Chapter 1
General introduction
GENERAL BACKGROUND

Cannabis is the most widely used illicit drug across the world (Hall & Degenhardt, 2007; National Drug Monitor, 2010; SAMHSA, 2009). It has been estimated that in the past year, 13% of the adult population in North America and Oceania have used cannabis, while 6% has used cannabis in Western Europe (Hall & Degenhardt, 2007). More specifically, in the Netherlands, 7.0% of adults was estimated to have used cannabis in 2009 (NDM, 2012). In adolescence, past year cannabis use is higher in the U.S. than in the Netherlands, with 28% of adolescents aged 15 years reporting any cannabis use in the U.S. (Johnston, O'Malley, Bachman, & Schulenberg, 2005), compared to 22.7% of 15-year-olds in the Netherlands (Monshouwer et al., 2006).

The use of cannabis is not without consequences. Even occasional cannabis use (i.e., less than weekly use in the past 6 months) in adolescence has been found to increase the risk of alcohol and nicotine dependence and educational problems at age 24 (Degenhardt et al., 2010). Cannabis use has also been related to other illicit drug use, as well as health-related problems, such as cardiovascular and respiratory problems, depression, suicidal behaviors, and psychotic outcomes (Fergusson, Horwood, & Swain-Campbell, 2002; Hall & Degenhardt, 2009; Moore et al., 2007). Onset of cannabis use in adolescence (before age 17) is related to a higher likelihood of alcohol dependence and higher levels of illicit substance use and abuse in young adulthood compared to onset of cannabis use after age 17 (Lynskey et al., 2003).

Escalation of cannabis use could lead to a cannabis use disorder (CUD). The Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV), defines cannabis abuse as endorsing at least one out of four criteria, and cannabis dependence as endorsing three or more out of seven criteria in a 12-month period (see Table 1.1 for a description of the criteria). It has been estimated that after first use, about 17% develop cannabis abuse and about 6% develop cannabis dependence (Wittchen, et al., 2008). As can be seen in Table 1.2, the prevalence of cannabis abuse is higher in a U.S. adult population sample than in a Dutch adult population sample, while the prevalence of cannabis dependence is similar across countries (De Graaf, Ten Have, Van Gool, & Van Dorsselaer, 2012; Stinson, Ruan, Pickering, & Grant, 2006).
General introduction

Table 1.1
Cannabis abuse and dependence criteria according to the DSM-IV

<table>
<thead>
<tr>
<th>Abuse</th>
<th>Dependence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role impairment</td>
<td>Tolerance</td>
</tr>
<tr>
<td>Hazardous use</td>
<td>Using larger amounts or longer than intended</td>
</tr>
<tr>
<td>Legal problems</td>
<td>More than once trying to stop or cut down</td>
</tr>
<tr>
<td>Social problems</td>
<td>Much time is spent getting or using cannabis</td>
</tr>
<tr>
<td></td>
<td>Give up or cut down on important activities</td>
</tr>
<tr>
<td></td>
<td>Use despite health/psychological problems</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>Withdrawal symptoms, such as irritability or physical symptoms, such as sweating or headache.</td>
</tr>
</tbody>
</table>

Table 1.2
Prevalence of cannabis use disorders among U.S. and Dutch adult cannabis users.

<table>
<thead>
<tr>
<th>Country</th>
<th>Cannabis abuse</th>
<th>Cannabis dependence</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>12-month prevalence 1.1%</td>
<td>0.3%</td>
</tr>
<tr>
<td></td>
<td>Lifetime prevalence 7.2%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>12-month prevalence 0.4%</td>
<td>0.3%</td>
</tr>
<tr>
<td></td>
<td>Lifetime prevalence 2.3%</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

Understanding risk and protective factors for cannabis use in adolescence and young adulthood is essential for the prevention of cannabis use and the escalation into a cannabis use disorder. Although in the general population fundamental risk and protective factors have been established, it is important to know whether these findings can be generalized to adolescents from different ethnic backgrounds. Immigrant adolescents are often underrepresented in general population studies, and only few studies specifically focus on this group in relation to cannabis use. Research on risk and protective factors in various subpopulations
Chapter 1

could contribute to a better understanding of predictors and mechanisms of cannabis use and better targeted prevention and intervention strategies.

Furthermore, research on the measurement of CUD is needed to establish if the criteria function similarly in various subpopulations, or if measurement bias threatens the validity of measuring CUDs. Measurement bias occurs when differences between subpopulations in endorsing the criteria do not reflect differences in the prevalence of these criteria amongst subgroups, but can be attributed to group heterogeneity in the CUD criteria, such as gender, age, or culture heterogeneity. Little research has been conducted on the functioning of the CUD criteria across various subgroups. Additionally, the relation between cannabis involvement, i.e. using cannabis and endorsing CUD symptoms, and mental health problems such as suicidal thoughts and behaviors, although important for prevention and intervention, has received little attention, and should be examined in more detail.

