Predictors and Outcomes of Adolescents' Sexual and Reproductive Health

An Ecological Approach

Raquel Nogueira Avelar e Silva

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Predictors and Outcomes of Adolescents' Sexual and Reproductive Health

An Ecological Approach

Voorspellers en uitkomsten van seksuele en reproductieve gezondheid van adolescenten

Een ecologische benadering

Thesis

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Raquel Nogueira Avelar e Silva
born in Carmo do Cajuru, Minas Gerais, Brazil

Erasmus University Rotterdam

Doctoral Committee

Prof. dr. O. Franco
Prof. dr. L. van Zoonen
Prof. dr. E.T.M. Laan

Promotor:
Prof. dr. H. Raat

Co-promotor:
Dr. D. van de Bongardt

For my parents,
especially for my mother.

List of Abbreviations

WHO	World Health Organization
SRH	Sexual and Reproductive Health
STIs	Sexually Transmitted Infections
LMICs	Low- and Middle-Income Countries
HICs	High-Income Countries
US	The United States
HIV	Human Immunodeficiency Virus
AIDS	Acquired Immune Deficiency Syndrome
UNAIDS	The Joint United Nations Programme on HIV/AIDS
RYM	Rotterdam Youth Monitor
Project STARS	Studies on Trajectories of Adolescent Relationships and Sexuality
Add Health	The National Longitudinal Study of Adolescent to Adult Health
PeNSE	Pesquisa Nacional de Saúde do Escolar
RCT	Randomized Controlled Trial

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Chapter 1

General Introduction

General Introduction

Sexual and Reproductive Health during Adolescence

The World Health Organization (WHO) understands sexual and reproductive health (SRH) as a state of physical and psycho-social well-being related to sexuality (e.g., experiences with sexual behaviors) and reproductive aspects (e.g., experiences with pregnancy).[1, 2] Sexuality encompasses biological sexual characteristics (e.g., reproductive organs), gender (e.g., psycho-social and cultural roles attached to the biological sex), sexual orientation (i.e., who a person is attracted to and wants to have a relationship with), and intimacy (i.e., a state of closeness that can be characterized by a physical, emotional or sexual expression with another person).[1, 2] In addition, sexuality can be expressed and experienced in various ways: in thoughts, fantasies, desires, behaviors, and relationships.[1, 2] To ensure that all people enjoy a healthy sexual and reproductive life, a set of sexual and reproductive rights has been established and recognized, internationally, since 1994, in the International Conference on Population and Development, in Cairo.[1, 2] This set of rights includes the right of all individuals to have mutually pleasurable, safe, and respectful sexual relationships, as well as the right to reproduce, and to decide if, when, and how often to do so.[1, 2] To achieve a healthy sexual and reproductive life, all individuals need to have access to accurate information about SRH, such as information on how and why it is important to have safe sex, and how and where to acquire effective, affordable, and acceptable contraception methods of their choice.[1, 2] The WHO recognizes that experiences with sexual behaviors are a normative aspect of sexual development, and when these experience are respectful (e.g., free of coercion) and safe (e.g., a sexual intercourse with a condom), they can contribute to improve SRH. As the experiences with sexual behaviors (coital and non-coital) and intimate relationships (e.g., a romantic relationship) typically start in adolescence (i.e., 10–19 years), the set of SRH rights applies to all individuals, from the stage of early adolescence onwards.[1, 2]

Although sexuality is a normative developmental aspect of adolescence, the experience with certain sexual behaviors (i.e., sexual intercourse) during early stages of adolescence (i.e., before 16 years) can have negative consequences for adolescents' SRH.[1-4] For instance, early sexual intercourse initiation (e.g., ≤16 years) has been associated with a higher risk for the contraction of sexually transmitted infections (STIs) and unwanted teen pregnancies.[3, 4] Amongst the reasons why early sexual intercourse initiation may have negative consequences for adolescents' SRH is the fact that, during early (i.e., 10–14 years) and middle adolescence (i.e., 15–16 years), adolescents tend to have a relatively limited knowledge about the risks involved in unprotected sexual activities.[1, 2] In addition, they may not yet have cognitive and emotional skills that are required to make responsible and healthy sexual decisions, such as decisions related to condom use.[1] This is because, generally, these cognitive and emotional skills are being developed up

until late adolescence (i.e., 17–19 years). Thus, the lack of these types of knowledge and skills in the early stages of adolescence may contribute, partly, to the increased risks associated with early sexual behaviors, such as unprotected sexual intercourse.[1, 2]

Worldwide, estimates of the WHO indicate that about 333 million STIs occur yearly, of which a considerable part affects adolescents aged 15–19 years.[1, 2] In addition, globally, about 17 million teenage girls younger than 20 years give birth every year.[1] These SRH problems among adolescents are a challenge for most countries, and are not restricted to Low- and Middle-Income Countries (LMICs).[1, 2] The United States (US) is one of the countries that stands out among High-Income Countries (HICs) because of the relatively high rates of STIs and teen pregnancy among American adolescents.[1, 2] Currently, about three million American adolescents contract STIs yearly, and the teen pregnancy rate (8.0%) is one of the highest among HICs.[1, 2] In contrast, adolescents in the Netherlands have a relatively optimal SRH.[5, 6] Dutch national statistics from 2017 showed that the prevalence rate of STIs among adolescents and young adults aged 12–24 years old were 15:1,000 for boys and 28:1,000 for girls, and the teen pregnancy rate was less than 2.0%.[6] In comparison with the US, prevalence rates from the Netherlands related to adolescents' SRH are four to ten times lower, indicating that Dutch adolescents have a relatively more optimal SRH than American adolescents.[7, 8]

When looking at adolescents' SRH in LMICs, one country that stands out, also because of the high rates of STIs among adolescents and teen pregnancy, is Brazil. Unlike most countries in Latin America, Brazil is neither reaching the Millennium Development Goal of combating HIV/ AIDS, nor the 2016 United Nations sustainable goal of ending the AIDS epidemic by 2030.[9] In fact, Brazil is currently facing an epidemic of syphilis, HIV, and other STIs, among adolescents.[9] A 2016-national report showed that, between 2010–2015, the incidence of acquired syphilis increased by 20.0% among adolescents aged 13–19 years.[10] In addition, a 2016 UNAIDS-Brazil report showed that, between 2006–2015, the incidence of HIV increased more than 50.0%, of which a considerable part occurred among adolescents aged 15–19 years.[9] Furthermore, about 630,000 (20.3%) teenage girls give birth yearly in Brazil, of which 30,000 (1.0%) girls are younger than 15 years old.[10]

From a global health point of view, the above mentioned statistics clearly show that both HICs and LMICs face a challenge regarding the improvement of adolescents' SRH.[1, 2] In addition, worldwide, American and Brazilian statistics indicate that effective (preventive) interventions (e.g., educational strategies) to improve adolescents' SRH (e.g., by reducing STIs among adolescents) are highly needed in different regions of the world.[2]

Strengthening our Understanding of Adolescents' SRH

To develop effective (preventive) interventions aimed at improving adolescents' SRH, we have to better understand the factors that are associated with adolescents' sexual behaviors (e.g., early sexual intercourse initiation) and other SRH outcomes (e.g., unwanted pregnancy).[2] To better comprehend these factors, the current thesis has used the ecological systems theory, which has become a dominant theoretical paradigm in the field of adolescent sexuality.[11] This theory states that various factors play a role in adolescents' SRH behaviors and outcomes.[11] Specifically, it postulates that these factors can be classified into different levels, which include 1) individual characteristics, and 2) social factors.[11]

By applying the ecological systems theory, meta-analyses and systematic literature reviews have shown that various individual and social factors are associated with adolescents' SRH behaviors and outcomes.[12-18] For instance, one of these reviews has shown that the presence of more depressive symptoms (an individual factor) was associated with early sexual intercourse initiation.[12] Examples of social factors associated with adolescents' SRH behaviors and outcomes include parent–adolescent relationship quality and parental monitoring.[14-16] Specifically, a higher-quality parent–adolescent relationship (i.e., more perceived warmth, support, and closeness in the relationship with parents), and higher levels of parental monitoring (i.e., more parental knowledge of their children's whereabouts) have been consistently associated, for instance, with a higher likelihood of condom use.[14-16] Moreover, other examples of social factors that have been associated with adolescents' sexual behaviors includes adolescents' perceptions of their peers' sexual behaviors. For instance, a meta-analysis has shown that adolescents who believed that more of their friends were sexually experienced, were more likely to engage in sexual behaviors themselves.[18]

Altogether, the literature on adolescent sexuality has yielded a valuable knowledge about individual and social factors that play a role in adolescents' SRH.[12-18] This body of knowledge has contributed to guide the development of educational (preventive) interventions aimed at improving adolescents' SRH, such as the use of online and mobile technologies to provide sexuality education.[19] However, notwithstanding progresses in understanding ecological factors that are associated with the development of adolescents' sexual behaviors and health, three problematic gaps in the literature can be observed. These serve as the departing point of this thesis.

Gaps in the Literature on Adolescents' SRH

A first content-related gap in the literature of adolescents' SRH is related to the fact that there are still potentially important ecological factors, which may be associated with the development of adolescents' sexual behaviors and health that have been rarely investigated. In the current thesis, we targeted three clear sets of ecological factors that

have been rarely investigated in relation to adolescents' SRH: physical activity behaviors (e.g., adolescents' participation in sports outside school),[20, 21] screen time behaviors (e.g., TV watching),[22-25] and the role of fathers (e.g., father–adolescent relationship quality).[16]

According to some scholars in the field of adolescent sexuality, more participation in sports outside school would be associated with early sexual intercourse initiation.[20] A possible rationale underlying this hypothesis could be related to the fact that adolescents who often play sports outside school, would be more likely to spend unsupervised time with peers, which may offer opportunities for adolescents to interact with potential sexual partners.[20] In fact, prospective studies conducted in US have indeed demonstrated that adolescents who spent more unsupervised time with their peers were more likely to engage in sexual intercourse.[15] However, findings from studies that investigated the associations between sports participation outside school and early sexual intercourse initiation are conflicting.[20, 21] For instance, another study showed no significant association between sports participation outside school and sexual intercourse.[21] Thus, little is known about the associations between adolescents' physical activity behaviors and sexual behaviors.

In relation to screen time behaviors, previous empirical research has found that adolescents at high risk for internet addiction were significantly more likely to have had sexual intercourse.[26] The authors have argued that these adolescents would be more likely to interact with potential sexual partners.[26] As a result, this virtual interaction with potential sexual partners could be a stimulus for sexual activity in real life.[26] On the other hand, more research is needed to investigate if and how adolescents' screen time behaviors would also be associated with subsequent early sexual intercourse initiation.

With regard to the role of fathers in adolescents' SRH, the content-related gap relates to the fact that the majority of the literature has focused only on the role of mothers.[14-16] This can be partly explained by a cultural aspect, as in many societies mothers are the primary caregivers of children, and the primary providers of education on sexuality, for both boys and girls.[27] Few studies have looked at the role of fathers in adolescents' sexual development, showing that, for instance, father–adolescent relationship quality was associated with their children's sexual behaviors (e.g., sexual intercourse initiation).[16] However, to the author's knowledge only two studies have investigated the association between the quality of the father-adolescent relationship and adolescents' sexual intercourse initiation.[16] These two studies found that adolescents who reported higher-quality relationships with their fathers were less likely to report subsequent sexual intercourse experience at 16–19 years.[16] Yet, these studies have been conducted in the US, and thus their results may not be generalizable to adolescents in other countries.[16] Thus, the role of fathers in adolescents' sexual behaviors should be investigated in different countries to assess if and how fathers may play a role in their children's sexual behaviors.

A second content-wise gap includes the fact that the majority of research on the development of adolescents' sexual behaviors and health has been conducted in HICs.[12-18] Global research on SRH of adolescents from LMICs relatively often has a focus on Sub-Saharan Africa.[28, 29] Thus, in general, research on SRH lacks focus on adolescents from certain LMICs. This is problematic because over 85.0% of adolescents' world population lives in LMICs, and over 85.0% of all new cases of STIs and teen pregnancy occur among adolescents from LMICs.[1, 2] The inclusion of LMICs in research on adolescents' SRH is highly needed to generate scientific knowledge that reflects the SRH of adolescents' world population more accurately. Further, cross-country comparisons of adolescents' SRH and ecological predictors thereof are rare, which is problematic because ecological factors related to adolescents' SRH may vary across cultural contexts.[30, 31] Cross-country comparisons may contribute to the identification of similarities and differences in adolescents' SRH behaviors and outcomes, and ecological predictors thereof.

A third gap in research on the development of adolescents' sexual behaviors and health relates to some important methodological issues. First, the majority of research on adolescent sexuality has used a cross-sectional design, which does not allow the assessment of changes in and predictive factors of adolescents' SRH over time.[12-14] Second, although in the past few decades, scholars have started employing more longitudinal designs, the majority of studies has looked at one direction of the associations between ecological factors and adolescents' SRH;[12-18] that is, ecological factors linking to subsequent adolescents' SRH, and not vice versa. However, according to the ecological systems theory,[11] bidirectional associations may be possible too; that is, adolescents' sexual behaviors linking to changes in ecological factors later in time (e.g., early sexual intercourse linking to subsequent suboptimal psychological wellbeing).[31] Third, only few studies have investigated possible explanatory mechanisms for found associations between ecological factors and adolescents' sexual behaviors, for instance, by investigating mediational paths.[32] This means that the mechanisms by which ecological factors and adolescents' SRH are interrelated over time, are not yet well understood.

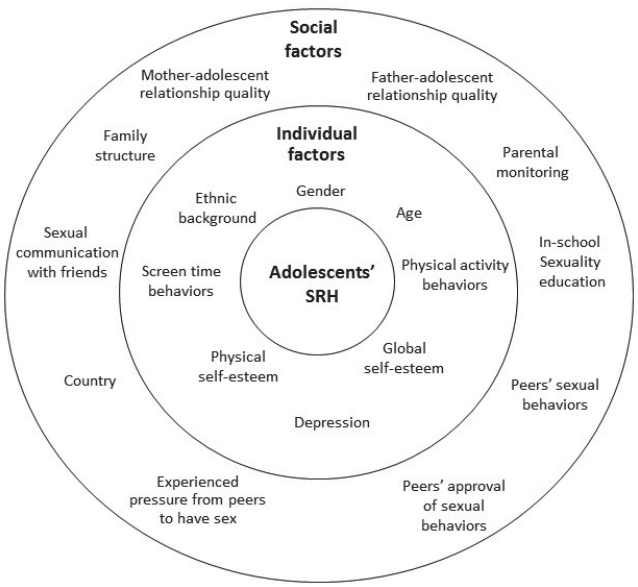
The Present Thesis

In the present thesis, we departed from these three gaps in the literature of adolescent sexuality. Specifically, the current thesis aimed at filling in these three gaps 1) by investigating a set of three potentially relevant but understudied individual and social factors that may be associated with adolescents' SRH, 2) by including a cross-country comparison of adolescents' SRH ecological predictors between two HICs that differ in adolescents' SRH (the Netherlands and the US) and a LMIC (Brazil), and 3) by employing longitudinal study designs, assessing bidirectional over-time associations between ecological factors and adolescents' sexual behaviors, and investigating explanatory factors of adolescents' sexual behaviors through meditation analyses.

Investigated Aspects of Adolescents' SRH and Ecological Predictors

Altogether, this thesis included five studies that investigated adolescents' SRH behaviors and outcomes, and various predictors thereof. Specifically, the SRH behaviors and outcomes included: adolescents' experiences with early sexual behaviors, timing of first sexual intercourse, number of sexual partners, condom use, contraceptive use, and teen pregnancy. In addition, the predictors were classified into: 1) individual factors, including: age, gender, ethnic background, physical activity behaviors, screen time behaviors, global self-esteem, physical self-esteem, and depression; 2) social factors, including: mother– and father–adolescent relationship quality, family structure, parental monitoring, sexual communication with friends, adolescents' perceptions of their peers' sexual behaviors, peers' approval of sexual behaviors, and peer pressure to have sex, in-school sexuality education, and country. See Figure 1.

Figure 1: Investigated Aspects of Adolescents' SRH and Ecological Predictors.[11]



Research Questions

To achieve the goals of this thesis, five central research questions were explored:

1) How are various physical activity and screen time behaviors associated with subsequent early sexual intercourse initiation? (Chapter 2)
2) How is adolescents' psychological well-being associated with adolescents' subsequent experiences with early sexual behaviors, and–vice versa–how adolescents' experiences with early sexual behaviors linked with their subsequent psychological well-being? (Chapter 3)

3) How are adolescents' relationships with mothers and fathers associated with subsequent early sexual intercourse initiation? (Chapter 4)
4) How is sexual communication with friends associated with adolescents' subsequent experiences with early sexual behaviors, and to what extent is this association explained by adolescents' perceptions of sexual peer norms? (Chapter 5)
5) What are the differences and similarities in adolescents' SRH behaviors and outcomes, and psychosocial predictors thereof, across the Netherlands, the United States, and Brazil? (Chapter 6)

Data and Sample Descriptions

Data for Chapters 2 and 4 were collected as part of the Rotterdam Youth Monitor (RYM),[35] a longitudinal youth health surveillance system that is incorporated into the preventive youth health care system of Rotterdam, one of the four largest cities in the Netherlands. For these studies that are described in Chapter 2 (n=2,141; $M_{age\ at\ T1}$=12.2 years) and Chapter 4 (n=2,931; $M_{age\ at\ T1}$=12.5 years), data from two waves (T1=2008-2009; T2=2010-2011) were used, with a 2-year interval between measurements. About half of the adolescents were from a non-Dutch ethnic background (i.e., 50.3%) and had a low educational level (i.e., 48.4%).

Data for Chapters 3 and 5 were collected as part of Project STARS (Studies on Trajectories of Adolescent Relationships and Sexuality), the first large-scale longitudinal study on adolescent sexual development, conducted in the Netherlands between 2010 and 2015.[33] In Project STARS, four waves of data were collected, with 6-month intervals between measurements (T1=Fall 2011, T2=Spring 2012, T3=Fall 2012, T4=Spring 2013). For both studies, only secondary school students (n=1,132; $M_{age\ at\ T1}$=13.3 years) were selected from the Project STARS school sample. Chapter 3 included data from all four waves; Chapter 5 included data from the first three waves. Also in both studies, about 12.0% of adolescents were from a non-Dutch ethnic background and approximately 42.0% had a low educational level.

The study that is described in Chapter 6 included three large, nationally representative datasets, collected in the Netherlands (Sex under the age of 25, 2005),[5] the US (Add Health: The National Longitudinal Study of Adolescent to Adult Health, 1996),[36] and Brazil (PeNSE: Pesquisa Nacional de Saúde do Escolar, 2015).[10] From the Dutch cross-sectional study Sex under the age of 25, data from n=3,003 adolescents were collected using online self-report questionnaires. From the American longitudinal study Add Health, data from n=14,539 adolescents were used, which were collected using self-report questionnaires applied in-school at wave I, and through in-home interviews at wave II.[36] In the Brazilian cross-sectional study PeNSE, data were collected from n=101,950 adolescents in 2015, using online self-report questionnaires. The pooled

analysis sample for Chapter 6 consisted of n=122,278 adolescents ($M_{age\ at\ T1}$=14.8 years), of whom the majority were from a non-European ethnic background.

Outline

Chapter 2 describes a two-wave longitudinal study that investigated the associations between physical activity and screen time behaviors with early sexual intercourse initiation (research question 1), in a large sample of Dutch adolescents.

Chapter 3 includes a four-wave longitudinal study, in which bidirectional associations between adolescents' psychological wellbeing (i.e., global self-esteem, physical self-esteem, and depression) and their experiences with early sexual behaviors were examined, among a sample of Dutch adolescents (research question 2). The combined effects of these psycho-social factors as predictors of early sexual behaviors and vice-versa (i.e., the effects of early sexual behaviors on psycho-social wellbeing) were tested by parent–adolescent relationship quality to assess whether these associations differed between low- or high-quality relationships with parents.

The third research question is addressed in Chapter 4. This chapter assessed prospective associations between mother-adolescent relationship quality and father–adolescent relationship quality and early sexual intercourse initiation, among a sample of Dutch adolescents.

Chapter 5 describes a study that assessed indirect over-time associations between adolescents' sexual communication with their friends and their experiences with early sexual behaviors through three types of sexual peer norms (research question 4). Specifically, in this chapter it was investigated whether the association between adolescents' sexual communication with their friends and their experiences with early sexual behaviors was explained by adolescents' perceptions of their peers' sexual behaviors (descriptive norms), peers' approval of sexual behaviors (injunctive norms), and experienced pressure from peers to have sex (peer pressure).

The fifth research question is addressed in Chapter 6. This chapter investigated five SRH behaviors and outcomes of adolescents, and six psycho-social predictors thereof, across the Netherlands, the US, and Brazil. The combined effects of all psycho-social factors as predictors of adolescents' SRH behaviors and outcomes were tested by country to examine whether the associations between psycho-social predictors and adolescents' SRH behaviors and outcomes differed across the Netherlands, the US, and Brazil.

Throughout the studies described in Chapters 2–5, gender differences in the associations between ecological factors and adolescents' SRH behaviors and outcomes were examined to assess whether these associations differed for boys and girls. Our consistent examination of gender differences and similarities relates to the fact that, in research on adolescent sexuality, in general, gender differences are expected.[34] This is because the culture of sexual double standards exists in many societies.[34] Accordingly, boys are

normally granted more sexual freedom and praised for engaging in sexual behaviors, whereas girls often suffer sexual restrictions and tend to be negatively judged when they engage in sexual behaviors.[34] Thus, we expected that adolescents' experiences with sexual behaviors, and ecological predictors thereof, would be different between boys and girls.[34]

The final Chapter of this thesis summarizes the findings of the five studies and implications for future research and public health policies and practice.

Table 1: Overview of research questions, methods, samples, predictors and outcomes of SRH, per chapter

	Research questions	Methods	Samples	Ecological predictors/ outcomes	Ecological SRH outcomes/ predictors
Chapter 2	How are various physical activity and screen time behaviors associated with subsequent early sexual intercourse initiation?	Self-report questionnaires 2 waves	Rotterdam Youth Monitor (RYM) school sample (n=2,141)	Physical activity behaviors, Screen time behaviors	Early sexual intercourse
Chapter 3	How is adolescents' psychological well-being associated with adolescents' subsequent experiences with early sexual behaviors, and–vice versa–how adolescents' experiences with early sexual behaviors linked with their subsequent psychological well-being?	Online, self-report questionnaires 4 waves	Project STARS school sample (n=716)	Global Self-esteem, Physical self-esteem, Depression, Early sexual behaviors	Early sexual behaviors
Chapter 4	How are adolescents' relationships with mothers and fathers associated with subsequent early sexual intercourse initiation?	Self-report questionnaires 2 waves	Rotterdam Youth Monitor (RYM) school sample (n=2,931)	Mother–adolescent relationship quality, Father–adolescent relationship quality	Early sexual intercourse
Chapter 5	How is sexual communication with friends associated with adolescents' subsequent experiences with early sexual behaviors, and to what extent is this association explained by adolescents' perceptions of sexual peer norms?	Online, self-report questionnaires 3 waves	Project STARS school sample (n=771)	Sexual communication with friends, Peers' sexual behaviors, Peers' approval of sexual behaviors, Peer pressure to have sex	Early sexual behaviors
Chapter 6	What are the differences and similarities in adolescents' SRH behaviors and outcomes, and psychosocial predictors thereof, across the Netherlands, the United States, and Brazil?	Online, self-report questionnaires 1 wave	Sex under the age of 25 (n=3,003), Add Health (n=14,539), PeNSE (n=101,950) Total pooled analysis sample (n=122,278)	Age, Gender, Ethnic background, Family structure, Parental monitoring, In-school sexuality education	Timing of first sexual intercourse, Number of sexual partners, Condom use, Contraceptive use, Teen pregnancy

References

1. UN, WHO. Every Woman Every Child The Global Strategy For Women's, Children's, and Adolescents' Health (2016-2030). 2015; Geneva, Switzerland
2. WHO. Sexually Transmitted Infections among Adolescents The Need for Adequate Health Services. 2005; Geneva, Switzerland
3. Sandfort TG, Orr M, Hirsch JS, Santelli J. Long-term health correlates of timing of sexual debut: results from a national US study. *Am J Public Health*. 2008;98(1): 155-161
4. Kaestle CE, Halpern CT, Miller WC and Ford CA. Young age at first sexual intercourse and sexually transmitted infections in adolescents and young adults. *Am J Epidemiol*. 2005;161(8): 774-80
5. De Graaf H, Van de Borne M, and Meijer S. Offline and Online Sexual Risk Behavior among Youth in the Netherlands: Findings from "Sex under the Age of 25". *Frontiers in Public Health*. 2018;6:72
6. De Graaf H, Borne M, Van den Nikkelen S, Twisk D, and Meijer S. *Seks onder je 25e: Seksuele gezondheid van jongeren anno 2017* [Sex under the age of 25: Sexual health of young people in the year 2017]. Delft: Eburon; 2017
7. Finer LB. Unintended pregnancy among US adolescents: Accounting for sexual activity. *Journal of Adolescent Health*. 2010; 47, 312–314. doi:10.1016/j.jadohealth.2010.02.002
8. Forhan SE, Gottlieb SL, Sternberg MR, Xu F, Datta SD, McQuillan GM, Markowitz LE. Prevalence of sexually transmitted infections among female adolescents aged 14 to 19 in the United States. *Pediatrics*. 2009; 124, 1505–1512. doi:10.1542/peds.2009-0674
9. UNAIDS. *Estatisticas Globais sobre HIV 2017* [Global Statistics on HIV 2017]. Available at: https://unaids.org.br/wp-content/uploads/2017/12/UNAIDSBR_FactSheet.pdf Accessed February 15, 2018
10. Ministério da Saúde Brasileiro. *Uma análise da situação de saúde e das causas externas 2014* [An analysis of population health and external causes 2014]. Brasilia, Distrito Federal: Ministério da Saúde Brasileiro; 2015
11. Bronfenbrenner U, Ceci SJ. Nature-Nurture Reconceptualized in Developmental Perspective: A Bioecological Model. *Psychol Rev*. 1994; 101(4):568–586. PMID: 7984707
12. Zimmer-Gembeck MJ, Helfand M. Ten years of longitudinal research on U.S. adolescent sexual behavior: Developmental correlates of sexual intercourse, and the importance of age, gender, and ethnic background. *Developmental Review*. 2008;28, 153- 224. doi:10.1016/j.dr.2007.06.001

13. Buhi ER, Goodson P. Predictors of adolescent sexual behaviour and intention: A theory-guided systematic review. *Journal of Adolescent Health*. 2007; 40, 4-21. doi:10.1016/j.jadohealth.2006.09.027
14. De Graaf H, Vanwesenbeeck I, Woertman L, and Meeus W. Parenting and adolescents' sexual development in Western societies: A literature review. *European Psychologist*. 2011;16:21–31. doi:10.1027/1016-9040/a000031
15. Dittus PJ, Michael SL, Becasen JS, Gloppen KM, McCarthy K, Guilamo-Ramos V. Parental Monitoring and Its Associations With Adolescent Sexual Risk Behavior: A Meta-analysis. *Pediatrics*. 2015;136(6):e1587-e1599
16. Guilamo-Ramos V, Bouris A, Lee J, et al. Paternal influences on adolescent sexual risk behaviors: a structured literature review. *Pediatrics*. 2012;130(5)
17. Widman L, Choukas-Bradley S, Noar SM, Nesi J, Garrett K. Parent-adolescent sexual communication and adolescent safer sex behavior: a meta-analysis. *JAMA Pediatrics*. 2016;170(1):52–61
18. Van de Bongardt D, Reitz E, Sandfort T, Deković M. A meta-analysis of the relations between three types of peer norms and adolescent sexual behavior. *Personality and Social Psychology Review*. 2015;19:203-234. doi:10.1177/1088868314544223
19. Guilamo-Ramos V, Bouris A, Lee J, et al. Potential for Using Online and Mobile Education with Parents and Adolescents to Impact Sexual and Reproductive Health. *Prevention Science*. 2015;16:53–60
20. Habel MA, Dittus PJ, De Rosa CJ, Chung EQ, Kerndt PR. Daily Participation in Sports And Students' Sexual Activity. *Perspect Sex Reprod Health*. 2010; 42(4): 244–50. doi: 10.1363/4224410 PMID: 21126300
21. Page RM, Hammermeister J, Scanlan A, Gilbert L. Is School Sports Participation a Protective Factor against Adolescent Health Risk Behaviors? Journal of Health Education. 1998; 29(3):186–92
22. Collins RL, Elliott MN, Berry SH, Kanouse DE, Kunkel D, Hunter SB, Miu A. Watching sex on television predicts adolescent initiation of sexual behavior. *Pediatrics*. 2004; 114(3):e280–9. PMID: 15342887
23. L'Engle KL, Brown JD, and Kenneavy k. The mass media are important context for adolescents' sexual behaviors. *Journal of Adolescent Health*. 2006;38:186–192
24. Bleakley A, Hennessy M, and Fishbein M. A Model of Adolescents' Seeking of Sexual Content in their Media Choices. *Journal of Sex Research*. 2011;48(4): 309–315
25. Mongraw-Chaffin ML, Peters SAE, Huxley RR, Woodward M. The Sex-Specific Association Between BMI and Coronary Heart Disease: A Systematic Review and Meta-Analysis Of 95 Cohorts with 12 Million Participants. *The Lancet Diabetes & Endocrinology*. 2015; 3(6):437–49

26. Sung J, Lee J, Noh HM, Park YS, Ahn EJ. Associations between the Risk of Internet Addiction and Problem Behaviors among Korean Adolescents Korean. *J Fam Med*. 2013; 34(2) 115–22
27. Keizer R, Lucassen N, Jaddoe V, Tiemeier H. A prospective study on father involvement and toddlers' behavioral and emotional problems: are sons and daughters differentially affected? *Fathering*. 2014;12(1):38–51
28. Mmari K, Sabherwal S. A Review of Risk and Protective Factors of Adolescent Sexual and Reproductive Health in Developing Countries: An Update. *Journal of Adolescent Health*. 2013:562–572
29. Doyle AM, Mavedzenge SN, Plummer ML, Ross DA. The sexual behaviour of adolescents in sub-Saharan Africa: patterns and trends from national surveys. *Tropical Medicine and International Health*. 2012;17(7):796–807
30. Madkour AS, De Looze M, Ma P, et al. Macro-Level Age Norms for the Timing of Sexual Initiation and Adolescents'
31. Meier AM. Adolescent first sex and subsequent mental health. Am J Sociol 2007; 112:1811–47
32. Early Sexual Initiation in 17 European Countries. *Journal of Adolescent Health*. 2014;55(1):114–121
33. Van de Bongardt D, Reitz E, Deković M. Indirect over-time relations between parenting and adolescents' sexual behaviors and emotions through global self-esteem. *Journal of Sex Research*. 2016;53(3):273–285
34. Kreager DA, Staff J. The Sexual Double Standard and Adolescent Peer Acceptance. *Soc Psychol Q*. 2009;72(2):143–164
35. Bannink R, Broeren S, Van de Looij-Jansen PM, De Waart FG, Raat H. Cyber and Traditional Bullying Victimization As A Risk Factor for Mental Health Problems and Suicidal Ideation in Adolescents. *PLoS One*. 2014; 9(4):94026.
36. Barnert ES, Dudovitz R, Nelson BB, Coker TR, Biely C, Li N, et al. How Does Incarcerating Young People Affect Their Adult Health Outcomes? *Pediatrics*. 2017;139(2):e20162624

Chapter 2

Early Sexual Intercourse: Prospective Associations with Adolescents' Physical Activity and Screen Time

Raquel Nogueira Avelar e Silva,[1] Anne Wijtzes,[1] Daphne van de Bongardt,[2] Petra van de Looij-Jansen,[3] Rienke Bannink,[1] Hein Raat.[1]

1. Department of Public Health, Erasmus Medical Center, Erasmus University Rotterdam, Rotterdam, the Netherlands.
2. Department of Psychology, Education and Child Studies, Erasmus University Rotterdam.
3. Department of Research and Business Intelligence, Municipality of Rotterdam, Rotterdam, the Netherlands.

