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Let's Take it Nice and Slow: Predictors of Delayed Sexual Onset among Dutch Adolescents between 2009 and 2017. A Time-Sequential Study.

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Abstract

The age at which Dutch adolescents had their first sexual intercourse significantly increased since 2012. To explain this potential broad-based delay, this study sought to examine (differences in) the predictors of sexual onset over time. The data used for analyses were from the Health Behaviour in School-aged Children (HBSC) study. The total sample consisted of 1,502 11-20 years old sexually experienced Dutch high-school students (713 participants from 2009 and 789 participants from 2017). Trends in the predictors of sexual onset were evaluated using hierarchical multiple regression analyses. It was found that lower education, a non-Western migration status, and early puberty were associated with an early sexual onset. Unexpectedly, gender (boys) was associated with an early age of onset, and higher levels of alcohol use were associated with a later age of onset. Furthermore, increasing levels of education, along with an altered structure of educational level in relation to sexual onset, may have (marginally) contributed to the delay in sexual onset. Concerning the growing educational inequalities in sexual onset, the results of this study could be of importance for policy and intervention purposes.

Keywords: Delayed Sexual Onset, Adolescent Sexual Development, Emerging Adulthood, Life-History Theory, Interdisciplinary Social Science

Samenvatting

De leeftijd waarop Nederlandse jongeren voor de eerste keer geslachtsgemeenschap hadden, is sinds 2012 gestegen. Door (verschillen in) voorspellers van seksuele start te onderzoeken, tracht deze studie de potentieel culturele verschuiving in seksuele start te verklaren. De data die gebruikt zijn voor deze studie zijn afkomstig uit de *Health Behaviour and School-aged Children* (HBSC) studie. De totale steekproef bestond uit 1.502 11 tot 20-jarige Nederlandse middelbare scholieren met seksuele ervaring (713 participanten uit 2009 en 789 participanten uit 2017). Trends in de voorspellers van seksuele start zijn bepaald aan de hand van hiërarchische meervoudige regressieanalyses. Uit de resultaten blijkt dat een laag opleidingsniveau, een niet westerse migratie status en vroege pubertijd samenhangen met een vroege seksuele start. Tegen de verwachtingen in, blijkt geslacht (jongen) samen te hangen met een vroege seksuele start en een hoge mate van alcoholgebruik samen te hangen met een late seksuele start. Daarnaast lijkt een toename in schoolniveau, samen met een verandering in de onderliggende structuur van schoolniveau in relatie tot seksuele start, (marginaal) te hebben bijgedragen aan de verschuiving van seksuele start tussen 2009 en 2017. Met het oog op de groeiende kloof in seksuele start tussen VMBO-b/t leerlingen en HAVO/VWO leerlingen, kunnen de resultaten van deze studie bijdragen aan beleids- en interventie doeleinden.

Keywords: Vertraagde Seksuele Start, Adolescentie, Emerging Adulthood, Life-History Theory, Interdisciplinaire Sociale Wetenschap

Introduction

Delayed Sexual Onset

In recent years, fewer adolescents engaged in adult activities, such as drinking alcohol, going out, driving, and having sexual intercourse (Twenge & Park, 2019). Likewise, the age at which Dutch adolescents had their first sexual intercourse significantly increased since 2012 (De Graaf et al., 2017; Stevens et al., 2017). A similar trend was found in a large research project in the United States (Ethier et al., 2018). Besides, the age of onset of *all* sexual behaviours and romantic relationships seems to be delayed (De Graaf et al., 2017).

With this shift in first sexual intercourse, the group of 'very early performers' (those who perform sexual intercourse before the age of 14) has decreased. Although sexuality is a normative component of adolescent development, early sexual onset is associated with significant risks, such as unprotected sexual intercourse, unplanned pregnancies, and STD's (De Graaf et al., 2017; Gambadauro, 2018). Moreover, the pattern of risky behaviours associated with early sexual performance tends to persist into adulthood (Huibregste et al., 2011).

A qualitative study revealed possible explanations for the delay in sexual onset among Dutch adolescents. These explanations included increased social media use, decreased alcohol use, elongation of childhood, and a growth of the non-Western immigrant population in the Netherlands (Cense, 2018). To understand the prevalence of the possible predictors by looking for results applicable to a larger population, quantification is needed. Therefore, the purpose of this study is to examine the predictors of a delayed sexual onset over the reporting periods of 2009 and 2017.

Theory: Delay in Adolescent Development

One way to conceptualize the delay in adolescent (sexual) development is the life-history theory (LHT). This theory dichotomises approaches to develop into slow and fast strategies. Accordingly, resource-rich environments lead to a slow life strategy, which comprises longer cultivation of the individual. On the contrary, a harsh and unpredictable environment during childhood may lead to faster developmental pathways, which may induce undertaking reproductive tasks (Twenge & Park, 2019).

In recent times, it appears that the entire developmental trajectory from early adolescence to adulthood is slower than it ever was. The concept of *emerging adulthood* captures the lengthening of youth into a phase that is not yet full adulthood (Arnett, 2000). Moreover, emerging adulthood is a unique life-history stage, as adult reproductive behaviours

are learned during this period. According to the LHT, improved living conditions may have postponed reproduction, and thus, the timing of first sexual intercourse among emerging adults (Hochberg & Konner, 2020).

Empirical Studies on the Predictors of Sexual Onset

Household Composition

Global studies revealed that adolescents who live in single-parent/blended households, regardless of when (or if) a divorce took place, are more likely to be sexually active earlier than those who live in an intact home (Ellis et al., 2003; Zimmer-Gembeck & Helfand, 2008; Ryan, 2015).

Family Affluence

It was found that economically disadvantaged youth are more likely to perform sexual intercourse at an earlier age than their peers (Singh & Darroch, 1999).

Migration Status and Gender

Although there are no differences in sexual onset between males and females, there are substantial gender-migration differences in sexual onset (De Graaf et al., 2012; Kann et al., 2014; Boislard et al., 2016; De Graaf et al., 2017). Accordingly, in 2012, a research project reported that non-Western girls were more likely to perform sexual intercourse at a later age compared to Western girls. Contrary, non-Western boys were found to be sexually active earlier compared to Western boys (De Graaf et al., 2012). However, more recently, a similar study reported no gender-migration differences in sexual onset (De Graaf et al., 2017).

Puberty

Adolescents who mature earlier are more likely to initiate sexual intercourse at an earlier age than their peers (Zimmer-Gembeck & Helfand, 2008; Baams et al., 2015).

