



## UvA-DARE (Digital Academic Repository)

### Adolescent sexual risk behavior on the internet

Baumgartner, S.E.

**Publication date**  
2013

[Link to publication](#)

#### **Citation for published version (APA):**

Baumgartner, S. E. (2013). *Adolescent sexual risk behavior on the internet*.

#### **General rights**

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

#### **Disclaimer/Complaints regulations**

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

# 5

---

## **Developmental Pathways of Online and Offline Sexual Risk Behavior During Adolescence: A Dual Trajectory Approach**

A shortened and adapted version of this chapter has been published as:

Baumgartner, S. E., Sumter, S. R., Peter, J., & Valkenburg, P. M. (2012). Identifying teens at risk: developmental pathways of online and offline sexual risk behavior. *Pediatrics*. doi: 10.1542/peds.2012-0842.

### **Abstract**

This study investigated the developmental pathways of online and offline sexual risk behavior from early to late adolescence. Moreover, we examined how online and offline sexual risk behaviors are related and which factors predict them. Dual trajectory analysis revealed that adolescents followed three different developmental pathways of online sexual risk behavior: no risk (70.2%), moderate risk (23.7%), and high risk (6.1%). The high-risk group followed an adolescence-limited developmental pathway. For offline sexual risk behavior, we identified a no risk (90.6%) and an increasing pathway (9.4%). Further analyses suggested that online and offline sexual risk behaviors are related and had common predictors (i.e., sensation seeking, low educational level, gender).

## **Developmental Pathways of Online and Offline Sexual Risk Behavior During Adolescence: A Dual Trajectory Approach**

One of the main tasks individuals face during adolescence is the development of sexuality (Buzwell & Rosenthal, 1996; Lerner & Galambos, 1998; Raffaelli & Crockett, 2003). For most adolescents, this period is characterized by an increased interest in sexuality and the initiation of sexual activities. Although these activities are part of normal adolescent development, some adolescents may also engage in sexual risk behaviors during this period, such as unprotected sex (Kotchick, Shaffer, & Forehand, 2001; Lerner & Galambos, 1998). Today, adolescents increasingly turn to the Internet to satisfy their sexual curiosity and to explore their sexuality (Boies, Cooper, & Osborne, 2004; Subrahmanyam, Smahel, & Greenfield, 2006; Valkenburg & Peter, 2011). Some adolescents may also use the Internet in more problematic ways, for example to send intimate information to strangers online or to search for sexual partners (Baumgartner, Valkenburg, & Peter, 2010a). In recent years, there has been growing interest into this new form of adolescent sexual risk behavior (Baumgartner, Valkenburg, & Peter, 2010b; Ybarra, Mitchell, Finkelhor, & Wolak, 2007).

Despite growing research on both online and offline risk behavior, not much is known about the development of these behaviors during adolescence and about individual differences in this development. This lack is striking because individuals do not undergo comparable changes in sexuality during any other period in their lives and adolescents may strongly differ in how they handle sexual risks in this period (Dahl, 2004). Whereas some adolescents may not engage in these risk behaviors at all, others may show heightened developmental pathways of sexual risk behavior. The first aim of this study, therefore, was to investigate longitudinally the specific pathways of online and offline sexual risk behavior during adolescence.

Because of the novelty of online sexual risk behavior, we also lack an understanding of how online and offline sexual risk behaviors are related. More specifically, we do not know whether online sexual risk behavior displaces offline sexual risk behavior or whether the two behaviors co-occur over time. In addition, we do not know whether the same or different psychological and social factors predict problematic pathways of online and offline sexual risk behavior. Knowing how these two types of behavior are related and whether they are influenced by common or different factors may help us prevent these behaviors more effectively. If the predictors for online and offline sexual risk behavior differ, interventions for online sexual risk behavior should be different from those for offline sexual risk behavior. Therefore, the second and third aim of this study were to investigate the relationship between the developmental pathways of online

and offline sexual risk behavior, and to examine the psychological and social antecedents of both types of sexual risk behavior.

Offline sexual risk behavior is a multidimensional construct, reflecting a number of different behaviors (Raffaelli & Crockett, 2003). It has been conceptualized either broadly (encompassing various sexual behaviors) or narrowly (focusing on only one specific sexual risk behavior; Kotchick et al., 2001). In this study, we focus on one specific type of offline sexual risk behavior, casual sex. We focus on this specific risk behavior because it has been argued that casual sex is an increasingly occurring form of sexual encounters among youth (Bogle, 2008; Heldman & Wade, 2010; Stinson, 2010). Moreover, casual sex has been related to higher risks of contracting STIs (Heldman & Wade, 2010).

Similar to offline sexual risk behavior, also online sexual risk behavior is multifaceted. In this study, we define online sexual risk behavior as the exchange of intimate, sexually oriented information or material with someone exclusively known online (Baumgartner et al., 2010a).

### **Developmental Trajectories of Online and Offline Sexual Risk Behavior**

It has been well established that risk taking peaks in adolescence (Arnett, 1996; Boyer, 2006; Dahl, 2004). This heightened risk taking has been attributed to the interplay between the socio-emotional and the cognitive-control systems (Steinberg, 2005, 2008). With the physiological, physical, and hormonal changes that accompany puberty, the socio-emotional system becomes more assertive (Dahl, 2004; Steinberg, 2008), which leads to an increase in reward-sensitivity, sensation-seeking and risk-taking. In contrast, the cognitive-control system only develops gradually. Many psychosocial capacities that inhibit risk behavior, such as emotion regulation and impulse control, are not yet fully developed in early to mid-adolescence. Therefore, adolescents are not always able to successfully regulate their impulses in risky situations and are more prone to engage in risk behaviors (Steinberg, 2008).

Although all adolescents undergo these biological changes, some adolescents handle these changes better than others and, therefore, engage in less problematic behavior during this period (Compas, Hinden, & Gerhardt, 1995; Dahl, 2004). One of the first conceptualizations of different risk engagement pathways was Moffitt's account of adolescence-limited delinquency (Moffitt, 1993). Moffitt suggested that juvenile delinquency comprises at least two different categories of individuals. The first group shows an adolescence-limited pathway with the typical increase in risk engagement until mid-adolescence and a decrease thereafter. A second group, the life-time persistent offenders, shows stable patterns of risk engagement throughout adolescence and adulthood.

Few studies have identified different trajectories of offline sexual risk behavior during adolescence. Murphy, Brecht, Herbeck, and Huang (2009) and Moilanen, Crockett, Raffaelli, and Jones (2010) described four pathways of sexual risk behavior during mid-adolescence to young adulthood. Both studies identified two groups that were comparable to the *adolescence-limited* and the *life-time persistent* group proposed by Moffitt (1993). However, both studies discovered two additional groups. One of these groups included a substantial number of adolescents who showed no sexual risk engagement over time. The other included adolescents who only started to engage in online sexual risk behavior in the transition to young adulthood. Murphy et al. (2009) and Moilanen et al. (2010) focused only on adolescents aged 15 or older. However, it has been shown that younger adolescents (e.g., 12-13 year-olds) may also be prone to engage in sexual risk behaviors (de Graaf, Meijer, Poelman, & Vanwesenbeeck, 2005). Therefore, to fully understand the onset and development of sexual risk behavior, it is necessary to also include younger adolescents.