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Abstract

Objectives

To assess the prospective associations of physical activity behaviors and screen time with early sexual intercourse (i.e., before 15 years), in a large sample of adolescents.

Methods

We used two waves of data of the Rotterdam Youth Monitor, a longitudinal study conducted in the Netherlands. The analysis sample consisted of 2,141 adolescents aged 12 to 14 years (mean age at baseline=12.2 years, SD=0.43). Physical activity (e.g., sports outside school), screen time (e.g., computer use), and early sexual intercourse were assessed by means of self-report questionnaires. Logistic regression models were tested to assess the associations of physical activity behaviors and screen time (separately and simultaneously) with early sexual intercourse, controlling for confounders (i.e., socio-demographics, substance use). Interaction effects with gender were tested to assess whether these associations differed significantly for boys and girls.

Results

Only sports club membership was a significant predictor of early sexual intercourse, the other physical activity behaviors were not. Adolescents (both boys and girls) who were members of a sports club (OR=2.17; 95% CI=1.33, 3.56) were more likely to have early sex. Significant gender-interaction effects indicated that boys who watched TV ≥2 hours/day (OR=2.00; 95% CI=1.08, 3.68) and girls who used the computer ≥2 hours/day (OR=3.92; 95% CI=1.76, 8.69) were also significantly more likely to engage in early sex.

Conclusions

These findings have implications for professionals in general pediatric healthcare, sexual health educators, policy makers, and parents, who should be aware of these possible prospective links between sports club membership, TV watching (for boys), and computer use (for girls) and early sexual intercourse. However, more research is needed. Continued research on determinants of adolescents' early sexual intercourse initiation can contribute to the strategies aimed at the improvement of adolescents' healthy sexual development and behaviors.

Introduction

Early sexual intercourse has been associated with an increased risk of having multiple lifetime sexual partners, unprotected sex, acquiring sexually transmitted infections (STIs), unwanted pregnancy,[1-6] and undesirable sexual outcomes, such as orgasm and sexual arousal problems.[4] In addition, recent studies have found that early sexual intercourse is associated with depression and low-self-esteem.[7-10] In light of the risks associated with early sexual intercourse initiation, the understanding of its determinants may contribute to the development of prevention and intervention strategies and policies aiming to improve adolescents' sexual health.[11] Established risk factors for early sexual intercourse include low parental educational level, low household income, single-parent family and poor quality of the parent-adolescent relationship.[12-17] But according to the classic ecological model, many others environmental factors (e.g., leisure time activities) may also affect adolescents' sexual development (e.g., early sexual intercourse).[18] However, few studies have analyzed the association between physical activity behaviors (e.g., sports participation outside school),[11, 19-24] and sedentary behavior (e.g., screen time),[25] with adolescents' sexual intercourse. Regular physical activity has many benefits for adolescents' physical,[26, 27] and psychological health,[28] such as improvement of the cardiorespiratory system,[26] muscle strength,[26] self-esteem,[28] and self-confidence.[28] In contrast, sedentary behaviors has often been identified as an important risk factor for diseases, such as cardiovascular diseases.[29]

Studies that investigated the associations between physical activity behaviors (e.g., sports participation outside school) and early sexual intercourse are conflicting.[11, 19-24, 27, 30] For instance, one study showed that the sports participation outside school was significantly associated with a lower likelihood of sexual intercourse.[11] Contrary, another study showed that adolescents who participated in sports outside school were significantly more likely to engage in sexual intercourse.[19] Other studies showed that girls (but not boys) who participated in sports outside school were less likely to report sexual intercourse, whereas for boys no significant association was found.[20-23] One study showed no significant association between sports participation outside school and sexual intercourse.[24] Studies that investigated the associations between screen time (e.g., computer use) and early sexual intercourse are scarce.[25] A cross-sectional study showed that adolescents with high risk for internet addiction were more likely to have sexual intercourse.[25]

Limitations of the studies include the cross-sectional design; only one of these studies had a prospective design,[11] and therefore evidence on the directionality of the associations is limited. In addition, the majority of these studies were conducted in the United States.[11, 19-24] As cultural aspects, including the sexual double standard and the type of sex education offered in schools (e.g., comprehensive versus focused on abstinence

until marriage) may also influence adolescents' sexual intercourse initiation, knowledge exclusively from one country may not be fully generalizable to adolescents from other countries. For instance, a cross-country comparison of the Netherlands and the United States showed that Dutch adolescents present relatively better sexual health outcomes than American adolescents.[31] A possible explanation could be due to the longstanding tradition of openness toward adolescent sexuality,[32] which can be seen in the provision of comprehensive sexual education in the Dutch secondary schools.[33] In addition, Dutch parents generally have a more positive and opened view of sexuality; sexual intercourse initiation in adolescence is seen by Dutch parents as a natural path of adolescents' sexual development.[34] Thus they often provide more sexual education to their children.[35] Furthermore, none of these studies have investigated the associations of physical activity behaviors and screen time with early sexual intercourse, i.e., defined by the World Health Organization (WHO) as intercourse initiated before the age of 15 years,[1-3] which is more likely to constitute a risk behavior than sexual intercourse per se.

This prospective study aimed to assess the associations of physical activity behaviors and screen time with early sexual intercourse in a large sample of adolescents. Because previous studies that investigated the associations between physical activity behaviors and sexual intercourse were conflicting,[11, 19-24] we have no clear hypothesis regarding these associations. Regarding screen time, we hypothesized that adolescents who reported more daily screen time would be more likely to report early sexual intercourse than adolescents who reported less daily screen time.[25] Furthermore, previous studies have demonstrated that adolescents' sexual development, including the initiation of sexual intercourse, differs for boys and girls.[36-41] In the Netherlands, for instance, a study showed that boys initiate sexual intercourse significantly earlier than girls.[41] These gender differences in adolescents' sexual intercourse initiation can be due to various reasons, including cultural aspects regarding sexuality (e.g., the sexual double standard).[36-39] In many Western cultures, boys, generally, have more sexual freedom, and pressure from a young age onwards to form and prove their masculinity through sexual activities, whereas girls have more sexual restrictions.[36-39] This sexual double standard could aid to explain why in many Western societies boys initiate sexual intercourse earlier than girls.[36-39] Considering these gender differences in adolescent sexual development, in the current study, we assessed the prospective associations of physical activity behaviors and screen time with early sexual intercourse, for boys and girls separately, and moreover, tested whether these associations differed for boys and girls.

Methods

Study Design

A prospective study was conducted using data from the Rotterdam Youth Monitor (RYM). This is a longitudinal youth health surveillance system that is incorporated into the preventive youth healthcare system of Rotterdam.[42] Its aim is to monitor the health, well-being, and behaviors of children and adolescents, to detect potential health risks and problems, and to take preventive measures.[42] During the years of 2008-2009 (T1) and 2010-2011 (T2), the RYM conducted a prospective study in secondary schools of Rotterdam and surrounding regions. In this study, data were collected among a community sample of 8,272 adolescents at baseline, and 3,184 adolescents at follow-up. For the current study, data from both waves were used, with a two-year interval between the measurements. At T1, 76 secondary schools (100% schools' participation rate) and 8,272 students who were enrolled in the first year of secondary school (95% students' participation rate) participated in the study. The main reason for non-response at baseline was students' illness at the time of questionnaires application. At follow-up, 45 schools (59% schools' participation rate) and 3,184 students who were enrolled in the third year of secondary school (38% students' participation rate) participated in the study again. The main reason for non-response at follow-up was that some schools were unwilling to participate in the study again. Other reasons included: students' absence at the time of the follow-up questionnaire administration (about 5%), students' transfer to another school that did not participate at follow-up, or students' repetition of a previous school year. Data were collected throughout the school year, except in the months of July and August (Dutch summer holidays). Administration of the questionnaires at schools were guided by trained researches, school nurses from the Municipal Public Health Service, and teachers.

Study Sample

For our analysis, we selected only students who participated at both measurements (n=3,184). In addition, to be able to predict the initiation of early sexual intercourse, i.e., before the age of 15 years,[1-3, 43] we selected only participants who were younger than 15 years old at both T1 and T2 (n=1,001 excluded) and who had never had sexual intercourse at T1 (n=26 excluded). Furthermore, we excluded participants with missing information on sexual intercourse at T1 (n=7) and/or T2 (n=9). This led to 2,141 adolescents for the analysis sample.

Ethics Statement

All data were collected within the government approved routine health examinations of preventive youth health care system of Rotterdam. Observational research with

anonymous data gathered in routine health examinations of preventive youth health care system of Rotterdam, does not fall within the ambit of the Dutch Act on research involving human subjects and does not require the approval of an ethics review board. The data of the Rotterdam Youth Monitor Study is protected by the Municipal Health Service of Rotterdam, which follows the Code of Conduct Health Research, of The Netherlands. All records/information were anonymized and de-identified prior to analysis. The questionnaires were completed on a voluntary basis, and confidentiality of responses was guaranteed. Adolescents received verbal information about these questionnaires each time they were applied, whereas their parents received written information at every assessment point. Adolescents and their parents were free to refuse participation. The data became available in the context of the government approved routine health examinations of the preventive youth health care of Rotterdam. Separate informed consent was therefore not required.[42] All records/information were anonymized and de-identified prior to analysis.

Measures

Physical Activity Behaviors. Physical activity behaviors were assessed by a set of 4 questions in the self-report questionnaire on: 1) cycling to school; 2) time cycling to school; 3) sports club membership; and 4) sports participation outside school. Cycling to school was measured using one item: "How many days per week do you go to school by bike?", (0=Never; 1=1 day; 2=2 days; 3=3 days; 4=4 days; 5=5 days). This variable was dichotomized (0=Never or 1=Ever). The time cycling to school was measured using one item "How long do you spend cycling to go and to go back from school?", (1=Zero; 2=<10 minutes; 3=10-20 minutes; 4=20-30 minutes; 5=30 minutes-1 hour; 6=>1 hour). This variable was dichotomized (0=<30 minutes/day; 1=≥30 minutes/day). Sports participation outside school was also measured using one item "How many days per week do you participate in sports outside school?", (0=0 days; 1=1 day; 2=2 days; 3=3 days; 4=4 days; 5=5 days; 6=6 days; 7=7 days). This variable was categorized into three categories (0=Never; 1=1-3 days/week; 2=4-7 days/week).

Screen Time Behaviors. Screen time included Television/Digital Versatile Disc (TV/DVD) watching and computer use (games, internet). TV/DVD watching was measured using one item "How many hours per day do you watch TV/DVD?", (0=zero hours; 1=1 hour; 2=2 hours; 3=3 hours; 4=4 hours; 5=5 hours). Computer use was also measured using one item "How many hours per day do you use the computer (e.g., for games or internet)?", (0=zero hours; 1=1 hour; 2=2 hours; 3=3 hours; 4=4 hours; 5=5 hours). These variables were dichotomized (0=<2 hours/day or 1=≥2 hours/day.[44, 45]

Early Sexual Behavior. Early sexual intercourse was defined as intercourse initiated under the age of 15 years as proposed by the WHO.[1-3] This variable was measured using one item "Have you ever had sexual intercourse? (by sexual intercourse we mean

penile-vaginal intercourse)", (0=No, never; 1=Yes, one time; 2=Yes, a couple of times; 3=Yes, regularly). This variable was dichotomized (0=Never; 1=Ever).

Potential Confounders. Based on previous studies, the following variables were considered potential confounders in the associations of physical activity behaviors and screen time with early sexual intercourse: gender, age, educational level, ethnic background, single-parent family, smoking, alcohol use and marijuana use. Students who were enrolled in basic or theoretical pre-vocational education (VMBO) were classified as attending a low educational level. Students who were enrolled in the general secondary education (HAVO) or pre-university education (VWO) were classified as attending a high educational level.[42, 46] According to the definition of Statistics Netherlands, adolescents were considered non-native Dutch if at least one of their parents was born abroad.[42, 46] A detailed description of the original variables can be found in Supplement Table 1.

Statistical Analyses

Descriptive statistics were used to portray the characteristics of the study sample. Prospective associations of physical activity behaviors and screen time with early sexual intercourse were assessed by a series of logistic regression models, stratified by gender.

First, a model was tested containing the confounders (i.e., gender, age, educational level, ethnic background, single-parent family, smoking, alcohol and marijuana use) and the physical activity behaviors (i.e., Model 1). Second, a model was tested containing the confounders and the screen time variables (i.e., Model 2). A third model was tested containing the confounders, the physical activity behaviors, and the screen time variables simultaneously (i.e., Model 3). In addition, we tested *model chi-square statistic* for models (i.e., Models 1, 2, and 3) and the difference between Models 1 and 3, and between Models 2 and 3, to assess which model had the best fit in the stratified analysis. *Model chi-square statistic* shows how much the model is improved after new variables are added into the model. Significant difference ($p<.05$) between the models shows which model has the best fit. When the difference between two models is significant, the model with the highest *chi-square* values is the model with the best fit.

In addition, we tested gender-interaction effects (i.e., gender x physical activity, gender x screen time, and gender x confounders) in the model with the best fit (i.e., Model 3), using data from the total study sample (not stratified). All analyses were conducted in 2015 with the Statistical Package for Social Sciences (SPSS) version 21.0 for Windows (IBM Corp., Armonk, NY, USA). A significance level of $p<.05$ was used to indicate significant effects.

Non-Response Analysis

Adolescents who were included in the prospective analysis sample (n=2,141) were compared with those who were excluded (n=6,131), using Chi-square tests. The results

of these tests showed that excluded adolescents were more often boys (X^2=14.2, *df*=1, p<.001), more often had a low educational level (X^2=420.0, *df*=1, *p* <.001), were more often native Dutch (X^2=7.3, *df*=2, p<.05), more often lived with both parents (X^2=57.0, *df*=1, p<.001), more often cycled to school (X^2=10.5, *df*=1, p<.001), more often cycled to school <30 minutes/day (X^2=44.1, *df*=1, p<.001), more often watched TV ≥2 hours/day (X^2=80.1, *df*=1, p<.001), and more often used a computer ≥2 hours/day (X^2=85.1, *df*=1, p<.001) than included adolescents. Differences in sports club membership *(X^2=1.1, df=1,* p=*.150)* and sports participation outside school *(X^2=3.0, df=2,* p=*.220)* were not statistically significant between included and excluded adolescents.

Results

Characteristic of the Study Sample

At baseline, mean age of adolescents was 12.2 years (SD=0.43). Additional characteristics of the study sample at baseline and the differences between boys and girls, can be seen in Table 1. Several significant gender differences were found. Girls were more likely than boys to be non-native Dutch (p<.01), to report living in a single-parent family (p<.01), not to be members of a sports club (p<.001) and to never participate in sports outside school (p<.001). Regarding the adolescents' early sexual intercourse initiation, boys were more likely than girls to report experience of sexual intercourse at T2 (p<.001).

Prospective Associations of Physical Activity and Screen Time Behaviors with Early Sexual Intercourse

Table 2 shows the logistic regression analyses of the associations of physical activity and screen time at baseline with early sexual intercourse at follow-up, stratified by gender.

Results of *chi-square difference tests* (Table 2) showed that Model 3 had a significantly better model fit than Models 1 and 2, both for boys ($\Delta\chi^2_{1\text{-}3}$ (df)=2; p=.002), ($\Delta\chi^2_{2\text{-}3}$ (df)=5; p=.032), and for girls ($\Delta\chi^2_{1\text{-}3}$ (df)=2; p=.006). Therefore, only the results from Model 3 are presented below.

With regard to the potential confounders, Model 3 revealed that, boys (but not girls) who had low educational level were significantly more likely to engage in early sexual intercourse between T1 and T2 than boys who had high educational level (OR=2.29; 95% CI=1.38, 3.81). In addition, Model 3 showed that boys and girls who lived in a single-parent family were significantly more likely to engage in early sexual intercourse between T1 and T2 than boys and girls who lived with both parents (OR_{boys}=2.29; 95% CI=1.38, 3.81), (OR_{girls}=2.29; 95% CI=1.38, 3.81). Model 3 also showed that girls

(but not boys) who smoked were significantly more likely to engage in early sexual intercourse between T1 and T2 than girls who did not smoke (OR=6.12; 95% CI=2.91, 12.83). Furthermore, Model 3 showed that boys (but not girls) who drink alcohol were significantly more likely to engage in early sexual intercourse between T1 and T2 than boys who did not drink alcohol (OR=2.14; 95% CI=1.09, 4.19). In the analyses for the total sample, we found significant interaction effects between gender and educational level (p=.010), and between gender and smoking (p=.009).

As can be seen in Table 2, Model 3 revealed that for boys and for girls, none of the physical activity behaviors were significantly associated with early sexual intercourse. We also found no significant interaction effects between gender and physical activity behaviors. Our results did show that sports club membership was a significant predictor of sexual intercourse initiation. Adolescents (both boys and girls) who were members of a sports club were significantly more likely to have early sexual intercourse (OR=2.17; 95% CI=1.33, 3.56) than adolescents who were not members of a sports club (Table 3).

For screen time variables, Model 3 revealed that TV watching for boys, and computer use for girls were significantly associated with early sexual intercourse initiation. Boys who watched TV ≥2 hours/day were significantly more likely to engage in early sexual intercourse between T1 and T2 than boys who watched TV <2 hours/day (OR=2.00; 95% CI=1.08, 3.68). Girls who used computer ≥2 hours/day were significantly more likely to engage in early sexual intercourse between T1 and T2 than girls who used computer <2 hours/day (OR=3.92; 95% CI=1.76, 8.69). We found two significant interaction effects between gender and TV watching (for boys only), (p=.026), and between gender and computer use (for girls only), (p=.030).

Discussion

This current study aimed to assess the prospective associations of physical activity behaviors and screen time with early sexual intercourse (i.e., sexual intercourse before 15 years) in a large population of adolescents.

Gender Differences

In our study, a relatively small percentage of adolescents initiated sexual intercourse between T1 and T2. This may be explained by the relatively young age of our participants (i.e $M_{age\ at\ T1}$=12.2 years). In the Netherlands, the average age at which adolescents initiate sexual intercourse is 16.6 years.[41] The fact that boys in our young sample were more likely to engage in early sexual intercourse (i.e., before 15 years) than girls is consistent with previous studies from different countries, including the Netherlands,[41] and the United States.[19, 23, 47] This gender difference may be related to our use of self-

reports about sexual behavior. The reliability of this method may be questioned, as boys are known to often over-report and girls to often under-report their sexual activities.[48] Alternatively, it may be related to the still existing sexual double standard. Recent studies on the sexual double standard during adolescence have shown that, in many societies, girls have gained more sexual freedom over the past decades, but despite this progress, the sexual double standard still exists, and in range of settings (e.g., schools), girls who start sexual intercourse at an early age may still be subjected to negative social sanctions or restrictions.[36-39] In another direction, these studies have shown that boys have, indeed, more sexual freedom than girls, and normally gain a better reputation after they start having sexual intercourse. For boys, early sexual intercourse may thus be related to their need to prove their masculinity,[23] whereas for girls, early sexual intercourse may bring more social costs (e.g., a bad reputation), and therefore, they may avoid the engagement in that behavior at an early age.[49] Therefore, this well-recognized historical and cultural phenomenon of the sexual double standard may aid to explain our findings that boys were significantly more likely than girls to engage in early sexual intercourse.

Physical Activity Behaviors and Early Sexual Intercourse

We found that in the total study sample, only sports club membership was a significant predictor of early sexual intercourse, whereas the other physical activity behaviors (e.g., sports participation outside school) were not. Partially, in line with our finding, we found a cross-sectional study conducted in the United States, which also showed no association between sports participation outside school and early sexual intercourse. Findings from studies that investigated the associations between physical activity behaviors and sexual intercourse are conflicting; the majority of these studies have a cross-sectional design,[19-24] and were conducted in the United States.[11, 19-24] Thus, to provide more insight about the role of physical activities in adolescents' early sexual intercourse initiation, future studies could investigate the longitudinal associations between specific types of sports on early sexual initiation.

To the authors' knowledge, no previous study investigated the associations between sports club membership and adolescents' sexual behavior (e.g., sexual intercourse initiation). In the total study sample, adolescents who were members of a sports club were significantly more likely to engage in early sexual intercourse than adolescents who were not members of a sports club. A possible explanation for our finding could be that adolescents who play sports in the setting of a sports club may be more likely to spend considerable unsupervised spare time with peers than those who practice sports in a different setting. A sports club may not only be a place where adolescents practice physical activities, but it may also be a place where adolescents interact with potential sexual partners (e.g., in the bars of the sports club), which could facilitate early sexual experiences. Prospective studies conducted in America have indeed demonstrated that

adolescents who spent more unsupervised time with their peers were more likely to engage in sexual intercourse.[19, 50, 51]

Although is likely that the associations between physical activity behaviors and early sexual intercourse differ for boys and girls,[20-23] in the present study, we did not find interaction effects of adolescents' gender with physical activity behaviors and early sexual intercourse. Given that there was a small number of boys and girls initiating sex between T1 and T2, a possible explanation for this finding could be due to the lack of power. Future studies could assess the associations between physical activity behaviors and adolescents' early sexual intercourse initiation in larger samples.

Screen Time Behaviors and Early Sexual Intercourse

We found that boys (but not girls) who watched TV ≥2 hours/day were significantly more likely to have early sexual intercourse than girls who watched TV <2 hours/day. This finding is partially line with previous studies that showed that a greater exposure to sexual content on TV/DVDs predicted sexual intercourse among adolescents (girls and boys).[47, 52, 53] However, to our knowledge this is the first study showing these associations with early sexual intercourse. Rates of sexual content in TV programs may vary across countries, but watching TV ≥2 hours/day may increase the level of exposure to sexual content. Thus a possible explanation for our finding could be that an increased exposure to sexual content may create an illusion in adolescents' minds that sexual intercourse is something crucial to daily life, which could be a stimulus for sexual intercourse.[47] The fact that TV watching ≥2 hours/day was associated with an increased risk of early sexual intercourse for boys only (not for girls) may be explained by the co-viewing status. For instance, a study found that adolescents who watched TV at least once per week with a peer of the opposite sex were significantly more likely to engage in sexual intercourse than adolescents who did not watched TV weekly with a friend of the opposite sex.[52] The presence of an opposite-sex peer could strengthen the influence of the media (sexual content), and perhaps boys are more susceptible.[52] However, this is difficult to ascertain because in our analysis we did not control for TV co-viewing status. An additional explanation for our finding may be an underlying lack of parental control in the life of their adolescent children.[11, 54] This notion is supported by a prospective study showing that adolescents who had parental limitation of TV watching were less likely to report early sexual intercourse.[54]

We also found that girls (but not boys) who used computer ≥2 hours/day were significantly more likely to engage in early sexual intercourse than boys who use computer <2 hours/day. Partially in line with our finding, a cross-sectional study also showed that adolescents at high risk for internet addiction (i.e., an indicator of screen time/computer use) were significantly more likely to have sexual intercourse.[25] A possible explanation for our finding could be that girls who are greatly exposed to computer use (e.g., high

internet use) may be more likely to contact a potential sexual partner online, as well as to be more solicited online for sex than boys who are highly exposed to computer use.[55] We do not know, however, what the reasons were for girls' computer use (e.g., homework, gaming, or viewing sexualized internet material). This is a relevant site for future studies.

Strengths and Limitations

To our knowledge, this is the first prospective study to assess the associations of physical activity behaviors and screen time (separately and simultaneously) with early sexual intercourse in a large sample of adolescents, for boys and girls. Furthermore, we were able to control for a wide range of potential confounders that have been associated with sexual intercourse. However, some limitations should be taken into account when interpreting the results. First, information on all variables was assessed by self-report questionnaires, which may have led to socially desirable answers. Second, early sexual intercourse was measured as a single indicator of sexual risk behavior. Third, comparability of our findings with findings from other studies conducted in others countries is difficult because the definition of early sexual intercourse differs in the literature. Whereas we have used the definition proposed by WHO, other studies used distinct definitions. Finally, non-response analyses comparing participants and non-participants, showed differences in sociodemographic characteristics, physical activity behaviors, and screen time. Selective participation is a common problem in longitudinal research on adolescents sexual development.[56] It may have affected our results; however, it is difficult to ascertain the consequences of selective participation because some features of non-participants could be considered a risk factor (e.g., excluded adolescents had more often low educational level at T1), and others a protective factor (e.g., excluded adolescents more often lived with both parents at T1).

Conclusions

The present study shows that for the whole sample (both boys and girls), only sports club membership was a significant predictor of early sexual intercourse, whereas the other physical activity behaviors were not. Adolescents who were members of a sports club were significantly more likely to have early sex. However, some predictors of early sexual intercourse were significant only for boys or girls. Specifically, boys who watched TV ≥2 hours/day and girls who used computer ≥2 hours/day were significantly more likely to engage in early sexual intercourse (i.e., before the age of 15 years, as proposed by the WHO). These findings have implications for professionals in general pediatric

healthcare, sexual health educators, policy makers, and parents, who should be aware of these possible prospective links between sports club membership, TV watching (for boys), and computer use (for girls) and early sexual intercourse. However, more research is needed to better understand the mechanisms underlying these associations, for instance by more closely exploring the socio-contextual factors in sports clubs that may contribute to opportunities for early sexual activities. Furthermore, the assessment of the associations between different features of sports (e.g., individual versus collective) and early sexual initiation may also provide more evidence and understanding about whether the type of sports that adolescents participate in is relevant in relation to adolescents' early sexual intercourse initiation. Also, further longitudinal studies examining the over-time associations of physical activity behaviors and screen time with sexual development, and the improvement of our understanding of gender and possible age differences therein, are important. Another important direction for future investigations includes the assessment of the associations of physical activities behaviors and screen time with early sexual intercourse in different countries, because socio-cultural aspects (e.g., offer of "comprehensive" versus "abstinence until marriage" sex education) may also influence effects of physical activities and screen time on the initiation of early sexual intercourse. Continued research on determinants of adolescents' early sexual intercourse initiation can contribute to the strategies aimed at the improvement of adolescents' healthy sexual development and behaviors.

Table 1: Descriptive characteristics of the prospective analysis sample, and gender differences, at baseline (n=2,141)

	Analysis sample						
	Total		Boys		Girls		*p* value [a]
	n	%	N	%	n	%	
Confounders							
Gender	2.141	100.0	1,030	48.1	1,111	51.9	-
Age							
0=11-12 years	1,730	80.8	833	48.2	897	51.8	**< .001**
Educational Level							
1=Low	852	39.8	393	46.1	459	53.9	.140
Ethnic background							
1=Non-native Dutch	956	44.7	428	44.8	528	55.2	**< .01**
Single-parent family							
1=Yes	440	20.6	182	41.4	258	58.6	**< .01**
Smoking							
1=Yes	196	9.2	106	54.1	90	45.9	.081
Alcohol use							
1=Yes	201	9.4	106	52.7	95	47.3	.180
Marijuana use							
1=Yes	6	0.3	4	66.7	2	33.3	.364
Physical activity behaviors							
Cycling to school							
0=Never	416	19.4	192	46.2	224	53.8	.380
Time cycling to school							
0=<30 minutes/day	1,486	69.6	716	48.2	770	51.8	.940
Sports club membership							
0=No	769	36.0	286	37.2	483	62.8	**< .001**
Sports outside school							
0=Never	226	10.6	63	27.9	163	72.1	**< .001**
Screen time							
TV/DVD watching							
1=≥2 hours/day	1,209	56.5	467	50.3	462	49.7	.083
Computer use							
1=≥2 hours/day	1,047	49.0	519	47.6	572	52.4	.630
Sexual Behavior							
Early sexual intercourse at T2							
1=Ever	129	6.0	79	61.2	50	38.8	**< .01**

Note: Non-native Dutch included: Surinamese, Turkish, Dutch Antillean, Moroccan, Cape Verdean, and other ethnicities.

[a] Differences in characteristics measured at T1 between boys and girls by Chi-Square tests (categorical variables).

Table 2: Results of logistic regression analyses of the prospective associations of physical activity behaviors and screen time with early sexual intercourse, stratified by gender (n=2,141)

	Model 1[a]		Model 2[b]		Model 3[c]	
	OR (95% CI)		OR (95% CI)		OR (95% CI)	
Confounders	Boys (n=1,023)	Girls (n=1,094)	Boys (n=1,025)	Girls (n=1,097)	Boys (n=1,020)	Girls (n=1,091)
Age (0=11-12 years)						
13-14 years	1.45 (0.83, 2.54)	0.84 (0.37, 1.92)	1.36 (0.78, 2.36)	0.80 (0.35, 1.81)	1.40 (0.80, 2.46)	0.84 (0.36, 1.93)
Educational level (0=High)						
Low	**2.51 (1.52, 4.15)*****	0.80 (0.40, 1.60)	**2.17 (1.33, 3.57)****	0.75 (0.38, 1.46)	**2.29 (1.38, 3.81)****	0.77 (0.38, 1.55)
Ethnic background (0=Native Dutch)						
Non-native Dutch	1.68 (0.98, 2.88)	0.77 (0.39, 1.55)	1.49 (0.90, 2.46)	0.74 (0.39, 1.39)	1.47 (0.85, 2.54)	0.77 (0.38, 1.57)
Single-parent family (0=No)						
Yes	**1.95 (1.12, 3.39)***	**2.31 (1.21, 4.40)***	1.74 (1.00, 3.01)	**2.18 (1.15, 4.12)***	**1.96 (1.12, 3.43)***	**2.14 (1.12, 4.09)***
Smoking (0=No)						
Yes	1.73 (0.89, 3.37)	**7.56 (3.61, 15.79)*****	1.70 (0.88, 3.28)	**6.24 (3.02, 12.86)*****	1.62 (0.84, 3.16)	**6.12 (2.91, 12.83)*****
Alcohol use (0=No)						
Yes	**2.30 (1.18, 4.47)***	1.62 (0.70, 3.74)	**2.05 (1.06, 3.97)***	1.29 (0.57, 2.94)	**2.14 (1.09, 4.19)***	1.43 (0.61, 3.35)
Marijuana use (0=No)						
Yes	3.80 (0.45, 32.28)	-	7.36 (0.85, 63,82)	-	5.44 (0.60, 49.19)	-
Physical activity behaviors						
Cycling to school (0=Never)						
Ever	0.62 (0.35, 1.11)	0.96 (0.43, 2.20)			0.65 (0.36, 1.16)	1.00 (0.45, 2.26)
Time cycling to school (0=<30 min/day)						
≥30 minutes/day	0.92 (0.50, 1.69)	0.60 (0.28, 1.27)			1.03 (0.56, 1.92)	0.64 (0.30, 1.39)
Sports club membership (0=No)						

Table 2: Results of logistic regression analyses of the prospective associations of physical activity behaviors and screen time with early sexual intercourse, stratified by gender (n=2,141): (*continued*)

	Model 1[a]		Model 2[b]		Model 3[c]	
	OR (95% CI)		OR (95% CI)		OR (95% CI)	
Yes	1.90 (1.00, 3.59)	1.73 (0.79, 3.79)			1.96 (1.03, 3.72)	1.69 (0.77, 3.71)
Sports outside school (0=Never)						
1-3 days	0.80 (0.24, 2.68)	0.48 (0.18, 1.30)			0.89 (0.26, 3.00)	0.53 (0.20, 1.43)
4-7 days	1.03 (0.32, 3.37)	0.67 (0.24, 1.82)			1.16 (0.36, 3.82)	0.74 (0.27, 2.02)
Screen Time						
TV/DVD watching (0=<2 hours/day)						
≥2 hours/day			**2.14 (1.18, 3.90)***	0.68 (0.35, 1.32)	**2.00 (1.08, 3.68)***	0.70 (0.35, 1.39)
Computer use (0=<2 hours/day)						
≥2 hours/day			1.24 (0.75, 2.06)	**4.30 (1.95, 9.44)*****	1.35 (0.80, 2.28)	**3.92 (1.76, 8.69)****
Model [d]	X^2 (12)=55.34***	X^2 (12)=53.96***	X^2 (9)=54.92***	X^2 (9)=63.48***	X^2 (14)=67.10***	X^2 (14)=64.00***

Note: Bold print indicates statistical significance. *p<.05 **p<.01 ***p<.001

[a] Model 1: Included confounders (i.e., gender, age, educational level, ethnic background, single-parent family, smoking, alcohol, and marijuana use) and physical activity behaviors.