Social Media Use

A Dutch survey revealed that adolescents who have high self-esteem and who spend a lot of time on social media are more likely to perform sexual activities at an earlier age than their peers (De Graaf et al., 2017). Contrary, the quantitative study of Cense (2018) suggested that social media creates a gap between the online world and the offline world, which subsequently could delay the step towards physical contact, and thus, sexual intercourse.

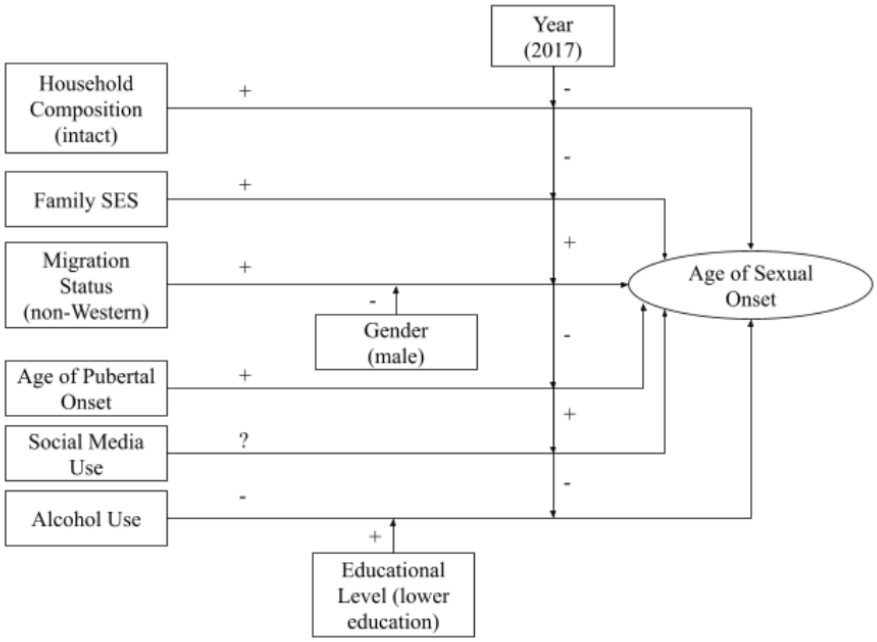
Alcohol Use and Educational Level

Alcohol use was found to be strongly associated with early sexual onset (Gambadauro, 2018). Furthermore, it was found that lower educated adolescents have sexual intercourse at a younger age than higher educated adolescents (De Graaf et al, 2012; De

Graaf et al., 2017). Moreover, alcohol use may interact with education level, as less-educated young adolescents more often engage in substance use and sexual activity compared to highly educated adolescents (De Looze et al., 2012).

Figure 1.

Research Model of the Hypothesised Predictors of a Delayed Sexual Onset (Over Time)



Note. "+" indicates a predicted positive association, "-" indicates a predicted negative association, and "?" indicates a predicted unknown association.

The Present Study

Previous research pointed out that household composition (Ellis et al., 2003; Zimmer-Gembeck & Helfand, 2008; Ryan, 2015), family SES (Sing & Darroch, 1999), migration status (De Graaf et al., 2012; Kann et al., 2014; Boislard et al., 2016; De Graaf et al., 2017), puberty (Zimmer-Gembeck & Helfand, 2008; Baams et al., 2015), social media use (De Graaf et al., 2017; Cense, 2018), and alcohol use (De Graaf et al., 2012; De Looze et al., 2012; De Graaf et al., 2014; Gambadauro, 2018) are associated with sexual onset. However, evidence regarding the relationship between social media use and sexual onset is scarce and inconsistent. Additionally, as the 'shift' in sexual onset only occurred recently, little to no evidence exists concerning this tendency (Cense, 2018). To date, no quantitative study has examined the possible correlates of the delay in first sexual intercourse among adolescents *over time*. To fill this gap in the literature, more research on trends in the predictors of sexual onset, as a proxy for a potential cultural shift in sexual behaviour, is necessary. Hence, the aim of this study is threefold:

1. explore the timing of first sexual intercourse over the reporting periods of 2009 and 2017 in the Netherlands;
2. examine how household composition, family SES, migration status, puberty, social media use, and alcohol use relate to the age of sexual onset among Dutch adolescents over time; and
3. investigate the consistency over time of household composition, family SES, migration status, puberty, social media use, and alcohol use as predictors of the age of sexual onset.

The following three research questions will be addressed: *Has the age of onset of first sexual intercourse among Dutch adolescents increased between 2009 and 2017?; Do household composition, family affluence, migration status, puberty, social media use and alcohol use account for predictors of sexual onset among Dutch adolescents?;* and *Has the relation between these predictors and sexual onset changed between 2009 and 2017?* Hence, household composition, family SES, migration status, puberty, social media use, and alcohol use will be included as predictors. Gender will be included as a moderator for migration status, as studies indicated gender-migration differences in the onset of first sexual intercourse (De Graaf et al., 2012; Kann et al., 2014; Boislard et al., 2016). Furthermore, educational level will be included as a moderator for alcohol use, as previous research revealed educational differences in alcohol use in relation to sexual onset (De Looze et al., 2012). Figure 1 shows the research model of this study.

First, in accordance with the LHT, it is hypothesised that the mean age at which Dutch adolescents experience first sexual intercourse increased between 2009 and 2017. Secondly, it is expected that adolescents who live in resource-rich contexts (related to a slow life strategy) are more likely to initiate sexual intercourse at a later age than those who live in less resource-rich contexts (related to a fast life strategy). Accordingly, it is hypothesised and shown in Figure 1 that family SES, an intact household, and pubertal onset are associated with later sexual onset. Additionally, it is hypothesised that a non-Western migration status is associated with later sexual onset, except for males. Furthermore, as a result of scarce and inconsistent evidence, it is hypothesised that social media use is either negatively or positively associated with sexual onset. Moreover, alcohol use is hypothesised to be associated with later sexual onset, although it is expected that this relation will less/not be true for adolescents who attain lower education.

Lastly, in accordance with the LHT, it is hypothesised that improved living conditions (e.g., upwards mobilisation, cultural normalisation, improved nutrition, and changes in the

Dutch alcohol legislation[1]), and the consequent possibility of extended individual cultivation, may have altered the structure of the possible predictors in relation to sexual onset. Speculatively, this might have contributed to a delayed onset of sexual intercourse (Cense, 2018; Patton, 2018; Twenge & Park, 2019; Hochberg & Konner, 2020).