Research on the development of *online* sexual risk behavior is scarce. A cross-sectional study on age differences in online sexual risk behavior found a slight increase in the engagement in online sexual risk behavior from early (12-13 years old) to late adolescence (16-17 years old); (Baumgartner et al., 2010b). This study also suggested that engagement in online sexual risk behavior varies considerably among adolescents. However, because this study was cross-sectional and investigated only differences in group averages, it was not able to identify distinct developmental pathways.

We expect that the pathways of online and offline sexual risk behavior differ. Specific characteristics of the Internet may affect the onset of online sexual risk behavior and the number of adolescents who engage in these behaviors. Internet research has shown that, especially for sensitive issues, adolescents benefit from the accessibility and perceived controllability of Internet-based communication (Peter & Valkenburg, 2006; Schouten, Valkenburg, & Peter, 2007). The accessibility of the internet gives young adolescents the opportunity to explore their sexuality at an earlier age (Valkenburg & Peter, 2011). The perceived controllability of internet communication gives adolescents a sense of safety, which allows them to interact more freely with others (Valkenburg & Peter, 2011). Therefore, we expect that adolescents not only start earlier with online sexual risk behaviors but also engage more often in online than in offline sexual risk behaviors.

### **Relationship Between Online and Offline Sexual Risk Behavior**

Two contrasting hypotheses have been formulated about the association between online and offline behavior: the displacement and the co-occurrence hypothesis (Valkenburg, Sumter, & Peter, 2011). These hypotheses can also be applied to the relationship between online and offline sexual risk behavior. The displacement hypothesis

(Lee & Kuo, 2002) posits that online activities are a substitution for offline activities, and thus predicts that online sexual risk behavior displaces offline sexual risk behavior. According to this hypothesis online and offline sexual risk behaviors are not or negatively related. The second hypothesis, the co-occurrence hypothesis, states that online and offline activities co-occur over time (Subrahmanyam, Kraut, Greenfield, & Gross, 2000; Valkenburg, et al., 2011). This hypothesis thus predicts that online and offline sexual risk behaviors are positively related.

The co-occurrence hypothesis seems to be most consistent with previous research on risk behavior. Individuals who engage in one type of risk behavior are typically more susceptible to engage in other types of risk behavior as well (Hair, Park, Ling, & Moore, 2009; Igra & Irwin, 1996; Kotchick et al., 2001). For example, sexual risk behavior has been related to heightened substance use (Guo et al., 2002) and to higher levels of delinquency (Aalsma, Tong, Wiehe, & Tu, 2010). Moreover, research that compared online and offline behaviors has found that online and offline behaviors are positively related (Valkenburg et al., 2011). Therefore, we predict that adolescents who show heightened pathways of online sexual risk behavior will also show heightened pathways of offline sexual risk behavior.

### **Predictors of Online and Offline Sexual Risk Behavior**

According to Moffitt's taxonomy, several psychological and social factors determine which developmental pathways adolescents follow. This implies that adolescents who follow a specific developmental pathway of risk behavior differ in these factors from adolescents who follow another developmental pathway. Sexual risk behavior is related to a wide range of psychological and social factors (Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2002; Kotchick et al., 2001). To investigate differences between adolescents who follow specific developmental risk pathways, we focus on two psychological factors, sensation seeking and life satisfaction, and one social factor, family cohesion. We chose those psychological and social factors because they are all consistent predictors of offline sexual risk behavior (Igra & Irwin, 1996). Because studies on online sexual risk behavior are rather new, it is unknown whether these factors are also related to online sexual risk behavior. Using predictors that have been well established for offline sexual risk behavior allows comparing the antecedents of online and offline sexual risk behavior.

Sensation seeking has been defined as a personality trait that is characterized as the willingness to engage in risks in order to increase stimulation and arousal (Zuckerman, 1990). Adolescents with high levels of sensation seeking are likely to engage in all sorts of behaviors that promise novel and varying sensations (Zuckerman, 1990). Therefore, it is

not surprising that individuals with high levels of sensation seeking have a higher number of sexual partners (Bancroft et al., 2004; Donohew et al., 2000), are more likely to engage in casual sex (Seto, Lalumiere, & Quinsey, 1995), and to have unprotected sex (Kalichman, Simbayi, Jooste, Vermaak, & Cain, 2008). Sensation seeking has also been related to online sexual behaviors, such as compulsive sexual online behaviors (Cooper, Delmonico, & Burg, 2000) and usage of online pornography (Peter & Valkenburg, 2006, 2011). Therefore, we expect that adolescents who follow heightened pathways of online and offline sexual risk behavior also have higher levels of sensation seeking than adolescents who abstain from sexual risk behavior.

Similarly, we expect that adolescents who differ in their developmental pathways of online and offline sexual risk behavior also differ in life satisfaction. Adolescents who are dissatisfied with their lives are more prone to engage in various risk behaviors, including sexual risk behavior (MacDonald, Piquero, Valois, & Zullig, 2005; Valois, Zullig, Huebner, Kammermann, & Drane, 2002). Likewise, adolescents who are less satisfied with their lives are more likely to engage in online risks (Livingstone & Helsper, 2007). These adolescents may use the internet as a substitution for missing offline gratifications (Baker & Moore, 2008; Peter & Valkenburg, 2006). We therefore expect that adolescents who follow heightened pathways of online and offline sexual risk behavior are less satisfied with their lives than adolescents who do not engage in online and offline sexual risk behavior.

As for social antecedents, we chose family cohesion because it has been shown to be a valid indicator of overall quality of family relationships (De Graaf, van de Schoot, Woertman, Hawk, & Meeus, 2012; Olson, 2000). Adolescents from coherent and supportive families report fewer sexual partners (Luster & Small, 1997), later sexual onset (De Graaf et al., 2012), fewer incidences of unprotected sexual intercourse and are less likely to engage in sexual intercourse with strangers (Metzler, Noell, Biglan, Ary, & Smolkowski, 1994). In families in which family cohesion is low and emotional support is lacking, adolescents may seek out support in romantic and sexual relationships (De Graaf et al., 2012). These adolescents may also look for emotional support on the Internet. Although for online risk behavior family quality has rarely been studied, poor emotional bonding is associated with higher levels of online harassment among youths (Ybarra & Mitchell, 2004). Moreover, adolescents from less cohesive families may be less monitored by their parents and may thus have more freedom to engage in sexual risk behavior, both online and offline. Therefore, we expect that adolescents who follow heightened pathways of online and offline sexual risk behavior have less coherent families than adolescents who do not engage in online and offline sexual risk behavior.

## Method

### Sample and Procedure

The data used in this study were drawn from a four-wave panel study with six months time intervals. Fieldwork was done by a Dutch research agency. This agency has a large online access panel consisting of 10,990 Dutch adolescents. Participants in the online access panel were originally recruited from random samples in traditional telephone, face to face, or mail surveys. From the participants in the online access panel, 2,092 adolescents were selected randomly and contacted by email. 1,765 agreed to participate in the study (response rate: 84.4%). Answering the online questionnaire took approximately 20 minutes. Institutional approval from the ethics board of the university, as well as parental and informed consent were obtained prior to participation. The participants received 5€ (approx. 7\$) for each completed questionnaire.

Of the 1,765 adolescents who completed the first questionnaire, 1,445, 1,206, and 1,016 also participated in Waves 2, 3, and 4, respectively. The attrition rates ranged from 18% to 16%. The retention rate of the sample was thus satisfactory. To check whether the rate of attrition was correlated with the outcome of interest, we conducted a logistic regression analysis with a dichotomous variable indicating whether participants were missing or not at Wave 4 as the dependent variable. Online and offline sexual risk behavior at Time 1 as well as demographic variables (i.e., age, gender, education) were entered as independent variables. None of these variables had a significant influence on the drop-out of participants (all  $p > .13$ ).