[b] Model 2: Included confounders and screen time variables.

[c] Model 3: Included confounders and physical activity behaviors and screen time variables simultaneously.

[d] Assessment of the model fit, using Chi-square difference tests.

Table 3: Results of logistic regression analyses of the prospective associations of physical activity behaviors and Screen time with early sexual intercourse, for the total study sample (n=2,141)

Early sexual intercourse	
	Model 3 [a]
	OR (95% CI)
	(n=2,111)
Confounders	
Gender (0=Girls)	
Boys	**1.73 (1.16, 2.59)****
Age (0=11-12 years)	
13-14 years	1.19 (0.75, 1.88)
Educational level (0=High)	
Low	**1.60 (1.07, 2.38)***
Ethnic background (0=Native Dutch)	
Non-native Dutch	1.20 (0.79, 1.83)
Single-parent family (0=No)	
Yes	**2.04 (1.35, 3.08)****
Smoking (0=No)	
Yes	**2.75 (1.70, 4.42)*****
Alcohol use (0=No)	
Yes	**1.82 (1.09, 3.05)***
Marijuana use (0=No)	
Yes	2.03 (0.29, 14.20)
Physical activity behaviors	
Cycling to school (0=Never)	
Ever	0.78 (0.49, 1.23)
Time cycling to school (0=<30 min/day)	
≥30 minutes/day	0.87 (0.54, 1.40)
Sports club membership (0=No)	
Yes	**2.17 (1.33, 3.56)****
Sports outside school (0=Never)	
1-3 days	0.58 (0.28, 1.21)
4-7 days	0.80 (0.39, 1.66)
Screen Time	
TV/DVD watching (0=<2 hours/day)	
≥2 hours/day	1.28 (0.82, 1.99)
Computer use (0=<2 hours/day)	
≥2 hours/day	**1.98 (1.29, 3.02)****

Note: Bold print indicates statistical significance. *p<.05, **p<.01, ***p<.001

[a] Model 3: Included confounders (i.e., gender, age, educational level, ethnic background, single-parent family, smoking, alcohol, and marijuana use), and physical activity behaviors and screen time variables simultaneously.

References

1. UNAIDS. Global AIDS response progress reporting 2013: Construction of core indicators for monitoring the 2011 UN Political Declaration on HIV/AIDS. Geneve, Switzerland World Health Organization (WHO) 2013:1-164
2. UNICEF, UNAIDS, UNFPA, ILO, WHO and The World Bank and 2011. Opportunity in Crisis: Preventing HIV from early adolescence to young adulthood. New York, USA: United Nations Children's Fund (UNICEF) 2011:1-61
3. WHO. Adolescents and Youths. Geneva, Switzerland: World Health Organization (WHO) 2012:3-27
4. Sandfort TG, Orr M, Hirsch JS and Santelli J. Long-term health correlates of timing of sexual debut: results from a national US study. Am J Public Health. 2008; 98(1):155-61.
5. Rissel CE, Richters J, Grulich AE, De Visser RO and Smith AM. Sex in Australia: first experiences of vaginal intercourse and oral sex among a representative sample of adults. Aust N Z J Public Health. 2003;27(2):131-7
6. Kaestle CE, Halpern CT, Miller WC and Ford CA. Young age at first sexual intercourse and sexually transmitted infections in adolescents and young adults. Am J Epidemiol. 2005;161(8): 774-80
7. Ciairano S, Bonino S, Kliewer W, Miceli R and Jackson S. Dating, Sexual Activity, and Well-Being in Italian Adolescents. Journal of Clinical Child & Adolescent Psychology. 2006;35(2): 275-82
8. Kastbom AA, Sydsjo G, Bladh M, Priebe G and Svedin CG. Sexual debut before the age of 14 leads to poorer psychosocial health and risky behaviour in later life. Acta Paediatr. 2015;104(1): 91-100
9. Longmore MA, Manning WD, Giordano PC and Rudolph JL. Self-Esteem, Depressive Symptoms, and Adolescents' Sexual Onset. Social Psychology Quarterly. 2004;67(3):279-95
10. Lara LAS and Abdo CHN. Age At Initial Sexual Intercourse And Health Of Adolescent Girls. Journal of Pediatric and Adolescent Gynecology. 2015;15:1-7
11. Nelson MC and Gordon-Larsen P. Physical Activity And Sedentary Behavior Patterns Are Associated With Selected Adolescent Health Risk Behaviors. Pediatrics. 2006;117(4):1281-90
12. Boislard P M-A and Poulin F. Individual, Familial, Friends-Related And Contextual Predictors of Early Sexual Intercourse. Journal of Adolescence. 2011;34(2): 289-300
13. Shneyderman Y and Schwartz SJ. Contextual and Intrapersonal Predictors of Adolescent Risky Sexual Behavior and Outcomes. Health Education & Behavior. 2013;40(4):400-14.

14. DiClemente RJ, Wingood GM, Crosby R, Sionean C, Cobb BK, Harrington K, Davies S, Hook EW and Oh MK. Parental Monitoring: Association With Adolescents' Risk Behaviors. Pediatrics. 2001;107(6):1363-8
15. Van de Bongardt D, De Graaf H, Reitz E and Dekovic M. Parents As Moderators of Longitudinal Associations Between Sexual Peer Norms And Dutch Adolescents' Sexual Initiation and Intention. J Adolesc Health. 2014;55(3):388-93
16. Kastbom ÅA, Sydsjö G, Bladh M, Priebe G and Svedin CG. Differences In Sexual Behavior, Health, And History Of Child Abuse Among School Students Who Had And Had Not Engaged in Sexual Activity by the Age of 18 Years: A Cross-Sectional Study. Adolescent Health, Medicine and Therapeutics. 2016;7:1-11
17. Siziya S, Muula AS, Kazembe LN and Rudatsikira E. Harmful Lifestyles' Clustering Among Sexually Active in-School Adolescents in Zambia. BMC Pediatrics. 2008;8:6
18. Bronfenbrenner U and Ceci SJ. Nature-Nurture Reconceptualized in Developmental Perspective: A Bioecological Model. Psychol Rev. 1994;101(4):568-86
19. Habel MA, Dittus PJ, De Rosa CJ, Chung EQ and Kerndt PR. Daily Participation in Sports And Students' Sexual Activity. Perspect Sex Reprod Health. 2010;42(4): 244-50
20. Taliaferro LA, Rienzo BA and Donovan KA. Relationships Between Youth Sport Participation and Selected Health Risk Behaviors from 1999 To 2007. J Sch Health. 2010;80(8):399-410
21. Kulig K, Brener ND and McManus T. Sexual Activity And Substance Use Among Adolescents by Category of Physical Activity Plus Team Sports Participation. Arch Pediatr Adolesc Med. 2003;157(9):905-12
22. Pate RR, Trost SG, Levin S and Dowda M. Sports Participation And Health-Related Behaviors Among US Youth. Arch Pediatr Adolesc Med. 2000;154(9): 904-11
23. Miller KE, Sabo DF, Farrell MP, Barnes GM and Melnick MJ. Athletic Participation and Sexual Behavior in Adolescents: The Different Worlds Of Boys And Girls. J Health Soc Behav. 1998;39(2):108-23
24. Page RM, Hammermeister J, Scanlan A and Gilbert L. Is School Sports Participation a Protective Factor against Adolescent Health Risk Behaviors? Journal of Health Education. 1998;29(3):186-92
25. Sung J, Lee J, Noh HM, Park YS and Ahn EJ. Associations between the Risk of Internet Addiction and Problem Behaviors among Korean Adolescents Korean. J Fam Med. 2013;34(2) 115-22
26. Radtke T, Kriemler S, Eser P, Saner H and Wilhelm M. Physical Activity Intensity and Surrogate Markers for Cardiovascular Health in Adolescents. Eur J Appl Physiol. 2013;113(5):1213-22

27. WHO. Physical Activity and Its Impact on Health Behavior Among Youth. (https://www.icsspe.org/sites/default/files/PhysicalActivity.pdf). International Council of Sport Science and Physical Education. 2016
28. Pedersen S and Seidman E. Team Sports Achievement And Self-Esteem Development Among Urban Adolescent Girls. Psychology of Women Quarterly. 2004; 28(4):12-22.
29. Mongraw-Chaffin ML, Peters SAE, Huxley RR and Woodward M. The Sex-Specific Association Between BMI and Coronary Heart Disease: A Systematic Review and Meta-Analysis Of 95 Cohorts with 1·2 Million Participants. The Lancet Diabetes & Endocrinology. 2015;3(6):437-49
30. Vuori MT, Kannas LK, Villberg J, Ojala SAK, Tynjälä JA and Välimaa RS. Is Physical Activity Associated with Low-Risk Health Behaviours Among 15-Year-Old Adolescents in Finland? Scandinavian Journal of Public Health. 2012;40(1): 61-8
31. De Graaf H, Kruijer H and Van Acker JMS. Sex onder je 25e. Seksuele gezondheid van jongeren in Nederland anno 2012. [Sex under 25. Sexual health of Dutch youth in 2012.] (Delft: Uitgeverij Eburon). 2012
32. Weaver H, Smith G and Kippax S. School-Based Sex Education Policies and Indicators of Sexual Health Among Young People: A Comparison of the Netherlands, France, Australia and the United States Sex Education. 2005;5(2):171-88
33. Van de Bongardt D, Bos HMW and Mouthaan I. Sexual and relational education practices in the Netherlands: Evidence of a discourse of erotics? Society for International Education Journal. 2013;7:76-103
34. Schalet AT. Raging Hormones, Regulated Love: Adolescent Sexuality and the Constitution of the Modern Individual in the United States and the Netherlands. Body & Society. 2000;6:75-105
35. Dodge B, Sandfort TGM, Yarber WL and De Wit J. Sexual Health Among Male College Students in the United States and the Netherlands. American Journal of Health Behavior. 2005;29(2):172-82
36. Bearinger LH, Sieving RE, Ferguson J and Sharma V. Global Perspectives on the Sexual and Reproductive Health of Adolescents: Patterns, Prevention, And Potential. The Lancet. 2007;369(9568):1220-31
37. Crawford M and Popp D. Sexual Double Standards: A Review And Methodological Critique of Two Decades of Research. J Sex Res. 2003;40(1):13-26
38. Kreager DA and Staff J. The Sexual Double Standard and Adolescent Peer Acceptance. Social Psychology Quarterly. 2009;72(2):143-64
39. Lyons H, Giordano P, Manning W and Longmore M. Identity, Peer Relationships, and Adolescent Girls' Sexual Behavior: An Exploration of the Contemporary Double Standard. Journal of sex research. 2011;48(4)437-49

40. Peltzer K and Pengpid S. Early Sexual Debut and Associated Factors among In-school Adolescents in Six Caribbean Countries. West Indian Medical Journal. 2015;64(4):351-6.
41. De Graaf H, Kruijer H and Van Acker JMS. Sex onder je 25e. Seksuele gezondheid van jongeren in Nederland anno 2012. [Sex under 25. Sexual health of Dutch youth in 2012.] (Delft: Uitgeverij Eburon). 2012
42. Bannink R, Broeren S, Van de Looij-Jansen PM, De Waart FG and Raat H. Cyber and Traditional Bullying Victimization As A Risk Factor for Mental Health Problems and Suicidal Ideation in Adolescents. PLoS One. 2014;9(4):94026
43. Neal SE and Hosegood V. How Reliable Are Reports of Early Adolescent Reproductive and Sexual Health Events in Demographic and Health Surveys? Int Perspect Sex Reprod Health. 2015;41(4):210-7
44. Council on Communication and Media. Children, Adolescents, and the Media. Pediatrics. 2013
45. Daniels SR, Hassink SG, Committee on Nutrition. The Role of the Pediatrician in Primary Prevention of Obesity. Pediatrics. 2015 July 1, 2015;136(1):275-92
46. Statistics Netherlands. Standaard Onderwijsindeling 2003. Voorburg/Heerlen, the Netherlands: Statistics Netherlands. 2004
47. Collins RL, Elliott MN, Berry SH, Kanouse DE, Kunkel D, Hunter SB and Miu A. Watching sex on television predicts adolescent initiation of sexual behavior. Pediatrics. 2004;114(3):e280-9
48. Siegel DM, Aten MJ and Roghmann KJ. Self-Reported Honesty Among Middle and High School Students Responding to a Sexual Behavior Questionnaire. Journal of Adolescent Health. 1998;23(1):20-8
49. Lyons H, Manning W, Giordano P and Longmore M. Predictors of Heterosexual Casual Sex Among Young Adults. Arch Sex Behav. 2013;42(4):585-93
50. Faurie C, Pontier D and Raymond M. Student Athletes Claim to Have More Sexual Partners than Other Students. Evolution and Human Behavior. 2004;25(1):1-8
51. Barnes G, Hoffman J, Welte J, Farrell M and Dintcheff B. Adolescents' Time Use: Effects on Substance Use, Delinquency and Sexual Activity. Journal of Youth and Adolescence. 2007;36(5):697-710
52. Parkes A, Wight D, Hunt K, Henderson M and Sargent J. Are sexual media exposure, parental restrictions on media use and co-viewing TV and DVDs with parents and friends associated with teenagers' early sexual behaviour? J Adolesc. 2013;36(6):1121-33
53. Brown JD, L'Engle KL, Pardun CJ, Guo G, Kenneavy K and Jackson C. Sexy Media Matter: Exposure to Sexual Content in Music, Movies, Television, and Magazines Predicts Black and White Adolescents' Sexual Behavior. Pediatrics. 2006;117(4):1018-27

54. Bersamin M, Todd M, Fisher D A, Hill DL, Grube JW and Walker S. Parenting Practices and Adolescent Sexual Behavior: A Longitudinal Study. Journal of Marriage and Family. 2008;70(1):97-112
55. Rice E, Winetrobe H, Holloway IW, Montoya J, Plant A and Kordic T. Cell Phone Internet Access, Online Sexual Solicitation, Partner Seeking, and Sexual Risk Behavior Among Adolescents. Arch Sex Behav. 2015;44(3):755-63
56. Zimmer-Gembeck MJ and Helfand M. Ten Years of Longitudinal Research on U.S. Adolescent Sexual Behavior: Developmental Correlates of Sexual Intercourse, and the Importance of Age, Gender And Ethnic Background. Developmental Review. 2008;28(2):153-224

Supplement Table 1: Description of the original variables

Variables	Items	Questions	Response options	Cutt-offs dichotomous
Physical Activity Behaviors	Cycling to school	How many days/week do go to sschool by bike?	Zero	Never
			1 day	Ever
			2 days	
			3 days	
			4 days	
			5 days	
	Timing cycling to school	How long do you spend cycling to go/ go back from school?	< 10 minutes	
			10-20 minutes	
			20-30 minutes	<30 minutes/ day
			30 minutes-1 hour	≥30 minutes/ day
			> 1 hour	
	Sports club membership	Are you a member of a sports club? (i.e., whether adolescents had a paid membership of a sports club).	No	No
			Yes	Yes
	Sports outside school	How many days/week do you participate in sports outside school?	Zero	Never
			1 day	
			2 days	
			3 days	1-3 days/ week
			4 days	4-7 days/ week
			5 days	
			6 daya	
			7 days	
Screen Time	TV/DVD watching	How many hours/day do you watch TV/DVD?	Zero	
			< 1 hour	
			1 hour	<2 hours/day
			2 hours	≥2 hours/day
			3 hours	

Supplement Table 1: Description of the original variables (*continued*)

Variables	Items	Questions	Response options	Cutt-offs dichotomous
			4 hours	
			5 hours	
Screen Time	Computer use	How many hours/day do you use computer (games, internet)?	Zero	
			< 1 hour	
			1 hour	<2 hours/day
			2 hours	≥2 hours/day
			3 hours	
			4 hours	
			5 hours	
Sexual Behavior	Early sexual intercourse	Have you ever had sexual intercourse (we mean penile-vaginal intercourse)?	No, never	Never
			Yes, 1 time	Ever
			Yes, a couple of times	
			Yes, regularly	
Potential Confounders	Gender	Are you a boy ir a girl?	Boy	Boy
			Girl	Girl
	Age	How old are you?	11 years	
			12 years	11-12 years
			13 years	13-14 years
			14 years	
			15 years	Excluded
			16 years	
			17 years	
			≥18 years	
	Educational Level	Indicate in which class you are and what kind of educational level you follow	VMBO-vocational	
			VMBO-theoretical	
			VMBO/HAVO	Low
			HAVO/VWO	High
			VWO	

Supplement Table 1: Description of the original variables (*continued*)

Variables	Items	Questions	Response options	Cutt-offs dichotomous
	Ethnic Background	In what country were you born?	Netherlands	Native-Dutch
			Suriname	Non-native Dutch
			Dutch Antilles of Aruda	
			Morocco	
			Turkey	
			Cape Verde	
			Other	
Potential Confounders	Single-parent family	Do you live with mother and father?	Yes, I live with my father and mother	Yes
			Yes, but sometimes I live with my mother and sometimes with my father	No
			No, I live with my father	
			No, I live with my mother	
			No, I live with my father and stepmother/ friend	
			No, I live with my mother and stepfather.friend	
			No, I live with other	
	Smoking	Have you ever smoked (cigarette)?	No, I have never smoked	No
			Yes, I smoked 1 or 2 times	Yes
			I smoke occasionally	
			I smoke daily	
	Alcohol	Do you sometimes drink alcohol?	No, never	No
			Yes, sometimes	Yes

Supplement Table 1: Description of the original variables (*continued*)

Variables	Items	Questions	Response options	Cutt-offs dichotomous
	Marijuana	Have you used marijuana?	Never	No
			1-2 times	Yes
			3-4 times	
			5-6 times	
			7-10 times	

Chapter 3

Bidirectional Associations Between Adolescents' Sexual Behaviors and Psychological Wellbeing: A Longitudinal Study

Raquel Nogueira Avelar e Silva,[1] Daphne van de Bongardt,[2] Laura Baams,[3] Hein Raat.[1]

1. Department of Public Health, Erasmus Medical Center, Erasmus University Rotterdam, Rotterdam, the Netherlands.
2. Department of Psychology, Education and Child Studies, Erasmus University Rotterdam, Rotterdam, the Netherlands.
3. Pedagogical and Educational Sciences, University of Groningen, Groningen, the Netherlands.

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Abstract

Purpose

Assessing bidirectional longitudinal associations between early sexual behaviors (≤16.0 years) and psychological wellbeing (global self-esteem, physical self-esteem, depression) among 716 adolescents, and the direct and buffering effect of parent-adolescent relationship quality.

Methods

We used data from Project STARS, a longitudinal study on adolescent sexual development in the Netherlands. Participants were 11.0-16.0 years old (mean age at T1=13.3 years). Self-reports from four waves of online questionnaires were used. Bidirectional longitudinal associations were assessed by linear mixed-effects models.

Results

At most waves, boys had significantly higher levels of psychological wellbeing than girls, but genders did not differ in experience with sexual behaviors. Engagement in early sexual behaviors did not predict lower levels of psychological wellbeing over time, and lower levels of psychological wellbeing did not predict more engagement in early sexual behaviors over time. Parent-adolescent relationship quality did not moderate these associations in either direction, although we found a significant direct effect, in which a higher-quality parent-adolescent relationship predicted more optimal levels of the three indicators of adolescents' psychological wellbeing (but not lower levels of early sexual activity) over time.

Conclusions

Our results show that, among Dutch adolescents, early sexual behaviors and psychological wellbeing were not interrelated. This may be explained by socio-cultural aspects of Dutch society, such as more normalization of sexual behaviors during adolescence. As a result, early sexual activity in and of itself was not related to lower psychological wellbeing over time. Yet, cross-cultural differences in links between adolescent sexuality and wellbeing should be further investigated.

Introduction

Normative adolescent development includes experiences with intimate relationships and sexual behaviors.[1] However, the engagement in sexual behaviors at an early age (i.e., before or at the age of 16.0 years) is associated with risky sexual behaviors, such as unprotected sex,[2] and negative implications for adolescents' health, including sexually transmitted infections (STIs),[3] and unwanted pregnancy.[4] Youths who initiate sexual behaviors during early (i.e., 10.0-14.0 years) and middle adolescence (15.0-16.0 years) are more likely to engage in risky sexual behaviors.[2] This may be related to their relatively limited knowledge about the risks involved in sexual activities, and experiencing more difficulty in negotiating condom use with their partners.[5, 6] In addition, they may not be cognitively and emotionally "ready" to make responsible and healthy sexual decisions (e.g., decisions related to consensual and safe sex).[7]

Besides the negative implications of early sexual behaviors for adolescents' sexual health, some studies have suggested that early sexual activity is also associated with suboptimal levels of psychological health.[8-19] One of these studies found a link between early sexual behavior and higher levels of depression.[10] The authors emphasized that, because of the cross-sectional design, both directions would be possible: psychological wellbeing affecting engagement in early sexual behaviors, or engagement in early sexual behaviors affecting psychological wellbeing.[10] For instance, it is possible that youth with higher levels of depression would engage in early sexual behaviors more often, as a strategy to release stress, achieve valued relationships, and enhance positive feelings.[10] In another study, it was indeed argued that engaging in early sexual behaviors could affect psychological wellbeing because, for younger adolescents (i.e., ≤16.0 years), early sexual encounters can be stressful life events.[12]

However, as most previous studies have used a cross-sectional design, they were not able to ascertain the directionally of the associations between early sexual behaviors and psychological wellbeing.[9-11] To the authors' knowledge, so far, only two longitudinal studies have assessed how engagement in early sexual behaviors predicts psychological wellbeing over time.[12, 13] These studies have found that early engagement in sexual behaviors predicted lower self-esteem and higher depression later on.[12, 13] Yet, so far, no longitudinal study has investigated how psychological wellbeing may predict early sexual behaviors. Thus, the first goal of the current study was to assess bidirectional longitudinal associations between adolescents' experience with early sexual behaviors (i.e., ≤16.0 years) and their psychological wellbeing (i.e., global self-esteem, physical self-esteem, and depression). Based on previous studies, we hypothesized that more optimal psychological wellbeing (i.e., higher levels of global and physical self-esteem, and lower levels of depression) would be associated with less engagement in early sexual behaviors over time, and vice versa.[12, 13]

Furthermore, ecological systems theories emphasize that adolescent development, including sexual development, is affected by social contexts, including the family system.[20] In line with these theories, empirical studies have demonstrated that a high-quality relationship between adolescents and their parents—characterized by high levels of warmth, closeness, and support—is related to later sexual behaviors,[21-24] and higher psychological wellbeing (e.g., higher levels of self-esteem).[15] In addition, a literature review has suggested that high-quality relationships with parents may buffer the associations between early sexual activity and psychological wellbeing. This means that among adolescents engaging in early sexual behaviors, those with a higher-quality relationship with their parents may have lower levels of, for instance, depression.[24]

Possible mechanisms by which high-quality relationships with parents may affect adolescents' sexual behaviors and psychological wellbeing may include the provision of positive environments with resources of support, which stimulates a more optimal wellbeing,[24] and responsible sexual decisions, such as engaging in sexual intercourse later.[15, 21] Therefore, the second goal of the current study was to investigate both the direct and moderating (i.e., buffering) effects of parent-adolescent relationship quality on early sexual behavior experience and psychological wellbeing, and the bidirectional associations between them. We hypothesized that these associations (in both directions) would be attenuated for adolescents with a high-quality relationship with their parents, meaning that for those adolescents, less optimal psychological wellbeing would be less strongly associated with early sexual activity, and engaging in early sexual behaviors would be less strongly related to their psychological wellbeing.[15]

Finally, previous studies have suggested that early engagement in sexual behaviors is associated with suboptimal psychological wellbeing for girls, but not for boys.[12-14] This may be because, in general, girls are more sensitive to stressful life events than boys.[14] Further, sexual double standards–in which boys are encouraged to initiate sexual behaviors to prove their masculinity, and are often praised for their sexual activities, while girls often meet sexual restrictions, and are judged negatively for being sexually active–still exist in many western societies.[25] Thus, engaging in early sexual behaviors may be more socially stressful for girls than for boys, affecting girls' psychological wellbeing more.[14] To test this, the third goal of the current study was to investigate gender differences in bidirectional associations between adolescents' sexual behavior experience and their psychological wellbeing. Consistent with previous studies, we hypothesized that these associations (in both directions) would be stronger for girls than for boys.[12-14]

Methods

Data for the present study were collected as part of Project STARS (Studies on Trajectories of Adolescent Relationships and Sexuality), a large-scale longitudinal study on adolescent sexual development, conducted in the Netherlands between 2010 and 2015. We used data from all four waves, collected among a school-based sample of 1,297 10-19-year-old adolescents, with six-month intervals between measurements (T1=Fall 2011, T2=Spring 2012, T3=Fall 2012, T4=Spring 2013). Participants were recruited from four secondary and eight elementary schools throughout the country. Adolescents and their parents received letters, brochures, and flyers describing the aims of the study. Parents received a form on which they could indicate if they did not want their child to participate in the study (i.e., passive informed consent).[26] Less than 7.0% of the approached adolescents decided not to participate or were not allowed to take part in the study by their parents. Data collection was supervised by researchers in order to introduce the study and the procedure, answer questions, and ensure maximum privacy. The questionnaires were completed on a voluntary basis, and confidentiality of the responses was guaranteed, as was the option to withdraw participation at any time. Adolescents completed online questionnaires in the classroom. After participation, adolescents received a book gift certificate (€5,00 at T1–€12,50 at T4). To curtail the length of the questionnaire and to minimize potential data loss due to weariness, at T1 and T2, the number of items was reduced for several scales with the use of a planned missing design.[27] Project STARS was approved by the ethics board of Utrecht University in the Netherlands.

Study Sample

For our prospective analysis sample, we selected only secondary school students (n=1,132), as the questionnaire for elementary school students (n=165) did not include all investigated instruments. Further, to be able to investigate adolescents' experiences with early sexual behaviors, we selected only adolescents ≤16.0 years old at all four waves (n=400 excluded). Moreover, there were some inconsistencies in adolescents' reports of their sexual behaviors (n=44). In some cases (n=28), corrections were possible, for instance when adolescents reported experience with sexual behaviors in all four waves, but the total number of sexual behaviors varied across waves (e.g., reporting experience with two sexual behaviors at T1, three sexual behaviors at T2 and at T4, but only one sexual behavior at T3). In such cases, we replaced the "inconsistent" value by the most conservative value (in the given example, we replaced the value of "1" at T3 by "3"). However, we did not have sufficient information to correct all inconsistencies (n=16 excluded). This resulted in a final prospective analysis sample of 716 adolescents

aged 11.0 to 16.0 years across all four waves (mean at T1=13.3 years, SD=0.57, and mean age at T4=14.8 years, SD=0.57).

Measures

Sexual Experience. To assess adolescents' experiences with sexual behaviors, participants were asked: "Have you ever had sex with another person? With sex we mean everything from touching and caressing to intercourse" (0=no, 1=yes).[22] Participants who answered "yes" subsequently reported on their experience with four non-coital and coital sexual behaviors: 1) naked touching or caressing (0=no, 1=yes); 2) manual sex (0=no, 1=yes); 3) oral sex (0=no, 1=yes), and 4) vaginal intercourse (0=no, 1=yes). The scores on the four items were summed into one variable, indicating the level of adolescents' experience with these four behaviors (0=experience with no sexual behavior, 4=experience with all sexual behaviors).[22] Cronbach's alphas varied from .82 (minimum) to .91 (maximum) across T1-T4, indicating a good internal consistency of the item-relations. A higher scale score indicated a higher level of experience with various sexual behaviors.

Global Self-Esteem. Adolescents' global self-esteem was assessed with an adapted version of the validated Harter's Self-Perception Profile for Adolescents (SPPA).[15, 28, 29] This instrument consisted of five items with a 5-scale response (e.g., "I'm often disappointed with myself"; 1=completely not true, 5=completely true). For this scale, a planned missingness (PM) design was implemented at T1 and T2: Participants were randomly assigned to three groups that completed a different combination of three items from the original 5-item scale (e.g., one core item and two randomly selected items). After negative items were reversed, average scale scores were computed based on the three items completed by each participant (α's varied from .77 to .78). Higher scale scores meant higher levels of global self-esteem.

Physical Self-Esteem. Adolescents' physical self-esteem was also assessed with the adapted version of Harter's SPPA, also consisting of five items with a 5-scale response (e.g., "I'm pretty happy with my appearance"; 1=completely not true, 5=completely true).[28, 29] Physical self-esteem was operationalized in the same way as global self-esteem (α's varied from .78 to .84). Higher scale scores indicated higher levels of physical self-esteem.

Depression. Adolescents' depression was measured using the Depressive Mood List (DML),[30, 31] including six items with a 5-scale response (e.g., "I often feel too tired to do things"; 0=never, 4=always). Depression was operationalized in the same way as the other psychological wellbeing measures (α's varied from .71 to .74). Higher average scale scores indicated higher levels of depression.

Parent-Adolescent Relationship Quality. The overall quality of adolescents' relationship with their parents was assessed at T1 with the Network of Relationship Inventory (NRI).[22, 23] Two subscales were used (Satisfaction and Conflict), consisting of

three items each (Satisfaction example-item: "How satisfied are you with the relationship with your mother/father?", Conflict example-item: "How much do you and your mother/father argue with each other?"; 1=none, 6=the most). Adolescents answered the items either for their mother or their father, based on their selection of who spent most time with them and had most caring tasks for them (most selected their mothers: 87.6%). After reversing the items for the Conflict subscale, the six items were averaged into one parent-adolescent relationship-score (α=.83 at T1). A higher mean score reflected a higher overall relationship quality.

Data Analysis

Missing value analysis indicated that, among the final analysis sample, there were no missing values for age, gender, educational level, and ethnic background. However, some T1-values were missing for family structure (5.8%), parent-adolescent relationship quality (7.6%), and sexual behaviors (6.1%). Among the psychological wellbeing indicators, there were two types of missing values: 1) non-planned, in which missingness was due to absence, and 2) planned, in which missingness was due to the planned missingness design. The non-planned missingness at T1 (i.e., 5.7% for global self-esteem, physical self-esteem, and depression) was completely at random (MCAR). The planned missingness at T1 was MCAR for all items, except for global self-esteem; percentages were: 36.0-70.0% for global self-esteem, 57.8-70.0% for physical self-esteem, and 38.5-70.1% for depression. All missing values at T1 were imputed using multiple imputation (across five sets), which is considered preferable over listwise deletion, even when values are not MCAR.[33] Missing values in the T2-T4 outcome-variables (global self-esteem, physical self-esteem, depression, and sexual behaviors) were dealt with in the main analyses.