Methods

Data

The data used for this study were from the Dutch Health Behaviour in School-aged Children (HBSC) study. The HBSC surveys were conducted in 2009 and 2017. Participation was voluntary, and anonymity and confidentiality were ensured. Questionnaires were administered in school classrooms by trained personnel. The time frame for filling out the questionnaires was between October and November in 2009 and 2017, respectively. Ethical and legal requirements for this type of survey were respected.

Study Population and Procedures

The population selected for sampling was pupils in the age range of 11 to 20 years old adolescents in secondary education. A cluster sampling method, in which schools or classes were used as sampling units, was used to select participants, and during the selection process, geographic distribution of the participants was taken into account. 13,219 Dutch high school pupils were included (5,827 Dutch pupils in 2009 and 7,392 Dutch pupils in 2017).

Data used for analyses were based on a sample of 1,502 participants who reported an age at which they experienced first sexual intercourse: 713 participants from 2009 and 789 participants from 2017. These data contained missing values for six variables: Family SES, migration status, sexual intercourse, social media use, alcohol use, and onset menarche. Missing values for social media use, alcohol use, and onset menarche were imputed with the mean scores of the variables.

Measures

Age at First Sexual intercourse

Age at first sexual intercourse was determined by the age at which participants first initiated sexual intercourse: *11 years old or younger; 12 years old; 13 years old; 14 years old; 15 years old; 16 years old; or 17 years old or older.*

Gender

Gender was measured dichotomously, with answer categories *boy* or *girl*.

Household Composition

Household composition was determined by seven dichotomous items, which could be answered with either *true* or *false*. The items assessed with whom the participant lived in their home(s). Answer categories were: 1=*complete family*, 2=*single mother*, 3=*single father*, 4=*mother and stepparent*, 5=*father and stepparent*, 6=*another*. Based on their household composition, participants were allocated to one of the following categories: *intact family* (1) or *non-intact family* (2, 3, 4, 5 or 6).

Family SES

Family SES was determined with the Family Affluent Scale (FAS), which is a tool to identify socioeconomic status of children and adolescents. Due to rapidly changing societies, FAS requires continuous development (Currie et al., 2008). Therefore, family affluence was determined with the four-item FAS II in 2009, and the six-item FAS III in 2017. Items included in both versions were: Does your family own a car/van? (0-2 points); Do you have your own bedroom? (0-1 points); How many computers does your family have? (0-3 points); and Did you go on holiday outside of the Netherlands in the past twelve months? (0-3 points). Additional items (FAS III) were: How many bathrooms does your house have? (0-3 points); and Does your family own a dishwasher? (0-1 point). Based on the sum of the scores (0-9 points in 2009 and 0-13 points in 2019), participants were allocated to one of the following categories: *low* (0-2 points in 2009 and 0-6 points in 2017), *middle* (3-5 points in 2009 and 7-9 points in 2017) and *high* (6-9 points in 2009 and 10-13 points in 2017) familial wealth.

Concerning the most recent version of de six-item FAS (FAS III), Cronbach's alpha was .47. Although an alpha of .70 or higher is generally considered to be adequate for research purposes, FAS is sensitive in differentiating levels of affluence as evidence by its validation against other measures of SES, and there is strong consistency in the associations between FAS and health outcomes across countries and between survey cycles (Currie et al., 2008).

Migration Status

Participant's migration status was assessed by three items: the country in which the participant was born, the country in which their mother was born, and the country in which their father was born. According to the Statistics Netherlands (CBS) guidelines[2], participants were allocated to one of the following categories: *Western* and *non-Western.*

Educational Level

Educational level was categorized on two levels: *lower education* (i.e., VMBO-b and VMBO-t) and *higher education* (i.e., HAVO and VWO).

Pubertal Onset

Pubertal onset was assessed by determining the age of first menarche. This question was only asked among female participants. For boys, the onset of puberty was not assessed in the HBSC-questionnaire.

Social Media Use

In 2009, social media usage was assessed by five items based on the participants' frequency of online communication. Participants were asked a question on the number of days spent on the internet per week. Response categories ranged from 0-7, with 0=*less than one day* and 7=*seven days*. Secondly, participants were asked a question regarding the number of hours spent on the internet per day. Response categories ranged from 1-10, with 1=*less than half an hour* and 10=*eight hours or more*. Ultimately, participants were asked questions regarding the number of days per week spent on several online communication platforms (i.e., MSN; e-mail; and Hyves, Facebook, CU2, Sugababes, Sugadudes, etc.). Answer categories ranged from 1-5, with 1=*never* and 5=*(almost) every day*.

In 2017, social media usage was assessed by four items based on the participants' frequency of online communication. Participants were asked questions regarding the frequency of online communications with (a group of) friends, online-friends, and other non-friends. Response categories of the frequency of online communication ranged from 1-6, with 1=*I do not know/N/A* and 6=*throughout most of the day*.

To investigate the underlying structure of the five-item questionnaire (used in 2009) and four-item questionnaire (used in 2017) assessing the frequency of social media communication, data were subjected to principal components analyses (PCA) with varimax rotation.

Regarding the five-item Social Media Usage Scale (SMUS) which was used in 2009, one factor (with an eigenvalue exceeding 1) was identified as underlying the four questionnaire items (see Table 1.1). In total, this factor accounted for 46,9% of the variance in the questionnaire data. Cronbach's alpha for the five-item SMUS was .70. Regarding the four-item Social Media Communication Scale (SMCS) which was used in 2017, one factor (with an eigenvalue exceeding 1) was identified as underlying the four questionnaire items (see Table 1.2). In total, this factor accounted for 49,6% of the variance in the questionnaire data. Cronbach's alpha for the four-item SMCS was .64.

Because social media use was assessed differently per survey cycle, the Barlett scores were saved from the PCA's. These standardised scores of social media use per survey cycle, indicating a more general factor of "Social Media Use", were used in the analysis ranging

from -3 to 3, with lower scores indicating lower levels of social media use and higher scores indicating higher levels of social media use[3].

Table 1.1

Varimax Rotated Factor Structure of the Five-Item Social Media Usage Scale used in 2009

		Loadings
Item		Factor 1
3.	Number of days spent on MSN per week	.823
1.	Number of days spent on the internet per week	.745
5.	Number of days spent on Hyves, Facebook, CU2, Sugababes, Sugadudes, etc. spent per week	.745
2.	Number of hours spent on the internet per day	.607
4	Number of days spent on e-mail per week	.467
	Percentage of Variance:	46,85%

Table 1.2

Varimax Rotated Factor Structure of the Four-Item Social Media Communication Scale used in 2017

		Loadings
Item		Factor 1
1.	Online contact with good friends	.827
2.	Online contact with a group of friends	.823
3.	Online contact with friends met via the internet	.631
4.	Online contact with others	.473
	Percentage of Variance:	49,61%

Alcohol Use

Monthly alcohol use was assessed by measuring the number of occasions on which the participant consumed alcoholic drinks on a 1-6 scale, with 1= *never* and 6=*twenty days or more*.