Three participants were excluded from the analyses because of inconsistent age information. The final sample, therefore, consisted of 1,762 adolescents (49% females). To analyze the data, we arranged the data according to the logic of an accelerated cohort-sequential design with age as the time variable. For example, we included all data for 16-year olds for the time point of age 16, no matter at which of the four waves a given subject was 16 years old. As an example, a participant who was 12 years old when s/he received the first questionnaire contributed data for ages 12, 12.5, 13, and 13.5. Because of this accelerated cohort-sequential design, we could cover an age range between 12 and 19.5 years in half year intervals. Previous research has shown that cohort-sequential designs adequately approximate true longitudinal designs and are suitable for modeling developmental trends (Duncan, Duncan, & Hops, 1996).

Because of the accelerated design, there was a different number of participants in each age group (12 years,  $N = 70$ ; 12.5 years,  $N = 206$ ; 13 years,  $N = 321$ ; 13.5 years,  $N = 433$ ; 14 years,  $N = 437$ ; 14.5 years,  $N = 475$ ; 15 years,  $N = 469$ ; 15.5 years,  $N = 460$ ; 16



years,  $N = 458$ ; 16.5 years,  $N = 463$ ; 17 years,  $N = 463$ ; 17.5 years,  $N = 474$ ; 18 years,  $N = 362$ ; 18.5 years,  $N = 226$ ; 19 years,  $N = 106$ ; 19.5 years,  $N = 26$ ).

## Measures

**Online sexual risk behavior.** We assessed online sexual risk behavior with four items used in previous research (Baumgartner et al., 2010a; Ybarra, Mitchell et al., 2007). These items were inspired by academic and public discussions (Ponte, Bauwens, & Mascheroni, 2009). These items have been linked to negative consequences, such as receiving unwanted sexual solicitation on the Internet (Mitchell et al., 2007). Participants indicated on a 5-point scale ranging from 0 (*never*) to 4 (*six times or more*) how often, in the last six months, they had participated in one of the following activities: 1) searched for someone on the Internet to talk about sex; 2) searched for someone on the Internet to have sex; 3) sent a photo or video in which they were partly naked to someone they only knew online; and 4) sent an address or telephone number online to someone they only knew online. Because the prevalence of these behaviors was very low, we transformed each variable into a binary variable 0 (*never*), 1 (*engaged in specific risk*). The four resulting binary online sexual risk behaviors were added into a count variable of online sexual risk behavior. This new variable could take values from 0 to 4 ( $M = 0.25$ ,  $SD = 0.65$  for Wave 1;  $M = 0.22$ ,  $SD = 0.60$  for Wave 2;  $M = 0.19$ ,  $SD = 0.58$  for Wave 3;  $M = 0.17$ ,  $SD = 0.51$  for Wave 4), and was used in all further analyses.

**Offline sexual risk behavior.** Risky sexual offline behavior, conceptualized as casual sexual intercourse, was measured using two items. Adolescents were asked (a) how often in the past six months they had sex with someone they had just met and (b) whether they had sex without condom with someone they had just met. Response categories ranged from 0 (*never*) to 4 (*six times or more*). These two variables were scored dichotomously (never vs. once or more in the past six months) and combined into a single count variable which could take values from 0 to 2. Means (standard deviations in parentheses) for the four waves were 0.07 (0.33), 0.06 (0.31), 0.04 (0.26), 0.05 (0.27), respectively.

**Predictors.** Three variables were included as predictors: sensation seeking, life satisfaction, and family cohesion. Because we assumed that these variables would predict risk behavior, we only included these variables as measured at Time 1 in the analyses.

**Sensation seeking.** We used the five items of the Brief Sensation Seeking Scale (Hoyle et al., 2002) that had the highest factor loadings in previous studies (Peter & Valkenburg, 2008) (e.g., “I would love to have new and exciting experiences, even if they are illegal”). Response categories ranged from 1 (*does not apply at all*) to 5 (*applies completely*). The five items formed a unidimensional scale with a Cronbach’s alpha of .87 ( $M = 2.09$ ,  $SD = 0.88$ ).

**Life satisfaction.** Life satisfaction was operationalized with the five-item Satisfaction-with-Life Scale (Diener, Emmons, Larsen, & Griffin, 1985). Response categories ranged from 1 (*does not apply at all*) to 5 (*applies completely*). The five items formed a unidimensional scale with a Cronbach's alpha of .87. Higher scores indicated more life satisfaction ( $M = 3.45$ ,  $SD = 0.74$ ).

**Family cohesion.** This construct was measured with four items from a Dutch adaptation of the Family Adaptability and Cohesion Evaluation Scales (Olson, 1996, 2000). The following four items from the cohesion subscale were used: 1) If you want something in our family, you have to take care of it yourself; 2) In my family, everybody mainly focuses on his/her own affairs; 3) In our family, everyone goes his own way; and 4) In our family, everyone decides for him/herself what suits him/her best. Response categories ranged from 1 (*does not apply at all*) to 5 (*applies completely*). Scores were reverse coded so that higher scores indicated more family cohesion. The four items formed a unidimensional scale with a Cronbach's alpha of .84 ( $M = 3.53$ ,  $SD = 0.81$ ).

**Control variables.** Because educational level and gender predict offline sexual risk behavior (De Graaf et al., 2005; Murphy et al., 2009; Petersen & Hyde, 2010), we included these variables as control variables. We operationalized education with a three-point scale reflecting the levels of the Dutch education system. Participants were asked to indicate the educational level they were attending at the moment or, if they were no longer following an education, the highest level they had completed. The youngest participants (12 year-olds), who have not yet been assigned to a specific educational level, were asked to which educational level they were expected to be assigned. Dutch children are typically able to give an accurate estimation of their subsequent educational level based on a national compulsory test they have to take at age 11. The scale ranged from 1 (*lowest education level*) to 3 (*highest educational level*) ( $M = 1.72$ ,  $SD = 0.81$ ).

### **Data Analytical Approach**

The analyses were conducted in three steps. First, we separately identified the different developmental pathways of online and offline sexual risk behavior. To identify different pathways of online and offline sexual risk behavior, we used semiparametric group based modeling (Nagin, 1999). This approach assumes that, within a given population, different groups of individuals exist whose engagement in a specific behavior follows distinct developmental pathways. In contrast to standard growth curve modeling, the main advantage of the group-based approach is that it allows to model distinctive developmental trajectories within a population (Nagin, 2005). Group-based modeling is especially suitable for our data because we expected strong inter-individual variations for the development of both online and offline sexual risk behavior.

To select the number of groups that best represent the heterogeneity in developmental trajectories, we followed the suggestions by Nagin (2005). The Bayesian Information Criterion (BIC) was used as a test statistic for model selection. The selection of the model with the largest BIC is recommended (Nagin, 2005). Models with progressively more groups were tested until model fit could not be further improved. After identifying the number of groups that best fit the model, different shapes for the trajectories (linear, quadratic, and cubic) were tested. Each individual in the sample was then assigned to the specific group that best fits his or her behavioral profile.