To address these issues, this thesis consists of two parts. The first part focusses on risk and protective factors of cannabis use in immigrant adolescents in the Netherlands, and across the adolescent years. The second part focusses on the heterogeneity in the CUD symptoms across different subpopulations and associations of cannabis involvement with suicidal thoughts and behaviors in young adulthood.

PART I
Risk and Protective Factors for Cannabis Use

Previous research has provided important insights in risk factors of adolescent cannabis use, abuse and dependence. According to the categorization of Von Sydow, Lieb, Pfister, Höfler, and Wittchen (2002), these factors can be classified as: 1) Demographic risk factors such as male gender and older age; 2) Substance-related risk factors including early tobacco use, alcohol use or abuse and peers’ substance use; 3) Intrapersonal variables such as genetic and biological risk factors, personality characteristics, psychopathology and childhood factors like behavior problems; and 4) Interpersonal variables such as the childhood family situation (impaired parent-child relationship, attachment problems, or low parental care). Although these risk factors of cannabis use have been extensively studied among
adolescents and young adults from the general population, it is yet unclear how findings can be generalized to adolescents from different ethnic backgrounds. Even though this group of adolescents faces specific challenges that might affect the risk of cannabis use, they are often underrepresented in general population studies and only few studies specifically focus on this group.

To fill this gap in the literature, we created the i4culture sample, a sample consisting of non-western immigrant adolescents and young adults aged 15 to 24 years that provided questionnaire and interview data on substance use and abuse and a wide range of risk factors of cannabis use. We included adolescents and young adults with Surinamese, Moroccan, Turkish, Antillean and Asian backgrounds, the largest ethnic populations in the Netherlands (www.cbs.nl). The Indonesia-Asian, Surinamese and Antillean immigrants originate from former Dutch colonies, and immigrated to the Netherlands for the first time in the 1940s, 1970s, and 1990s, respectively. Chinese-Asian, Moroccan and Turkish immigrants have been coming to the Netherlands since the 1930s (Chinese-Asian) and 1960s (Moroccan and Turkish). In the present thesis, we examined acculturation as a specific risk factor of cannabis use in immigrant adolescents. In addition, we compared native Dutch and non-western immigrant adolescents’ associations of parenting with cannabis use. Subsequently, we investigated longitudinal effects of parenting on cannabis use in a native Dutch adolescent population.

**Acculturation in Relation to Cannabis Use**

Acculturation has been defined as the degree of cultural maintenance and adaptation to the host culture. Acculturation seems important for determining a person’s risk in terms of mental health problems, well-being, and substance use (Koneru, Weisman de Mamani, Flynn, & Betancourt, 2007). To understand the relation between acculturation and cannabis use, the cultural values paradigm has been found to be useful (Unger et al., 2004). According to this paradigm, cultural values of the host country shape attitudes and behaviors towards substance use, thereby promoting or protecting against substance use. Consequently, becoming more acculturated to a culture with more positive values toward substance use, such as the Netherlands, will increase the risk of substance use (Unger et al., 2004).
Acculturation has been conceptualized in different ways. In the present thesis, we looked at acculturation strategies (Berry, 1997), where people feel either attached to the host culture (assimilation), to their culture of origin (separation), to both cultures (integration) or to neither culture (marginalization), in relation to past year cannabis use in a sample of immigrant Dutch adolescents and young adults. Also, we looked at linguistic acculturation, a strong indicator of acculturation (Rogler, Cortes, & Malgady, 1991; Serrano & Anderson, 2003), in relation to past year cannabis use. In searching to explain the relation between acculturation and cannabis use, we tested affiliation with cannabis-using peers as a mediating factor. The cultural values paradigm states that adolescents who are acculturated to a culture with more tolerant values towards substance use, are more likely to affiliate with peers who use substances, which subsequently would increase the risk of substance use in immigrant adolescents (Unger et al., 2000).