Chi-square tests and one-way ANOVA tests were performed to assess gender differences in key variables. Longitudinal bidirectional associations between adolescents' experience with early sexual behaviors and their psychological wellbeing were investigated by linear mixed-effects model (LMM) analyses, which were conducted in two steps. First, we assessed bidirectional associations for the total sample in four models, reflecting the four outcomes (i.e., global self-esteem, physical self-esteem, depression, and sexual behaviors, respectively). Initially, we tested models containing only socio-demographics: gender, age, educational level, ethnic background (Crude Models 1-4). After this, we tested models by adding family variables: family structure, and parent-adolescent relationship quality (Basic Models 1-4). Finally, we tested the full models, by adding the main predictor(s): either early sexual behaviors (Full Models 1-3), or the three indicators of psychological wellbeing (Full Model 4). Second, we tested interaction effects by adding all interaction terms simultaneously to the Full Models. We tested interaction effects between relationship quality at T1 and the four main predictors (i.e., global self-esteem, physical self-esteem, depression, and sexual behaviors, respectively)

at T1 to assess whether the associations between early sexual behaviors and psychological wellbeing differed across low- or high- quality relationships with parents. We also tested gender-interaction effects to assess whether the associations between adolescents' experience with early sexual behaviors and their psychological wellbeing differed for boys and girls. In case of a significant interaction effect, we re-ran the Full Model separately for adolescents with a low- or high-quality parent-adolescent relationship (i.e., M±1SD), or separately for boys and girls.

Below, we report the pooled LLM results (across the five multiple imputation datasets). These typically only yield unstandardized regression coefficients, however, standardized regression coefficients were obtained by standardizing all variables before the LLM analyses. A significance level of $p<.05$ was used to indicate significant effects. All analyses were performed using the SPSS, version 21.

Results

Analysis Sample Characteristics

At T1, 13 adolescents (1.8 %) were sexually experienced: 7 boys and 6 girls, all older than 13.3 years, which was the mean age at T1. Specifically, these 13 adolescents were 13.3–14.4 years (mean=13.7 years). At T4, 94 adolescents (13.3 %), 50 boys and 44 girls, were sexually experienced. Thus, 81 adolescents (11.5 %), 43 boys and 38 girls, became sexually experienced between T1 and T4. Additional characteristics of the analysis sample at T1, and differences between boys and girls can be seen in Tables 1-3. At all four time points, gender similarity was found in experience with sexual behaviors and parent-adolescent relationship quality. However, boys had significantly more optimal levels of psychological wellbeing than girls: at all four time points, boys reported significantly higher levels of global and physical self-esteem, and at T2-T4 boys also reported significantly lower levels of depression than girls.

Bidirectional Associations Between Adolescents' Sexual Behaviors and Psychological Wellbeing

Table 4 shows that early sexual behaviors at T1 did not significantly predict changes over time in any of the psychological wellbeing indicators. This was the case for both boys and girls, as shown by the non-significant gender-interaction effects (Supplement Table 1). Although a higher-quality parent-adolescent relationship at T1 significantly predicted more optimal levels of all three indicators of adolescents' psychological wellbeing, non-significant moderation effects of parent-adolescent relationship quality (Supplement Table 1) indicated that the associations between early sexual behaviors and

psychological wellbeing did not differ across low- or high- quality relationships with parents.

Similarly, Table 5 shows that none of the psychological wellbeing indicators at T1 significantly predicted changes over time in adolescents' experience with early sexual behaviors. Again, no significant moderation effects were found, neither of parent-adolescent relationship quality, nor of gender, (Supplement Table 2) indicating that, the associations between psychological wellbeing and early sexual behaviors did not differ significantly across low- or high- quality relationships with parents or between boys and girls. Analyses of the bidirectional associations between early sexual behaviors and psychological wellbeing were repeated among the total sample of secondary school students by including also adolescents aged 16.1-18.8 years old, to examine the robustness of our results. These sensitivity analyses (data not presented) showed similar results to the original ones, indicating that our original results were robust.

Discussion

In the current study, we assessed longitudinal bidirectional associations between adolescents' experience with early sexual behaviors (i.e., ≤16.0 years) and their psychological wellbeing. Contrasting our hypotheses and previous findings,[10, 12, 13, 19] our results revealed that early sexual behaviors and psychological wellbeing were not associated over time, in either direction. Below, we discuss three possible explanations for our findings.

First, due to the relatively young study sample (mean age at T1=13.3 years), only 13 adolescents (1.8%) in our analysis sample reported experience with sexual behaviors at T1. Thus, our results may have been driven by a limited variation in adolescents' sexual behaviors. However, sensitivity analyses, in which we have repeated the bidirectional associations between early sexual behaviors and psychological wellbeing among the total sample of adolescents by also including 16.1-18.8 years old, showed similar results, indicating that our original results were robust.

Second, the current study included a comprehensive measure of sexual behavior, ranging from touching and caressing to sexual intercourse. Although this better reflects adolescents' sexual behavior trajectories than one item about sexual intercourse,[5] it may be that "lower-risk" sexual behaviors, such as caressing, are less strongly related to psychological wellbeing than for instance intercourse, at this stage of adolescence.

Third, previous studies, demonstrating associations between adolescents' experiences with early sexual behaviors at baseline and suboptimal psychological wellbeing at follow-up, were conducted in the United States,[12-14] whereas the current study was conducted in the Netherlands. Thus, another possible explanation for our results, which

show no associations between adolescents' early sexual behaviors and their psychological wellbeing, may be related to socio-cultural aspects.[34-37] Generally, American society tends to be characterized by a relative disapproval of adolescent sexual behaviors, whereas Dutch society is characterized by more normalization of sexual behaviors in this life stage. For example, a comparative study among parents has revealed that American parents generally believed that engagement in sexual behaviors of 16.0-years-old adolescents should be prohibited, whereas Dutch parents commonly accepted these behaviors when occurring within contexts of intimate relationships.[34] It is possible that parental (dis)approval of adolescents' sexual behaviors, as well as reasons and contexts in which they occur, such as age and (non)intimate relationships, may contribute to different linkages with psychological wellbeing.

Another example relates to public health policies and practices. In the United States, there are schools that support abstinence-until-marriage programs, whereas in the Netherlands, all schools are required by law to provide comprehensive sexuality education.[36, 37] Because of these differences in educational policies and practices, and in socio-cultural environments of (dis)approval by which adolescent sexuality is seen, the experience of early sexual behaviors among Dutch adolescents may not be related to lower levels of psychological wellbeing as it may among American adolescents. More studies are needed to improve our understanding of how socio-cultural determinants within and across countries play a role in adolescent sexuality and wellbeing, and interlinkages between these two, across adolescent development. Relevant directions for future studies encompass the investigation of parental attitudes toward youth sexuality, the type of sexuality education provided in schools, and gender-related issues, such as the prevalence of sexual double standards, and perceptions of masculinity/feminity.[36-38]

Further, countering our hypothesis,[15, 21-23] we found that the links between early sexual behaviors and psychological wellbeing were non-significant, in either direction, regardless of the quality of adolescents' relationship with their parents. Thus, no evidence was found for a buffering effect of parent-adolescent relationship quality on these bidirectional associations. However, although higher-quality relationships were not linked with early sexual behaviors, we found a direct protective effect of a higher-quality parent-adolescent relationship at T1 on all three indicators of psychological wellbeing over time. This is consistent with socio-ecological theories,[20] and previous empirical findings,[15] and emphasizes the importance of a warm, close, and supportive relationships between adolescents and their parents for adolescents' psychological wellbeing.[39]

Finally, in contrast with our hypothesis,[12-14] our findings showed no differences between boys and girls. This, too, may be related to socio-cultural characteristics of the Netherlands, such as the relative normalization of adolescent sexual behaviors by Dutch parents,[34] and possible lower prevalence of sexual double standards,[35] which may explain

the gender similarity in the non-linkages between adolescents' early sexual behaviors and their psychological wellbeing.

Strengths and Limitations

Major strengths of our study included the longitudinal design that allowed us to investigate whether adolescents' engagement in early sexual behaviors was associated with their psychological wellbeing over time, and vice versa. Moreover, in line with the literature, we also assessed the moderating effects of parent-adolescent relationship quality and gender in the aforementioned associations, which allowed us to understand better for whom these associations existed (i.e., for all adolescents, or for subgroups). However, our study also has several limitations. First, adolescents were followed for an 18-month period. It may be that effects of early engagement in sexual behaviors on psychological wellbeing or other developmental outcomes can be observed later in life. Future studies on adolescent sexual development may increase the follow-up time, reflecting a life course approach. Second, our analysis sample consisted mostly of native-Dutch adolescents, which hampers generalizability of our results to adolescents with different ethnic backgrounds. Finally, only self-report measures were included, which may have led to socially desirable answers.[40] However, the longitudinal design of our study allowed us check the over-time validity of adolescents' reports on their experience with sexual behaviors, after which we could exclude adolescents who reported inconsistently over time.

Conclusions

In the current study, early sexual activity in and of itself was not related to lower psychological wellbeing over time. But the types of sexual behaviors that young adolescents engage in, their cognitive and emotional evaluation of these experiences, and the relational contexts in which they take place are important to investigate further, and may prove to be particularly important factors to focus on for educators, health care professionals, and parents.[7]

Table 1: Descriptive Characteristics of the Prospective Analysis Sample and Gender Differences at T1

	Boys (n=358)			Girls (n=358)			
	n	%	Mean (SD)	n	%	Mean (SD)	p[a]
Age							
11–16 years			13.3 (0.58)			13.3 (0.57)	.897
Educational Level [b]							
Low	150	41.9		126	35.2		**.039**
High	208	58.1		232	64.8		
Ethnic background [c]							
Native Dutch	316	88.3		316	88.3		.546
Non-Native Dutch	42	11.7		42	11.7		
Sexual Identity [d]							
Heterosexual	292	98.3		307	99.7		.092
LGB	5	1.7		1	0.3		
Family Structure [e]							
Living with both biological parents	251	74.7		266	78.5		.144
Not living with both biological parents	85	25.3		73	21.5		
Relationship Quality							
1–6			4.65 (0.65)			4.73 (0.68)	.139
Global Self-Esteem							
1–5			4.24 (0.76)			3.91 (0.94)	**< .001**
Physical Self-Esteem							
1–5			3.67 (0.86)			3.20 (0.93)	**< .001**
Depression							
1–5			2.20 (0.71)			2.28 (0.77)	.173
Sexual Behaviors							
0–4			0.03 (0.23)			0.03 (0.25)	.992

[a] Significance level of differences in characteristics measured at T1 between boys and girls by Chi-Square tests (categorical variables) and One-way ANOVA tests (continuous variables). Bold print indicates statistical significance: $^{*}p<.05$ $^{**}p<.01$ $^{***}p<.001$.

[b] Low educational level=pre-vocational education. High educational level=senior general education and pre-university education.

[c] Native Dutch=adolescent and both parents born in the Netherlands. Non-Native Dutch=adolescent or at least one parent was not born in the Netherlands.

[d] Sexual Identity=assessed how adolescents described themselves: Heterosexual=boys attracted to girls, and girls attracted to boys. LGB=Lesbian (girls attracted to girls), Gay (boys attracted to boys), or Bisexual (attracted to both boys and girls).

[e] Family Structure=assessed whether adolescents lived with both biological parents or not. This variable was dichotomized: 0=Living with both biological parents or 1=Not living with both biological parents.

Table 2: Adolescents' Reported Experiences with Sexual Behaviors at Each Measurement Occasion (T1–T4)

	T1		T2		T3		T4	
	n	%	n	%	n	%	n	%
Boys (n=358)								
No experience with any sexual behaviors	328	97.9	325	95.9	321	92.8	307	86.0
Experience with								
Naked touching or caressing	7	2.1	8	2.4	22	6.4	43	12.0
Manual sex	3	0.9	9	2.7	20	5.8	40	11.2
Oral sex	1	0.3	8	2.4	13	3.8	25	7.0
Vaginal sexual intercourse	1	0.3	5	1.5	12	3.5	26	7.3
Total experience with sexual behaviors [a]	12	3.6	30	9.0	67	19.5	134	37.5
Girls (n=358)								
No experience with sexual behaviors	331	98.2	328	96.2	322	92.5	313	87.7
Experience with								
Naked touching or caressing	4	1.2	9	2.6	23	6.6	42	11.8
Manual sex	4	1.2	12	3.5	23	6.6	38	10.6
Oral sex	3	0.9	6	1.8	13	3.7	21	5.9
Vaginal sexual intercourse	2	0.6	5	1.5	9	2.6	21	5.9
Total experience with sexual behaviors [a]	13	3.9	32	9.4	68	19.5	122	34.2

[a] These numbers and percentages do not add up to the total number of participants who reported experience with one or more sexual behaviors, because some adolescents had experience with more than one sexual behavior.

Table 3: Sexual Behaviors, Psychological Wellbeing, and Parent-Adolescent Relationship Quality at T2-T4, for Boys and Girls

	Boys (n=358)		Girls (n=358)			
	Mean	SD	Mean	SD	F[a]	df_1, df_2
Sexual Behaviors						
T2	0.08	0.42	0.08	0.44	0.00	1, 678
T3	0.17	0.69	0.17	0.69	0.08	1, 692
T4	0.38	1.04	0.34	0.98	0.19	1, 712
Global Self-Esteem						
T2	4.23	0.78	3.74	0.99	**49.38*****	1, 670
T3	4.23	0.71	3.83	0.89	**44.06*****	1, 693
T4	4.16	0.76	3.76	0.89	**42.46*****	1, 714
Physical Self-Esteem						
T2	3.69	0.92	3.15	0.98	**54.75*****	1, 670
T3	3.79	0.83	3.23	0.97	**67.32*****	1, 685
T4	3.79	0.82	3.19	0.96	**78.59*****	1, 707
Depression						
T2	2.15	0.81	2.44	0.84	**20.86*****	1, 670
T3	2.16	0.71	2.41	0.73	**21.28*****	1, 684
T4	2.26	0.76	2.50	0.76	**18.35*****	1, 707
Relationship Quality						
T2	4.65	0.65	4.61	0.75	0.55	1, 676
T3	4.64	0.68	4.61	0.74	0.31	1, 693
T4	4.52	0.71	4.57	0.74	0.65	1, 714

[a] Significance level of differences in characteristics measured at T2-T4 between boys and girls by One-way ANOVA tests. Bold prints indicate statistical significance: $^{*}p<.05$ $^{**}p<.01$ $^{***}p<.001$.

Table 4: Linear Mixed Model Results of Experience with Sexual Behaviors at T1 Predicting Psychological Wellbeing Over Time (Waves 1-4)

	Crude Model 1: Global Self-Esteem		Basic Model 1: Global Self-Esteem		Full Model 1: Global Self-Esteem	
	B (SE)	*β*	B (SE)	*β*	B (SE)	*β*
Socio-demographics						
Gender (0=Girls)	**0.40 (.06)**	**0.47*****	**0.42 (.05)**	**0.49*****	**0.43 (.05)**	**0.50*****
Age	0.07 (.04)	0.05	**0.09 (.04)**	**0.06***	**0.09 (.05)**	**0.06***
Educational Level (0=High)	0.01 (.05)	0.01	0.04 (.05)	0.05	0.04 (.05)	0.05
Ethnic background (0=Non-native Dutch)	**0.21 (.08)**	**0.24****	**0.19 (.08)**	**0.22*****	**0.19 (.08)**	**0.22***
Family environment						
Family Structure (0=Not living with both biological parents)			**0.14 (.06)**	**0.16***	0.12 (.06)	0.14
Relationship Quality			**0.21 (.04)**	**0.16*****	**0.22 (.04)**	**0.17*****
T1 Predictors						
Sexual Behaviors					-0.06 (.17)	-0.01
Sexual Behaviors × Time					-0.01 (.04)	-0.00
	Crude Model 2: Physical Self-Esteem		Basic Model 2: Physical Self-Esteem		Full Model 2: Physical Self-Esteem	
	B (SE)	*β*	B (SE)	*β*	B (SE)	*β*
Socio-demographics						
Gender (0=Girls)	**0.55 (.06)**	**0.59*****	**0.56 (.06)**	**0.60*****	**0.57 (.06)**	**0.60*****
Age	0.05 (.05)	0.03	0.06 (.05)	0.04	0.07 (.05)	0.04
Educational Level (0=High)	-0.01 (.06)	-0.02	0.00 (.06)	0.00	0.01 (.06)	0.01
Ethnic background (0=Non-native Dutch)	**0.20 (.09)**	**0.21***	**0.19 (.09)**	**0.20***	**0.18 (.09)**	**0.20***
Family environment						
Family Structure (0=Not living with both biological parents)			0.07 (.07)	0.08	0.10 (.07)	0.10
Relationship Quality			**0.11 (.04)**	**0.08***	**0.12 (.04)**	**0.10***
T1 Predictors						
Sexual Behaviors					-0.02 (.17)	-0.00
Sexual Behaviors × Time					-0.00 (.04)	-0.01

Table 4: Linear Mixed Model Results of Experience with Sexual Behaviors at T1 Predicting Psychological Wellbeing Over Time (Waves 1-4) (*continued*)

	Crude Model 3: Depression		Basic Model 3: Depression		Full Model 3: Depression	
	B (SE)	*β*	B (SE)	*β*	B (SE)	*β*
Socio-demographics						
Gender (0=Girls)	**-0.22 (.04)**	**-0.28*****	**-0.24 (.05)**	**-0.31*****	**-0.24 (.04)**	**-0.31*****
Age	-0.00 (.04)	-0.00	-0.01 (.04)	-0.1	-0.02 (.04)	-0.02
Educational Level (0=High)	-0.01 (.04)	-0.01	-0.04 (.05)	-0.05	-0.04 (.04)	-0.06
Ethnic background (0=Non-native Dutch)	**-0.15 (.06)**	**-0.18***	-0.12 (.07)	-0.16	-0.12 (.06)	-0.16
Family environment						
Family Structure (0=Not living with both biological parents)			**-0.10 (.05)**	**-0.14***	-0.11 (.06)	-0.15
Relationship Quality			**-0.22 (.04)**	**-0.18*****	**-0.22 (.04)**	**-0.19****
T1 Predictors						
Sexual Behaviors					0.26 (.15)	0.08
Sexual Behaviors × Time					-0.06 (.04)	-0.02

Notes: Bold prints indicate statistical significance: *p<.05 **p<.01 ***p<.001. Reference groups are equal to zero. B=unstandardized regression coefficients. SE=standard error. β=standardized regression coefficient.

Table 5: Linear Mixed Model Results of Psychological Wellbeing at T1 Predicting Experience with Sexual Behaviors Over Time (Waves 1-4)

	Crude Model 4: Sexual Behaviors		Basic Model 4: Sexual Behaviors		Full Model 4: Sexual Behaviors	
	B (SE)	β	B (SE)	β	B (SE)	β
Socio-demographics						
Gender (0=Girls)	0.00 (.02)	0.02	0.04 (.05)	0.05	0.01 (.02)	0.09
Age	**0.06 (.02)**	**0.15*****	**0.36 (.02)**	**0.39*****	**0.06 (.02)**	**0.39*****
Educational Level (0=High)	**0.06 (.02)**	**0.20****	**0.18 (.05)**	**0.44*****	**0.05 (.02)**	**0.44****
Ethnic background (0=Non-native Dutch)	-0.01 (.03)	-0.11	-0.10 (.07)	-0.24	-0.01 (.03)	-0.10
Family environment						
Family Structure (0=Not living with both biological parents)			**-0.04 (.02)**	**-0.22***	**-0.02 (.02)**	**-0.22***
Relationship Quality			-0.03 (.02)	-0.10	-0.02 (.02)	-0.06
T1 Predictors						
Global Self-Esteem					0.04 (.02)	0.06
Global Self-Esteem × Time					-0.02 (.01)	-0.02
Physical Self-Esteem					-0.00 (.01)	-0.05
Physical Self-Esteem × Time					-0.01 (.01)	-0.00
Depression					0.03 (.02)	0.08
Depression × Time					-0.01 (.01)	-0.01

Notes: Bold prints indicate statistical significance: *p<.05 **p<.01 ***p<.001. Reference groups are equal to zero. B=unstandardized regression coefficients. SE=standard error. β=standardized regression coefficient.

References

1. Heywood W, Patrick K, Smith A A and Pitts M. Associations Between Early First Sexual Intercourse and Later Sexual and Reproductive Outcomes: A Systematic Review of Population-Based Data. Arch Sex Behav; 2014:1-39
2. WHO. Adolescents and Youths. Geneva, Switzerland. World Health Organization (WHO); 2012:3-27
3. Sandfort T G, Orr M, Hirsch J S and Santelli J. Long-term health correlates of timing of sexual debut: results from a national US study. Am J Public Health 2008; 98:155-61
4. Wellings K, Nanchahal K, Macdowall W, McManus S, Erens B, Mercer C H, Johnson A M, Copas A J, Korovessis C, Fenton K A and Field J. Sexual behaviour in Britain: early heterosexual experience. Lancet 2001; 358:1843-50
5. De Graaf H, Kruijer H and Van Acker J M, S. Sex onder je 25e. Seksuele gezondheid van jongeren in Nederland anno 2012. [Sex under 25. Sexual health of Dutch youth in 2012.] Delft: Uitgeverij Eburon
6. Hensel D J, Selby S, Tanner A E and Fortenberry J D. A Daily Diary Analysis of Condom Breakage and Slippage During Vaginal Sex or Anal Sex Among Adolescent. Women Sexually Transmitted Diseases 2016; 43:531-6
7. Van de Bongardt D, Yu R, Deković M and Meeus W H J. Romantic relationships and sexuality in adolescence and young adulthood: The role of parents, peers, and partners. European Journal of Developmental Psychology 2015; 12:497-515
8. Kowaleski-Jones L and Mott F L. Sex, Contraception and Childbearing Among High-Risk Youth: Do Different Factors Influence Males and Females? Family Planning Perspectives 1998; 30:163-9
9. Rubin A G, Gold M A and Primack B A. Associations Between Depressive Symptoms and Sexual Risk Behavior in a Diverse Sample of Female Adolescents. Journal of Pediatric and Adolescent Gynecology 2009; 22:306-12
10. Brawner B M, Gomes M M, Jemmott L S, Deatrick J A and Coleman C L. Clinical depression and HIV risk-related sexual behaviors among African American adolescent females: Unmasking the numbers. AIDS care 2012; 24:618-25
11. Rivera-Rivera L, Leyva-López A, García-Guerra A, de Castro F, González-Hernández D and de los Santos L M. Inicio de relaciones sexuales con penetración y factores asociados en chicos y chicas de México de 14-19 años de edad con escolarización en centros públicos. Gaceta Sanitaria 2016; 30:24-30
12. Meier A M. Adolescent First Sex and Subsequent Mental Health. American Journal of Sociology 2007; 112:1811-47
13. Sabia J J and Rees D I. The effect of adolescent virginity status on psychological well-being. Journal of Health Economics 2008; 27:1368-81

14. Hallfors D D, Waller M W, Bauer D, Ford C A and Halpern C T. Which Comes First in Adolescence—Sex and Drugs or Depression? American Journal of Preventive Medicine 2005; 29:163-70
15. Van de Bongardt D, Reitz E and Dekovic M. Indirect Over-Time Relations Between Parenting and Adolescents' Sexual Behaviors and Emotions Through Global-Self-Esteem. J Sex Res 2015; 53:273-85
16. Udell W, Sandfort T, Reitz E, Bos H and Dekovic M. The Relationship Between Early Sexual Debut and Psychosocial Outcomes: A Longitudinal Study of Dutch Adolescents. Arch Sex Behav 2010; 39:1133-45
17. Longmore M A, Manning W D, Giordano P C and Rudolph J L. Self-Esteem, Depressive Symptoms, and Adolescents' Sexual Onset. Social Psychology Quarterly 2004; 67:279-95
18. Kastbom A A, Sydsjo G, Bladh M, Priebe G and Svedin C G. Sexual debut before the age of 14 leads to poorer psychosocial health and risky behaviour in later life. Acta Paediatr 2015; 104:91-100
19. Lehrer J A, Shrier L A, Gortmaker S and Buka S. Depressive Symptoms as a Longitudinal Predictor of Sexual Risk Behaviors Among US Middle and High School Students. Pediatrics 2006:118-189
20. Bronfenbrenner U and Ceci S J. Nature-nurture reconceptualized in developmental perspective: a bioecological model. Psychol Rev 1994; 101:568-86
21. Nogueira Avelar e Silva R, Van de Bongardt D, Van de Looij-Jansen P, Wijtzes A and Raat H. Mother– and Father–Adolescent Relationships and Early Sexual Intercourse. Pediatrics 2016; 138(6):1-9
22. Van de Bongardt D, De Graaf H, Reitz E and Dekovic M. Parents as moderators of longitudinal associations between sexual peer norms and Dutch adolescents' sexual initiation and intention. J Adolesc Health 2014; 55:388-93
23. De Graaf H, Vanwesenbeeck I, Woertman L and Meeus W. Parenting and adolescents' sexual development in western societies: A literature review. European Psychologist 2011; 16:21-31
24. Markham C M, Lormand D, Gloppen K M, Peskin M F, Flores B, Low B and House L D. Connectedness as a predictor of sexual and reproductive health outcomes for youth. J Adolesc Health 2010; 46:23-41
25. Kreager D A and Staff J. The Sexual Double Standard and Adolescent Peer Acceptance Social. Psychology Quarterly 2009; 72:143-64
26. Ruiz-Canela M, Burgo C L-d, Carlos S, Calatrava M, Beltramo C, Osorio A and de Irala J. Observational research with adolescents: a framework for the management of the parental permission. *BMC Medical Ethics* 2013; 14:1-9
27. Graham J W, Taylor B J, Olchowski A E and Cumsille P E. Planned missing data designs in psychological research. Psychological Methods 2006; 11:323-43

28. Harter S. Self-Perception Profile for Adolescents: Manual and Questionnaires. Denver University of Denver 2012
29. Wichstraum L. Harter's Self-Perception Profile for Adolescents: Reliability, Validity, and Evaluation of the Question Format. Journal of Personality Assessment 1995; 65:100-16.
30. Kandel D B and Davies M. Epidemiology of depressive mood in adolescents: An empirical study. Archives of General Psychiatry 1982; 39:1205-12
31. Zhang S, Baams L, van de Bongardt D and Dubas J S Intra- and Inter-Individual Differences in Adolescent Depressive Mood: the Role of Relationships with Parents and Friends Journal of Abnormal Child Psychology 2017
32. Furman W and Buhrmester D. Methods and Measures: The Network of Relationships Inventory: Behavioral Systems Version. International Journal of Behavioral Development 2009; 33:470-8
33. Sterne J A C, White I R, Carlin J B, Spratt M, Royston P, Kenward M G, Wood A M and Carpenter J R. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. BMJ 2009:338
34. Schalet A T. Not under my roof: Parents, teens, and the culture of sex. Chicago, IL: University of Chicago Press 2011
35. Dodge B, Sandfort T G M, Yarber W L and de Wit J. Sexual Health Among Male College Students in the United States and the Netherlands. American Journal of Health Behavior 2005; 29:172-82
36. Weaver H, Smith G and Kippax S. School-based sex education policies and indicators of sexual health among young people: a comparison of the Netherlands, France, Australia and the United States *Sex Education* 2005; 5:171-88
37. Van de Bongardt D, Bos H M W and Mouthaan I. Sexual and relational education practices in the Netherlands: Evidence of a discourse of erotics? Society for International Education Journal 2013; 7:76-103
38. Margaret E. Greene, Zohra Rasekh and Amen KA. In this Generation: Sexual and Reproductive Health Policies for a Youthful World. Washington, D.C., USA: Population Action International 2002
39. Bulanda R E and Majumdar D. Perceived Parent–Child Relations and Adolescent Self-Esteem. Journal of Child and Family Studies 2009; 18:203-12
40. Brener N D, Billy J O G and Grady W R. Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: evidence from the scientific literature. Journal of Adolescent Health 2003; 33:436-57

Supplement Table 1: Linear Mixed Model Results of Experience with Sexual Behaviors at T1 Predicting Psychological Wellbeing Over Time (Waves 1-4): Models with Interaction Effects of Gender, and Relationship Quality

	Full Model 1: Global Self-Esteem		Full Model 2: Physical Self-Esteem		Full Model 3: Depression	
	B (SE)	*β*	B (SE)	*β*	B (SE)	*β*
Socio-demographics						
Gender (0=Girls)	**0.43 (.05)**	**0.50*****	**0.56 (.06)**	**0.60*****	**-0.24 (.04)**	**-0.31*****
Age	**0.09 (.05)**	**0.06***	0.07 (.05)	0.03	-0.02 (.03)	-0.02
Educational Level (0=High)	0.04 (.05)	0.05	0.01 (.06)	0.01	-0.05 (.04)	-0.06
Ethnic background (0=Non-native Dutch)	**0.20 (.08)**	**0.23***	**0.19 (.09)**	**0.20***	-0.13 (.07)	-0.16
Family Environment						
Family Structure (0=Not living with both biological parents)	0.12 (.07)	0.14	0.09 (.06)	0.09	**-0.12 (.06)**	**-0.15***
Relationship Quality	**0.24 (.04)**	**0.18*****	**0.14 (.05)**	**0.08****	**-0.22 (.04)**	**-0.20*****
T1 Predictors						
Sexual Behaviors × Time	-0.01 (.04)	-0.00	-0.02 (.04)	-0.00	-0.06 (.04)	-0.02
Interaction Effects						
Relationship Quality × Sexual Behaviors	-0.20 (.11)	-0.03	-0.12 (.14)	-0.02	0.18 (.10)	0.03
Gender × Sexual Behaviors	0.09 (.20)	0.03	0.13 (.20)	0.06	-0.02 (.17)	-0.01

Notes: Bold prints indicate statistical significance: *p<.05 **p<.01 ***p<.001. Reference groups are equal to 0. B=unstandardized regression coefficients. SE=standard error. β=standardized regression coefficients.