Once the ideal number of groups has been identified, model adequacy is tested with the average posterior probabilities of group membership. The posterior probabilities of group membership measure each individual's likelihood of belonging to his or her assigned group (Nagin, 2005). Nagin (2005) recommends that the average posterior probabilities should exceed a minimum of .70 for each group. An average posterior probability of above .70 indicates that, on average, individuals are well assigned to their groups.

In the second step of data analysis, the overlap between online and offline sexual risk behavior is investigated by conducting a dual trajectory analysis. This allows us to test whether pathways of online and offline sexual risk behavior co-occur. This analysis relates the developmental trajectories of the two behaviors in a single summary statistical model (Nagin, 2005). The main advantage of the dual trajectory model is that it estimates the joint probabilities of membership in trajectory groups across behaviors. These joint probabilities are a summary of the developmental linkages between the two studied outcomes (Nagin, 2005).

In the third and final step of data analysis, we conducted multinomial logistic regressions to analyze the predictors of group membership for online and offline sexual risk behavior.

## **Results**

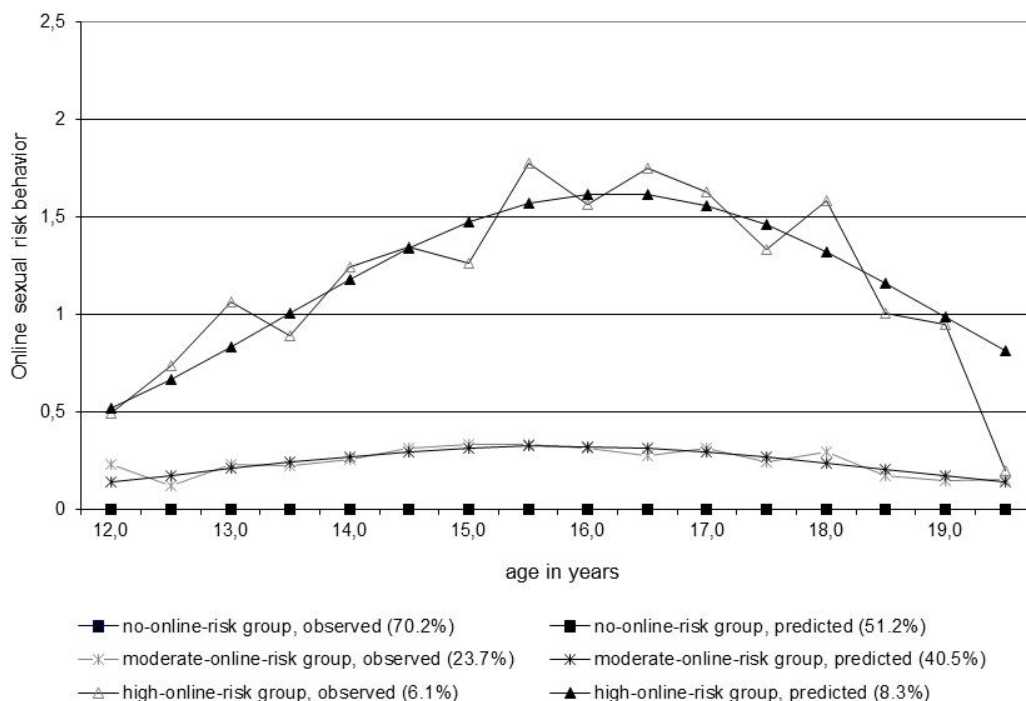
### **Trajectories of Online Sexual Risk Behavior**

Using the group-based approach, we tested one-group to four-group models of trajectories for online sexual risk behavior. The trajectories were modeled using the zero-inflated Poisson (ZIP) model. The ZIP model is particularly useful for count variables when the data provides more zeros than expected under the Poisson assumption (Nagin, 2005). The BIC continued to improve until the three group solution (BIC values: -3259.11, -2898.58, -2823.02, and -2837 for the one-, two-, three-, and four-group solutions, respectively). Therefore, the three group model was selected as the best fitting model. To identify the shapes of the trajectories, we subsequently analyzed models with different

shapes (linear, quadratic, cubic). Again, the model with the highest BIC was selected. The final model resulted in a three-group model with one group that was specified to have zero probability of risk engagement throughout the time period to account for adolescents who did not engage in online sexual risk behavior at all (Muthén, 2004) and two quadratic curves (BIC = -2811.85).

The three trajectory groups of the final model are displayed in Figure 5.1. The first group, ‘no-online-risk,’ consisted of 70.2% of the sample and represents those who did not engage in online sexual risk behavior during adolescence. 23.7% of the adolescents belonged to the second group ‘moderate-online-risk.’ This group showed low levels of risk engagement over time. Although these adolescents engaged in low levels of online sexual risk behavior, the shape shows a slight increase in mid-adolescence (15-16 years) and a decline thereafter. The final group, ‘high-online-risk,’ comprised 6.1% of the adolescents. These adolescents showed elevated levels of risk engagement over time and followed the typical curvilinear risk behavior trajectory, with an increase in risk behavior from early to mid-adolescence and a decline of risk engagement from mid- to late-adolescence. The APPs of group membership were all above .73, indicating that individuals were well matched to their assigned group.

**Figure 5.1.** The Development of Online Sexual Risk Behavior



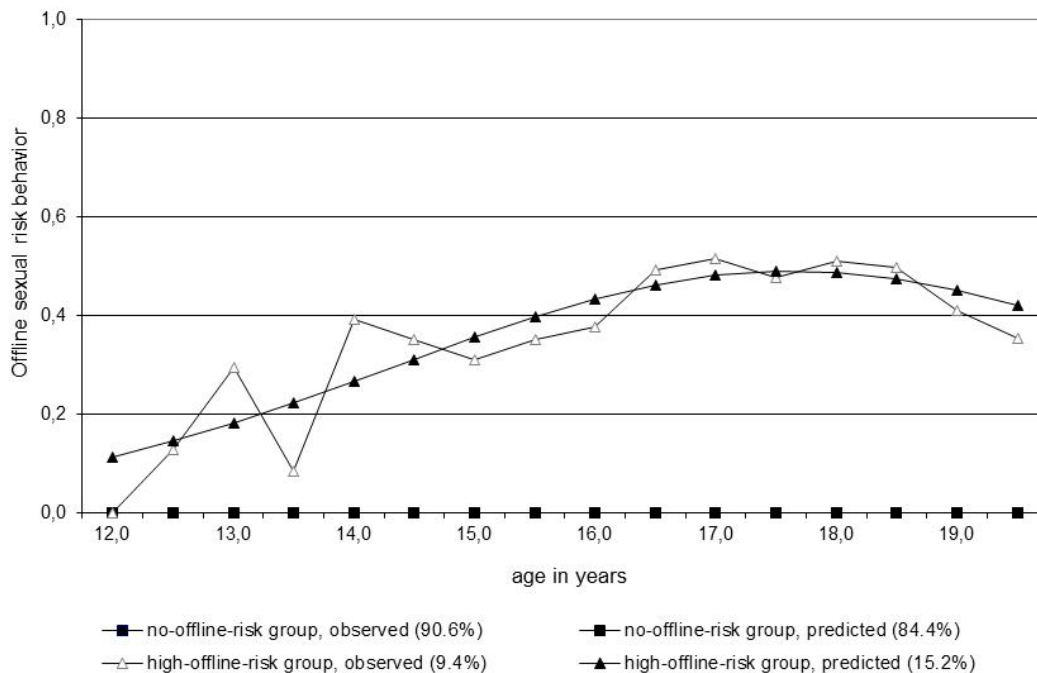
*Note.* Figure 5.1 displays the estimated and predicted curves for the three online sexual risk behavior groups.