Statistical Analysis

Data analyses were performed using SPSS version 26. Descriptive analyses and independent sample t-tests were conducted to characterize the samples per survey cycle. Prior to interpreting the results of the analyses, several assumptions were evaluated (Appendix A). Due to the large sample sizes, for all tests, a p-value of less than .01 was used to determine significance.

Main Effect Analysis

First, to assess the size and direction of the independent linear relationship between sexual onset and the possible predictors, bivariate Pearson's product-moment correlation coefficients between the predictors of sexual onset and the age of sexual onset were examined. Next, to measure the unique contributions of the predictors while controlling for confounding factors, for all survey cycles, multivariate regression analyses (MRA) were conducted. These analyses focused on the main effects of the proposed key predictors.

Interaction with Survey Cycle

To test whether the associations of the predictors of sexual onset were similar across survey cycle, first, the main effect with time (i.e., survey cycle) was added to the model. Thereafter, interaction effects with time were added to the model as well. The survey cycle year 2009 was used as a referent group in these analyses.

Subsample Analysis: Pubertal Onset among Girls

To test the hypothesis that pubertal onset can account for a proportion of the variance in sexual onset, the same procedure was repeated for all subsamples of girls.

Results

Participants

Descriptives of the characteristics of the respondents in 2009 and 2017 can be found in Table 2.1. and Table 2.2. The two samples were highly similar in terms of gender, migration status, pubertal onset, and social media use. Results of the t-tests indicated that, compared to the 2009 sample, the 2017 sample contained older adolescents, more students in higher education, and more adolescents from low and middle SES families and non-intact families. Furthermore, alcohol use declined, but most importantly, the age of onset of first intercourse increased.

T-tests further revealed that, both in 2009 and 2017, girls reported a higher age of onset compared to boys. Similarly, adolescents from middle and high SES families, with a Western migration status, and higher education, reported later age of onset compared to, respectively, adolescents from lower SES families, with a non-Western migration status, and who attained lower education. For both survey cycles, there were no differences between adolescents from middle and high SES families. Furthermore, in 2009 adolescents from intact families reported a later age of onset compared to adolescents from non-intact families. In

Table 2.1

Descriptions of the Participants per Survey Sample

	2009 (*N*=713)			2017 (*N*=789)			Total (*N*=1,502)		
	N	%	Age Onset Sexual Intercourse	N	%	Age Onset Sexual Intercourse	N	%	Age Onset Sexual Intercourse
Gender									
Boys	394	55.3 %	14.0[a]	431	54.6 % [-]	**14.3[a]**	825	54.9 %	14.2[a]
Girls	319	44.7 %	14.2[a]	358	45.4 % [-]	**14.8[b]**	677	45.1%	14.5[b]
Household Composition									
Intact Family	500	70.1 %	14.1[a]	501	63.5 % [v]	**14.6[a]**	1,001	66.6 %	14.4[a]
Non-intact Family	213	29.9 %	13.8[b]	288	36.5 % [^]	**14.5[a]**	501	33.4 %	14.2[a]
Family Affluence									
Low	37	5.2 %	13.4[a]	77	9.8 % [^]	13.7[a]	114	7.6 %	13.6[a]
Middle	232	32.5 %	14.1[a]	372	47.1 % [^]	**14.7[b]**	604	40.2 %	14.5[b]
High	444	62.3 %	14.1[a]	340	43.1 % [v]	**14.6[b]**	784	52.2 %	14.3[b]
Educational Level									
Lower Education	484	67.9 %	13.9[a]	329	41.7 % [v]	13.9[a]	813	54.1 %	13.9[a]
Higher Education	229	32.1 %	14.4[b]	460	58.3 % [^]	**15.1[b]**	689	45.9 %	14.8[b]
Migration Status									
Western	604	84.7 %	14.1[a]	674	85.4 % [-]	**14.6[a]**	1,278	85.1 %	14.4[a]
Non-Western	107	15.3 %	13.5[b]	115	14.6 % [-]	**14.2[b]**	224	14.9 %	13.9[b]

Note. Age sexual onset (2017) written in bold indicates a significant increase in the age of onset of sexual intercourse (p <.01, 2-tailed) compared to 2009. Differences in the composition of categories (gender, household composition, family affluence, educational level, and migration status) between survey cycles are indicated with [^] (increase compared to 2009), [v] (decease compared to 2009), [-] (no differences compared to 2009). Each subscript letter ([a, b, c]) denotes a subset of categories (gender, household composition, family affluence, educational level, and migration status) whose column proportions differ significantly from each other at the .01 level (2-tailed).

Table 2.2

Mean scores, Standard Deviations (SD), Minimum Scores (Min), Maximum Scores (Max), and Pearson's Correlations (r) for each Predictor per Survey Sample

	2009 (*N* = 713)					2017 (*N* = 789)					Total (*N* = 1,502)				
	Mean	SD	Min	Max	*r*	Mean	SD	Min	Max	*r*	Mean	SD	Min	Max	*r*
Age	15.06	1.08	12	18	0.53**	15.76 ^	1.39	12	20	0.65**	15.43	1.30	12	20	0.62**
Age Sexual Onset	14.05	1.27	11	17	-	14.57 ^	1.53	11	17	-	14.33	1.43	11	17	-
Age Menarche (Girls)	12.14	1.12	7	15	0.35*	12.29 -	1.36	8	16	0.29*	12.22	1.25	7	16	0.32*
Social Media Use	0.41	0.98	- 3	2	0.06	0.30 -	0.96	- 3	3	-0.10*	0.36	0.93	-3	3	0.13*
Alcohol Use	3.22	1.60	1	6	0.06	2.55 ˅	1.33	1	6	0.15*	2.87	1.50	1	6	0.06

Note. Differences in the mean scores of categories (age, age sexual onset, age menarche, social media use, and alcohol use) between survey cycles are indicated with ^ (increase compared to 2009), ˅ (decease compared to 2009), - (no differences compared to 2009). * p <.01(2-tailed). ** p <.001(2-tailed).

2017, however, no differences between adolescents from intact or non-intact households were observed (see Table 2.1). Pearson correlations between predictors and age of onset show that social media consumption was not associated with the age of onset in 2009 and negatively in 2017. Additionally, alcohol use was not associated with the age of onset in 2009 and positively in 2017. For girls, the age of onset of menarche was positively associated with the age of onset in both survey cycles (see Table 2.2).