Sources of Parental Knowledge and Cannabis Use
Parental knowledge of their children’s activities, whereabouts, and friendships has been found to be negatively related to maladaptive behaviors in native populations (e.g., Lac & Crano, 2009; Laird, Criss, Pettit, Dodge, & Bates, 2008; Moore, Rothwell, & Segrott, 2010). When specifying the sources of this knowledge, Stattin and Kerr (2000) defined three: parental solicitation, where parents actively ask their children about their whereabouts; parental control, where parents control their children’s whereabouts by using rules and restrictions; and child disclosure, where the child voluntarily provides this information. Of these three sources, child disclosure has been found to contribute most to parental knowledge (Kerr & Stattin, 2000; Stattin & Kerr, 2000) and to be the most important factor in relation to maladaptive behavior (e.g., Keijsers, Branje, Van der Valk, & Meeus, 2010; Keijsers, Frijns, Branje, & Meeus, 2009; Kerr & Stattin, 2000; Kerr, Stattin, & Burk, 2010; Stattin & Kerr, 2000; Vieno, Nation, Pastore, & Santinello, 2009). A possible explanation is that parents of children who disclose more are better able to give their children advice on decisions and behaviors, thereby protecting them from maladaptive behaviors (Buhrmester & Prager, 1995; Marshall, Tilton-Weaver, & Bosdret, 2005).
Studies addressing the relation between these sources of parental knowledge and substance use comparing native and immigrant adolescents are scarce. The cultural-ecological model developed by Ogbu (1981) proposes that the goals that parents want to achieve for their children are similar across native and immigrant families (e.g., health and success). However, parents from different cultures may use different strategies in order to achieve these goals, depending on their resources such as the childrearing theories of parent’s culture on how best to raise children. According to this model, the association between different parenting behaviors and adolescent substance use may differ between native and non-western immigrant families. In addition, previous studies have shown that various parenting styles may not have the same effects in all cultures (Kotchick & Forehand, 2002). On the one hand, authoritative parenting, an effective parenting strategy in western families characterized by reasoning and induction, is not always advantageous in non-western immigrant families. On the other hand, authoritarian parenting, which is viewed as a non-effective parenting strategy in western families characterized by restrictions and rules, can have positive results for non-western immigrant children (Kotchick & Forehand, 2002). Similar to authoritarian parenting, parental control is characterized by restrictions and rules. As an authoritarian parenting style can have positive results for non-western immigrant children, it may be that for non-western immigrant adolescents parental control as a source of information is related to adaptive behaviors, such as low levels of substance use.

We examined the cross-sectional relation of the sources of parental knowledge, that is parental solicitation, parental control, and child disclosure, with alcohol and cannabis use among native Dutch and non-western immigrant adolescents. In addition, in order to determine the direction of the association between the sources of parental knowledge and alcohol and cannabis use, we examined the prospective, bidirectional relations between the sources of parental knowledge and substance use across the adolescent years (age 13 to 18 years) in a native Dutch population.
PART II

Cannabis Use Disorder Criteria

Several risk and protective factors have been identified in relation to cannabis abuse and dependence. However, the validity of the criteria of cannabis abuse and dependence is less well studied. In the present thesis, part II focuses on measurement bias of the criteria across different subpopulations. Additionally, we examined the relation of cannabis use and endorsing CUD criteria with suicidal thoughts and behaviors.

Measurement Bias of Cannabis Use Disorder Criteria

In general, examining measurement bias across groups is necessary to make statements about the validity of a construct. In the absence of measurement bias, cannabis users with equal levels of CUD would endorse an equal number of CUD criteria, irrespective of the subpopulations they belong to (i.e., male or female, adolescent or adult). In case of measurement bias, differences in prevalence rates of criteria within various subpopulations do not reflect true differences, but can be attributed to, for example, differences in meaning of those criteria. For a valid measure of CUD across subpopulations, research on the functionality of CUD across different populations is necessary.

Several researchers found various biases in the DSM-IV CUD criteria across different subpopulations: Hartman et al. (2008) studied the utility of DSM-IV cannabis abuse/dependence symptoms in a substance abuse treatment sample, an adjudicated sample, and a community sample. They found that with equal levels of CUD, the severity estimates of the criteria hazardous use, legal problems, social problems, tolerance and larger/longer use significantly differed among the three samples, suggesting that these items indicate greater severity of cannabis problems in some populations as compared to others. Agrawal and Lynskey (2007) investigated whether gender contributes to differences in DSM-IV abuse/dependence criteria, and found that women were more likely to endorse failed quit attempts and use despite problems, while men were more likely to endorse hazardous use and legal problems at a similar level of CUD severity. Mewton et al. (2010) found that hazardous use showed measurement bias across different age groups. Cannabis users aged 25 or above were more likely to endorse hazardous use
at low levels of CUD severity, while those aged 18–24 were more likely to endorse this criterion at high levels of CUD severity, indicating that hazardous use is a more discriminating measure of CUD for those aged 18-24 than for those aged 25 or above. These studies underline the importance to further study measurement bias across different subpopulations.

In the present thesis, we had the unique opportunity to examine the likelihood of endorsement of CUD criteria by comparing a nation-wide sample of the U.S. with a general population sample of the Netherlands, and across young adult (18-24) and older adult (25+) cannabis users. Because of the apparent measurement bias across gender, we simultaneously examined measurement bias across gender when focusing on measurement bias across different subpopulations.