### Trajectories of Offline Sexual Risk Behavior

For offline sexual risk behavior, two groups fit the data best. The BIC for this model was -1069.31. For the one and three group model, the BICs were -1234.99 and -1061.82, respectively. A four group model did not converge. One group was specified to have zero probability of risk engagement. For the second group, a quadratic shape fit the data best (final BIC = -1058.10). The trajectories of the two groups are displayed in Figure 5.2. Average posterior probabilities for the two offline groups indicated that the individuals were well matched to their assigned groups, with .94 for the no-offline-risk group and 1.0 for the high offline risk group. Similar to online sexual risk behavior, one large group of adolescents did not engage in offline sexual risk behavior (90.6%). Adolescents in the second group, ‘high-offline-risk,’ showed increasing levels of offline sexual risk behavior until age 18 which then slightly levels off (9.4%).

Comparing the developmental trajectories of online and offline sexual risk behavior, it shows that the 'high-online-risk' group starts at higher levels in early adolescence (12-13 years) and increases faster than the 'high-offline-risk' group. However, whereas the 'high-offline-risk' group continues to increase until age 18 and levels off only slightly after that time, the 'high-online-risk' group peaks in mid-adolescence (15-16 years) and declines thereafter.

**Figure 5.2.** Development of Offline Sexual Risk Behavior



*Note.* Figure 5.2 displays the estimated and predicted curves for both offline sexual risk behavior groups.

### **Dual Trajectory Model of Online and Offline Sexual Risk Behavior**

The second aim of the study was to investigate the relationship between the trajectories of online and offline sexual risk behavior. To investigate whether the co-occurrence or displacement hypothesis were supported, we analyzed a dual trajectory model. This model jointly estimates the trajectories of online and offline sexual risk behavior based on the results of the single trajectories. Model estimation of the dual trajectory model resulted in a BIC of -3786.78.

Table 5.1 displays the joint probabilities of online and offline sexual risk behavior groups. Panel A of Table 5.1 shows the probability of belonging to the two offline trajectories conditional on online group memberships. This panel indicates that if an individual belonged to the 'no-online-risk' group, he or she had a very high probability of belonging to the 'no-offline-risk' group (99%). Thus, adolescents who took no online risks were also not likely to engage in offline sexual risk behavior. Similarly, if adolescents belonged to the 'high-online-risk' group, the probability that they also belonged to the 'high-offline-risk' group was 76%. This finding suggests that adolescents who engaged in high levels of online sexual risk behavior were also very likely to engage in offline sexual risk behavior. If adolescents belonged to the 'low-online-risk' group, the likelihood that they engaged in offline sexual risk was lower (18%) than the likelihood that they did not engage in offline sexual risk behavior (82%).

Panel B of Table 5.1 reports the probability of online group membership conditional on the two offline sexual risk groups. This table shows that adolescents who did not engage in offline sexual risks had a probability of only 2.5% of belonging to the 'high-online-risk' group. The probability of being in the 'no-online-risk' group was also higher (59%) than being in the 'moderate-online-risk' group (39%) for adolescents who do not engage in offline sexual risks. Panel C of Table 5.1 depicts the joint probabilities of membership in the online and offline sexual risk behavior groups.

Overall, the findings provided strong support for the co-occurrence hypothesis, but not for the displacement hypothesis. Thus, engagement in online and offline sexual risk behavior was closely related.

**Table 5.1.** Relationship of Online Sexual Risk Behavior and Offline Sexual Risk Behavior

A. Probability of Offline Group Membership Conditional on Online Group Membership			
	No-online-risks	Moderate-online-risks	High-online-risks
No-offline-risks	0.99	0.82	0.24
High-offline-risks	0.01	0.18	0.76
Total	1.0	1.0	1.0

B. Probability of Online Group Membership Conditional on Offline Group Membership		
	No-offline-risks	High-offline-risks
No-online-risks	0.59	0.03
Moderate-online-risks	0.39	0.51
High-online-risks	0.02	0.46
Total	1.0	1.0

C. Joint Probability of Online Groups and Offline Groups		
	No-offline-risks	High-offline-risks
No-online-risks	0.50	0.00
Moderate-online-risks	0.33	0.08
High-online-risks	0.02	0.07
Total		1.0

### Predictors of Group Membership

Table 5.2 displays the distribution of gender and education for each trajectory group. To predict the three online sexual risk groups, we conducted a multinomial logistic regression with sensation seeking, life satisfaction, family cohesion, gender, education, and amount of online communication as independent variables (see Table 5.3). Higher levels of sensation seeking and lower life satisfaction significantly predicted being in the 'moderate-online-risk' or 'high-online-risk' group in comparison to the 'no-online-risk' group.

Moreover, adolescents from less coherent families were more likely to belong to the 'moderate-online-risk' or 'high-online-risk' group. Adolescents following lower levels of education were more likely to be in the 'high-' or 'moderate-online-risk' groups in comparison to the 'no-online-risk' group. Finally, adolescents who spent more time with online communication were more likely to belong to the 'high-' or 'moderate-online-risk' groups in comparison to the 'no-online-risk' group. Online communication and gender also significantly differentiated between adolescents in the 'moderate-' and 'high-online-risk' group with more boys and adolescents who spend more time communicating online belonging to the 'high-online-risk' group.

A logistic regression analysis with the two offline sexual risk groups as the dependent variable showed that sensation seeking and educational level were significant predictors of offline sexual risk behavior.

**Table 5.2.** Distribution of Gender and Education for Online and Offline Sexual Risk Behavior Groups

	Gender		Education		
	Males	Females	Low level	Middle level	High level
No-online-risk (N=1237), %	49.4	50.6	48.0	27.2	24.8
Moderate-online-risk (N = 417), %	52.8	47.2	55.9	23.1	21.1
High-online-risk (N = 108), %	62.0	38.0	62.4	25.7	11.9
No-offline-risk (N = 1597)	50.2	49.8	49.3	26.8	23.9
High-offline-risk (N = 165)	58.2	41.8	64.9	19.5	15.6

*Note.* Gender differences: for online sexual risk behavior  $\chi^2 = 7.06$ , *Cramer's V* = 0.06;  $p < .05$ . For offline sexual risk behavior  $\chi^2 = 3.79$ , *Cramer's V* = 0.05;  $p = 0.05$ .

Differences in education: for online sexual risk behavior behavior  $\chi^2 = 16.21$ , *Cramer's V* = 0.07;  $p = 0.01$ . For offline sexual risk behavior  $\chi^2 = 13.77$ , *Cramer's V* = 0.09;  $p < 0.01$ .