Multivariate Analyses

Unstandardised (*B*) and standardised (β) regression coefficients and squared semi-partial correlations (sr^2) for each predictor in the regression model are reported in Table 3.1 and 3.2. The interaction plots are displayed in Figure 2.1 and Figure 2.2.

In 2009, the results of the model 1 hierarchical MRA, showed that the proposed predictors were significantly associated with sexual onset. In model 2 (not in table), the interaction variables for alcohol use by education and migration status by gender were added to the regression equation, R^2 = .07, adjusted R^2 = .06, F (9, 701) = 6.11, p <.001. Both interactions were non-significant. Model 1 explains 7% of the variance in the outcomes. By Cohen's (1988) conventions, an effect of this magnitude can be considered "small" (f^2 = .08).

In 2017, the results of the model 1 hierarchical MRA, showed that the proposed predictors were significantly associated

with sexual onset. In model 2 (not in table), the interaction variables for alcohol use by education and migration status by gender were added to the regression equation, R^2 = .20, adjusted R^2 = .19, F (9, 778) = 21.50, p <.001. Both interactions were non-significant. Model 1 explains 20% of the variance in the outcomes. An effect of this magnitude can be considered "medium" (f^2 = .25) (Cohen, 1988).

Based on the total sample, the results of the model 1 hierarchical MRA, showed that proposed predictors were significantly associated with sexual onset. In model 2 (not in table), the interaction variables for alcohol use by education and migration status by gender were added to the regression equation, R^2 = .14, adjusted R^2 = .13, F (9, 1,489) = 26.48, p <.001. Both interactions were non-significant. Model 1 explains 14% of the variance in the outcomes. An effect of this magnitude can be considered "medium" (f^2 = .16) (Cohen, 1988).

Based on the subsample of girls in 2009, the results of the model 1 hierarchical MRA, showed that proposed predictors were significantly associated with sexual onset. In model 2 (not in table), the interaction variable for alcohol use by education was added to the regression equation, R^2 = .17, adjusted R^2 = .15, F (8, 310) = 8.18, p <.001. The interaction was non-significant. Model 1 explains 17% of the variance in the outcomes. An effect of this magnitude can be considered "medium" (f^2 = .20) (Cohen, 1988).

Based on the subsample of girls in 2017, the results of the model 1 hierarchical MRA, showed that proposed predictors were significantly associated with sexual onset. In model 2 (not in table), the interaction variable for alcohol use by education was added to the regression equation R^2 = .24, adjusted R^2 = .22, F (8, 348) = 13.44, p <.001. The interaction was non-significant. Model 1 explains 24% of the variance in the outcomes. An effect of this magnitude can be considered "medium" (f^2 = .30) (Cohen, 1988).

Based on the total subsample of girls, the results of the model 1 hierarchical MRA, showed that proposed predictors significantly associated with sexual onset. In model 2 (not in table), the interaction variable for alcohol use by education was added to the regression equation, R^2 = .22, adjusted R^2 = .21, F (8, 667) = 13.82, p <.001. The interaction was non-significant. Model 1 explains 22% of the variance in the outcomes. An effect of this magnitude can be considered "medium" (f^2 = .28) (Cohen, 1988).

Interactions with Time

Main Effect of Time

In model 3, the main effect of survey cycle (Year) was added to the regression equation and accounted for an additional significant 1% of the variance in sexual onset. This indicates that, compared to 2009, sexually active adolescents showed a later onset in 2017. In

Table 3.1

Unstandardised (B) and Standardised (β) Regression Coefficients and Squared Semi-partial Correlations (sr^2) for Each Predictor in a Regression Model Predicting Trends in Sexual Onset

	2009 (N = 710)			2017 (N = 787)			Total sample (N = 1.502)		
Variable	*B* [95% CI]	*β*	sr^2	*B* [95% CI]	*β*	sr^2	*B* [95% CI]	*β*	sr^2
Model 1									
Gender (girls)	0.18 [-0.002, 0.370]	0.07	.01	0.42 [0.220, 0.612]**	0.14	.02	0.33 [0.192, 0.467]**	0.12	.01
Household Composition (intact)	-0.24 [-0.436, -0.040]	-0.09	.01	0.04 [-0.168, 0.240]	0.01	.00	-0.06 [-0.205, 0.085]	-0.02	.00
Family SES	0.07 [-0.087, 0.266]	0.03	.00	0.07 [-0.086, 0.222]	0.03	.00	0.02 [-0.094, 0.126]	0.01	.00
Educational Level (higher education)	0.38 [0.190, 0.579]**	0.14	.02	1.12 [0.917, 1.321]**	0.36	.12	0.91 [0.775, 1.049]**	0.32	.10
Migration Status (non-Western)	-0.46 [-0.731, -0.196]**	-0.13	.02	-0.20 [-0.481, 0.079]	-0.05	.00	-0.33 [-0.524, -0.129]**	-0.08	.01
Social Media Communication	0.70 [-0.034, 0.172]	0.05	.00	-0.12 [-0.226, -0.022]	-0.08	.01	-0.06 [-0.132, 0.015]	-0.04	.00
Alcohol Use	0.02 [-0.037, 0.080]	0.03	.00	0.14 [0.060, 0.210]**	0.12	.01	0.05 [0.004, 0.097]	0.05	.00
Model 3									
Year (2017)							0.383 [0.236, 0.539]**	0.13	.01
Model 4									
Year x Gender							0.23 [-0.039, 0.505]	0.18	.00
Year x Household Composition							0.27 [-0.014, 0.561]	0.20	.00
Year x Family SES							0.00 [-0.222, 0.222]	0.00	.00
Year x Educational Level							0.76 [0.465, 1.049]**	0.64	.01
Year x Migration Status							0.27 [-0.123, 0.663]	0.15	.00
Year x Social Media Communication							-0.19 [-0.339, -0.045]*	-0.21	.00
Year x Alcohol Use							-0.11 [0.013, 0.205]	0.17	.00

Note. CI = confidence interval. Model 2 and model 5 are not included in the table. Coefficients of determination (R^2) and the modified coefficients of determination (adjusted R^2), and *F*-values and *p*-values for model 2 and model 5 of the regression model are reported in the manuscript.