Supplement Table 2: Linear Mixed Model Results of Psychological Wellbeing at T1 Predicting Experience with Sexual Behaviors Across Waves 1-4: Model with Interaction Effects of Gender, and Relationship Quality

	Full Model 4: Sexual Behaviors	
	B (SE)	*β*
Socio-demographics		
Gender (0=Girls)	0.01 (.02)	0.01
Age	**0.06 (.02)**	**0.14*****
Educational Level (0=High)	**0.05 (.02)**	**0.19****
Ethnic background (0=Non-native Dutch)	-0.01 (.03)	-0.10
Family Environment		
Family Structure (0=Not living with both biological parents)	-0.02 (.02)	-0.06
Relationship Quality	-0.02 (.02)	-0.06
T1 Predictors		
Global Self-Esteem × Time	-0.02 (.01)	-0.02
Physical Self-Esteem × Time	-0.01 (.01)	-0.00
Depression × Time	-0.01 (.01)	-0.01
Interaction Effects		
Relationship Quality × Global Self-Esteem	0.01 (.05)	0.01
Relationship Quality × Physical Self-Esteem	0.02 (.05)	0.02
Relationship Quality × Depression	-0.04 (.04)	-0.04
Gender × Global Self-Esteem	0.01 (.08)	0.01
Gender × Physical Self-Esteem	0.08 (.07)	0.08
Gender × Depression	-0.00 (.09)	-0.00

Notes: Bold prints indicate statistical significance: *p<.05 **p<.01 ***p<.001. Reference groups are equal to 0. B=unstandardized regression
coefficients. SE=standard error. β=standardized regression coefficient

Chapter 4

Mother– and Father–Adolescent Relationships and Early Sexual Intercourse

Raquel Nogueira Avelar e Silva,[1] Daphne van de Bongardt,[2] Petra van de Looij-Jansen,[3] Anne Wijtzes,[1] Hein Raat.[1]

1. Department of Public Health, Erasmus Medical Center, Erasmus University Rotterdam, Rotterdam, the Netherlands.
2. Department of Psychology, Education and Child Studies, Erasmus University Rotterdam.
3. Department of Research and Business Intelligence, Municipality of Rotterdam, Rotterdam, the Netherlands

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Abstract

Objectives

To assess the prospective associations between mother-adolescent and father-adolescent relationship quality and early sexual intercourse initiation (i.e., ≤16 years) among a large sample of Dutch adolescents.

Methods

Two waves of data from the Rotterdam Youth Monitor, a longitudinal study in the Netherlands, were used. The analysis sample consisted of 2,931 adolescents aged 12-16 years ($M_{age\text{-}T1}$=12.5 years, SD=0.61; $M_{age\text{-}T2}$=14.3 years, SD=0.60). Variables were assessed by means of self-report questionnaires. Prospective associations between mother-adolescent and father-adolescent relationships and early sexual initiation were assessed by logistic regression analyses, stratified by gender, controlling for various potential confounders.

Results

We found that only girls (not boys) having a higher-quality relationship with mothers were significantly less likely to have initiated early sexual intercourse between T1 and T2. Bivariate findings showed that both girls and boys having a higher-quality relationship with their father at T1 were significantly less likely to have engaged in early sexual intercourse between T1 and T2, but when assessed multivariately, these associations were no longer significant, neither for boys nor for girls.

Conclusions

We found that a higher-quality relationship between adolescents and their parents, especially between mothers and daughters may help to protect against early sexual initiation. Pediatricians and other healthcare professionals should be able to explain to parents that early sexual intercourse initiation can be associated with negative health outcomes, but that parents can play an important role in promoting healthy sexual behaviors.

Introduction

Adolescence is a period in which many adolescents start exploring intimate relationships and sexual behaviors, including intercourse.[1, 2] Although the initiation of sexual intercourse is a normative step in adolescents' sexual development,[1, 2] early sexual intercourse initiation (i.e., before the average age) may be problematic.[3-12] Early sexual intercourse has been associated with risky sexual behaviors (e.g., unprotected sex),[3-6] Sexually Transmitted Infections (STIs),[7-10] and unwanted pregnancy.[7, 11] Early sexual starters tend to lack social, emotional and cognitive skills that are normally gained with general life experiences, including experiences with romantic and sexual partnerships.[13-15] In addition, early sexual starters have limited knowledge about the risks involved in unprotected sexual intercourse, such as the possibility of contracting STIs.[16] These specificities of young adolescents may partly explain why early sexual intercourse is associated with negative outcomes.[13-16] Understanding the determinants of early sexual intercourse may contribute to promote effective preventive strategies to improve adolescents' sexual health.

According to the ecological systems theory, both the social environment (e.g., family) and the quality of the relationships within the social environment (e.g., parent-adolescent relationships), play a role in adolescents' sexual development.[17] The literature consistently shows that a poor parent-adolescent relationship quality – defined as adolescents' perception of little warmth, support and closeness from their parents,[18] is associated with a higher likelihood of engaging in sexual intercourse at an early age.[19-23] However, the majority of studies on the parent-adolescent relationship quality and adolescents' sexual behavior have focused only on the role of mothers.[19-21] This can partly be explained by a cultural aspect: in many societies mothers are the primary caregivers of children, and the primary providers of education on sexuality, for both boys and girls.[24-26] Recently, studies have begun to look at the role of fathers in adolescents' sexual development, showing that, for instance, fathers' involvement may positively affect their children's sexual development.[27-29] To the authors' knowledge, two studies have investigated the association between the quality of the father-adolescent relationship and adolescents' sexual intercourse initiation.[27, 28] Two studies found that adolescents who reported higher-quality relationship with their father at baseline (age=15-19 years) were less likely to report sexual intercourse experience at follow-up (age=16-19 years).[27, 28] However, one study included girls only,[28] and both studies were conducted in the United States.[27, 28] As mother-adolescent and father-adolescent relationships may differ for boys and girls,[19, 30-33] and vary across cultures,[34] results from these studies may not be generalizable to other countries.

In the present study, we assessed prospective associations between mother-adolescent and father-adolescent relationship quality and early sexual intercourse initiation

among Dutch adolescents, defined as first sexual intercourse experience before or at the age of 16 years, which is the average age at which Dutch adolescents initiate sexual intercourse.[35] Firstly, based on previous studies' findings,[19-23, 36, 37] we hypothesized that adolescents who would report a higher-quality relationship with their mother and/or father would be less likely to initiate early sexual intercourse ≤16 years. Secondly, as the literature also shows that the associations between parent-adolescent relationship quality and the timing of sexual intercourse are stronger for girls than for boys,[19, 30-33] we hypothesized that a higher-quality relationship with their mother and/or father would be more strongly associated with a lower likelihood of engaging in early sexual intercourse for girls than for boys.

Methods

Study Design

We used data that were collected as part of the Rotterdam Youth Monitor (RYM), a longitudinal youth health surveillance system that is incorporated into the preventive youth healthcare system of Rotterdam, one of the four largest cities in the Netherlands.[38, 39] Data were collected among a community sample of adolescents who were enrolled in secondary schools located in Rotterdam and surroundings. For the present study, data from two waves were used, with a two-year interval between measurements. At T1 (2008-2009), 76 schools and 8,272 students in the first year of secondary school participated in the measurement (i.e., 100% school and 95% student participation rate). At T2 (2010-2011), 45 schools and 3,184 students participated in the follow-up measurement (i.e., 59% school and 38% student participation rate). The main reason for non-response at follow-up was that some schools were no longer able to participate.[38] Administration of the questionnaires at schools was guided by trained researchers, school nurses from the Municipal Public Health Service, and teachers.

Study Sample

For our analyses, we selected only students who participated in both measurements (n=3,184). In addition, to be able to predict the initiation of early sexual intercourse (i.e., ≤16 years),[35] we selected only participants who never had sexual intercourse at T1 (n=70 excluded) and who were ≤16 years old at both T1 and T2 (n=3 excluded). Furthermore, we excluded participants with missing information on: age at T1 and/or at T2 (n=3), mother-adolescent or father-adolescent relationship quality at T1 (n=167), and sexual intercourse at T1 and/or at T2 (n=10). Results from Chi-square tests and one-way ANOVAs showed that adolescents who were included in the final analysis sample (n=2,931) were more often younger ($p<.01$), enrolled in higher educational levels ($p<.001$), non-

native Dutch (p<.001), more often lived with both biological parents (p<.001), and also reported a higher-quality relationship with their mother (p<.001) than adolescents who were excluded from the analyses (n=4,808).

Ethics Statement

Activities of the preventive youth healthcare system of Rotterdam, of which the RYM is part, have been approved by the Dutch government. The data of the RYM is protected by the Municipal Health Service of Rotterdam, which follows the Code of Conduct Health Research of the Netherlands. Adolescents received verbal information about the questionnaires each time they were applied, and their parents received written information regarding every assessment. Adolescents and their parents were free to decline participation. The questionnaires were completed on a voluntary basis, and confidentiality of responses was guaranteed.[38] Observational research (i.e., not experimental) with confidential data gathered in routine health care does not fall within the ambit of the Dutch Act on research involving human subjects, and therefore does not require the approval of an ethics review board; separate informed consent was therefore not required.[39] Data were de-identified prior to analyses.

Measures

Early Sexual Intercourse. Early sexual intercourse was measured using one item: "Have you ever had sexual intercourse? (With sexual intercourse we mean penile-vaginal intercourse)" (1=never; 2=once; 3=a couple of times; 4=regularly). For the present analyses, the item was dichotomized (0=never; 1=ever).[40]

Mother-Adolescent Relationship. The quality of the mother-adolescent relationship was measured at baseline using the Family Attachment Scale of *The Communities That Care Youth Survey*, for which a good validity and reliability have been reported.[18, 41, 42] This scale included three items (i.e., "Do you feel close to your mother?"; "Do you share your thoughts and feelings with your mother?"; "Do you enjoy spending time with your mother?"), which were scored on a four-point scale (0=NO!; 1=no; 2=yes; 3=YES!). A total score was calculated by averaging the scores on the three items (α=.72), where higher scores mean higher-quality mother-adolescent relationship (*M*=2.60).

Father-Adolescent Relationship. The quality of the father-adolescent relationship was operationalized in the same way as the mother-adolescent relationship quality, but "mother" was replaced by "father" in the three items (α=.78; *M*=2.44).

Parental Monitoring. Parental monitoring was included as a potential confounder, and was assessed as the level at which parents monitored adolescents' behaviors.[42] This variable was also measured at baseline using the Family Attachment Scale,[41] by five items (i.e., "When I am not at home, one of my parents knows where I am and who I am with"; "My parents ask if I've gotten my homework done"; "Would your parents

know if you did not come home on time?"; "My family has clear rules about alcohol and drug use"; "Would your parents find out if you were using drugs?"), which were scored on a four-point scale (0=NO!; 1=no; 2=yes; 3=YES!). A total score was calculated by averaging the scores on the five items (α=.71), where higher scores mean a higher level of parental monitoring (*M*=2.42).

Statistical Analyses

Descriptive statistics were used to portray the analysis sample characteristics at baseline. One-way ANOVA tests were applied to compare differences in T1 variables between adolescents who did and did not engage in early sexual intercourse between T1 and T2. Prospective associations between mother-adolescent and father-adolescent relationship quality and early sexual intercourse initiation were assessed by a series of logistic regression analyses, stratified by gender. In the first two regression models, mother-adolescent relationships quality and father-adolescent relationship quality were included in the models separately. In the third model, mother-adolescent and father-adolescent relationship quality were added to the model simultaneously, to adjust for each other's independent contribution. We also tested gender-interaction effects (i.e., gender x mother-adolescent relationships, gender x father-adolescent relationships), in order to assess whether the found effects from the stratified analyses were indeed really statistically different for boys and girls. All regression models included the following potential confounders: gender,[40] age,[40] educational level,[19, 38] ethnic background,[43] family structure,[43-45] and parental monitoring.[46-48] A significance level of $p<.05$ was used to indicate significant effects.

Results

The final sample for the prospective analyses included 2,931 adolescents aged 12 to 16 years ($M_{age@T1}$=12.5 years, SD=0.61; $M_{age@T2}$=14.3 years, SD=0.60). Table 1 presents participants' descriptive characteristics at T1. A total of 233 adolescents (8.0%), including 77 girls (2.6%) and 156 boys (5.4%), had initiated sexual intercourse between T1 and T2.

Table 2 shows the bivariate differences in T1 parenting variables between early and later sexual initiators. Girls who had initiated sexual intercourse between T1 and T2 scored significantly lower on parental monitoring and on relationship quality with their mothers and fathers than girls who had not initiated sex. Boys who had initiated sexual intercourse between T1 and T2 scored significantly lower on parental monitoring and on relationship quality with their fathers than boys who had not initiated sex.

Results from the logistic regression analyses stratified by gender (Table 3) show that for girls, higher-quality relationship with mothers (Crude Model Mothers) and with fathers (Crude Model Fathers) were significantly associated with a lower likelihood of early sexual intercourse initiation. However, when mothers and fathers were combined in one model simultaneously (Full Model), only higher-quality relationship with mothers remained a significant protective factor against early sexual intercourse initiation, whereas the relationship with fathers became non-significant. For boys, neither relationship (with mothers or fathers) was significantly associated with early sexual initiation, neither in the Crude models, nor in the Full Model.

We found one significant gender-interaction effect, indicating that only for girls (not for boys) having a higher-quality relationship with mothers was linked to a lower likelihood to initiate early sexual intercourse between T1 and T2 (OR=0.66; 95% CI=0.50, 0.88, p=0.01).

Discussion

In the current study we assessed prospective associations between mother-adolescent and father-adolescent relationship quality and early sexual intercourse initiation (i.e., ≤16 years) among a large sample of Dutch adolescents. The results of both bivariate and multivariate analyses showed that only for girls (not for boys) having a higher-quality relationship with mothers was prospectively linked to a lower likelihood to initiate early sexual intercourse. Furthermore, bivariate findings showed that both girls and boys who reported a higher-quality relationship with their father at T1 were significantly less likely to have engaged in early sexual intercourse between T1 and T2. However, when assessed multivariately, the associations between father-adolescent relationship quality and early sexual initiation were no longer significant, neither for boys nor for girls. Overall, our results are partially in line with our hypotheses and consistent with previous studies. Yet, our findings also expand the existing literature in several ways.

Firstly, our finding that a higher-quality relationship with mothers is a protective factor against early sexual initiation for girls, but not for boys, is in line with previous studies.[19, 30-33] This may be related to the fact that mothers are still the primary providers of sexuality education within families,[35] and also that mothers talk more often about sexuality with daughters than with sons.[49-53] According to social learning theory,[54] girls tend to learn more from and behave more according to their mothers' role modelling, whereas boys tend to learn more from and behave more according to their fathers' role modelling.[54-56] Thus, having a high-quality relationship with mothers may contribute to more frequent parent-adolescent sexual communication,[49-51] which in turn has been associated with a lower likelihood of early sexual intercourse initiation, particularly for

girls.[49, 52] Future studies should further examine the exact mechanisms underlying the protective effects of a high-quality relationship with mothers.

Secondly, although our bivariate findings suggested that a higher-quality relationship with fathers may protect both girls and boys against early sexual initiation, the multivariate analysis results indicated no significant protective effect from fathers, neither both boys nor for girls. This finding differed from findings of previous studies.[27, 28] It may be that in our multivariate regression models, we have accounted for variables that have been consistently associated with adolescents' sexual initiation, such as family structure,[43-45] and parental monitoring,[46-48] which in turn may have reduced the unique predictive value of father-adolescent relationship quality. Also, our study included younger adolescents (i.e., 12-15 years at T1 and 12-16 years at T2), than previous studies, which included older adolescents (i.e., 15-19 years,[28] and 16-19 years,[27]). This could suggest that fathers may be more influential on adolescents' sexual initiation when their children are older, perhaps because they start communicating about sexuality after their children have already formed interest in sex.[49] Finally, our different findings for fathers compared to American studies may also be related to specificities of Dutch society.[25] Dutch fathers spend, on average, half as much time with their children compared to Dutch mothers.[26] In fact, of all OECD countries, Dutch fathers spend the least time with their children (except for Austria).[57] As consequence, Dutch fathers share relatively few activities with their children,[57] which may also contribute to their reduced influence on the timing of adolescents' sexual initiation. More research is needed to investigate other possible mechanisms through which Dutch fathers may play a role in adolescents' sexual development, above and beyond the quality of the relationship between adolescents and their fathers. Assessing the role of father's participation in shared activities with their children,[29, 58] father's (dis)approval of their children engaging in sex,[59] fathers' behavioral control or autonomy stimulation,[29] and the frequency of father-adolescent communication about sexuality,[52] may be relevant directions for future research.

Overall, the current study contributes to the ample scientific evidence showing that a high-quality relationship between adolescents and their parents, especially between mothers and daughters, may help to protect against early sexual initiation. Furthermore, our findings are line with socio-ecological theory,[17] and family systems theory,[60] which emphasize that various aspects of complex family environments, including the quality of parent-adolescent relationships and parental monitoring, contribute to the timing of adolescents' sexual initiation. More empirical research is needed to further advance our understanding of how different family relationships (i.e., father-son, father-daughter, mother-daughter, and mother-son dyads),[29, 61] and other parenting practices (e.g., levels of involvement, control, and sexual communication) interact with each other and influence adolescents' sexual development.

Strengths and Limitations

The present study has several strengths, including the longitudinal design, which allowed us to assess prospective associations between parent-adolescent relationship quality and early sexual intercourse initiation. Another innovative aspect was that, whereas previous studies have focused exclusively on the role of mothers,[19-22, 49] we also investigated the role of fathers in early sexual intercourse initiation. Furthermore, whereas most studies that assessed the associations between parent-adolescent relationship quality and early sexual intercourse initiation have been conducted in United States, our study was conducted in the Netherlands, where adolescents are known for relatively better sexual health outcomes compared to other countries.[35, 49]

However, a few limitations should be taken into account when interpreting the results. First, information on all variables was assessed by self-report questionnaires, which may have led to socially desirable answers. Second, non-response analyses showed significant differences between adolescents included in the analysis sample and those who were excluded, with the latter being significantly older, enrolled in lower educational levels, living less often with both parents, reporting lower levels of parental monitoring, and reporting lower-quality relationships with their mothers and fathers. These differences allow inferring that the effects of mother-adolescent and father-adolescent relationships on early sexual intercourse initiation may have been underestimated. Finally, the assessment of sexual intercourse as a single outcome may be a potential limitation of our study, because the majority of Dutch adolescents (73.0%) follow a so-called progressive sexual trajectory, initiating different sexual behaviors in a stepwise manner: touching at M_{age}=15.1 years, manual sex at M_{age}=16.1 years, and sexual intercourse at M_{age}=16.6 years.[31] These other types of sexual activities may also carry potential health risks. Yet, assessing early sexual intercourse initiation is specifically relevant for our understanding of adolescents' risky sexual behavior and healthy sexual development, because of its evidenced link with unprotected sex,[3-6] Sexually Transmitted Infections (STIs),[7-10] and unwanted pregnancy.[7, 11]

Clinical Implications

Notwithstanding the need for more research, the findings from the current study have relevant implications for pediatricians and other healthcare professionals. International guidelines published by the American Academy of Pediatrics,[62, 63] describe the engagement in sexual behaviors as a normative aspect of the developmental stage of adolescence, and suggest that pediatricians and other healthcare professionals have a responsibility to help promote a healthy sexual development of adolescents.[62, 63] Hence,

they should be able to explain to parents that early sexual intercourse initiation can be associated with negative health outcomes (e.g., STIs, unwanted pregnancy), but that parents can play an important role in stimulating healthy sexual behaviors.[17] Specifically, by cultivating a high-quality relationship with their child, parents can contribute to create a healthy developmental environment that may help adolescents to develop responsible decision making skills,[29, 64, 65], which may positively affect their sexual behaviors, for instance regarding the "right time" to initiate sexual intercourse.[29, 64] By increasing awareness about this topic, pediatricians and other healthcare professionals can help parents to promote healthy adolescent sexual development.

Table 1: Descriptive characteristics of the analysis sample at T1

	n	%	Mean (SD)
Gender			
Girls	1,447	49,4	
Age			
11-16 years			12.5 (0.61)
Educational Level			
Low	1,420	48.4	
Ethnic background			
Non-native Dutch	1,475	50.3	
Family Structure			
Living with both biological parents	2,385	81,5	
Not living with both biological parents	540	18.5	
Living partially with mothers and partially with fathers	165	5.6	
Living with mothers only	328	11.2	
Living with fathers only	25	0.9	
Living with others[a]	22	0.8	
Parental monitoring[b]			
0–3			2.42 (0.53)
Mother-adolescent attachment relationship[c]			
0–3			2.60 (0.48)
Father-adolescent attachment relationship[d]			
0–3			2.43 (0.59)

Notes: Non-native Dutch included Surinamese, Turkish, Dutch Antillean, Moroccan, Cape Verdean.
Family Structure was assessed as whether adolescents lived with both biological parents or not. This variable was dichotomized: 0=Living with both biological parents or 1=Not living with both biological parents.
[a] Living with others included living alone or in a boarding school for children or in a residence for children.
[b] Parental monitoring: a higher score on the scale (0–3) means higher level of parental monitoring.
[c] Mother-adolescent attachment relationship: a higher score on the scale (0–3) means a better relationship between adolescents and their mothers.
[d] Father-adolescent attachment relationship: a higher score on the scale (0–3) means a better relationship between adolescents and their fathers.

Table 2: One-way ANOVA results of bivariate differences in T1 parenting variables between early and later sexual initiators

	Girls (n=1,447)					Boys (n=1,484)				
	Engagement in early sexual intercourse between T1 and T2									
	No (n=1,370)		Yes (n=77)			No (n=1,328)		Yes (n=156)		
	Mean	(SD)	Mean	(SD)	F	Mean	(SD)	Mean	(SD)	F
Age	12.43	(0.61)	12.56	(0.68)	3.14	12.45	(0.60)	12.66	(0.64)	**16.90*****
Parental monitoring	2.46	(0.49)	2.18	(0.62)	**22.26*****	2.40	(0.53)	2.22	(0.72)	**16.72*****
Mother-adolescent relationship	2.62	(0.45)	2.26	(0.68)	**44.89*****	2.54	(0.47)	2.47	(0.55)	2.96
Father-adolescent relationship	2.39	(0.60)	2.07	(0.75)	**19.90*****	2.50	(0.52)	2.40	(0.54)	**5.09***

Notes: Bold print indicates statistical significance. $^{*}p<.05$ $^{**}p<.01$ $^{***}p<.001$.

Table 3: Logistic regression analyses results for associations between mother-adolescent and father-adolescent attachment relationship at T1 and early sexual intercourse between T1 and T2, stratified by gender

	Crude Model (Mothers)[a] OR (95% CI)		**Crude Model (Fathers)[b] OR (95% CI)**		**Full Model (Mothers and Fathers)[c] OR (95% CI)**	
	Boys (n=1,481)	Girls (n=1,443)	Boys (n=1,481)	Girls (n=1,443)	Boys (n=1,481)	Girls (n=1,443)
Socio-demographics						
Age	**1.38 (1.04, 1.83)***	1.28 (0.87, 1.90)	**1.39 (1.05, 1.83)***	1.26 (0.86, 1.85)	**1.39 (1.05, 1.84)***	1.27 (0.86, 1.88)
Educational Level (0=High)	**2.18 (1.49, 3.19)*****	1.22 (0.72, 2.07)	**2.18 (1.49, 3.20)*****	1.28 (0.75, 2.16)	**2.18 (1.49, 3.20)*****	1.23 (0.72, 2.08)
Ethnic background (0=Dutch)	1.44 (1.00, 2.07)	0.68 (0.40, 1.14)	1.43 (0.99, 2.06)	0.63 (0.37, 1.05)	1.43 (0.99, 2.06)	0.67 (0.40, 1.12)
Family Environment						
Family Structure (0=Living with both biological parents)	**2.49 (1.70, 3.64)*****	**3.22 (1.96, 5.28)*****	**2.45 (1.67, 3.60)*****	**3.09 (1.87, 5.10)*****	**2.44 (1.66, 3.59)*****	**3.14 (1.90, 5.18)*****
Parental monitoring	**0.63 (0.48, 0.83)*****	**0.63 (0.40, 0.97)***	**0.64 (0.48, 0.84)*****	**0.50 (0.34, 0.77)*****	**0.63 (0.47, 0.84)*****	**0.63 (0.40, 0.98)***
Mother-adolescent attachment relationship	0.95 (0.67, 1.35)	**0.43 (0.28, 0.64)*****			1.04 (0.66, 1.63)	**0.45 (0.29, 0.70)*****
Father-adolescent attachment relationship			0.90 (0.66, 1.22)	**0.69 (0.49, 0.97)***	0.88 (0.60, 1.30)	0.88 (0.60, 1.30)

Notes: Bold print indicates statistical significance. *p<.05 **p<.01 ***p<.001. OR=Odds Ratio. 95% CI=Confidence Interval. Reference groups are equal to zero.

[a] Crude Model (Mothers) included socio-demographics (i.e., age, educational level and ethnic background), family variables (i.e., family structure, parental monitoring) and mother-adolescent attachment relationship.

[b] Crude Model (Fathers) included socio-demographics, family environment variables and father-adolescent attachment relationship.

[c] Full model included socio-demographics, family environment variables, mother-adolescent and father-adolescent attachment relationship simultaneously.

Table 4: Logistic regression analysis results for associations between mother-adolescent and father-adolescent attachment relationship at T1 and early sexual intercourse between T1 and T2

	Full Model (Mothers and Fathers)[a] (n=2,924)	
Socio-demographics	**OR**	**95% CI**
Gender (0=girls)	**2.25**	**(1.67, 3.03)*****
Age	**1.33**	**(1.06, 1.67)***
Educational Level (0=High)	**1.81**	**(1.33, 2.46)*****
Ethnic background (0=Dutch)	1.01	(0.82, 1.48)
Family Environment		
Family Structure (0=Living with both biological parents)	**2.69**	**(1.99, 3.64)*****
Parental monitoring	**0.64**	**(0.50, 0.80)*****
Mother-adolescent attachment relationship	**0.70**	**(0.51, 0.95)***
Father-adolescent attachment relationship	0.96	(0.73, 1.26)

Notes: Bold print indicates statistical significance. *p<.05 **p<.01 ***p<.001. OR=Odds Ratio. 95% CI=Confidence Interval. Reference groups are equal to zero.

[a] Full model included socio-demographics, family environment variables, mother-adolescent and father-adolescent attachment relationship simultaneously.

References

1. Aarons SJ, Jenkins RR. Sex, Pregnancy, and Contraception-related Motivators and Barriers among Latino and African-American Youth in Washington, DC. *Sex Education*. 2002;2(1):5-30
2. Heywood W, Patrick K, Smith AA, Pitts M. Associations Between Early First Sexual Intercourse and Later Sexual and Reproductive Outcomes: A Systematic Review of Population-Based Data. *Arch Sex Behav*. 2014:1-39
3. Stone N, Ingham R. Factors affecting British teenagers' contraceptive use at first intercourse: the importance of partner communication. *Perspect Sex Reprod Health*. 2002;34(4):191-197
4. UNAIDS. Global AIDS response progress reporting 2013: Construction of core indicators for monitoring the 2011 UN Political Declaration on HIV/AIDS. Geneve, Switzerland World Health Organization (WHO); 2013. p. 1 - 164
5. UNICEF, UNAIDS, UNFPA, ILO, WHO and The World Bank. Opportunity in Crisis: Preventing HIV from early adolescence to young adulthood. New York, USA: United Nations Children's Fund (UNICEF); 2011. p. 1 - 61
6. WHO. Adolescents and Youths. Geneva, Switzerland. World Health Organization (WHO); 2012. p. 3-27
7. Edgardh K. Sexual behaviour and early coitarche in a national sample of 17 year old Swedish girls. *Sexually Transmitted Infections*. 2000;76(2):98-102
8. Sandfort TG, Orr M, Hirsch JS, Santelli J. Long-term health correlates of timing of sexual debut: results from a national US study. *Am J Public Health*. 2008;98(1): 155-161
9. Rissel CE, Richters J, Grulich AE, de Visser RO, Smith AM. Sex in Australia: first experiences of vaginal intercourse and oral sex among a representative sample of adults. *Aust N Z J Public Health*. 2003;27(2):131-137
10. Kaestle CE, Halpern CT, Miller WC, Ford CA. Young age at first sexual intercourse and sexually transmitted infections in adolescents and young adults. *Am J Epidemiol*. 2005;161(8):774-780
11. Wellings K, Nanchahal K, Macdowall W, McManus S, Erens B, Mercer CH, et al. Sexual behaviour in Britain: early heterosexual experience. *Lancet*. 2001; 358(9296):1843-1850
12. Ann M. Meier. Adolescent First Sex and Subsequent Mental Health. *American Journal of Sociology*. 2007;112(6):1811-1847
13. Ciairano S, Bonino S, Kliewer W, Miceli R, Jackson S. Dating, Sexual Activity, and Well-Being in Italian Adolescents. *Journal of Clinical Child & Adolescent Psychology*. 2006;35(2):275-282

14. Dixon-Mueller R. How Young Is "Too Young"? Comparative Perspectives on Adolescent Sexual, Marital, and Reproductive Transitions. *Studies in Family Planning*. 2008;39(4):247-262
15. Van de Bongardt D, Yu R, Deković M, Meeus WHJ. Romantic relationships and sexuality in adolescence and young adulthood: The role of parents, peers, and partners. *European Journal of Developmental Psychology*. 2015;12(5):497-515
16. De Graaf H, Kruijer H, Van Acker JM, S. *Sex onder je 25e. Seksuele gezondheid van jongeren in Nederland anno 2012. [Sex under 25. Sexual health of Dutch youth in 2012.]*. Delft: Uitgeverij Eburon; 2012
17. Bronfenbrenner U, Ceci SJ. Nature-nurture reconceptualized in developmental perspective: a bioecological model. *Psychol Rev*. 1994;101(4):568-586
18. Arthur MW, Briney JS, Hawkins JD, Abbott RD, Brooke-Weiss BL, Catalano RF. Measuring risk and protection in communities using the Communities That Care Youth Survey. *Evaluation and Program Planning*. 2007;30(2):197-211
19. McNeely C, Shew ML, Beuhring T, Sieving R, Miller BC, Blum RWM. Mothers' influence on the timing of first sex among 14- and 15-year-olds. *Journal of Adolescent Health*. 2002;31(3):256-265
20. Bobakova D, Geckova AM, Klein D, van Dijk JP, Reijneveld SA. Protective and risk factors of early sexual initiation in youth subcultures. *Eur J Contracept Reprod Health Care*. 2013;18(4):242-250
21. Price MN, Hyde JS. Perceived and observed maternal relationship quality predict sexual debut by age 15. *J Youth Adolesc*. 2011;40(12):1595-1606
22. Guilamo-Ramos V, Bouris A, Lee J, McCarthy K, Michael SL, Pitt-Barnes S, et al. Paternal influences on adolescent sexual risk behaviors: a structured literature review. *Pediatrics*. 2012;130(5):e1313-1325
23. Shneyderman Y, Schwartz SJ. Contextual and Intrapersonal Predictors of Adolescent Risky Sexual Behavior and Outcomes. *Health Education & Behavior*. 2013; 40(4):400-414
24. DiClemente RJ, Wingood GM, Crosby R, Cobb BK, Harrington K, Davies SL. Parent-adolescent communication and sexual risk behaviors among African American adolescent females. *J Pediatr*. 2001;139(3):407-412
25. Keizer R, Lucassen N, Jaddoe V, Tiemeier H. A prospective study on father involvement and toddlers' behavioral and emotional problems: Are sons and daughters differentially affected? *Fathering*. 2014;12(1):38-51
26. Portegijs W, Keuzenkamp S. Nederland deeltijdland [Netherlands part-time country] The Hague, Netherlands: SCP; 2008
27. Regnerus MD, Luchies LB. The Parent-Child Relationship and Opportunities for Adolescents' First Sex. *Journal of Family Issues*. 2006;27(2):159-183