**Table 5.3.** Results of the (Multinomial) Logistic Regressions for the Online and Offline Sexual Risk Groups

	B(SE)	95% CI for odds ratio		
		Lower	Odds ratio	Upper
<b>No-online-risk vs. Moderate-online-risk</b>				
Intercept	-0.37 (0.58)			
Sensation seeking	0.38 (0.08)***	1.25	1.47	1.71
Life satisfaction	-0.26 (0.09)**	0.65	0.77	0.92
Family cohesion	-0.26 (0.08)**	0.66	0.77	0.91
Gender	-0.16 (0.14)	0.65	0.85	1.12
Education	-0.14 (0.07) †	0.74	0.87	1.02
Online communication	0.12 (0.03)***	1.05	1.12	1.20
<b>No-online-risk vs. High-online-risk</b>				
Intercept	-0.73 (1.02)			
Sensation seeking	0.39 (0.14)**	1.13	1.47	1.93
Life satisfaction	-0.30 (0.16) †	0.55	0.74	1.01
Family cohesion	-0.50 (0.13)**	0.45	0.61	0.81
Gender	-0.78 (0.22)**	0.28	0.46	0.74
Education	-0.33 (0.15)*	0.63	0.72	0.98
Online communication	0.32 (0.06)***	1.23	1.38	1.55
<b>Moderate-online-risk vs. High-online-risk</b>				
Intercept	-0.36 (0.97)			
Sensation seeking	0.01 (0.14)	0.76	1.01	1.33
Life satisfaction	-0.04 (0.15)	0.70	0.96	1.32
Family cohesion	-0.25 (0.14)	0.58	0.78	1.05
Gender	-0.63 (0.23)*	0.32	0.53	0.88
Education	-0.18 (0.15)	0.61	0.83	1.15
Online communication	0.21 (0.06)**	1.09	1.23	1.39
<b>No-offline-risk vs. High-offline-risk</b>				
Constant	-3.37 (.78)***			
Sensation seeking	0.88 (.11)***	1.94	2.41	3.00
Life satisfaction	-0.13 (.12)	0.70	0.88	1.10
Family cohesion	-0.16 (.11)	0.69	0.85	1.05
Gender	-0.04 (.18)	0.68	0.96	1.37
Education	-0.40 (.12)**	0.53	0.03	0.85

Note. †  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . For online sexual risk behavior,  $R^2 = .10$  (Cox & Snell), .13 (Nagelkerke). Model  $\chi^2(12) = 146.32, p < .001$ . For offline sexual risk behavior,  $R^2 = 0.06$  (Cox & Snell), .13 (Nagelkerke). Model  $\chi^2(5) = 98.33, p < .001$ .

## Discussion

This study examined the developmental pathways of online and offline sexual risk behavior from early to late adolescence. Using a group-based modeling approach, we found substantial variation in the developmental course of online and offline sexual risk engagement. For engagement in online sexual risk behavior, three distinct groups were identified. One large group of adolescents did not engage in online sexual risk behavior during adolescence. A second group showed moderate levels of risk engagement, and a third group showed higher levels of risk engagement. The 'moderate-' and 'high-online-risk' groups followed the typical developmental pathway of risk behavior, with an increase from early to mid-adolescence, a peak in mid-adolescence, and a decline thereafter (Dahl, 2004; Jessor, 1992; Steinberg & Morris, 2001). The 'high-online-risk' group is comparable to the adolescence-limited group proposed by Moffitt (1993). This finding suggests that online sexual risk behavior follows pathways similar to many offline risk behaviors. During adolescence, individuals may show a heightened engagement not only in offline risk behavior but also in online risk behavior.

Identifying these groups advances our understanding of the rather new phenomenon of online sexual risk behavior. In contrast to public concerns and fears (Ponte et al., 2009), the majority of adolescents behaved responsibly online. Engagement in online sexual risk behavior is, similar to many types of offline risk behavior, not a mass phenomenon among youth; rather, it is confined to a small group of adolescents.

The identified developmental pathways of online sexual risk behavior extend previous findings on age differences in online sexual risk behavior. A previous cross sectional study that averaged the levels of online sexual risk engagement for several adolescent and adult age groups did not reveal any age differences for middle adolescents and adults (Baumgartner et al., 2010b). This result may be due to the cross-sectional nature of that study, which investigated different individuals for each age group. Another reason may be that averaging the levels of online sexual risk engagement masks important differences across individuals. Even if our 'high-online-risk' group decreases its online sexual risk behavior in the transition to adulthood, this group may still retain a certain level of online risk during adulthood. It is also possible that some individuals engage in online sexual risk behavior only later in life because of specific life events. Future research is needed to understand the developmental course of online sexual risk behavior not only in adolescence but also in adulthood.

For offline sexual risk behavior, we identified two distinctive trajectories. Similar to online sexual risk behavior, we found one large group that showed no risk engagement over the course of adolescence. This finding indicates that the majority of adolescents in the sample did not engage in offline sexual risk behavior at all. However, one small group

showed increasing levels of risk engagement over the course of adolescence. This group started at low levels of risk engagement at age 12, increased their risk engagement until age 18 when it slightly leveled off.

These two trajectories were also found in previous research on the development of offline sexual risk behavior (Moilanen et al., 2010; Murphy et al., 2009). However, previous research has identified two more groups: a constantly-high group and a decreasing group (Moilanen et al., 2010). Moreover, the high risk group in previous studies consisted of more individuals than in our study. These differences may be due to the inclusion of younger age groups in our sample. The decreasing-risk groups in previous studies typically decreased their behavior only in their early twenties (Moilanen et al., 2010; Murphy et al., 2009). Such a group could not be identified with our adolescent sample. These differences may be also due to the broader conceptualization of risk behavior in previous study. Previous research has also included items such as whether adolescents ever had sex and the numbers of sexual partners (Kotchick et al., 2001). By including these more general items, previous studies may have found more inter-individual variation. The study extends previous findings by showing that adolescents that follow the high offline sexual risk trajectory may already start engaging in these risks early in adolescence.

A second important finding of this study is that the developmental trajectories of online and offline sexual risk behavior were closely related. The results clearly support the co-occurrence hypothesis of online and offline sexual risk behavior. The displacement hypothesis could not be supported. The finding that online and offline sexual risk behavior co-occur is in line with previous studies on the relationship between online and offline behavior (Valkenburg et al., 2011). This finding is also in line with previous studies that have established that risk behaviors are typically linked (Kotchick et al., 2001). This study was the first to reveal a relationship between online and offline sexual risk behaviors. Most importantly, our findings show that nearly all of the adolescents who engaged in high levels of risky sexual offline behavior also engaged in increased levels of online sexual risk behavior. This finding suggests that adolescents who engage in high levels of offline sexual risk behavior also use the Internet for sexual experimentation.

There are at least two explanations for the strong overlap between online and offline sexual risk behavior. The first explanation is that engagement in one behavior increases the likelihood of engaging in the other behavior (Igra & Irwin, 1996). For example, searching for sexual partners online may subsequently lead to casual sex with these partners. It may also be that adolescents first experiment with their sexuality online before they dare or have the possibility to engage in sexual behaviors offline. Our findings partly support this argument because online sexual risk behavior peaked earlier during

adolescence than offline sexual risk behavior. It may thus be that online sexual risk behavior is a precursor of offline sexual risk behavior.

The second explanation for the strong overlap between both behaviors is that they are determined by common factors (Igra & Irwin, 1996). The results showed that high levels of sensation seeking and lower education in particular were predictors of both behaviors. These factors also predict a variety of other risk behaviors (Arnett, 1996). Some adolescents may thus be predisposed by psychological as well as social factors to engage in a variety of risk behaviors.