* p <.01. ** p <.001

Table 3.2

Unstandardised (B) and Standardised (β) Regression Coefficients and Squared Semi-partial Correlations (sr^2) for Each Predictor in a Regression Model Predicting Trends in Sexual Onset among Girls

	2009 (*N* = 288)			2017 (*N* = 342)			Total sample (*N* = 630)		
Variable	*B* [95% CI]	*β*	sr^2	*B* [95% CI]	*β*	sr^2	*B* [95% CI]	*β*	sr^2
Model 1									
Household Composition (intact)	-0.27 [-0.515, -0.016]	-0.11	.01	0.03 [-0.221, 0.279]	0.01	.00	-0.07 [-0.246, 0.113]	-0.03	.00
Family SES	-0.16 [-0.361, 0.037]	-0.09	.01	-0.09 [-0.288, 0.101]	-0.05	.00	-0.20 [-0.366, -0.061]*	-0.10	.01
Educational Level (higher education)	0.32 [0.078, 0.557]*	0.14	.02	0.96 [0.705, 1.217]**	0.36	.12	0.80 [0.632, 0.973]**	0.32	.10
Migration Status (non-Western)	-0.31 [-0.705, 0.094]	-0.08	.01	-0.23 [-0.604, 0.138]	-0.06	.00	-0.29 [-0.562, -0.011]	-0.07	.00
Pubertal Onset	0.31 [0.206, 0.407]**	0.32	.10	0.23 [0.144, 0.324]**	0.25	.06	0.28 [0.212, 0.348]**	0.28	.08
Social Media Communication	0.02 [-0.108, 0.150]	0.02	.00	-0.13 [-0.265, 0.007]	-0.09	.01	-0.08 [-0.176, 0.014]	-0.06	.00
Alcohol Use	-0.03 [-0.107, 0.043]	-0.04	.00	0.08 [-0.031, 0.185]	0.07	.00	-0.01 [-0.073, 0.055]	-0.10	.00
Model 3									
Year (2017)							0.40 [0.217, 0.584]**	0.16	.02
Model 4									
Year x Household Composition							0.29 [-0.069, 0.646]	0.25	.00
Year x Family SES							0.07 [-0.214, 0.349]	0.06	.00
Year x Educational Level							0.67 [1.028, 0.404]**	0.66	.01
Year x Migration Status							0.03 [-0.552, 0.591]	0.02	.00
Year x Pubertal Onset							-0.08 [-0.212, 0.063]	-0.13	.00
Year x Social Media Communication							-0.15 [-0.335, 0.042]	-0.17	.00
Year x Alcohol Use							-0.19 [-0.589, 0.210]	-0.30	.00

Note. CI = confidence interval. Model 2 and model 5 are not included in the table. Coefficients of determination (R^2) and the modified coefficients of determination (adjusted R^2), and *F*-values and *p*-values for model 2 and model 5 of the regression model are reported in the manuscript.

* $p < .01$ ** $p < .001$

combination, the eight predictor variables explained 15% of the variance in sexual onset. A combined effect of this magnitude can be considered "medium" (f^2 = .18) (Cohen, 1988).

Additionally, for the total subsample of girls, in model 3, the main effect of survey cycle (Year) was added to the regression equation and accounted for an additional significant 2% of the variance in sexual onset. This indicates that, compared to 2009, sexually active adolescent girls showed later onset in 2017. In combination, the eight predictor variables explained 24% of the variance in sexual onset. A combined effect of this magnitude can be considered "medium" (f^2 = .32) (Cohen, 1988).

Interaction Effects of Time

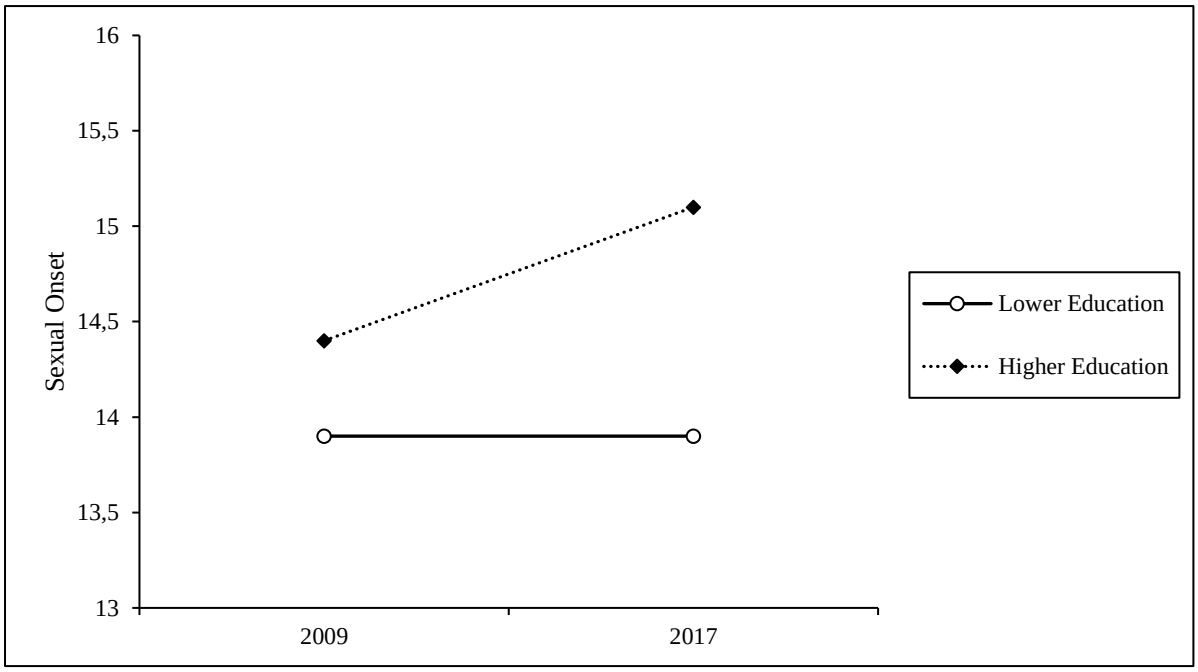
In model 4, the interaction effects with survey cycle were added to the regression equation and accounted for an additional significant 2% of the variance in sexual onset. In model 5 (not in table), the interaction effects of alcohol use by education by survey cycle and migration status by gender by survey cycle were added to the regression equation, R^2 = .18, adjusted R^2 = 0.17, F (19, 1,479) = 17, p <.001. Both interactions were non-significant. In combination, the eight predictor variables and their interactions with time explained 18% of the variance in sexual onset over time. A combined effect of this magnitude can be considered "medium" (f^2 = .22) (Cohen, 1988).