28. Rink E, Tricker R, Harvey SM. Onset of sexual intercourse among female adolescents: the influence of perceptions, depression, and ecological factors. *J Adolesc Health*. 2007;41(4):398-406
29. Coley RL, Votruba-Drzal E, Schindler HS. Fathers' and mothers' parenting predicting and responding to adolescent sexual risk behaviors. *Child Dev*. 2009; 80(3):808-827
30. Van de Bongardt D, Reitz E, Dekovic M. Vroeg seksueel debuut in Nederland: een longitudinale studie naar de rol van individuele kenmerken, opvoeding en leeftijdgenoten. [Early sexual debut in the Netherlands: A longitudinal study on the role of individual characteristics, parenting, and peers.] *Kin en Adolescent Themanummer: "Intieme Relaties en Seksualiteit" [Child and Adolescent Special Issue: "Intimate Relationship and Sexuality"]*. 2012(33):194-205
31. De Graaf H, Vanwesenbeeck I, Meijer S, Woertman L, Meeus W. Sexual trajectories during adolescence: relation to demographic characteristics and sexual risk. *Arch Sex Behav*. 2009;38(2):276-282
32. De Graaf H, Vanwesenbeeck I, Woertman L, Meeus W. Opvoeding en seksuele ontwikkeling van adolescenten: Een literaturstudie [Parenting and sexual development of adolescents: A literature study]. *Pedgogiek*. 2011;29:10-31
33. Rose A, Koo HP, Bhaskar B, Anderson K, White G, Jenkins RR. The influence of primary caregivers on the sexual behavior of early adolescents. *Journal of Adolescent Health*. 2005;37(2):135-144
34. Shwalb DW, Shwalb BJ, Lamb ME. Fathers in Cultural Context *Psychol Stud*. 2013;58(4):464-465
35. de Graaf H, Kruijer H, Van Acker J, Meijer S. *Sex onder je 25e. Seksuele gezondheid van jongeren in Nederland anno 2012. [Sex under 25. Sexual health of Dutch youth in 2012.]*. Delft: Uitgeverij Eburon; 2012
36. Guilamo-Ramos V, Bouris A, Jaccard J, Gonzalez B, McCoy W, Aranda D. A parent-based intervention to reduce sexual risk behavior in early adolescence: building alliances between physicians, social workers, and parents. *J Adolesc Health*. 2011;48(2):159-163.
37. Kirby D. Antecedents of adolescent initiation of sex, contraceptive use, and pregnancy. *Am J Health Behav*. 2002;26(6):473-485
38. Bannink R, Broeren S, van de Looij-Jansen PM, Raat H. Associations between parent-adolescent attachment relationship quality, negative life events and mental health. *PLoS One*. 2013;8(11):e80812
39. Bannink R, Broeren S, van de Looij-Jansen PM, de Waart FG, Raat H. Cyber and traditional bullying victimization as a risk factor for mental health problems and suicidal ideation in adolescents. *PLoS One*. 2014;9(4):e94026

40. Boislard P M-A, Poulin F. Individual, familial, friends-related and contextual predictors of early sexual intercourse. *Journal of Adolescence*. 2011;34(2):289-300
41. Arthur MW, Hawkins JD, Pollard JA, Catalano RF, Baglioni AJ, Jr. Measuring risk and protective factors for substance use, delinquency, and other adolescent problem behaviors. The Communities That Care Youth Survey. *Eval Rev*. 2002; 26(6):575-601
42. Briney JS, Brown EC, Hawkins JD, Arthur MW. Predictive validity of established cut points for risk and protective factor scales from the communities that care youth survey. *J Prim Prev*. 2012;33(5-6):249-258
43. Manlove J, Wildsmith E, Ikramullah E, Terry-Humen E, Schelar E. Family environments and the relationship context of first adolescent sex: Correlates of first sex in a casual versus steady relationship. *Soc Sci Res*. 2012;41(4):861-875
44. Longmore MA, Manning WD, Giordano PC, Rudolph JL. Self-Esteem, Depressive Symptoms, and Adolescents' Sexual Onset. *Social Psychology Quarterly*. 2004;67(3):279-295
45. Price MN, Hyde JS. When two isn't better than one: predictors of early sexual activity in adolescence using a cumulative risk model. *J Youth Adolesc*. 2009; 38(8):1059-1071
46. Wight D, Williamson L, Henderson M. Parental influences on young people's sexual behaviour: A longitudinal analysis. *Journal of Adolescence*. 2006;29(4): 473-494
47. Capaldi DM, Stoolmiller M, Clark S, Owen LD. Heterosexual risk behaviors in at-risk young men from early adolescence to young adulthood: prevalence, prediction, and association with STD contraction. *Dev Psychol*. 2002;38(3):394-406
48. Jovic S, Delpierre C, Ehlinger V, Sentenac M, Young H, Arnaud C, et al. Associations between life contexts and early sexual initiation among young women in France. *Perspect Sex Reprod Health*. 2014;46(1):31-39
49. Van de Bongardt D, de Graaf H, Reitz E, Dekovic M. Parents as moderators of longitudinal associations between sexual peer norms and Dutch adolescents' sexual initiation and intention. *J Adolesc Health*. 2014;55(3):388-393
50. Dittus PJ, Jaccard J. Adolescents' perceptions of maternal disapproval of sex: relationship to sexual outcomes. *J Adolesc Health*. 2000;26(4):268-278
51. Jaccard J, Dittus PJ, Gordon VV. Maternal correlates of adolescent sexual and contraceptive behavior. *Fam Plann Perspect*. 1996;28(4):159-165, 185
52. Widman L, Choukas-Bradley S, Noar SM, Nesi J, Garrett K. Parent-adolescent sexual communication and adolescent safer sex behavior: A meta-analysis. *JAMA Pediatrics*. 2016;170(1):52-61
53. Kapungu CT, Baptiste D, Holmbeck G, McBride C, Robinson-Brown M, Sturdivant A, et al. Beyond the "Birds and the Bees": Gender Differences in Sex-Related

Communication Among Urban African-American Adolescents. *Family Process*. 2010;49(2):251-264

54. Bandura A. *Social Learning Theory* New York, NY: General Learning Press; 1971
55. Daniel RM. Social Learning and Personality Development. *American Sociological Review*. 1966;31(1):128-130
56. Morgan SP, Lye DN, Condran GA. Sons, Daughters, and the Risk of Marital Disruption. *American Journal of Sociology*. 1988;94(1):110-129
57. Institute F. The Fatherhood Report 2010-11 The fairness in families index. Abergovenny, UK: Fatherhood Institute; 2010
58. Ream GL, Savin-Williams RC. Reciprocal associations between adolescent sexual activity and quality of youth-parent interactions. *J Fam Psychol*. 2005; 19(2):171-179
59. Dittus P, Jaccard J, Gordon V. The Impact of African American Fathers on Adolescent Sexual Behavior. *Journal of youth and adolescence*. 1997;26(4):445-465
60. Michael N, Schwartz R. *Family Therapy: Concepts and Methods*. 10 ed. Boston Pearson; 2013
61. van de Bongardt D, Reitz E, Overbeek G, Boislard M-A, Burk B, Deković M. Observed Normativity and Deviance in Friendship Dyads' Conversations About Sex and the Relations With Youths' Perceived Sexual Peer Norms. *Arch Sex Behav*. 2016:1-14
62. Alderman EM. Ama guidelines for adolescent preventive services (gaps): Recommendations and rationale. *JAMA*. 1994;272(12):980-981
63. Hagan JF, Shaw JS, PM D. Bright Futures Guidelines for Health Supervision of Infants, Children, and Adolescents. https://brightfutures.aap.org/materials-and-tools/guidelines-and-pocket-guide/Pages/default.aspx. Published 2008. Accessed 16 June, 2016
64. de Graaf H, Vanwesenbeeck I, Woertman L, Meeus W. Parenting and adolescents' sexual development in western societies: A literature review. *European Psychologist*. 2011;16(1):21-31
65. Van de Bongardt D, Reitz E, Dekovic M. Indirect Over-Time Relations Between Parenting and Adolescents' Sexual Behaviors and Emotions Through Global-Self-Esteem. *J Sex Res*. 2015;53(3):273-285

Chapter 5

Longitudinal Associations between Sexual Communication with Friends and Early Sexual Behaviors through Perceived Sexual Peer Norms

Raquel Nogueira Avelar e Silva,[1] Daphne van de Bongardt,[2] Merel Plat,[3] Ellen Reitz,[3] Hein Raat,[1] Maja Deković.[3]

1. Department of Public Health, Erasmus Medical Center, Erasmus University Rotterdam, Rotterdam, the Netherlands.
2. Department of Psychology, Education and Child Studies, Erasmus University Rotterdam, Rotterdam, the Netherlands.
3. Utrecht Centre for Child and Adolescent Studies, Utrecht University, Utrecht, the Netherlands.

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Abstract

In the current study, we investigated the association between online and face-to-face sexual communication with friends and adolescents' subsequent experiences with sexual behaviors, and examined whether this association was mediated by adolescents' perceptions of three types of sexual peer norms: (1) peers' sexual behaviors (descriptive norms), (2) peers' approval of sexual behaviors (injunctive norms), and (3) peer pressure to have sex. We used data from Project STARS, a longitudinal study on adolescent sexual development in the Netherlands. Self-report data were collected via online questionnaires (T1–T3) from 771 adolescents aged 11.0–16.0 years ($M_{age@T1}$=13.3 years). We found that more frequent sexual communication with friends at T1 predicted a significant increase in experiences with sexual behaviors between T1–T3, for both boys and girls. Mediation analyses showed that this association was partially explained by the three sexual peer norm perceptions at T2, with a stronger total indirect effect for girls than for boys. That is, more sexual communication with friends predicted adolescents' subsequent perceptions of 1) more sexual behaviors, 2) more approval towards sex, and 3) more peer pressure to have sex among their peers, which, in turn, predicted an increase in their own experiences with sexual behaviors between T1–T3.

Introduction

The initiation of intimate relationships and sexual behaviors is a normative part in adolescent development (Tolman & McClelland, 2011). Nonetheless, early engagement in sexual intercourse (i.e., ≤16.0 years) can have negative consequences for adolescents' sexual health, such as the contraction of sexually transmitted infections (STIs) and unwanted pregnancy (Sandfort, Orr, Hirsch, & Santelli, 2008; Kaestle, Halpern, Miller, & Ford, 2005). During early (i.e., 10–14 years) and middle adolescence (i.e., 15–16 years), adolescents tend to have a relatively limited knowledge about the risks involved in unprotected sexual activities (UNICEF et al., 2011). In addition, they may not have sufficient cognitive and emotional skills that are required to make responsible and healthy decisions about sexual and reproductive health, such as decisions related to condom use (Dixon-Mueller, 2008). This is because, generally, these cognitive and emotional skills are being developed up until late adolescence (i.e., 17–19 years). Thus, the lack of these skills in the early stages of adolescence may contribute, partly, to increase the risks associated with early sexual behaviors.

Ecological systems theories conceptualize that both individual (e.g., age, ethnic background) and social factors (e.g., parents, peers) affect adolescent sexual development (Bronfenbrenner, 1994). Parents are important protective factors of adolescent sexual health (Nogueira Avelar e Silva, Van de Bongardt, Van de Looij-Janse, Wijtzes, & Raat, 2016; Van de Bongardt, De Graaf, Reitz, & Deković, 2014). However, particularly during adolescence, peers (e.g., friends, classmates, age-mates) become increasingly present in adolescents' social contexts. As a result, they become a notable reference group for adolescents' behavioral decisions, including decisions about sexual behaviors (Steinberg & Sheffield, 2001). Thus, the role of peers in adolescents' sexual behaviors is important to consider in research on adolescent sexuality (Berten, & Van Rossem, 2011).

Previous empirical research that has investigated peer aspects in relation to adolescents' sexual behaviors, has shown, for instance, that more frequent communication with friends about sexuality-related topics was associated with a higher likelihood of subsequent sexual intercourse initiation (Busse, Fishbein, Bleakley, & Hennessy, 2010). A possible explanation for this association may be related to the fact that, during sexual talks, friends exchange information about their sexual behaviors, which can contribute to adolescents' increased awareness of their friends' sexual behaviors. In turn, this increase in levels of adolescents' awareness of their friends' sexual behaviors could stimulate adolescents' own sexual behaviors by role modeling (Bandura, 1971).

This mechanism by which adolescents' sexual behaviors and those of their peers are interlinked can be explained, theoretically, by social norm theory (Bandura, 1971). This theory posits that individuals, in general, tend to behave according to social norms that they perceive as prevalent, accepted, and desired among their peers (Cialdini, & Gold-

stein, 2004). Thus, adolescents would be more likely to engage in sexual behaviors when they perceive this as a usual behavior among their peers (Van de Bongardt et al., 2015). The literature increasingly distinguishes three types of sexual peer norms: descriptive, injunctive, and peer pressure (Van de Bongardt et al., 2015). Descriptive norms refer to adolescents' perceptions of their peers' sexual behaviors (e.g., how many of their friends have ever had sexual intercourse; Ali & Dwyer, 2011). These norms could motivate adolescents' own sexual behaviors because they might reason that if their friends behave in a certain way, it must be a good or wise thing to do (Ali & Dwyer, 2011). Injunctive norms refer to adolescents' perceptions of their peers' (dis)approval towards sex (Akers et al., 2011). Several studies showed that adolescents who perceived that their friends were more permissive towards sex, were more likely to engage in sexual behaviors themselves (O'Sullivan, & Brooks-Gunn, 2005; Santelli, Kaiser, Hirsch, Radosh, Simkin, & Middlestadt, 2004). Peer pressure refers to an explicit pressure that adolescents perceive from their peers to engage in sexual behaviors, regardless of adolescents' own wishes (Santor, Messervey, & Kusumakar, 2000). Adolescents may be motivated to conform to such peer pressure (e.g., to engage in an expected behavior) because of perceived social benefits (e.g., social acceptance, or an increase in popularity) when they do conform, or social losses (e.g., social rejection, or a decrease in popularity) when they do not conform. A meta-analysis has shown that, of these three types of sexual peer norms, descriptive norms were most strongly related to adolescents' own sexual behaviors (i.e., adolescents who believed that more of their friends were sexually experienced, were more likely to engage in sexual behaviors themselves), whereas peer pressure showed the weakest link with adolescents' likelihood to engage in sexual behaviors (Van de Bongardt et al., 2015).

Although adolescents' perceptions of sexual peer norms may explain the identified link between sexual communication with friends and adolescents' sexual behaviors, only one longitudinal study has investigated these interlinkages among 14–16-year old American adolescents (Busse et al., 2010). Besides assessing the association between sexual communication with friends and sexual intercourse initiation, this study examined whether this association was explained by two types of sexual peer norms: descriptive and injunctive norms (which, for analysis, were combined into a new variable: "normative pressure", based on the average scores on descriptive and injunctive norms). The results of the mediation analysis showed that adolescents who communicated more frequently with their friends about sexuality-related topics, perceived more normative pressure, that is, that their friends had increased experience with sexual behaviors (descriptive norm), and that their friends approved more of having sex (injunctive norm). Subsequently, these perceptions were associated with a higher likelihood of sexual intercourse initiation (Busse et al., 2010). This study contributed to advance our understanding of how friends may play a role in adolescents' sexual behaviors (i.e., through sexual communication

and sexual norms) (Busse et al., 2010). The present study aimed to further advance this understanding, through three methodological considerations.

First, Busse and colleagues (2010) examined two types of sexual peer norms only. Theoretically and empirically, all the three types of norms (i.e., descriptive norms, injunctive norms, and peer pressure) are important to consider in research on adolescent sexual development, because they are distinct and have different predictive values (Cialdini et al., 2004; Van de Bongardt et al., 2015). Additionally, although Busse and colleagues (2010) measured descriptive and injunctive norms separately, for analysis, they were combined (averaged) into one social norm variable "normative pressure". The use of a composite variable is not consistent with social norm theory, nor with empirical research that shows that all three types of sexual peer norms are distinct and have a unique predictive value (Cialdini et al., 2004; Van de Bongardt et al., 2015). In the current study, therefore, we included all the three types of sexual peer norms (i.e., descriptive norms, injunctive norms, and peer pressure), and assessed their unique explanatory role in the link between sexual communication with friends and adolescents' sexual behaviors.

Second, the study of Busse and colleagues (2010) included exclusively sexual intercourse as sexual behavior. This is a rather narrow conceptualization of sexual behavior, considering that most adolescents (73%) progress from less intimate sexual behaviors (e.g., naked touching) to increasingly more intimate behaviors (e.g., sexual intercourse) (De Graaf, Vanwesenbeeck, Meijer, Woertman, & Meeus, 2009). Hence, as a considerable part of adolescents engage in other non-coital sexual behaviors before their first sexual intercourse experience, a sole focus on sexual intercourse provides limited insight into adolescents' early sexual behaviors. Our study extends the current literature by utilizing a broader conceptualization of sexual behaviors, which varied from naked touching to sexual intercourse, and thus more accurately reflects the reality of early adolescent sexuality, and the role of peers therein.

Third, although the study of Busse and colleagues (2010) examined sexual communication with friends in real life, in contemporary societies, adolescents are increasingly using online communication, such as instant messaging, on a daily basis (Doornwaard, Van den Eijnden, Overbeek, & Ter Bogt, 2015; Doornwaard, Bickham, Rich, Vanwesenbeeck, Van de Eijnden, Ter Bogt, 2014). Moreover, the majority of adolescents tend to share personal information (thoughts, feelings, and experiences) almost as frequently during online communication with their friends as during face-to-face communication (Valkenburg, Sumter, & Peter, 2011). Yet, to the authors' knowledge, no studies have yet included both types of sexual communication with friends in the investigation of the interlinkages between sexual communication with friends and subsequent sexual behaviors. Our study extends the literature by including both types of communication with friends (i.e., online and face-to-face).

In sum, in the present longitudinal study, we assessed the association between sexual communication (online and face-to-face) with friends at T1 and changes in adolescents' experiences with early sexual behaviors (i.e., ranging from naked touching to intercourse) between T1–T3. In addition, we examined whether this association was mediated (i.e., explained) by three types of sexual peer norms at T2 (i.e., descriptive, injunctive, and peer pressure). Based on the aforementioned theoretical rationale and empirical evidence, firstly, we hypothesized that adolescents who communicated more frequently with their friends about sexuality-related topics at T1 would gain experience with more types of sexual behaviors between T1–T3 (H1). Secondly, we hypothesized that adolescents who communicated more frequently with their friends about sexuality-related topics at T1 would perceive, at T2, that: 1) more of their friends had experience with sexual behaviors (i.e., descriptive norms), 2) their friends approved more of having sex (i.e., injunctive norms), and 3) there was more pressure from their peers to have sex (i.e., peer pressure), (H2). Thirdly, we hypothesized that adolescents who perceived, at T2, that: 1) more of their friends had experiences with sexual behaviors, 2) their friends approved more of having sex, and 3) their peers exerted more pressure to have sex would gain experience with more types of sexual behaviors between T1–T3 (H3). Fourthly, we hypothesized that the association between sexual communication with friends at T1 and adolescents' sexual behaviors between T1–T3 would be mediated by all three types of sexual peer norms at T2. Specifically, we expected that, in these associations, the mediating effect of descriptive norms would be stronger than those of injunctive norms and peer pressure (H4) (Van de Bongardt et al., 2015).

Finally, we examined gender differences in both direct and indirect associations between sexual communication with friends and early sexual behaviors through sexual peer norms. In general, gender differences are expected in research on adolescent sexuality. This may be related to the culture of sexual double standards that exists in many societies, meaning that the expectations for boys' and girls' sexual behaviors are different (Kreager & Staff, 2009). Normally, boys are granted more sexual freedom, and girls tend to experience more sexual restrictions (Kreager & Staff, 2009). These cultural differences in expectations for boys' and girls' sexual behaviors often translate into more positive evaluations of boys' and more negative evaluations of girls' early sexual behaviors (Kreager & Staff, 2009). Accordingly, research has demonstrated gender differences in adolescents' sexual behaviors and the interlinkages between sexuality-related peer aspects and sexual behaviors (Van de Bongardt et al., 2015; Kapungu et al., 2010). Moreover, overall, girls tend to be more susceptible to social influences (Cialdini et al., 2004) and tend to be more sensitive to peers' social evaluations than boys (Rudolph & Conley, 2005). Thus, our final hypothesis is that, both direct and indirect associations between sexual communication with friends and sexual behaviors through perceived sexual peer norms would be stronger for girls than for boys (H5).

Methods

Participants

Data for the current study were collected as part of Project STARS (Studies on Trajectories of Adolescent Relationships and Sexuality), a large-scale longitudinal study on adolescent sexual development, conducted in the Netherlands between 2010 and 2015 (Deković, Van Aken, Ter Bogt, & Van Geert, 2010). We used data from waves 1–3, collected among a school based sample of 1,297 10- to 19-year-old adolescents, with 6-month intervals between measurements (T1=Fall 2011, T2=Spring 2012, T3=Fall 2013, T4=Spring 2013). Participants were recruited from four secondary and eight elementary schools throughout the Netherlands. Adolescents and their parents received letters, brochures, and flyers describing the aims of the study. Parents received a form on which they could indicate if they did not want their child to participate in the study (i.e., passive informed consent) (Deković et al., 2010). Less than 7.0% of the approached adolescents decided not to participate or were not allowed to take part in the study by their parents. Data collection was supervised by researchers in order to introduce the study and the procedures, answer questions, and ensure privacy. Adolescents completed online questionnaires in the classroom. This was done on a voluntary basis, and confidentiality of the responses was guaranteed, as was the option to withdraw participation at any time. After participation, adolescents received a book gift certificate (increasing in value from €5,00 at T1 to €12,50 at T4). Project STARS was approved by the ethics board of Utrecht University in the Netherlands.

Study Sample

For the current study, we used the first three waves of data. We selected only secondary school students (n=1,132), as the questionnaire for elementary school students (n=165) did not include all investigated instruments. Moreover, to be able to investigate adolescents' experiences with early sexual behaviors, we selected only adolescents ≤16.0 years old across T1–T3 (n=345 excluded). Inconsistencies in adolescents' reports of their sexual behaviors (e.g., reporting sexual experience at T2 and T4, but reporting no sexual experience at T1 and T3; n=44) were either corrected (n=28) or excluded (n=16), depending on the available information on sexual behaviors across the waves. This resulted in a final prospective analysis sample of 771 adolescents.

Measures

Sexual Experience. To assess adolescents' experience with non-coital and coital sexual behaviors, participants were asked: "Have you ever had sex with another person? With sex we mean everything from touching and caressing to intercourse" (0=no, 1=yes). Participants who answered "yes" subsequently reported on their experience (0=no,

1=yes) with four types of non-coital and coital sexual behaviors: 1) naked touching or caressing; 2) manual sex; 3) oral sex, and 4) vaginal intercourse. The scores on the four items were summed into one variable, indicating the level of adolescents' experience with these four behaviors (0=experience with no sexual behavior, 4=experience with all sexual behaviors; Doornwaard et al., 2015; Van de Bongardt et al., 2014; Nogueira Avelar e Silva, Van de Bongardt, Baams, & Raat, 2018). Cronbach's alphas varied from .85 (minimum) to .91 (maximum) across T1–T3, indicating a good internal consistency of these items. Higher scale scores indicated experience with more types of sexual behaviors.

Sexual Communication with Friends. At T1, adolescents reported how often they communicated with their friends about four sexuality-related topics: 1. Being in love and relationships, 2. What you do or do not want to do sexually, 3. With whom you do or do not want to have sex and why, and 4. How you can do sexual things (1=never, 6=very often). They answered these questions two times, once for face-to-face communication ("How often do you discuss these topics with your friends when you are together?"), and once for online communication, ("How often do you discuss these topics with your friends on the Internet, for example through MSN, e-mail, Skype, or chat?"). An overall score was calculated by averaging the scores of the eight items (α=.85). Higher scale scores indicated more frequent online and offline sexual communication with friends.

Sexual Peer Norms. Descriptive norms were measured at T2 with one item to assess adolescents' perceptions of their friends' sexual experiences: "How many of your best friends do you think have experience with intercourse?" (1=none of my friends, 6=all of my friends) (Van de Bongardt et al., 2014). Higher scores indicated that adolescents perceived more friends as having sexual experiences.

Injunctive norms were measured at T2 with an adapted version of an item that has previously been used to measure parental and peer sexual attitudes: "My best friends believe that boys and girls our age should not yet have sex" (1=completely not true, 6=completely true) (Van de Bongardt et al., 2014). Scores were reversed so that higher score indicated that adolescents perceived that their friends were more approving of having sex.

Peer pressure was measured at T2 with one item from the Peer Pressure Scale (Santor et al., 2000): "I feel pressured to have sex, because a lot of people my own age have already had sex" (1=never, 6=very often) (Van de Bongardt et al., 2014). Higher scores indicated that adolescents experienced more pressure from their peers to have sex.

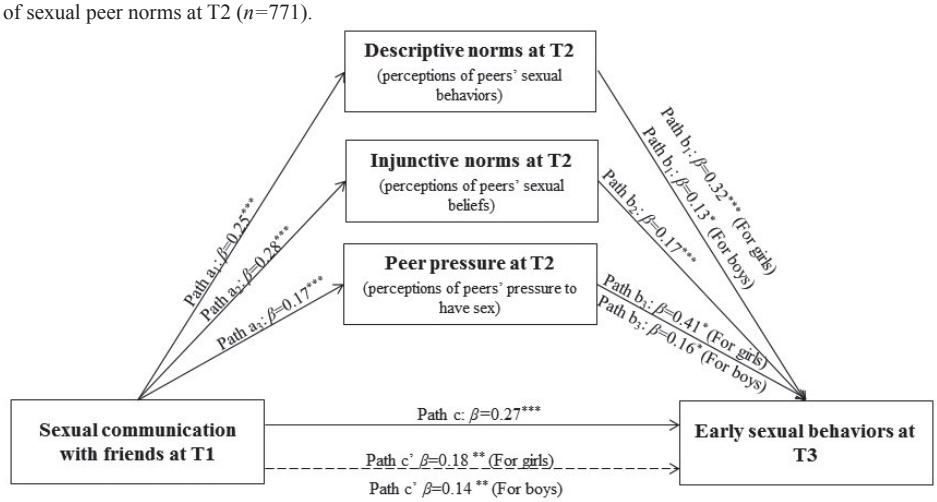
Data Analysis

Descriptive statistics were used to portray the analysis sample characteristics. Chi-square tests and one-way ANOVA tests were performed in SPSS to assess gender differences in all variables. Mediation analyses were performed, using SPSS-macro

PROCESS version 3.0, developed by Hayes (2017), to assess the direct and indirect associations between sexual communication with friends at T1 and early sexual behaviors between T1–T3, through sexual peer norms at T2. To assess whether all three perceived sexual peer norms together (i.e., a set of mediators) explained the association between sexual communication and early sexual behaviors, we extracted the total indirect effect from these mediation analyses, which were conducted in four steps.

Firstly, in the total analysis sample, we assessed the longitudinal association between online and face-to-face sexual communication with friends at T1 and changes in adolescents' experiences with early sexual behaviors between T1–T3. Secondly, we examined whether this association was mediated by the three types of peer sexual norms (i.e., descriptive, injunctive, and peer pressure) at T2. Thirdly, we tested gender-interaction effects to examine whether there were statistically significant differences between boys and girls in all paths of the mediation analyses (see Figure 1). Fourthly, when significant gender-interaction effects were found, we performed the mediation analyses stratified by gender to show the paths separately for boys and girls. In all mediation models, we controlled for T1 covariates (i.e., gender, age, ethnic background, educational level, family structure, and sexual behaviors). Based on the literature, these variables are considered to be potential confounders of the investigated associations (Zimmer-Gembeck, & Helfand, 2008).

Figure 1. Moderated Mediation analyses of the association between adolescents' sexual communication with friends at T1 and experience with early sexual behaviors between T1–T3, through perceptions of three types of sexual peer norms at T2 (n=771).



Notes. $^{*}p<.05$ $p<.01$ $^{***}p<.001$. Significant moderation effects of gender are indicated by p values. Significant gender-interaction effects were found in paths c' ($p<.001$), b_1 ($p=.022$), and b_3 ($p=.010$).

In the first path (path c), we assessed the direct effect between online and face-to-face sexual communication with friends at T1 and changes in adolescents' experiences with early sexual behaviors between T1–T3. In the second set of paths, we assessed the associations between sexual communication with friends at T1 and the three types of sexual peer norms at T2: descriptive norms (path a_1), injunctive norms (path a_2), and peer pressure (path a_3). In the third set of paths, we investigated the associations between the three types of sexual peer norms at T2 (i.e., descriptive norms (path b_1), injunctive norms (path b_2), and peer pressure (path b_3), and changes in adolescents' experiences with early sexual behaviors between T1–T3. In the fourth path (path c'), we investigated the indirect effect of online and face-to-face sexual communication with friends at T1 on adolescents' experiences with early sexual behaviors between T1–T3, with three mediators at T2 included in the model.

Missing value analysis indicated that, in the final analysis sample, there were missing values among: family structure (5.2%), sexual behaviors at T1 (5.4%), sexual communication with friends (7.4%), descriptive norms (16.0%), injunctive norms (9.6%), peer pressure (11.5%), and sexual behaviors at T3 (0.5%). Little's Missing Completely at Random (MCAR) tests indicated that values were missing completely at random for all variables, except for sexual behaviors at T3: $\chi^2(7)=16.116$, $p=.024$. In the first set of mediation analyses, we dealt with missing values using multiple imputation in SPSS across five datasets, which is considered preferable over listwise deletion, even when values are not MCAR (Sterne et al., 2009). To assess whether the results from these mediation analyses performed with and without multiple imputation differed, sensitivity analyses were performed. Because the results from these analyses were similar in significance and effect size, we used the five multiple imputation datasets for analyses, and reported the pooled results.

Moreover, to assess whether each of the three mediators indirectly affected the likelihood of adolescents' experiences with early sexual behaviors separately, yet conditional on the inclusion of the other two mediators in the model, we conducted a second set of mediation analyses to calculate the specific indirect effects. As specific indirect effects cannot be obtained from SPSS-macro PROCESS, they were calculated using the bootstrapping method (5,000 bootstrap iterations), because they are rarely normally distributed (Preacher, & Hayes, 2008). In the results, we report bias-corrected confidence intervals, which are more accurate than percentile intervals, as they are adjusted for skewness and bias in the bootstrap distribution (Preacher & Hayes, 2008). Finding a significant total indirect effect is not a prerequisite for investigating specific indirect effects, because it is possible to find specific indirect effects even when there is a non-significant total indirect effect (Preacher & Hayes, 2008). Therefore, in the description of the results, we present both total indirect effect (Table 2) and specific indirect effects (Table 3).

Furthermore, the fact that the total indirect effect was extracted from the first set of mediation analyses, performed using the multiple imputation datasets (Table 2; n=771), and the specific indirect effects for the three separate sexual peer norms (Table 3; n=533) were calculated in the second set of mediation analyses, using the bootstrapping method, explains the difference in sample size between the two tables. However, as the sensitivity analyses indicated similar results for models with and without multiple imputation, we did not expect this to affect the findings.

For all analyses, standardized regression coefficients were obtained by standardizing all variables before the mediation analyses were conducted (Rothman, 2012), and a significance level of p<.05 was used to indicate significant effects.

Results

Descriptive Analyses

The final prospective analysis sample included 771 adolescents aged 11.0–16.0 years old across three waves, 49.5% girls (mean age at T1=13.4 years, SD=0.64, and mean age at T3=14.3 years, SD=0.58). Table 1 shows that the final prospective analysis sample, 44.0% of adolescents had a low educational level, about 88.0% were from a Dutch ethnic background, and 74.2% lived with both biological parents. In addition, this table shows that, at T1, girls reported significantly more frequent online and face-to-face sexual communication with their friends than boys (p=.007). At T2, perceptions of friends' sexual behaviors (descriptive norms) were similar between boys and girls. However, boys perceived that their friends approved more of having sex (injunctive norms) significantly more than girls (p<.001). Moreover, boys experienced significantly more pressure from their peers to have sex than girls (p<.001). In total, 96 boys (24.8%) and 81 girls (26.1%) were sexually experienced at T3; specific behaviors included: naked touching (8.0% boys and 8.2% girls), manual sex (7.8% boys and 8.4% girls), oral sex (4.9% boys and 5.3% girls), and vaginal sexual intercourse (4.1% boys and 4.2% girls).