Determining the predictors of online and offline sexual risk behavior allows us to identify adolescents in high-risk groups and potentially tailor preventions to these adolescents. Adolescents engaging in online sexual risk behavior were less satisfied with their lives, had higher levels of sensation seeking, came from less cohesive families and were lower educated. Moreover, these adolescents spent more time with online communication. It seems that adolescents who are troubled in their everyday lives may turn to the internet as a substitution for missing offline gratifications (Wolak, Mitchell, & Finkelhor, 2003). Therefore, parents, teachers, and practitioners may be well advised to pay particular attention to adolescents who are not satisfied with their lives in order to prevent potentially adverse online sexual risk behavior in this group. Concerning the prevention of online and offline sexual risk behavior, the findings suggest that public campaigns may particularly center on adolescent sensation seekers and choose formats and techniques that these adolescents value (Morgan, Palmgreen, Stephenson, Hole, & Lorch, 2003; Palmgreen, Donohew, Lorch, Hoyle, & Stephenson, 2001). Finally, the findings suggest that prevention programs should target low-educated adolescents in particular.

Some limitations of the study should be noted. First, the measurement of online sexual risk behavior is limited to sexual online communication with strangers. Other potentially risky sexual online behaviors, such as sending sexual material to friends, have not been investigated in this study. The interpretation of the findings should thus be limited to the four behaviors we measured. For future studies it would be desirable to include additional sexual risk behaviors. To further advance our understanding of the meaning of online activities in adolescent sexual development, it may also be important to investigate developmental pathways of healthy online sexual behavior. Similarly, offline sexual risk behavior in this study was conceptualized as engaging in casual sexual intercourse. Although this behavior is considered a particularly 'risky' form of offline sexual risk behavior (Heldman & Wade, 2010), it would be desirable for future studies to incorporate a broader measurement of offline sexual behavior to fully reflect adolescents sexual development and not only the development of risky sexual behavior.

In sum, the present study provides a detailed picture of the developmental pathways of online and offline sexual risk behavior as well as the interrelations of these two behaviors. The findings suggest that adolescents' online and offline behaviors are closely related. Although online and offline sexual risk taking is behaviorally very different (e.g. searching for sexual partners online vs. engaging in casual sex), the same adolescents engage in high levels of online and offline sexual risk behavior. In particular for adolescents who are prone to engage in high levels of offline sexual risk behavior, the Internet may be a place to experiment with their sexuality before engaging in offline sexual risk behavior. Thus, to fully comprehend the development of adolescents' sexual risk behavior, researchers should also take adolescents' sexual online behavior into account.

## References

- Aalsma, M. C., Tong, Y., Wiehe, S. E., & Tu, W. Z. (2010). The impact of delinquency on young adult sexual risk behaviors and sexually transmitted infections. *Journal of Adolescent Health, 46*, 17-24.
- Arnett, J. J. (1996). Sensation seeking, aggressiveness, and adolescent reckless behavior. *Personality and Individual Differences, 20*, 693-702.
- Baker, J. R., & Moore, S. M. (2008). Distress, coping, and blogging: Comparing new MySpace users by their intention to blog. *CyberPsychology & Behavior, 11*, 81-85.
- Bancroft, J., Janssen, E., Carnes, L., Goodrich, D., Strong, D., & Long, J. S. (2004). Sexual activity and risk taking in young heterosexual men: The relevance of sexual arousability, mood, and sensation seeking. *Journal of Sex Research, 41*, 181-192.
- Baumgartner, S. E., Valkenburg, P. M., & Peter, J. (2010a). Assessing causality in the relationship between adolescents' risky sexual online behavior and their perceptions of this behavior. *Journal of Youth and Adolescence, 39*, 1226-1239.
- Baumgartner, S. E., Valkenburg, P. M., & Peter, J. (2010b). Unwanted online sexual solicitation and risky sexual online behavior across the lifespan. *Journal of Applied Developmental Psychology, 31*, 439-447.
- Bogle, K. A. (2008). *Hooking up: Sex, dating, and relationships on campus*. New York: New York University Press.
- Boies, S. C., Cooper, A., & Osborne, C. S. (2004). Variations in internet-related problems and psychosocial functioning in online sexual activities: Implications for social and sexual development of young adults. *Cyberpsychology & Behavior, 7*, 207-230.
- Boyer, T. W. (2006). The development of risk-taking: A multi-perspective review. *Developmental Review, 26*, 291-345.
- Buzwell, S., & Rosenthal, D. (1996). Constructing a sexual self: Adolescents' sexual self-perceptions and sexual risk-taking. *Journal of Research on Adolescence, 6*, 489-513.
- CBS (2009). *Relatie en gezin aan het begin van de 21ste eeuw*. Den Haag: Centraal Bureau voor de Statistiek.
- Compas, B. E., Hinden, B. R., & Gerhardt, C. A. (1995). Adolescent Development - Pathways and Processes of Risk and Resilience. *Annual Review of Psychology, 46*, 265-293.
- Cooper, A., Delmonico, D. L., & Burg, R. (2000). Cybersex users, abusers, and compulsives: New findings and implications. *Sexual Addiction & Compulsivity, 7*, 5-29.
- Dahl, R. E. (2004). Adolescent brain development: A period of vulnerabilities and opportunities - Keynote address. *Adolescent Brain Development: Vulnerabilities and Opportunities, 1021*, 1-22.

- de Graaf, H., Meijer, S., Poelman, J., & Vanwesenbeeck, I. (2005). *Seks onder je 25<sup>e</sup>*. Delft: Eburon.
- De Graaf, van de Schoot, R., Woertman, L., Hawk, S. T., & Meeus, W. (2012). Family cohesion and romantic sexual initiation: A three wave longitudinal study. *Journal of Youth and Adolescence, 41*, 583-592.
- Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment, 49*, 71-75.
- Donohew, L., Zimmerman, R., Cupp, P. S., Novak, S., Colon, S., & Abell, R. (2000). Sensation seeking, impulsive decision-making, and risky sex: implications for risk-taking and design of interventions. *Personality and Individual Differences, 28*, 1079-1091.
- Duncan, S. C., Duncan, T. E., & Hops, H. (1996). Analysis of longitudinal data within accelerated longitudinal designs. *Psychological Methods, 1*, 236-248.
- Guo, J., Chung, I. J., Hill, K. G., Hawkins, J. D., Catalano, R. F., & Abbott, R. D. (2002). Developmental relationships between adolescent substance use and risky sexual behavior in young adulthood. *Journal of Adolescent Health, 31*, 354-362.
- Hair, E. C., Park, M. J., Ling, T. J., & Moore, K. A. (2009). Risky behaviors in late adolescence: Co-occurrence, predictors, and consequences. *Journal of Adolescent Health, 45*, 253-261.
- Heldman, C., & Wade, L. (2010). Hook-up culture: Setting a new research agenda. *Sexuality Research and Social Policy, 7*, 323-333.
- Hoyle, R. H., Stephenson, M. T., Palmgreen, P., Lorch, E. P., & Donohew, R. L. (2002). Reliability and validity of a brief measure of sensation seeking. *Personality and Individual Differences, 32*, 401-414.
- Igra, V., & Irwin, C. E., Jr. (1996). Theories of adolescent risk-taking behavior. In R. J. DiClemente, W. B. Hansen & L. E. Ponton (Eds.), *Handbook of Adolescent Health Risk Behavior* (pp. 35-51). New York: Plenum Press.
- Jessor, R. (1992). Risk behavior in adolescence: A psychosocial framework for understanding action. *Developmental Review, 12*, 374-390.
- Kalichman, S. C., Simbayi, L., Jooste, S., Vermaak, R., & Cain, D. (2008). Sensation seeking and alcohol use predict HIV transmission risks: Prospective study of sexually transmitted infection clinic patients, Cape Town, South Africa. *Addictive Behaviors, 33*, 1630-1633.
- Kotchick, B. A., Shaffer, A., & Forehand, R. (2001). Adolescent sexual risk behavior: A multi-system perspective. *Clinical Psychology Review, 21*, 493-519.
- Lee, W., & Kuo, E. C. Y. (2002). Internet and displacement effect: Children's media use and activities in Singapore. *Journal of Computer-Mediated Communication, 7*, 0.

