, bijvoorbeeld door ouders bewust te maken van de schadelijkheid van vroegtijdig drinken en het belang van het stellen van regels ten aanzien van alcoholgebruik. Dit proefschrift is grotendeels gebaseerd op de onderzoekstak van het programma 'Alcohol en Opvoeding', welke in het leven is geroepen om de rol van ouders in het voorkomen van vroegtijdig drinken beter te begrijpen en vervolgens op basis van de verkregen kennis preventieactiviteiten te kunnen ontwikkelen en verbeteren. Gaandeweg is het programma (Alcohol en Opvoeding) uitgebreid met een boodschap richting ouders omtrent tabak en cannabisgebruik van jongeren. Vanaf 2010 werd het programma 'Roken, Alcohol en Cannabis Opvoeding' genoemd. Aangezien er weinig bekend was over 1) de relatie tussen cannabis-specifieke opvoeding en cannabis en harddrugsgebruik door adolescenten, en 2) de effectiviteit van gezinsinterventies ter preventie van cannabis en harddrugsgebruik door adolescenten, werden deze onderwerpen eveneens onderzocht in dit programma en werden vervolgens onderdeel van dit proefschrift.

Deel I: De rol van ouders in het voorkomen van alcoholgebruik door adolescenten

Het eerste deel van dit proefschrift betreft de rol van drinkpatronen van ouders en alcohol-specifieke opvoedingsaspecten in relatie tot alcoholgebruik door jongeren in de algemene populatie en mogelijke verschillen in deze associaties 1)

gedurende de ontwikkelingsfase van adolescenten en 2) tussen jongens en meisjes, en tussen jongeren op verschillende schoolniveaus. Vervolgens beantwoordden we de vraag of het alcoholgebruik van adolescenten en alcohol-specifiek opvoedingsgedrag te beïnvloeden is door gezinsinterventies in het algemeen, en meer specifiek, of het programma "Hou vol: Geen alcohol!" invloed heeft op het drink- en opvoedgedrag van Nederlandse adolescenten en hun ouders.

Ten eerste onderzochten we de relatie tussen specifieke drinkpatronen van vaders en moeders en zowel de initiatie als de ontwikkeling van alcoholgebruik bij 12-15 jarigen (hoofdstuk 2). Slechts twee van de zes drinkpatronen van ouders bleken gerelateerd aan het alcoholgebruik van hun kind. Dat wil zeggen, alleen het hebben van een zwaar drinkende vader of twee ouders die in het weekend zwaar drinken voorspelde vroeg en veel drinken bij het kind, zelfs wanneer er gecontroleerd werd voor sociaal-demografische factoren en ouderlijke regels omtrent alcoholgebruik. De invloed van zwaar (weekend) drinken verschilde tussen jongens en meisjes en was met name sterk onder VMBO leerlingen (ten opzichte van HAVO/VWO leerlingen).

Naast drinkpatronen van ouders speelt ook alcohol-specifiek opvoedingsgedrag van ouders een belangrijke rol in het alcoholgebruik van adolescenten. Hoofdstuk 3 laat bijvoorbeeld zien dat adolescenten minder vaak drinken wanneer hun ouders strenge regels stellen ten aanzien van alcoholgebruik, wanneer zij constructieve gesprekken met hun ouders hebben over alcoholgebruik, en wanneer ouders zich bewust zijn van de mogelijke schadelijkheid van vroegtijdig drinken. Deze verbanden werden herhaaldelijk gevonden op drie metingen tussen 2007 en 2011 en waren hetzelfde voor jongens en meisjes en voor leerlingen van verschillende schoolniveaus. Wel bleken deze verbanden sterker voor oudere adolescenten ten opzichte van jongere adolescenten. Hoofdstuk drie laat tevens zien dat Nederlandse ouders tussen 2007 en 2011 strengere regels zijn gaan stellen ten aanzien van alcoholgebruik, met als uitzondering de ouders van 16-jarigen. Verder waren er in 2011 minder adolescenten die wel eens alcohol dronken ten opzichte van 2007, maar dat gold niet voor de 16-jarigen. Het aantal glazen dat jongeren dronken veranderde niet in de periode van 2007 tot 2011.

Corresponderend met de consistente rol van ouders in het voorkomen van alcoholgebruik door jongeren liet hoofdstuk 4 zien dat gezinsinterventies effectief kunnen zijn in het voorkomen en verminderen van alcoholgebruik door adolescenten. Om de effectiviteit van gezinsinterventies in het voorkomen en verminderen van alcoholgebruik door adolescenten te kwantificeren hebben we in hoofdstuk 4 een meta-analyse uitgevoerd van gerandomiseerde gecontroleerde studies (RCT's). We includeerden 18 artikelen waarin negen onafhankelijke

studies werden beschreven. Deze studies samennemend bleek dat gezinsinterventies effectief kunnen zijn in het uitstellen en verminderen van alcoholgebruik van adolescenten. Er bestond echter wel heterogeniteit tussen de studies die rapporteerden over het uitstellen van alcoholgebruik. Maar de meest succesvolle interventies bleken effectief in het uitstellen van alcoholgebruik zelfs tot 48 maanden na de interventie. De resultaten van deze meta-analyse suggereren dat het effect van gezinsinterventies, over het geheel genomen, klein maar consistent is en effectief tot zelfs 48 maanden na de interventie. Dit bewijs is echter alleen gebaseerd op studies die zijn uitgevoerd in de V.S.