Tests of Mediation

Tables 2–3 and Figure 1 display the results of all mediation analyses (paths: c, a_1, a_2, a_3, b_1, b_2, b_3, and c') that were performed to test the hypothesis that three types of sexual peer norms at T2 would mediate the association between online and face-to-face sexual communication with friends at T1 and adolescents' experiences with early sexual behaviors between T1–T3.

Direct Path between Adolescents' Sexual Communication with Friends at T1 and Experiences with Sexual Behaviors between T1–T3 (Path c)

Table 2 shows the results of the direct association between adolescents' online and face-to-face sexual communication with friends at T1 and experiences with early sexual behaviors between T1–T3 (path c). The findings for the total analysis sample showed that more frequent sexual communication with friends at T1 significantly predicted an increase in experiences with sexual behaviors between T1–T3 (β=0.27; p<.001). The results of gender-interaction test (not presented in the table) showed that this path was not moderated by gender (p=.632), and thus that this path was similar for boys and girls.

Paths between Adolescents' Sexual Communication with Friends at T1 and Three Sexual Peers Norms at T2 (Paths a_1, a_2, a_3)

Regarding path a_1, the analyses for the total analysis sample showed that more frequent online and face-to-face sexual communication with friends at T1 significantly predicted that adolescents perceived more of their friends as having experience with sexual behaviors (descriptive peer norms) at T2 (β=0.25; p<.001). This association was moderated by gender (p<.001). The analyses stratified by gender showed that, although the association was significant for both boys (β=0.14; p=.003) and girls (β=0.36; p<.001), it was significantly stronger for girls than for boys.

In relation to path a_2, the analyses for the total analysis sample showed that more frequent sexual communication with friends at T1 significantly predicted that adolescents perceived more of their friends as approving sexual behaviors at T2 (β=0.28; p<.001). This link was not moderated by gender (p=.588).

With regard to path a_3, the analyses for the total analysis sample showed that more frequent sexual communication with friends at T1 significantly predicted that adolescents experienced more pressure from their peers to have sex (β=0.17; p<.001). This link was also not moderated by gender (p=.077).

Paths between Three Sexual Peer Norms at T2 and Experiences with Early Sexual Behaviors between T1–T3 (Paths b_1, b_2, b_3)

Regarding path b_1, the analyses for the total analysis sample showed that adolescents who perceived more of their friends as having sexual experiences at T2 reported significantly more sexual behaviors between T1–T3 (β=0.25; p<.001). This link differed by gender (p=.022): the association was significantly stronger for girls (β=0.32; p<.001) than for boys (β=0.13; p=.021).

In relation to path b_2, the analyses for the total analysis sample showed that adolescents who perceived more of their friends as approving of sex at T2 reported significantly more sexual behaviors between T1–T3 (β=0.17; p<.001). This link was not moderated by gender (p=.984).

With regard to path b_3, the analyses for the total analysis sample showed that more peer pressure at T2 significantly predicted more sexual behaviors between T1–T3 (β=0.23; p<.001). This association was moderated by gender (p=.010), and was –again– significantly stronger for girls (β=0.41; p=.017) than for boys (β=0.16; p=.007).

Indirect Paths between Adolescents' Sexual Communication with Friends at T1 and Experiences with Early Sexual Behaviors between T1–T3, Mediated by Three Sexual Peer Norms at T2 (Path c')

To test whether all three perceived sexual peer norms together (i.e., as a set of mediators) explained the association between sexual communication with friends at T1 and changes in early sexual behaviors between T1–T3, we extracted the total indirect effect, from the mediation analyses (Table 2; path c'). The results for the total analysis samples showed that, when the three mediators at T2 were included in the model, the direct predictive effect of sexual communication with friends at T1 on sexual behaviors between T1–T3 weakened, but remained significant (β=0.16; p<.001). This result indicates partial mediation, meaning that, as a set, the three sexual peer norms partly explained the association between adolescents' sexual communication with friends at T1 and sexual behaviors between T1–T3. The result of gender-interaction effects showed that the mediation differed significantly by gender (p<.001), with a significantly stronger mediation effect for girls (β=0.18; p=.005) than for boys (β=0.14; p=.005).

Specific Indirect Effects

To assess whether each of the three mediators indirectly effected the likelihood of adolescents' experiences with early sexual behaviors between T1–T3 separately, yet conditional on the inclusion of the other two mediators in the model, we calculated the specific indirect effects in a second set of mediation analysis, using bootstrapping (Table 3). The results for the total analysis sample showed that the specific indirect effects of each of the three sexual peer norms were significant: descriptive norms (β=0.06; BA 95% CI: 0.02, 0.14), injunctive norms (β=0.03; BA 95% CI: 0.01, 0.08), and peer pressure (β=0.04; BA 95% CI: 0.01, 0.11).

These findings indicate that all the three sexual peer norms partly explained the association between sexual communication with friends at T1 and changes in adolescents' experiences with early sexual behaviors between T1–T3. However, no significant gender-interaction effects have been found in the tests of specific indirect effects, indicating that all three types of sexual peer norms partially explained the association between sexual communication with friends and increased experience with sexual behaviors similarly for both boys and girls.

Discussion

In the current study, we investigated the association between adolescents' sexual communication (online and face-to-face) with friends at T1 and changes in their experiences with early sexual behaviors between T1–T3, examining whether this association was mediated by three types of sexual peer norms at T2 (i.e., descriptive, injunctive, and peer pressure). Moreover, gender differences were examined in all these associations.

Aligning with our five hypotheses and previous findings (Busse et al., 2010), our study showed: First, adolescents (both boys and girls) who had more frequent online and face-to-face sexual communication with their friends at T1 had a significant increase in experiences with sexual behaviors between T1–T3 (H1). Second, we found that adolescents who had more frequent sexual communication (online and face-to-face) with their friends at T1 significantly perceived, at T2, that: 1) more of their friends had experiences with sexual behaviors (descriptive norms), 2) their friends approved more of having sex (injunctive norms), and 3) there was more pressure from their peers to have sex (peer pressure), (H2). Third, our study showed that adolescents who, at T2, perceived that: 1) more of their friends had experiences with sexual behaviors, 2) their friends approved more of having sex, and 3) their friends exerted more pressure to have sex, had a significant increase in experiences with sexual behaviors between T1–T3 (H3). Moreover, the links between adolescents' perceptions of these sexual peer norms at T2 and changes in early sexual behaviors between T1–T3, were stronger for girls than for boys (H3 and H5). Regarding our fourth hypothesis, our findings from the mediation analysis (i.e., total indirect effect) showed that the association between adolescents' online and face-to-face sexual communication with friends at T1 and sexual behaviors between T1–T3 was partially explained by the three sexual peer norms at T2, for both boys and girls (H4). Moreover, as expected, the total indirect effect in the mediation analysis was stronger for girls than for boys (H4 and H5).

The findings reflecting our hypotheses 1–4 confirm the rationale that the mechanism of role modeling partly underlie these associations between sexual communication with friends and sexual peer norms (Bandura, 1971, Cialdini et al., 2004). Specifically, it may be that during sexuality-related talks, friends exchange information about their own sexual behaviors, which may shape adolescents' perceptions of their friends sexual behaviors, attitudes towards sex, and peer pressure to have sex. In turn, adolescents' perceptions of their friends' sexual peer norms could stimulate adolescents' own sexual behaviors. That is, adolescents may reason that if their friends behave in a certain way, it must be a wise thing to do.

The role of injunctive norms in adolescents' increased experiences with early sexual behaviors between T1–T3 relates to the extent to these norms are in accordance with adolescents' own values. When peers' approval of having sex is in accordance with ado-

lescents' own positive attitudes towards sexual behaviors, adolescents are more likely to initiate those behaviors themselves (White, Hogg, & Terry, 2002).

Moreover, they may be motivated to conform to their peer behaviors (e.g., to engage in an expected behavior) because of perceived social benefits (e.g., social acceptance) when they do conform, or social losses (e.g., social rejection) when they do not conform (Van de Bongardt et al., 2015). It has been shown that those adolescents who experienced more pressure from their peers to have sex were more likely to engage in sexual behaviors at an early age (Van de Bongardt et al., 2015).

By examining mediation pathways of the associations between sexual communication with friends, three types of sexual peer norms, and subsequent sexual behaviors, our study contributes to advance the understanding on how friends play a role in adolescents' sexual behaviors, through an interplay of communication and norms about sex. However, the fact that we found only partial mediation means that there are other factors that contribute to explain these links too. Perhaps, factors such as the frequency at which adolescents watch pornography together could be another explanatory factor of the association between adolescents' sexual communication with friends and engagement in sexual behaviors over time (Harris, 1994). The investigation hereof can be a direction for future studies.

Finally, the findings concerning gender differences in the associations between sexual communication with friends and early sexual behaviors between T1–T3, through sexual peer norms are in line with our hypothesis that both direct and indirect links would be stronger for girls than for boys (Van de Bongardt et al., 2015). An elucidation for these differences can be related to the fact that, generally, girls have lower levels of global self-esteem than boys (Nogueira et al., 2018), which may contribute to make them more sensitive to peer norms than boys. Future studies should further investigate how sexual peer norms affect girls' sexual behaviors more strongly than boys' behaviors, for example, by testing a potential buffering effect of self-esteem on the association between sexual peer norm perceptions and adolescents' experiences with early sexual behaviors over time.

Strengths and Limitations

The current study has some major strengths. Firstly, it includes the use of a longitudinal study design, which allowed us assess over-time changes (i.e., an increase) in adolescents' experiences with early sexual behaviors, and to which extent peers contribute to these modifications in sexual behaviors. Secondly, by measuring various sexual behaviors, ranging from naked touching to intercourse, and thus, not only intercourse, all adolescents who had experience with any of these behaviors were included in the

present study. As such, the use of this broad conceptualization of early sexual behavior allowed us to assess the role of peers in the initial stages of intimate and sexual behaviors in early adolescence. Thirdly, our study also extended the literature by including both online and face-to-face communication in the measures. Considering the contemporary increasing popularity of online communication among peers (Doornwaard et al., 2015; Van de Eijnden et al., 2014), the examination of online communication, in addition to face-to-face communication, is a clear strength of our study.

The present study also has its limitations. First, although this study employed a longitudinal design, we only assessed our mediation model in one direction. However, even though we considered sexual communication with friends as a predictor of adolescents' perceptions of sexual peer norms, it is plausible that adolescents' perceptions of sexual norms among their peers also affect the way in which adolescents talk about sex with their friends. Similarly, the frequency of sexual communication with friends may not only predict subsequent changes in their sexual behaviors, but changes in their sexual behaviors may very well also predict subsequent changes in how often adolescents talk about sex (e.g., their own sexual experiences) with their friends (Van de Bongardt et al., 2017). Future longitudinal studies need to further investigate the extent to which these associations are bidirectional.

Second, because the sample consisted mainly of adolescents with a Dutch ethnic background, generalizability of the results to other ethnic groups may be limited. Third, the data were collected with adolescents' self-reports, which may have led to bias. It has been found that boys often over-report, and girls often under-report sexual experiences (Siegel, Aten, & Roghmann, 1998). However, self-reports are the commonly the only feasible method to assess sexual behavior. Finally, research has shown that adolescents often have misperceptions of sexual peer norms, as they tend to overestimate peers' sexual experiences and their positive attitudes toward sex (Prentice, 2008; Martens et al., 2006). On the other hand, perceptions of sexual norms among peers have been found to be stronger correlates of adolescents' own sexual behavior than actual peer-reported behaviors and attitudes, even when these perceptions are incorrect (Prentice, 2008).

The findings of the current study have implications for educators, health care professionals, and parents. When deploying prevention and intervention strategies to promote adolescents' sexual health, the influence of friends on adolescents' sexual behaviors through communication about sex and perceptions of sexual peer norms, should be taken into account. Using peer education to inform adolescents about actual sexual behaviors and attitudes among youth (e.g., average ages at which most adolescents start engaging in various sexual behaviors) may be particularly effective for the correction of existing misperceptions (Agha & Van Rossem, 2004; Caron, Godin, Otis, & Lambert, 2004). In addition, parents should be aware of the fact that peers play a role in adolescents' sexual behaviors, for instance through communication about sexuality, and through sexuality-

related norms among peers. But also, parents should be aware that they themselves play a role in their children' experiences with sexual behaviors (Van de Bongardt et al., 2014; Nogueira et al., 2016). For example, Van de Bongardt and colleagues (2014) found that more frequent parent–adolescent communication significantly reduced the effects of sexually active friends and experienced peer pressure on early adolescents' intentions to have sex (Van de Bongardt et al., 2014).

Overall, our study indicates that sexual peer norms partly explain the associations between sexual communication with friends and adolescents' experiences with early sexual behaviors between T1–T3, contributing to advance the understanding on how friends play a role in adolescents' sexual behaviors, through an interplay of communication and norms about sex.

Table 1: Descriptive Characteristics of the Prospective Analysis Sample and Gender Differences

	Boys (*n*=389)			Girls (*n*=382)			
	n	%	Mean (SD)	n	%	Mean (SD)	*p* [b]
T1 Covariates [a]							
Age							
11.0–16.0 years			13.4 (0.64)			13.4 (0.62)	.798
Educational Level [c]							
Low	171	44.0		145	38.0		.053
High	218	56.0		237	62.0		
Ethnic Background [d]							
Native Dutch	342	87.9		335	87.7		.506
Non-native Dutch	47	12.1		47	12.3		
Family Structure [e]							
Living with both Biological Parents	273	74.2		281	77.4		.176
Not living with both Biological Parents	95	25.8		82	22.6		
Early Sexual Behaviors							
			0.06 (0.35)			0.03 (0.25)	.231
T1 Predictor [a]							
Sexual Communication with Friends							
			1.74 (0.79)			1.90 (0.79)	.007
T2 Mediators [a]							
Descriptive Norms							
			1.44 (0.88)			1.44 (0.92)	.874
Injunctive Norms							
			3.08 (1.75)			2.58 (1.60)	<.001
Peer Pressure							
			1.38 (0.78)			1.15 (0.55)	.001
T3 Outcome							
Early Sexual Behaviors							
			0.23 (0.79)			0.25 (0.83)	.767

Notes: [a] Missing values were found among family structure (5.2%), sexual behaviors (5.4%), sexual communication with friends (7.4%), descriptive norms (16.0%), injunctive norms (9.6%), peer pressure (11.5%), and sexual behaviors (0.5%), as described in the text.

[b] Significance level of differences for Chi-Square tests (categorical variables) and One-way ANOVA tests (continuous variables).

[c] Low educational level=1=pre-vocational education. High educational level=0=senior general education and pre-university education.

[d] Native Dutch=0=adolescent and both parents born in the Netherlands. Non-native Dutch=1=adolescent or at least one parent was not born in the Netherlands.

[e] Family Structure=assessed whether adolescents lived with both biological parents or not. This variable was dichotomized: 0=Living with both biological parents and 1=Not living with both biological parents.

Table 2: Mediation Analyses of the Associations between Sexual Communication with Friends at T1 and Changes in Adolescents' Experience with Early Sexual Behaviors between T1–T3, through Perceived Sexual Peer Norms at T2, in the Total Sample, and Stratified by Gender

	Sexual Behaviors between T1–T3								
	Total Analysis Sample (*n*=771)			Boys (*n*=389)			Girls (*n*=382)		
	B (SE)	*β*	*p*	B (SE)	*β*	*p*	B (SE)	*β*	*p*
Path c: Predictor-> Outcome									
	0.25 (.04)	0.27	<.001	0.19 (.05)	0.21	<.001	0.33 (.06)	0.36	<.001
Path c' (Indirect): -> Predictor Mediators -> Outcome									
	0.15 (.04)	0.16	<.001	0.13 (.05)	0.14	.005	0.16 (.06)	0.18	.005
Paths a: Predictor -> Mediators									
Descriptive Norms (a_1)	0.29 (.05)	0.25	<.001	0.16 (.05)	0.14	.003	0.43 (.08)	0.36	<.001
Injunctive Norms (a_2)	0.62 (.08)	0.28	<.001	0.65 (.11)	0.30	<.001	0.62 (.10)	0.28	<.001
Peer Pressure (a_3)	0.14 (.03)	0.17	<.001	0.17 (.06)	0.20	<.001	0.15 (.04)	0.17	<.001
Paths b: Mediators-> Outcome									
Descriptive Norms (b_1)	0.19 (.04)	0.25	<.001	0.10 (.04)	0.13	.021	0.24 (.05)	0.32	<.001
Injunctive Norms (b_2)	0.07 (.02)	0.17	<.001	0.06 (.02)	0.15	.004	0.08 (.03)	0.18	.008
Peer Pressure (b_3)	0.25 (.04)	0.23	<.001	0.17 (.06)	0.16	.007	0.44 (.07)	0.41	.017

Notes. Analyses included covariates at T1 (i.e., gender, age, ethnic background, educational level, family structure, and sexual behaviors).
B=unstandardized regression coefficients; SE=standard error; β=standardized regression coefficient.
Significant gender-interaction effects were found in paths c' ($p<.001$), b_1 ($p=.022$), and b_3 ($p=.010$), as discussed in the text.

Table 3: Specific Indirect Effects of Mediation Models, in the total analysis sample, and stratified by gender

	Changes in Sexual Behaviors between T1–T3		
	Total Analysis Sample [a] (*n*=533)	Boys (*n*=256)	Girls (*n*=277)
	Point Estimate (BA 95% CI) [b]	Point Estimate (BA 95% CI)	Point Estimate (BA 95% CI)
Sexual Communication with Friends			
Specific indirect effects			
Descriptive Norms	0.06 (0.02, 0.14)	0.01 (-0.01, 0.04)	0.11 (0.01, 0.28)
Injunctive Norms	0.03 (0.01, 0.08)	0.05 (0.01, 0.11)	0.02 (-0.02, 0.06)
Peer Pressure	0.04 (0.01, 0.11)	0.02 (-0.01, 0.09)	0.04 (-0.02, 0.14)

Notes. [a] Analyses included covariates (i.e., gender, age, ethnic background, educational level, family structure, and sexual behaviors at T1)
[b] BA 95% CI=Bias corrected 95% confidence intervals.

References

Agha, S., & Van Rossem, R. (2004). Impact of a school-based peer sexual health intervention on normative beliefs, risk perceptions, and sexual behavior of Zambian adolescents. *Journal of Adolescent Health*, *34*, 441-452. doi:10.1016/j.jadohealth.2003.07.016

Akers, A. Y., Gold, M. A., Bost, J. E., Adimora, A. A., Orr, D. P., & Fortenberry, J. D. (2011). Variation in sexual behaviors in a cohort of adolescent females: The role of personal, perceived peer, and perceived family attitudes. *Journal of Adolescent Health*, *48*, 87-93. doi:10.1016/j.jadohealth.2010.05.004

Ali, M. M., & Dwyer, D. S. (2011). Estimating peer effects in sexual behavior among adolescents. *Journal of Adolescence*, *34*, 183-190. doi:10.1016/j.adolescence.2009.12.008

Bandura, A. (1971). *Social learning theory*. New York, NY: General Learning Press.

Berten, H., & Van Rossem, R. (2011). Mechanisms of peer influence among adolescents: cohesion versus structural equivalence. *Sociological Perspectives*, *54*, 183-204. doi:10.1525/sop.2011.54.2.183

Busse, P., Fishbein, M., Bleakley, A., & Hennessy, M. (2010). The role of communication with friends in sexual initiation. *Communication Research*, *37*, 239-255. doi: 10.1177/0093650209356393

Caron, F., Godin, G., Otis, J., & Lambert, L. D. (2004). Evaluation of a theoretically based AIDS/STD peer education program on postponing sexual intercourse and on condom use among adolescents attending high school. *Health Education Research*, *19*, 185-197. doi:10.1093/her/cyg017

Cialdini, R. B., & Goldstein, N. J. (2004). Social influence: Compliance and conformity. *Annual Reviews, 55,* 591-621. doi:10.1146/annurev.psych.55.090902.142015

Crawford, M., & Popp, D. (2003). Sexual double standards: A review and methodological

critique of two decades of research. *Sex Roles*, *40*, 13-26. doi:10.1080/00224490309552163

De Graaf, H., Vanwesenbeeck, I., Meijer, S., Woertman, L. & Meeus, W. (2009). Sexual trajectories during adolescence: Relation to demographic characteristics and sexual risk. *Archives of Sexual Behavior*, *38*, 276-282. doi:10.1007/s10508-007-9281-1

Deković, M., Van Aken, M. A. G., Ter Bogt, T. F. M. & Van Geert, P. (2010). *Sexuality and intimate relations of Dutch youth: Developmental trajectories and developmental context (Project STARS).* Research project, Netherlands Organization for Scientific Research (NWO) Grant no. 431-99-018.

Dixon-Mueller, R. (2008). How young is "too young"? Comparative transitions on adolescent sexual, marital, and reproductive transitions. *Studies in Family Planning, 39*, 247-262.

Doornwaard, S. M., Van den Eijnden, R. J. J. M., Overbeek, G., & Ter Bogt, T. F. M. (2015). Differential developmental profiles of adolescents using sexually explicit internet material. *The Journal of Sex Research*, *52*, 269-281. doi: 10.1080/00224499.2013.866195

Doornwaard, S. M., Bickham, D. S., Rich, M., Vanwesenbeeck, I., Van de Eijnden R. J. J. M., Ter Bogt, T. F. M. (2014). Sex-related online behaviors and adolescents' body and sexual self-perceptions. *Pediatrics, 134,* 1103-1110. doi:10.1542/peds.2014-0592

Gross, E. F. (2004). Adolescent Internet use: What we expect, what teens report. *Applied Developmental Psychology*, *25*, 633-649. doi:10.1016/j.appdev.2004.09.005

Hayes, A. F. (2018). Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach. 1-692. New York: The Guilford Press.

Harris, A. M. (1994). Pornography and Premarital Sexual Activity Among LDS Teenagers. *Brigham Young University, 63.*

Kaestle, C. E., Halpern, C. T., Miller, W. C., Ford, C. A. (2005). Young age at first sexual intercourse and sexually transmitted infections in adolescents and young adults. *Am J Epidemiol, 8,* 774–780.

Kapungu, C. T., et al. (2010). Beyond the "birds and the bees": Gender differences in sex-related communication among urban African-American adolescents. *Family Process*, *49*, 251-264. doi:10.1111/j.1545-5300.2010.01321.x

Kreager, D. A., & Staff, J. (2009). The Sexual Double Standard and Adolescent Peer Acceptance *Social Psychology Quartely, 72*, *143-164,* doi:10.1177/019027250907200205

Lyons, H., Giordano, P. C., Manning, W. D., & Longmore, M. A. (2011). Identity, peer relationships, and adolescent girls' sexual behavior: An exploration of the contemporary double standard. *The Journal of Sex Research*, *48*, 437-449. doi: 10.1080/00224499.2010.506679

Maguen, S., & Armistead, L. (2006). Abstinence among female adolescents: Do parent matter above and beyond the influence of peers? *American Journal of Orthopsychiatry*, *76*, 260-264. doi:10.1037/0002-9432.76.2.260

Martens, M. P., Page, J. C., Mowry, E. S., Damann, K. M., Taylor, K. K., & Cimini, M. D. (2006). Differences between actual and perceived student norms: An examination of alcohol use, drug use, and sexual behavior. *Journal of American College Health*, *54*, 295-300. doi:10.3200/JACH.54.5.295-300

Nogueira, A. S. R., Van de Bongardt, D., Baams, L., & Raat, H. (2018). Bidirectional associations between adolescents' sexual behaviors and psychological well-being. *Journal of Adolescent Health, 62,* 63-71.

Nogueira, A. S. R., Van de Bongardt, D., Van de Looij-Jansen, P., Wijtzes, A., Raat, H. (2016). Mother- and father-adolescent relationships and early sexual intercourse. *Pediatrics, 138*, 1-9. doi:10.1542/peds.2016-0782

O'Sullivan, L. F., & Brooks-Gunn, J. (2005). The timing of changes in girls' sexual cognitions and behaviors in early adolescence: A prospective, cohort study. *Journal of Adolescent Health*, *37*, 211-219. doi:10.1016/j.jadohealth.2004.08.019

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, *40*, 879-891. doi:10.3758/BRM.40.3.879

Prentice, D. A. (2008). Mobilizing and weakening peer influence as mechanisms for changing behavior. In M. J. Prinstein & K. A. Dodge (Eds.), *Understanding Peer Influence in Children and Adolescents.* 161-180. New York: The Guilford Press.

Rothman, K. (2012). Epidemiology: An Introduction (2nd Ed). 1-268. Oxford: Oxford University Press.

Rudolph, K. D., & Conley, C. S. (2005). The socioemotional costs and benefits of social-evaluative concerns: Do girls care too much? *J Pers., 73,* 115–138. doi: 10.1111/j.1467-6494.2004.00306.x.

Sandfort, T. G., Orr, M., Hirsch, J. S., Santelli, J. (2008). Long-term health correlates of timing of sexual debut: results from a national US study. *Am J Public Health, 98,* 55–161.

Santelli, J. S., Kaiser, J., Hirsch, L., Radosh, A., Simkin, L., & Middlestadt, S. (2004). Initiation of sexual intercourse among middle school adolescents: the influence of psychosocial factors. *Journal of Adolescent Health*, *34*, 200-208. doi:10.1016/j.jadohealth.2003.06.004

Santor, D. A., Messervey, D., & Kusumakar, V. (2000). Measuring peer pressure, popularity, and conformity in adolescent boys and girls: Predicting school performance, sexual attitudes, and substance abuse. *Journal of Youth and Adolescence*, *29*, 163-182. doi:10.1023/A:1005152515264

Siegel, D. M, Aten, M. J, Roghmann, K. J. (1998). Self-reported honesty among middle and high school students responding to a sexual behavior questionnaire. *Journal of Adolescent Health*, *23*, 20-28. doi:10.1016/S1054-139X(97)00274-7

Sieving, R. E., Eisenberg, M. E., Pettingell, S., & Skay, C. (2006). Friends' influence on adolescents' first sexual intercourse. *Perspectives on Sexual and Reproductive Health*, *38*, 13-19. doi:10.1363/3801306

Steinberg, L., & Morris, A. S. (2001). Adolescent development. *Annual Review of Psychology*, *52*, 83-110. doi:10.1146/annurev.psych.52.1.83

Sterne, J. A. C., et al. (2009). Multiple imputation for missing data in epidemiological and clinical research: Potential and pitfalls. *BMJ,* 338.

UNICEF, UNAIDS, UNFPA, ILO, WHO, and The World Bank. (2011). Opportunity in Crisis: Preventing HIV From Early Adolescence to Young Adulthood. New York, NY: *United Nations Children's Fund (UNICEF),* 1–61

Valkenburg, P. M., Sumter, S. R., & Peter, J. (2011). Gender differences in online and offline self-disclosure in pre-adolescence and adolescence. *British Journal of Developmental Psychology*, *29*, 253-269. doi:10.1348/2044-835X.002001

Van de Bongardt, D., De Graaf, H., Reitz, E., & Deković, M. (2014). Parents as moderators of longitudinal associations between sexual peer norms and Dutch adolescents' sexual initiation and intention. *Journal of Adolescent Health*, *55*, 388-393. doi:10.1016/j.jadohealth.2014.02.017

Van de Bongardt, D., Reitz, E., Overbeek, G., Boislard, M. A., Burk, W. J., & Deković, M. (2017). Observed normativity and deviance in friendship dyads' conversations about sex and the relations with youths' perceived sexual peer norms. *Archives of Sexual Behavior*, *46*, 1793-1806. doi:10.1007/s10508-016-0763-x

Van de Bongardt, D., Reitz, E., Sandfort, T., & Deković, M. (2015). A meta-analysis of the relations between three types of peer norms and adolescent sexual behavior. *Personality and Social Psychology Review*, *19*, 203-234. doi: 10.1177/1088868314544223

Widman, L., Choukas-Bradley, S., Noar, S. M., Nesi, J., Garrett, K. (2016) Parent-adolescent sexual communication and adolescent safer sex behavior: a meta-analysis. *JAMA Pediatrics, 170,* 52-61. doi:10.1001/jamapediatrics.2015.2731

White, K. M., Hogg, M. A., & Terry, D. J. (2002). Improving attitude-behavior correspondence through exposure to normative support from a salient ingroup. *Basic and Applied Social Psychology*, *24*, 91-103. doi:10.1207/S15324834BASP2402_2

Zimmer-Gembeck, M. J., Helfand, M. (2008). Ten years of longitudinal research on U.S. adolescent sexual behavior: Developmental correlates of sexual intercourse, and the importance of age, gender, and ethnic background. *Developmental Review*, 28, 153- 224. doi:10.1016/j.dr.2007.06.001

Chapter 6

Adolescents' Sexual and Reproductive Health: A Comparison across the Netherlands, the United States, and Brazil

Raquel Nogueira Avelar e Silva,[1] Daphne van de Bongardt,[2] Margherita Malanchini,[3] Hanneke de Graaf,[4] Kathryn Paige Harden,[3] Hein Raat.[1]

1. Department of Public Health, Erasmus Medical Center, Erasmus University Rotterdam, Rotterdam, the Netherlands.
2. Department of Psychology, Education and Child Studies, Erasmus University Rotterdam, Rotterdam, the Netherlands.
3. Department of Psychology, the University of Texas at Austin, Austin, the United States.
4. Dutch Centre of Expertise on Sexual and Reproductive Health and Rights (Rutgers), Utrecht, the Netherlands.

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Abstract

Background and Objectives

Research on adolescents' sexual and reproductive health (SRH) lacks focus on low- and middle-income countries and cross-country comparisons. In this study, we investigated five aspects of adolescents' SRH (timing of first sexual intercourse, number of sexual partners, condom use, contraceptive use, teen pregnancy) and six psycho-social predictors thereof (gender, age, ethnic background, family structure, parental monitoring, in-school sexuality education) across the Netherlands, the United States, and Brazil.

Methods

Using three large, nationally representative datasets, this study included 122,278 adolescents (11.0–19.9-years, M=14.8). Cox-proportional-hazard, ordered, and logistic regressions were performed to assess psycho-social predictors of SRH, and cross-country differences.

Results

Overall, Dutch and Brazilian adolescents showed more optimal SRH (e.g., more condom/contraceptive use, lower teen pregnancy rates) than American adolescents. Regarding psycho-social predictors, across all countries, boys reported more sexual partners, more condom use, and less contraceptive use than girls. In all countries, adolescents who lived with both biological parents and who received more in-school sexuality education were more likely to report fewer sexual partners, and more condom/contraceptive use. The effect of parental monitoring on SRH differed cross-culturally. While in Brazil and in the Netherlands, more parental monitoring was associated with more optimal SRH outcomes, these associations differed in the United States.

Conclusions

By identifying cross-country differences in adolescents' SRH and psycho-social predictors thereof, as well as similar protective factors of adolescents' SRH, such as more in-school sexuality education, our findings may contribute to the development of effective strategies to improve adolescents' SRH.