- Lerner, R. M., & Galambos, N. L. (1998). Adolescent development: Challenges and opportunities for research, programs, and policies. *Annual Review of Psychology, 49*, 413-446.
- Livingstone, S., & Helsper, E. J. (2007). Taking risks when communicating on the internet: The role of offline social-psychological factors in young people's vulnerability to online risks. *Information, Communication & Society, 10*, 619-644.
- Luster, T., & Small, S. A. (1997). Sexual abuse history and number of sex partners among female adolescents. *Family Planning Perspectives, 29*, 204-211.
- MacDonald, J. M., Piquero, A. R., Valois, R. F., & Zullig, K. J. (2005). The relationship between life satisfaction, risk-taking behaviors, and youth violence. *Journal of Interpersonal Violence, 20*, 1495-1518.
- Metzler, C. W., Noell, J., Biglan, A., Ary, D., & Smolkowski, K. (1994). The social context for risky sexual behavior among adolescents. *Journal of Behavioral Medicine, 17*, 419-438.
- Mitchell, K. J., Finkelhor, D., & Wolak, J. (2007). Online requests for sexual pictures from youth: Risk factors and incident characteristics. *Journal of Adolescent Health, 41*, 196-203.
- Moffitt, T. E. (1993). Adolescence-limited and life-course-persistent antisocial-behavior - a developmental taxonomy. *Psychological Review, 100*, 674-701.
- Moilanen, K. L., Crockett, L. J., Raffaelli, M., & Jones, B. L. (2010). Trajectories of sexual risk from middle adolescence to early adulthood. *Journal of Research on Adolescence, 20*, 114-139.
- Morgan, S. E., Palmgreen P., Stephenson, M. T., Hole, R.H., Lorch. E.P. (2003). Associations between message features and subjective evaluations of the sensation value of antidrug public service announcements. *Journal of Communication, 53*, 512-526.
- Murphy, D. A., Brecht, M. L., Herbeck, D. M., & Huang, D. (2009). Trajectories of HIV risk behavior from age 15 to 25 in the national longitudinal survey of youth sample. *Journal of Youth and Adolescence, 38*, 1226-1239.
- Muthén, B. (2004). Latent variable analysis: Growth mixture modeling and related techniques for longitudinal data. In D. Kaplan (Ed.), *Handbook of quantitative methodology for the social sciences* (pp. 345-368). Newbury Park, CA: Sage Publications.
- Nagin, D. S. (1999). Analyzing developmental trajectories: A semiparametric, group-based approach. *Psychological Methods, 4*, 139-157.
- Nagin, D. S. (2005). *Group-based modeling of development*. Cambridge, MA: Harvard University Press.



- Olson, D. H. (1996). Clinical assessment and treatment interventions using the circumplex model. In F. W. Kaslow (Ed.), *Handbook of relational diagnosis and dysfunctional family patterns* (pp. 59-80). New York: John Wiley and Sons.
- Olson, D. H. (2000). Circumplex model of marital and family systems. *Journal of Family Therapy*, 22, 144-167.
- Palmgreen, P., Donohew, L., Lorch, E. P., Hoyle, R. H., & Stephenson, M. T. (2001). Television campaigns and adolescent marijuana use: Tests of sensation seeking targeting. *American Journal of Public Health*, 91, 292-296.
- Peter, J., & Valkenburg, P. M. (2006). Adolescents' exposure to sexually explicit material on the Internet. *Communication Research*, 33, 178-204.
- Peter, J., & Valkenburg, P. M. (2008). Adolescents' exposure to sexually explicit internet material, sexual uncertainty, and attitudes toward uncommitted sexual exploration: Is there a link? *Communication Research*, 35, 569-601.
- Petersen, J. L., & Hyde, J. S. (2010). A meta-analytic review of research on gender differences in sexuality, 1993-2007. *Psychological Bulletin*, 136, 21-38.
- Ponte, C., Bauwens, J., & Mascheroni, G. (2009). Children and the internet in the news: agency, voices and agendas. In S. Livingstone & L. Haddon (Eds.), *Kids online. Opportunities and risks for children* (pp. 159-172). Bristol, UK: The Policy Press.
- Raffaelli, M., & Crockett, L. (2003). Sexual risk taking in adolescence: The role of self-regulation and attraction to risk. *Developmental Psychology*, 39, 1036-1046.
- Schouten, A. P., Valkenburg, P. M., & Peter, J. (2007). Precursors and underlying processes of adolescents' online self-disclosure: Developing and testing an "Internet-attribute-perception" model. *Media Psychology*, 10, 292-314.
- Seto, M. C., Lalumiere, M. L., & Quinsey, V. L. (1995). Sensation seeking and males sexual strategy. *Personality and Individual Differences*, 19, 669-675.
- Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends in Cognitive Sciences*, 9, 69-74.
- Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Developmental Review*, 28, 78-106.
- Steinberg, L., & Morris, A. S. (2001). Adolescent development. *Annual Review of Psychology*, 52, 83-110.
- Stinson, R. D. (2010). Hooking up in young adulthood: A review of factors influencing the sexual behavior of college students. *Journal of College Student Psychotherapy*, 24, 98-115.
- Subrahmanyam, K., Kraut, R. E., Greenfield, P. M., & Gross, E. (2000). The impact of home computer use on children's activities and development. *Future of Children*, 10, 123-144.

- Subrahmanyam, K., Smahel, D., & Greenfield, P. (2006). Connecting developmental constructions to the internet: identity presentation and sexual exploration in online teen chatrooms. *Developmental Psychology, 42*, 395-406.
- Valkenburg, P. M., & Peter, J. (2011). Online communication among adolescents: An integrated model of its attraction, opportunities, and risks. *Journal of Adolescent Health, 48*, 121-127.
- Valkenburg, P. M., Sumter, S. R., & Peter, J. (2011). Gender differences in online and offline self-disclosure. *British Journal of Developmental Psychology, 29*, 253-269.
- Valois, R. F., Zullig, K. J., Huebner, E. S., Kammermann, S. K., & Drane, J. W. (2002). Association between life satisfaction and sexual risk-taking behaviors among adolescents. *Journal of Child and Family Studies, 11*, 427-440.
- Wolak, J., Mitchell, K.J., Finkelhor, D. (2003). Escaping or connecting? Characteristics of youth who form close online relationships. *Journal of Adolescence, 26*, 106-119.
- Ybarra, M. L., & Mitchell, K. J. (2004). Youth engaging in online harassment: Associations with caregiver-child relationships, Internet use, and personal characteristics. *Journal of Adolescence, 27*, 319-336.
- Ybarra, M. L., Mitchell, K. J., Finkelhor, D., & Wolak, J. (2007). Internet prevention messages - Targeting the right online behaviors. *Archives of Pediatrics & Adolescent Medicine, 161*, 138-145.
- Zuckerman, M. (1990). The psychophysiology of sensation seeking. *Journal of Personality, 58*, 313-345.