**Cannabis Involvement and Suicidal Thoughts and Behaviors**

Cannabis use and cannabis use disorders have been found to be related to various mental health problems, such as depression, psychosis, and suicidality (e.g., Buckner, Joiner Jr, Schmidt, & Zvolensky, 2012; Fergusson, Horwood, & Swain-Campbell, 2003; Lynskey et al., 2004; Wittchen et al., 2007). While depression and psychoses have been studied in detail, little is known about the relation between cannabis involvement and suicidal thoughts and behaviors. In addition, previous studies on suicidal thoughts and behaviors have focused mainly on suicidal ideation, while only few studies have focused on attempts. The etiology of suicide attempts that are planned beforehand might differ from attempts that are not planned but occur as an impulsive act. For example, Borges, Walters, and Kessler (2000) showed that using one or more substances was related to suicide attempts without planning (SANP), but not to suicide attempts that were planned (SAP). The authors attributed this difference to the disinhibition hypothesis, which proposes that, when using drugs, the capacity to inhibit impulsive attempts is reduced, therefore increasing the risk of suicide attempts (Mayfield & Montgomery, 1972; Rossow & Wichström, 1994). The finding is also consistent with the notion, as stated by Conner et al. (2007) in their study on alcohol dependent men and women, that SANP are related to impulsivity, while SAP are more likely to be related to depression (Harriss, Hawton, & Zahl, 2005).
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In the present thesis, we examined the relationship of cannabis involvement with suicidal thoughts and behaviors, including suicidal ideation, and plans and attempts (planning without attempt, SAP and SANP), while accounting for demographics such as age and gender, comorbid psychopathologies and other substance involvement.

**Aims and outline**

The main objectives of this thesis were to examine risk and protective factors of cannabis use in immigrant Dutch adolescents and young adults, and to study cannabis use disorder symptoms, including measurement bias across different subpopulations. Additionally, the endorsement of these symptoms in relation to suicidal thoughts and behaviors was studied. The specific aims were:

**PART I**

1. To outline the design of i4culture, a study including immigrant adolescents and young adults of various non-western ethnic backgrounds in the Netherlands (CHAPTER 2);
2. To examine acculturation as a risk factor of cannabis use in non-western immigrant Dutch adolescents and young adults (CHAPTER 3);
3. To study the sources of parental knowledge as risk and protective factors of cannabis use across native Dutch and non-western immigrant adolescents (CHAPTER 4) and across adolescence in a native Dutch population (CHAPTER 5);

**PART II**

4. To examine measurement bias in CUD criteria across different subgroups, that is across country (U.S. versus the Netherlands; CHAPTER 5), gender (CHAPTERS 6 & 7), and age group (18-24 versus 25+; CHAPTER 7);
5. To investigate the relationship of cannabis involvement with suicidal thoughts and behaviors, including suicidal ideation, and suicidal planning and attempts (CHAPTER 8).
Samples and methods
In this thesis, we used five different datasets to answer our research questions.

1. i4culture (CHAPTERS 2 - 4):
   Participants in *i4culture* are 989 non-western Dutch adolescents and young adults (mean age 19.08 years old, SD = 2.64, 54.1% female) from Surinamese, Moroccan, Turkish, Antillean, Asian, and other ethnic backgrounds, living in or around the four major cities in the Netherlands: Amsterdam, the Hague, Rotterdam, and Utrecht.

2. RADAR (CHAPTERS 4 & 5):
   The Research on Adolescent Development and Relationships (RADAR) study is a multi-informant, longitudinal population-based cohort study aimed at understanding the interplay between adolescent relationships with family and friends and various developmental outcomes. In total, 497 adolescents (43.1% female) were followed annually from age 13 (wave 1) to age 18 (wave 6).

3. Zuid-Holland (CHAPTER 6):
   The Zuid-Holland study (Verhulst, Akkerhuis, & Althaus, 1985) is a longitudinal general population study in the Netherlands that started in 1983 (wave 1, n = 2,076). Data on cannabis abuse and dependence were collected during the sixth data wave in 1997, when all participants were aged 18-31 years (n = 1581; 53.6% female).

4. NESARC (CHAPTERS 6 & 7):
   The National Epidemiological Survey on Alcohol and Related Conditions (NESARC; Grant, Moore, Shepard, & Kaplan, 2003) is a U.S. population, nation-wide sample with 43,093 participants ranging in age between 18 and 99 (57.0% female). Data from the first wave were collected in 2001-2002 by the U.S. Bureau Census, on behalf of the National Institute on Alcohol Abuse and Alcoholism.
5. Australian Twin Registry (CHAPTER 8):

The Australian Twin Registry (ATR) is a community-based dataset, consisting of two samples. Sample 1 included 6,257 individuals (55.2% female) aged 24–36 (mean age 29.9, SD = 2.5) who were interviewed between 1996 and 2000. Sample 2 included 3,326 twins (64.8% female), aged 27–40 (mean age 31.9, SD = 2.5), who were interviewed between 2005 and 2009.