In hoofdstuk 5 werd de effectiviteit van een gezinsinterventie onderzocht (Hou vol: Geen alcohol!), welke onder andere gericht is op het verbeteren van alcohol-specifieke opvoedingsgedragingen, zoals constructieve ouder-kind communicatie en strikte regels ten aanzien van alcohol. In de regio Zuid Holland-Zuid werden 213 kinderen (11-12 jarigen) en hun moeders willekeurig toegewezen aan een preventieprogramma of een controle conditie. Het programma bestond uit 5 magazines, elk 8 pagina's, die maandelijks naar de gezinnen in de interventiegroep werden verzonden. Elk van de vijf magazines bevatte informatie voor moeders en spelletjes en opdrachten voor de moeders en kinderen om samen door te nemen gericht op verschillende onderwerpen ten aanzien van het alcoholgebruik van kinderen en het opvoedgedrag van ouders. Een website en bijbehorend logboek voorzag de jongere elke maand van extra informatie, opdrachten en spelletjes. Deelnemende ouders in de controle groep ontvingen eenmalig een standaard folder van het Trimbos-instituut over alcohol en opvoeding. We analyseerden mediatie effecten gebruik makend van één voor- en twee nametingen (5 en 12 maanden na de voormeting). We onderzochten het effect van de interventie op alcohol cognities van de adolescenten via vermeende mediatoren (frequentie en kwaliteit van ouder-kind communicatie, regels over alcohol, het maken van een niet-drinken afspraak en toezicht van ouders). "Hou vol: Geen alcohol!" leidde tot een verhoogde frequentie van alcohol-specifieke communicatie, meer zogenaamde niet-drinken afspraken, en meer ouderlijk toezicht. Bovendien beschouwden jongeren in de experimentele conditie drinken als schadelijker en hadden zij een lagere intentie om te drinken, ten opzichte van jongeren in de controle groep. Het effect van het programma op vermeende schadelijkheid van alcohol werd gemedieerd door een toename in het aantal gesprekken over alcohol, maar dat gold alleen voor jongens. Ondanks dat de bevindingen van deze goedkope en makkelijk uitvoerbare gezinsinterventie veelbelovend zijn, konden deze resultaten niet gerepliceerd worden in een latere RCT. Ook werden geen significante effecten gevonden op daadwerkelijk drink-

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gedrag van de jongeren. Mogelijke oorzaken van deze verschillen tussen de twee RCT's worden besproken.

Deel II: De rol van ouders in het voorkomen van cannabisgebruik door adolescenten

Er is weinig bekend over de rol van cannabis-specifieke opvoeding in het voorkomen van cannabisgebruik door adolescenten. In tegenstelling tot alcoholgebruik door adolescenten zouden ouders mogelijk weinig directe invloed kunnen hebben op het cannabisgebruik van adolescenten aangezien dit illegaal is en voornamelijk gebruikt wordt zonder dat ouders hiervan weten of hier hun goedkeuring aan verlenen. Mogelijk zou de invloed van ouders dus voornamelijk indirect kunnen zijn, bijvoorbeeld door algemene opvoedingsgedragingen. Maar conform de relatie tussen alcohol-specifieke opvoeding en alcoholgebruik van adolescenten, zouden mogelijk ook cannabis-specifieke opvoedingsgedragingen cannabisgebruik door adolescenten kunnen ontmoedigen. Daarnaast zou de ervaring van ouders met cannabisgebruik een rol kunnen spelen in cannabis-specifieke opvoedingsgedragingen en het cannabisgebruik van adolescenten. In hoofdstuk 6 onderzochten we de relatie tussen algemene en cannabis-specifieke opvoedingsgedragingen en cannabis en harddrugsgebruik van adolescenten. Resultaten laten zien dat 1) ervaring van ouders met cannabisgebruik gerelateerd is aan een hogere kans op ooit en recent cannabisgebruik door adolescenten, en 2) strikte cannabis-specifieke regels gerelateerd zijn aan minder recent cannabisgebruik en minder kans op ooit gebruik van harddrugs, zelfs wanneer gecontroleerd werd voor sociaal-demografische factoren, algemene opvoeding, tabaksgebruik van adolescenten en ouders en ouderlijke regels ten aanzien van tabak. We vonden geen interactie tussen ouderlijk cannabis gebruik en cannabis-specifieke regels in relatie tot cannabis en harddrugsgebruik van adolescenten, wat impliceert dat cannabis-specifieke regels even sterk samenhangen met drugsgebruik van adolescenten in gezinnen waarin ouders al dan niet met cannabis hebben geëxperimenteerd.