Again, for the total subsample of girls, in model 4, the interaction effects with survey cycle were added to the regression equation and accounted for an additional significant 2% of the variance in sexual onset over time. In model 5 (not in table), the interaction effect of alcohol use by education by survey cycle was added to the regression equation, R^2 = .27, adjusted R^2 = 0.25, F (17, 658) = 14.25, p <.001. The interaction was non-significant. In combination, the eight predictor variables and their interactions with time explained 27% of the variance in sexual onset. A combined effect of this magnitude can be considered "large" (f^2 = .37) (Cohen, 1988).

As can be seen in Table 3.1, the only significant predictors of the variance in sexual onset in the first and third regression model were main effects of educational level (2%) and migration status (2%) in the subsample of 2009; gender (2%), educational level (12%) and alcohol use (1%) in the subsample 2017; and gender (1%), educational level (10%) migration status (1%), and year (1%) in the total sample. Furthermore, in model 4, interaction effects of year by educational level (1%) and year by social media use (0%) were found to be significant predictors of the variance in sexual onset over time. The interaction of year by educational level (see Figure 2.1) indicates that the increase in the age of onset of first sexual

Figure 2.1

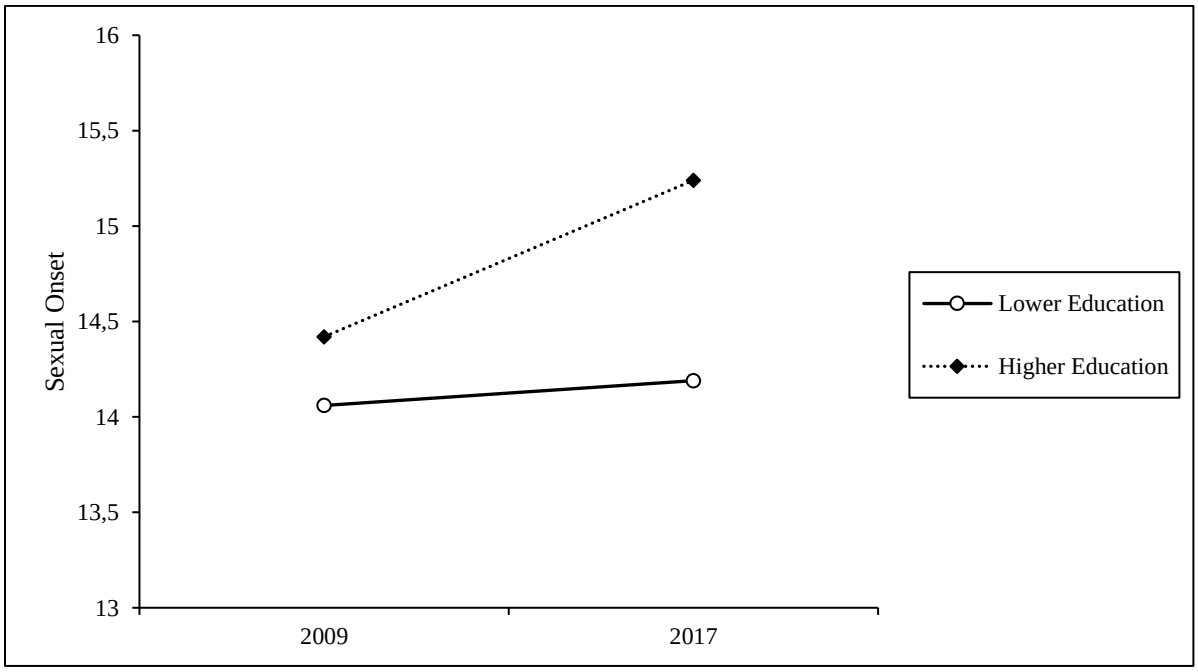
Age of Sexual Onset for the Two-way Interaction of Educational Level by Survey Cycle



Note. Lower educated students 2009 = 484, higher educated students 2009 = 229, *N* = 713 (2009). Lower educated students 2017 = 329, higher educated students 2017 = 460 *N* = 789 (2017).

Figure 2.2

Age of Sexual Onset for the Two-way Interaction of Educational Level by Survey Cycle for the Subsample of Girls



Note. Lower educated females 2009 = 216, higher educated females 2009 = 103, *N* = 319 (2009). Lower educated females 2017 = 135, higher educated females 2017 = 223 *N* = 358 (2017).

intercourse was only prevalent among students who attain higher education, but not among lower educated adolescents. The explained variance of the interaction of year by social media remains below de minimis levels (0%) and will therefore not be plotted and interpret.

As can be seen in Table 3.2, the only significant predictors of the variance in sexual onset among girls in the first and third regression model were main effects of educational level (1%) and pubertal onset (10%) in the subsample of girls in 2009; educational level (12%) and pubertal onset (6%) in the subsample of girls in 2017; and family SES (1%), educational level (10%) pubertal onset (8%), and year (2%) in the total subsample of girls. Furthermore, in model 4 (see Table 3.2), the interaction effect of year by educational level (1%) was found to be a significant predictor of the variance in sexual onset over time, indicating that the increase in the age of onset of first sexual intercourse was steeper among female students who attain higher education, compared to lower educated females (see Figure 2.2).

Discussion and Conclusions

Discussion

To explain the potential broad-based delay in sexual onset over time, this study sought to examine the predictors of sexual onset among Dutch adolescents between 2009 and 2017. The first research question regarded the shift in the age of sexual onset over time. The results show that, consistent with prior research (De Graaf et al., 2017; Stevens et al., 2017), the mean age at which Dutch adolescents had first sexual intercourse increased between 2009 and 2017.

The second research question regarded predictors in the age of onset over the reporting periods of 2009 and 2017. In accordance with prior research (De Graaf et al., 2012; De Looz et al., 2012; Kann et al., 2014; Boislard et al., 2016; De Graaf et al., 2017), it was found that lower education (in both 2009 and 2017) and non-Western migration status (in 2009) were associated with early sexual onset. Unexpectedly, in 2017, gender (boys) was also associated with early sexual onset, whilst higher levels of alcohol use were associated with later sexual onset. In line with previous studies (Zimmer-Gembeck & Helfand, 2008; De Graaf et al., 2012; De Looze et al., 2012; Baams et al., 2015; De Graaf et al., 2017), in the subsample of girls (in both 2009 and 2017), lower education and early puberty were associated with early sexual onset.

The third research question regarded differences in the relations of the predictors of sexual onset between 2009 and 2017. In line with the LHT (Hochberg & Konner, 2020), our results revealed a change in the structure of educational level and social media use in relation to sexual onset. Surprisingly, the underlying structures of the other predictors remained consistent.

Concerning educational level, the interaction effect with year indicates that the delay in sexual onset was only prevalent among higher educated students but not among lower educated students, and steeper among higher educated females compared to lower educated females. Moreover, the effect of educational level became stronger over time (from 2% in 2009 to 12% in 2017). Along with the growing number of students who attain higher education (CBS, 2019), the results of our study suggest that the altered composition *and* structure of educational level in relation to sexual onset might have contributed to the delay in sexual onset over time. Although, the explained variance remains at 1% very limited. Furthermore, changes in the relation between social media use and sexual onset unlikely contributed to the delay in sexual onset, as the explained variance of this interaction was neglectable (0%). Lastly, no differences in the compositions of gender and migration status, and a decline in alcohol use between 2009 and 2017, along with stability in these predictors over time, suggest that these predictors most likely did not contribute to the delay in sexual onset.

Besides, as previously signalled by De Looze et al. (2012), the interaction of educational level by time also indicates that the educational inequalities in sexual onset are *still* growing. Speculatively, the growing educational differences in sexual onset may be explained by peer relations and parenting practices, as previous research revealed that lower educated adolescents reported less parental knowledge on their whereabouts and reported spending more time with peers compared to higher educated adolescents. These factors were both found to mediate the relationship with early sexual onset and may therefore play a protective role in early sexual initiation among higher educated adolescents (De Looze et al., 2012).

Alternative explanations for the delay in sexual onset may further be found in parental practices, peer relations, or cultural pressure. For example, general parenting styles, sexually-specific parenting, and parental support, control, and knowledge were also found to play an important protective role in the stages of adolescent sexual trajectories (De Graaf et al., 2009; Van de Bongardt et al., 2014). Additionally, decisions about sexual onset are strongly bound to social context, with peers playing an important role in creating a sense of normative

behaviour (Hampton et al., 2005). Moreover, despite variations between adolescents in relation to sexual onset, all youth live in the same culture. That is the culture of success. Speculatively, adolescents experience high pressure from their parents and society. Also, with respect to sexual activity, it is emphasized to make good choices. Subsequently, insecurities and fear of failure could contribute to a later sexual onset (Cense, 2018).

Strengths and Limitations

A strength of this study is that the analyses were based on a national sample of adolescents, which allows drawing conclusions that apply to the entire adolescent population in the Netherlands (Clarke-Stewart & Parke, 2014). Additionally, this study does not only have research implications but also implications for the public health domain. Especially concerning the growing educational inequalities in sexual onset, lower educated adolescents remain a vulnerable group in sexual risk behaviour.

Furthermore, our study also has some limitations. First, the analyses were based on cross-sectional data. Therefore, we cannot make any causal inferences. Secondly, concerning social media use, comparing two different scales could be seen as a controversial method. However, we constructed underlying factors that were similar in content, and subsequently, introduced factor scores in our analyses in order to explore whether social media use would be a stable or changing factor in predicting the age of sexual onset. Thirdly, although we included several confounding variables in our model, most likely, there will be residual confounding (Skelly et al., 2012). Furthermore, assumptions of equal variance, linearity, heteroskedasticity, and multicollinearity were violated, which could bias the results. Lastly, our data were based on adolescent self-report, and we know from previous studies that adolescents may not always report their sexual activity honestly and accurately. For example, boys tend to overstate their level of sexual activity and girls tend to understate it (Kaestle et al., 2005). This might explain the unexpected association of gender and sexual onset.

Conclusion and Implications

Although this study provided evidence on how a change in the structure of educational level in relation to sexual onset may have contributed to the delay in first sexual intercourse over time, and which other determinants may have not, the overall results were unexpected, yet highly intriguing. However, which other predictors further may have contributed to the delay in sexual onset remains unknown. Furthermore, concerning the growing educational inequalities in sexual onset, the findings of this study could be of importance for policy and intervention purposes. Nevertheless, to get a full understanding of the delay in sexual onset, further research is required. For example, it could be of importance

to investigate other possible time-dependent associations between sexual onset and more interpersonal, psychological, or cultural determinants.

Endnotes

[1] As of 1 January 2014, the minimum legal alcohol purchase and consumption age was raised from 16 to 18 in the Netherlands. More information on the change in the Dutch alcohol legislation can be found on the following website: https://www.rijksoverheid.nl/onderwerpen/alcohol/alcohol-wetgeving

[2] Migration background according to the CBS guidelines: "*The country with which a person has the closest ties, based on his/her parents' country of birth or his/her own country of birth. The migration background of a person with a first-generation migration background is defined as his or her country of birth. The migration background of a person with a second-generation migration background is defined as his or her mother's country of birth, unless the mother's country of birth is the Netherlands. In that case, the migration background is defined as the father's country of birth."* More information on the CBS guidelines can be found on the following website: https://www.cbs.nl/en-gb/onze-diensten/methods/definitions/migration-background

[3] This procedure was advised in discussions and personal correspondence between the author, her tutor and a researcher from the Methods and Statistics department, Utrecht University.

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Appendix A

Testing of Assumptions

Principal Components Analyses

Prior to running the PCA, examination of the data indicated that not every variable was perfectly normally distributed. Given the robust nature of factor analysis, these deviations were not considered problematic. Furthermore, relationships between pairs of variables were generally linear.

Independent Samples t-test

All Shapiro-Wilk statistics were significant, indicating that the assumption of normality was violated. Levene's test was also significant, thus equal variances can not completely be assumed.

Bivariate Analyses

Prior to calculating the *r*, the assumptions of normality, linearity, and homoscedasticity were assessed, a visual inspection of the normal Q-Q and detrended Q-Q plots for each variable confirmed that all were not perfectly normally distributed. Similarly, visually inspecting a scatterplot of the sexual onset against all other variables confirmed that the relationship between these variables was not completely linear and heteroskedastic.

Multivariate Regression Analyses

Prior to interpreting the results of the MRA, several assumptions were evaluated. First, stem-and-leaf plots and boxplots indicated that not each variable in the regression was perfectly normally distributed, and free from univariate outliers. Second, inspection of the normal probability plot of standardised residuals as well as the scatterplot of the standardised residuals against standardised predicted values indicated that assumptions of normality, linearity and homoscedasticity of residuals were not perfectly met. Third, Mahalanobis distance did exceed the critical χ^2 for df=3 (at $\alpha = .001$) for some cases in the data file, indicating that multivariate outliers could be of concern. Finally, even after mean centring variables, relatively high tolerances for most predictors in the final regression model indicated that multicollinearity could interfere with outcome of the MRA.