Aansluitend aan deze preliminaire bevindingen omtrent de relatie tussen cannabis-specifieke opvoedingsgedragingen en cannabisgebruik van adolescenten, onderzochten we de effectiviteit van gezinsinterventies ter preventie van cannabis en harddrugsgebruik door adolescenten (hoofdstuk 7). Dat wil zeggen, we voerden een systematische literatuurstudie en meta-analyse uit van RCT's. Cannabisgebruik is relatief gebruikelijk in de algemene populatie, maar wordt frequenter gebruikt onder hoog-risico jongeren. Daarom zijn we geïnteresseerd

in drie typen interventies, namelijk universele preventie (onder jongeren in de algehele populatie), selectieve preventie (bedoeld voor risico jongeren) en geïndiceerde preventie (gericht op jongeren die reeds drugs gebruiken/ misbruiken). We includeerden 39 artikelen waarin 22 RCT's beschreven werden. Uit deze studies bleek dat universele gezinsinterventies gericht op zowel ouders als kinderen waarschijnlijk effectief zijn in het voorkomen en verminderen van cannabisgebruik door adolescenten, maar niet in het voorkomen van harddrugsgebruik. Onder hoog-risico groepen is er geen duidelijk bewijs voor de effectiviteit van gezinsinterventies in het voorkomen en verminderen van drugsgebruik en drugsmisbruik/ afhankelijkheid. De drie kleine RCT's welke uitgevoerd werden onder jongeren die reeds drugs gebruikten gaven enige aanwijzingen dat dergelijke programma's drugsgebruik zouden kunnen doen afnemen.

Bovenstaande bevindingen hebben een aantal implicaties voor toekomstig onderzoek en voor preventie. Ten eerste moeten ouders en preventiewerkers zich bewust zijn dat zwaar (weekend) drinken door ouders invloed heeft op hun kinderen, resulterend in eerder beginnen en zwaarder drinken.

Ten tweede komt de gelijktijdige daling van alcoholgebruik onder jongeren en de toename van een aantal alcohol gerelateerde opvoedingsgedragingen van ouders onder 12-15 jarigen overeen met preventie boodschappen gericht aan ouders om het alcoholgebruik van hun kind uit te stellen tenminste tot hun 16^e verjaardag. De bevinding dat alcoholgebruik onder 16-jarigen en de hoeveelheid alcohol onder 12-16 jarigen *niet* gedaald zijn suggereert dat toekomstige beleids- en preventiemaatregelen meer aandacht zouden moeten besteden aan de hoeveelheid alcohol die jongeren drinken en aan het voorkomen van alcoholgebruik door adolescenten van 16 jaar en ouder.

Ten derde is een daling in het vroegtijdig drinken bereikt en zijn bestaande gezinsinterventies effectief gebleken in het voorkomen van vroegtijdig drinken en mogelijk ook in het voorkomen van cannabisgebruik door adolescenten. Daarom lijkt de tijd gekomen om onderzoeks- en preventie inspanningen te kenteren naar risico jongeren wiens middelengebruik verontrustend hoog is terwijl de beschikbare preventie programma's dun gezaaid zijn en onvoldoende bewijs bestaat omtrent hun effectiviteit.

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Dankwoord (Acknowledgements)

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ABOUT THE AUTHOR

About the author

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Curriculum Vitae

Evelien Vermeulen-Smit (1980) ontving in 2002 haar Bachelor diploma aan de Hogeschool van Amsterdam. Na afronding van haar studie 'Voeding en Diëtetiek' werkte zij een aantal maanden als diëtist op de polikliniek van het Leids Universitair Medisch Centrum. Aansluitend vertrok zij voor een aantal maanden naar het Midden-Oosten, waar zij o.a. vrijwilligerswerk deed. Vervolgens werkte zij als diëtist in het Diaconessenziekenhuis te Utrecht en in het VU Medisch Centrum te Amsterdam. Na afronding van haar studie 'Nutrition and Health' aan de Wageningen Universiteit ontving zij in 2006 haar master (MSc) diploma (cum laude), met een specialisatie in 'Epidemiology and Public Health'. Sindsdien is zij als onderzoeker werkzaam bij het Trimbos instituut. Zij is betrokken bij verschillende monitoringsstudies waarin o.a. het middelengebruik en het opvoedgedrag van jongeren en hun ouders wordt onderzocht (Peilstationsonderzoek Scholieren en Ouders en Health Behavior in School-aged Children). Tevens heeft zij veel onderzoek gedaan binnen het nationale preventie programma "Roken, alcohol en cannabis opvoeding". Als lid van het Methoden en Technieken team treedt zij binnen het Trimbos instituut op als expert op het gebied van verschillende kwantitatieve onderzoeksmethoden zoals meta-analyses en 'structural equation modeling'. Na afronding van haar promotieonderzoek zal zij werkzaam blijven bij het Trimbos Instituut op de afdeling Epidemiologie en Nationale Monitor GGZ.