Introduction

The initiation of sexual behaviors is a normative step during adolescence.[1] However, risky sexual behaviors (e.g., sexual intercourse without condoms) are associated with negative outcomes, such as the contraction of sexually transmitted infections (STIs), and teen pregnancies.[1] The World Health Organization estimates that about 333 million curable STIs occur worldwide yearly, of which a considerable part affects adolescents aged 15.0–19.9 years.[1] In addition, globally, about 17 million teenage girls younger than 20.0 years give birth, every year.[1]

Sexual and reproductive health (SRH) problems among adolescents are a challenge for most countries, and are not restricted to low- and middle-income countries (LMIC).[1] For example, in the United States (US) about three million adolescents contract STIs yearly, and, the teen pregnancy rate (8.0%) is one of the highest among high-income countries (HICs).[1] However, there are countries where adolescents have a relatively optimal SRH, such as the Netherlands (NL), showing low rates of STIs and teen pregnancies among adolescents.[2]

Understanding the factors that affect adolescents' SRH behaviors and outcomes is a fundamental step towards the improvement of adolescents' SRH. Ecological systems theories suggest that a complexity of factors, such as individual (e.g., gender), and social (e.g., in-school sexuality education), affect adolescents' SRH behaviors and outcomes.[3] As empirical knowledge has been accumulated about adolescents' SRH, it has become clear that adolescents' sexual behaviors, safe or risky, are, indeed, related to a variety of ecological factors.[4-20]

Up to now, there are, at least, two notable gaps in research on predictors of adolescents' SRH. Firstly, cross-country comparisons of adolescents' SRH and predictors thereof are scarce,[14] which is problematic because psycho-social factors that affect adolescents' SRH may vary across cultural contexts. Secondly, empirical knowledge on predictors of SRH focus on adolescents from HICs.[4-19] Global research on SRH of adolescents from LMICs relatively often has a focus on Sub-Saharan Africa.[21] This is problematic because over 85.0% of adolescents' world population lives in LMICs.[1]

Further, over 85.0% of all new cases of STIs and teen pregnancy occur among adolescents from LMICs.[1] Unlike most countries in Latin America, Brazil is neither reaching the Millennium Development Goal of combating HIV/Aids, nor the 2016 United Nations sustainable goal of ending the Aids epidemic by 2030.[1] The country is currently facing an epidemic of syphilis, HIV, and other STIs, among adolescents.[22, 23] A 2016-national report showed that, between 2010–2015, the incidence of acquired syphilis increased about 20.0% among adolescents aged 13.0–19.9 years.[22] And, a 2016 UNAIDS-Brazil report showed that, between 2006–2015, the incidence of HIV increased more than 50·0%, of which a considerable part occurred among adolescents aged 15.0–19.9 years.[23]

Furthermore, about 630,000 (20.3%) teenage girls give birth yearly in Brazil, of which 30,000 (1.0%) girls are younger than 15.0 years old.[24]

The inclusion of LMICs in research on adolescents' SRH is highly needed to generate scientific knowledge that reflects more accurately the SRH of adolescents' world population. Moreover, cross-country comparisons may contribute to the identification of similarities and differences in SRH behaviors and outcomes, as well as differences and similarities in risk and protective factors, and thus shed some light on possible explanations for cross-country variations in adolescents' SRH. Hereto, in the current study, we investigated the associations between five aspects of adolescents' SRH (i.e., timing of first sexual intercourse, number of sexual partners, condom use, contraceptive use, teen pregnancy) and six psycho-social predictors thereof (gender, age, ethnic background, family structure, parental monitoring, in-school sexuality education) across the Netherlands, the United States, and Brazil.

Methods

Study Design

We used data from three large, nationally representative datasets, collected in the Netherlands (Sex under the age of 25, 2005),[25] the US (Add Health, 1996),[26] and Brazil (PeNSE, 2015).[27] In the cross-sectional study Sex under the age of 25, data were collected using online self-report questionnaires, and a total of 4,820 adolescents and young adults (11.0–24.9 years) participated in the study.[25] In the longitudinal study Add Health, we used data from wave I, collected using self-report questionnaires applied in-school among 90,118 adolescents (11.0–21.0 years), and wave II, collected through in-home interviews applied to 14,738 adolescents.[26] In the cross-sectional study PeNSE, data were collected in 2015, using online self-report questionnaires, and a total of 102,072 adolescents (5.8–20.0 years), who were enrolled in the last year of secondary education, participated in the study.[27]

For the current study, we selected only adolescents 11.0–19.9 years old (n=122 Brazilians, n=1,817 Dutch, and n=199 Americans excluded). The final analysis samples included 101,950 Brazilian adolescents (M=14.4 years, SD=1.03, 51.7% girls), 3,003 Dutch adolescents (M=16.2 years, SD=2.22, 51.1% girls), and 14,539 American adolescents (M=16.6 years, SD=1.56, 51.4% girls). Across all three countries, adolescents differed significantly in various characteristics (table 1). The final pooled analysis sample included 122,278 adolescents (M=14.8 years, SD=1.44, 51.8% girls).

Variables

We harmonized the three national datasets by recoding comparable variables across the datasets into overall measures, after which, we merged the three harmonized datasets into one pooled dataset. A detailed description of how all variables were originally measured, and how they were harmonized is shown in Supplementary Table 1.

Regarding adolescents' SRH behaviors and outcomes, timing of first sexual intercourse assessed the age at which adolescents had their first sexual intercourse (≥9.0–19.9 years). If adolescents have never had sexual intercourse, a value of their age at the moment of the survey (11.0–19.9 years) was attributed to the variable timing of first sexual intercourse. Otherwise, a value of their age at first sexual intercourse (≥9.0–19.9 years) was given. Condom use measured whether adolescents had used a condom during their last sexual intercourse experience, or with their last partner (0=No, 1=Yes). Contraceptive use measured whether adolescents had used a contraceptive method, other than condoms, during their last sexual intercourse experience, or with their last partner (0=No, 1=Yes). Number of sexual partners assessed how many people adolescents have had sexual intercourse with (1=1 sexual partner to 6=≥6 sexual partners). Teen pregnancy assessed whether girls had ever been pregnant as a teen (<20.0 years), (0=No, 1=Yes).

Statistical Analysis

Analyses were performed in four steps. After descriptive inspections of the analysis samples' characteristics, we investigated the psycho-social predictors of adolescents' SRH behaviors and outcomes, using different types of multivariate regression analyses. For timing of first sexual intercourse, we applied cox-proportional hazard regression; this approach may be applied when the outcome measures refers to the time it takes until a certain event occurs.[28] Ordered logistic regression was performed for the number of sexual partners. Logistic regression was performed for condom use, contraceptive use, and teen pregnancy. All psycho-social predictors were added into the regression models simultaneously, to adjust for each other's independent contribution. Third, we tested interaction effects between country and all psycho-social predictors (e.g., country × gender) to assess whether the associations between psycho-social predictors and adolescents' SRH behaviors and outcomes differed significantly across countries. In case of a significant country-interaction effect in the pooled analysis sample, we re-tested the interaction effect in subgroups: BR-NL, BR-US, and NL-US, to identify the exact between-country difference.

Missing value analysis indicated that the percentage of missing values were <10.0% for almost all variables, but >10.0% for some variables (e.g., 83.1% for contraceptive use in the American dataset, among adolescents who have had sexual intercourse), (supplementary table 1). All missing values were imputed using multiple imputation across five sets,[29] using SAS statements proc mi and proc mianalyze.[30] All analyses were conducted

using SAS 9.4. A significance level of $p<.01$ was used to indicate any significant effects, including interaction effects.

Ethical Approval

All data used in the current study have been collected with the approval of country-specific Institutional Review Board (IRB) or law.[25-27] Sex under the age of 25 was exempt from medical-ethical committee under Dutch law. All waves of Add Health have been approved by the IRB of the Office of Human Research Ethics, at the University of North Carolina at Chapel Hill. PeNSE was approved by the National Commission of Research Ethics. In all studies, adolescents received written information about the questionnaires, completed the questionnaires on a voluntary basis, and were free to withdraw participation at any time. All information was anonymized and de-identified prior to analysis.[25-27]

Results

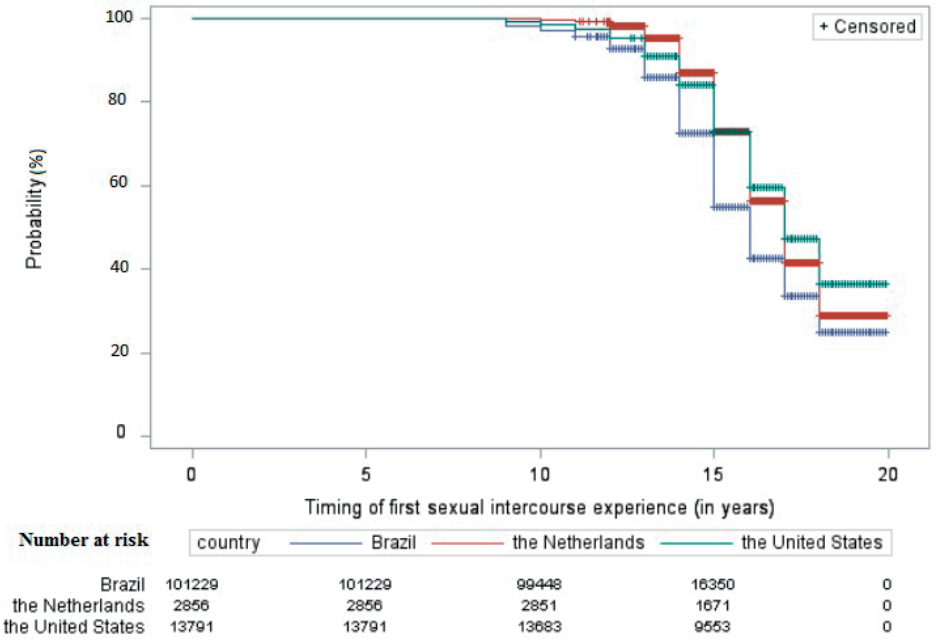
Characteristics of the Analysis Samples

Psycho-social predictors, and adolescents' SRH behaviors and outcomes (except for gender) differed significantly across all three countries and subgroups: BR-NL, BR-US, and NL-US (table 1).

Brazilian adolescents were on average 1.8 years younger than Dutch and 2.4 years younger than American adolescents. The proportion of adolescents from a European ethnic background was higher in the Netherlands, followed by the US, and Brazil. The percentages of adolescents who lived with both biological parents, and the levels of parental monitoring were higher in the Netherlands, followed by Brazil, and by the US. The provision of in-school sexuality education was higher in the Netherlands, followed by Brazil, and by the US.

Further, the percentage of adolescents who have had sexual intercourse was higher in the US (44.3%), followed by the Netherlands (39.4%), and Brazil (28.1%). On average, Brazilian adolescents have had their first sexual intercourse (M=14.0 years) earlier than Dutch (M=15.3 years), and American adolescents (M=15.6), (table 1, figure 1). American adolescents had significantly more sexual partners (n=2.9) than Dutch (n=2.6) and Brazilian (n=2.5) adolescents. American adolescents (52.3%) used condoms significantly less often than Dutch (65.4%) and Brazilian adolescents (69.2%). Also, American adolescents (43.4%) used other contraceptives significantly less often than Dutch (56.7%) and Brazilian (72.5%) adolescents. Finally, American girls (21.3%) were significantly more likely to have been pregnant as a teen than Brazilian (9.4%) and Dutch girls (2.8%).

Figure 1: Timing of first sexual intercourse experience



Psycho-Social Predictors of Adolescents' SRH Behaviors and Outcomes

Timing of First Sexual Intercourse

Table 2 shows the associations between psycho-social predictors and timing of first sexual intercourse. Country-interaction effects showed that, in all three countries, adolescents from a non-European ethnic background, and who did not live with both biological parents were more likely to initiate sexual intercourse earlier. In Brazil only, boys were more likely to initiate sexual intercourse earlier than girls. In the Netherlands and Brazil, more parental monitoring was associated with later sexual intercourse initiation, whereas in the US, more parental monitoring was associated with earlier sexual intercourse initiation. In Brazil, more in-school sexuality education was associated with earlier sexual intercourse initiation, whereas in the Netherlands, more in-school sexuality education was associated with later sexual intercourse initiation, and in the US no association was found.

Number of Sexual Partners

Table 3 shows the associations between psycho-social predictors and number of sexual partners. Country-interaction effects indicated that, in all three countries, boys and adolescents from a non-European ethnic background were more likely to have more sexual partners. In addition, in all countries, adolescents who lived with both biological

parents, and received more in-school sexuality education were more likely to have fewer sexual partners. In Brazil and in the Netherlands, older adolescents were more likely to have more sexual partners, and adolescents who received more parental monitoring were more likely to have fewer sexual partners. In the US, more parental monitoring was associated with more sexual partners.

Condom Use

Table 4 shows the associations between psycho-social predictors and condom use, contraceptive use, and teen pregnancy. The results of country-interaction effects showed that, in all three countries, adolescents who lived with both biological parents and received more in-school sexuality education were more likely to have used condoms. In the Netherlands and in the US, boys were more likely to have used condoms than girls. In Brazil, older adolescents were more likely to have used condoms, whereas in the Netherlands and in the US, younger adolescents were more likely to have used condoms. In Brazil only, adolescents who received more parental monitoring were more likely to have used condoms.

Contraceptive Use Other Than Condom Use

With regard to contraceptive use other than condom use, the results from country-interaction effects revealed that, in all three countries, girls, adolescents with a European background, older adolescents, adolescents who lived with both biological parents and adolescents who received more in-school sexuality education were more likely to have used a contraceptive technique other than condoms (such as pills and withdrawal). In Brazil only, more parental monitoring was associated with a higher likelihood of contraceptive use.

Teen Pregnancy

Finally, regarding teen pregnancy, the results of country-interaction effects showed that, in all countries, girls who lived with both biological parental were less likely to have been pregnant as a teen. Older girls, in Brazil and in the US, and girls from a non-European ethnic background in the US only, were more likely to have been pregnant as a teen. In the Netherlands, girls who received more parental monitoring were less likely to have been pregnant as a teen, whereas in US, girls who received more parental monitoring were more likely to have been pregnant as a teen. In-school sexuality education was not linked to teen pregnancy in any of the three countries.

Discussion

Using three national datasets, the current study investigated the associations between six psycho-social predictors (i.e., gender, age, ethnic background, family structure, pa-

rental monitoring, and in-school sexuality education) and five aspects of adolescents' SRH (i.e., timing of first sexual intercourse, number of sexual partners, condom use, contraceptive use, and teen pregnancy), across the Netherlands, the US, and Brazil.

First, our findings showed that adolescents' SRH behaviors and outcomes differed significantly across all three countries, and subgroups (BR-NL, BR-US, and NL-US). Overall, Dutch and Brazilian adolescents had relatively more optimal SRH (i.e., fewer sexual partners, more condom use, more use of contraceptive techniques other than condom use, and lower rates of teen pregnancy) in comparison with American adolescents. The fact Dutch and Brazilian adolescents used condom and other contraceptives significantly more often than American adolescents, may also explain the relatively low rates of teen pregnancy in the Netherlands and in Brazil in comparison with the US.

Because the data from the US sample was old (collected in 1996), the results should be interpreted with caution. A 2017 study that used more recent US national surveys (i.e., Youth Risk Behaviors Surveys) to assess trends in adolescents' SRH between 2003 and 2015 indicated, for instance, that there were declines in self-reported condom use among adolescents in the US (e.g., 69.0% in 2003 to 58.1% in 2015, among white male adolescents aged, on average, 16.0 years old).[31] In comparison with the findings regarding condom use among Dutch adolescents (i.e., 65.4%) and Brazilian adolescents (i.e.,69.2%) in the current study, condom use in the US is relatively low.

A less optimal SRH outcome of Brazilian adolescents was the relatively early sexual intercourse initiation in comparison with the other two samples. It should be noted however that the mean age of the Brazilian adolescents in the sample for analysis was relatively low (the average age was 1.8 years lower than Dutch and 2.4 years lower than American adolescents in this study).

Second, our findings on psycho-social predictors of adolescents' SRH revealed that, in all three countries, boys were more likely than girls to have more sexual partners, more condom use, and less contraceptive use. These findings are in line with socio-cultural aspects of sexual double standards, at which boys are encouraged to prove their masculinity, and girls are encouraged to constrain their sexuality.[32] As results, boys are often incentivized, and praised for having more sexual partners, whereas girls are often incentivized not to have many sexual partners, being negatively judged when they do so.[32]

Another notable finding concerns the observation that, in all three countries, living with both biological parents was a protective factor of adolescents' SRH (i.e., later sexual intercourse initiation, fewer sexual partners, more condom and contraceptive use, and lower rates of teen pregnancies). This cross-country result is in line with previous literature that shows that living with both biological parents is a consistent protective factor of adolescents' SRH.[33] The presence of both biological parents rather than one may generate a positive environment with more sources of support, which may promote more responsible sexual decision-making, and contribute to more optimal SRH.[33] Family

structure (i.e., not living with both biological parents) may be considered non-modifiable risk factor of adolescents' SRH. However, the family structure can be still relevant for educational practices. For instance, it may be important to target health education to adolescents who do not live with both biological parents.

The associations between parental monitoring and adolescents' SRH behaviors and outcomes, however, differed between the countries. In Brazil and in the Netherlands (where the overall levels of parental monitoring were higher compared to the US), parental monitoring was associated with more optimal SRH outcomes than in the US. These findings may also be explained by the observed differences in family structure (i.e., prevalence of single-parent families) between the countries, because living with both biological parents may be linked with more parental monitoring.[34]

Our findings also revealed that, in all three countries, more in-school sexuality education predicted significantly more optimal SRH (i.e., fewer sexual partners, more condom and more contraceptive use). These results may be explained by the fact that comprehensive sexuality education promote adolescents' SRH by teaching them the reasons by which is important to use condom and other contraceptives as well as how to use contraceptives adequately. By teaching these sensitive topics comprehensively, sexuality education facilitates the learning process and contributes to raise adolescents' awareness of the risks involved in unprotected sexual relations, improving adolescents' SHR.[16-18] In fact, our results also showed that Dutch and Brazilian adolescents (who received significantly more in-school sexuality education than American adolescents) had significantly more optimal SRH than American adolescents. These findings may also be explained by socio-cultural aspects across the three countries. In both Brazil,[27] and the Netherlands,[16] all schools are required by law to provide comprehensive in-school sexuality education, whereas in the US, there are schools that provide abstinence-only-programs.[15] While in-school comprehensive sexuality education is effective in promoting adolescents' SRH,[17] abstinence-only programs are ineffective, because they often withhold relevant information on SRH, such as information on why and how to use condom and other contraceptives.[15] Thus, our findings show that the provision of in-school comprehensive sexuality education is effective in improving adolescents' SRH.

Strengths and Limitations

Strengths of the current study include the fact that, using three large, national, harmonized datasets (122,278 adolescents in total), this is a first study that has included a LMIC in a cross-country comparison on adolescents' SRH and psychosocial predictors thereof. However, potential limitations include the fact that information on all variables was assessed by self-reported questionnaires, which may have led to socially desired

responses. Moreover, the use of a cross-sectional design did not allow us to assess the predictive associations over time.

The used datasets were collected at different times (Brazilian data in 2015, the data from Netherlands in 2005, and the data from the US in 1996). Research has shown that, over the past decade, changes in Dutch adolescents' sexual behaviors were relatively small.[35] The data regarding the US adolescents are old; therefore we recommend a new study to replicate our results. For example, a 2017 study in the US has shown a decline in condom use mong adolescents between 2003 and 2005.[31]

We recommend continuous updates of important nationally representative monitors of adolescents' SRH, and predictors thereof. Further, to facilitate the development of new cross-country studies, nationally representative monitors should use similar measures on adolescents' SRH.

Implications

The American Academy of Pediatrics emphasizes the relevant role of pediatricians in clinical practices relating to sensitive topics, such as adolescents' SRH.[36] Our findings are valuable for pediatricians and other health care professionals, who, in their clinical practice, can diagnose and treat STIs among adolescents, and who can advise adolescents and their parents about risk and protective factors of adolescents' SRH, based on scientific evidence. Our findings are also relevant for public health policies because they can inform the development of effective strategies to improve SRH, such as strategies to prevent and reduce STIs and unwanted teen pregnancy among adolescents. Public health policies can also call for more cross-country and longitudinal research on SRH in adolescents in Brazil and other LMICs, which is a need that has been highlighted by the current study. By showing cross-national findings, countries can learn from each other through an international knowledge exchange and, when possible, implement similar prevention strategies to promote adolescents' SRH. By showing psycho-social predictors of SRH over-time, longitudinal studies are likely to contribute to more assertive strategies to improve adolescents' SRH. Finally, our study indicates a need of more research on the various ecological factors that may play a role in adolescents' SRH behaviors and outcomes, such as the type of relationships (romantic, casual) in which sexual behaviors occur.[4] By taking more ecological factors into account, research can provide further insights into which groups are, for instance, more or less likely to have a more optimal SRH.

Table 1: Descriptive Characteristics of the Analysis Samples, and Differences across Countries

	Pooled Analysis Sample (n=122,278)			Brazil (n=101,950)			the Netherlands (n=3,003)			the United States (n=14,539)			Cross-country Differences [a]		
	n	%	Mean (SD)	n	%	Mean (SD)	n	%	Mean (SD)	n	%	Mean (SD)	BR-NL	BR-US	NL-US
Psycho-social predictors															
Gender													.5410	.5702	.8129
Girls	63,368	51.8		52,729	51.7		1,536	51.1		7,471	51.4				
Boys	58,910	48.2		49,221	48.3		1,467	48.9		7,068	48.6				
Age													<.0001	<.0001	<.0001
11.0–19.9 years			14.8 (1.44)			14·4 (1.03)			16.2 (2.22)			16·6 (1·56)			
Ethnic background													<.0001	<.0001	<.0001
European	45,898	37.6		33,736	33.0		2,239	74.6		7,505	51.6				
Non-European	76,262	62.4		68,109	67.0		764	25.4		7,021	48.4				
Family structure													<.0001	<.0001	<.0001
Living with both biological parents	69 244	57.1		58,596	57.5		2 451	83.5		5,907	43.1				
Not living with both biological parents	51 974	42.9		43,224	42.5		484	16.5		7,792	56.9				
Unstandardized parental monitoring [b]						4.6 (2.21)			8.1 (2.90)			4·6 (1·38)	<.0001	<.0001	<.0001
Unstandardized in-school sexuality education [c]						2.3 (0.93)			3.1 (1.09)			1·8 (0·51)	<.0001	<.0001	<.0001
SRH behaviors and outcomes															
Sexual intercourse experience													<.0001	<.0001	<.0001
No	84,165	69.3		72,925	71.9		1,739	61.0		8,045	55.7				
Yes	37,272	30.7		28,533	28.1		1,132	39.4		6,408	44.3				

Table 1: Descriptive Characteristics of the Analysis Samples, and Differences across Countries (*continued*)

	Pooled Analysis Sample (n=122,278)			Brazil (n=101,950)			the Netherlands (n=3,003)			the United States (n=14,539)			Cross-country Differences [a]		
	n	%	Mean (SD)	n	%	Mean (SD)	n	%	Mean (SD)	n	%	Mean (SD)	BR-NL	BR-US	NL-US
Timing of first sexual intercourse													<.0001	<.0001	<.0001
≤9.0–≥19.9 years			14.2 (1.49)			14.0 (1.28)			15.3 (1.90)			15·6 (1·83)			
Number of sexual partners (Mean, SD)			2.8 (1.88)			2.5 (1.81)			2.6 (1.81)			2·9 (1·79)	<.0001	<.0001	<.0001
1 partner	12,057	36.0		10,209	36.0		470	41.6		886	31.4				
2 partners	6,531	19.5		5,475	19.3		217	19.2		599	21.3				
3 partners	4,399	13.0		3,675	13.0		151	13.4		441	15.6				
4 partners	2,534	7.6		2,142	7.6		64	5.6		250	8.9				
5 partners	1,829	5.5		1,501	5.3		63	5.6		221	7.8				
≥6 partners	6,152	18.4		5,356	18.9		165	14.6		422	15.0				
Condom use during last sexual intercourse, or with last partner													.0101	<.0001	<.0001
No	11,525	33.4		8,432	30.8		367	34.6		2,454	47.8				
Yes	22,988	66.6		18,933	69.2		695	65.4		2,685	52.3				
Contraceptive use during last sexual intercourse, or with last partner													<.0001	<.0001	<.0001
No	8,701	29.4		6,936	27.5		477	43.3		1,388	56.6				
Yes	20,938	70.6		18,240	72.5		625	56.7		1,066	43.4				
Teen pregnancy													<.0001	<.0001	<.0001
No	13,959	89.0		9,349	90.6		992	97.2		2,578	78.7				

Table 1: Descriptive Characteristics of the Analysis Samples, and Differences across Countries (*continued*)

	Pooled Analysis Sample (n=122,278)			Brazil (n=101,950)			the Netherlands (n=3,003)			the United States (n=14,539)			Cross-country Differences [a]		
	n	%	Mean (SD)	n	%	Mean (SD)	n	%	Mean (SD)	n	%	Mean (SD)	BR-NL	BR-US	NL-US
Yes	1,720	11.0		966	9.4		29	2.8		698	21.3				

[a] Significance levels of differences in characteristics of the analysis samples between Brazil and the Netherlands (BR-NL), Brazil and the United States (BR-US), and the Netherlands and the United States (NL-US), by Chi-Square tests (categorical variables) or one-way ANOVA tests (continuous variables).

[b] Unstandardized sum scale scores for parental monitoring, varying from (0–12) in the Netherlands, (0–6) in the United States, and (0–8) in Brazil. However, standardized variables have been used in the ANOVA tests.

[c] Unstandardized scale scores for in-school sexuality education varying from (0–4) in the Netherlands, (0–2) in the United States, and (0–3) in Brazil. However, standardized variables have been used in the ANOVA tests.

Table 2: Cox Proportional Hazard Analyses Results for the Associations between Psycho-social Predictors and Timing of first sexual intercourse (years)

	Timing of first sexual intercourse											
	Pooled Analysis Sample (n=117 876)		Brazil (n=101 229)		the Netherlands (n=2856)		the United States (n=13791)		Country-interaction Effects [b]			
	HR (95% CI)	P Value	HR (95% CI)	P Value	HR (95% CI)	P Value	HR (95% CI)	P Value	Pooled	BR-NL	BR-US	NL-US
Psycho-social predictors [a]												
Gender	1.78 (1.75–1.80)	<.0001	2.03 (1.98–2.08)	<.0001	0.84 (0.74–0.94)	<.0001	0.98 (0.93–1.03)	.3879	<.0001	<.0001	<.0001	.1694
Age	1.59 (1.53–1.66)	<.0001	0.98 (0.97–0.99)	.0208	1.03 (0.99–1.08)	.1149	0.98 (0.95–1.00)	.0334	<.0001	<.0001	.0664	<.0001
Ethnic background	2.28 (2.24–2.32)	<.0001	1.18 (1.15–1.21)	<.0001	1.05 (1.02–1.10)	<.0001	1.16 (1.11–1.23)	<.0001	<.0001	.0006	.5708	<.0001
Family structure	1.38 (1.35–1.41)	<.0001	1.40 (1.37–1.43)	<.0001	1.22 (1.03–1.44)	<.0001	1.55 (1.46–1.63)	<.0001	<.0001	.0537	.0011	<.0001
Parental monitoring	0.88 (0.87–0.89)	<.0001	0.83 (0.82–0.84)	<.0001	0.84 (0.79–0.89)	<.0001	1.14 (1.10–1.17)	<.0001	<.0001	.4495	<.0001	<.0001
In-school sexuality education	1.05 (1.04–1.06)	<.0001	1.07 (1.06–1.08)	<.0001	0.91 (0.85–0.97)	<.0001	1.01 (0.99–1.05)	.1889	<.0001	<.0001	.0003	.0002

Notes: A significance level of p<.01 was used to indicate significant effects. HR<1.00 indicates a lower hazard of early sexual intercourse initiation. HR>1.00 indicates a higher hazard of early sexual intercourse initiation.

[a] References groups are: Girls, European, Living with both biological parents.

[b] Significance levels of country-interaction effects (i.e., Country × Gender, Country × Age, Country × Ethnic background, Country × Family structure, Country × Parental monitoring, Country × In-school sexuality education) have been firstly tested in the pooled analysis sample. If a significant country-interaction effect was found in the pooled analysis sample, country-interaction effects were further tested in the subgroups of Brazil and the Netherlands (BR-NL), Brazil and the United States (BR-US), and the Netherlands and the United States (NL-US).

Table 3: Ordered Logistic Regression Analyses Results for the Associations between Psycho-social Predictors and Number of Sexual Partners

	Number of Sexual Partners (1–6 sexual partners) [b]											
	Pooled Analysis Sample (n=37 277)		Brazil (n=28 533)		the Netherlands (n=2 336)		the United States (n=6408)		Country-interaction Effects [c]			
	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value	Pooled	BR-NL	BR-US	NL-US
Psycho-social predictors [a]												
Gender	2.81 (2.70–2.92)	<.0001	3.32 (3.17–3.48)	<.0001	3.29 (3.15–3.45)	<.0001	1.46 (1.26–1.69)	<.0001	<.0001	<.0001	<.0001	.0068
Age	1.14 (1.12–1.14)	<.0001	1.30 (1.27–1.32)	<.0001	1.23 (1.21–1.26)	<.0001	1.00 (0.94–1.05)	.9249	<.0001	<.0004	.0017	.1290
Ethnic background	2.20 (2.14–2.28)	<.0001	1.14 (1.08–1.19)	<.0001	1.21 (1.16–1.27)	<.0001	1.29 (1.12–1.50)	.0006	<.0001	.0006	.3174	<.0001
Family structure	1.26 (1.21–1.31)	<.0001	1.19 (1.14–1.25)	<.0001	1.24 (1.19–1.29)	<.0001	1.01 (0.86–1.19)	.8665	.0128	-	-	-
Parental monitoring	0.86 (0.85–0.90)	<.0001	0.90 (0.89–0.92)	<.0001	0.90 (0.87–0.91)	<.0001	1.13 (1.04–1.23)	.0005	<.0001	.0038	<.0001	<.0001
In-school sexuality education	0.96 (0.95–0.98)	<.0001	0.96 (0.94–0.98)	.0009	0.96 (0.94–0.98)	.0004	0.97 (0.90–1.04)	.4086	.3694	-	-	-

Notes: A significance level of p<.01 was used to indicate significant effects. OR<1.00 indicates a lower odds of having more sexual partners. OR>1.00 indicates a higher odds of having more sexual partners.

[a] References groups are: Girls, European, Living with both biological parents.

[b] Probabilities modeled are cumulated over the lower ordered values.

[c] Significance levels of country-interaction effects (i.e., Country × Gender, Country × Age, Country × Ethnic background, Country × Family structure, Country × Parental monitoring, Country × In-school sexuality education) have been firstly tested in the pooled analysis sample. If a significant country-interaction effect was found in the pooled analysis sample, country-interaction effects were further tested in the subgroups of Brazil and the Netherlands (BR-NL), Brazil and the United States (BR-US), and the Netherlands and the United States (NL-US).

Table 4: Logistic Regression Analyses Results for the Associations between Psycho-social Predictors and Adolescents' Sexual and Reproductive Outcomes

	Condom use during last sexual intercourse or with last partner											
	Pooled Analysis Sample (n=35,779)		Brazil (n=27,365)		the Netherlands (n=2,006)		the United States (n=6,408)		Country-interaction Effects [b]			
	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value	Pooled	Br-NL	Br-US	NL-US
Psycho-social predictors [a]												
Gender	1.25 (1.20–1.31)	<.0001	1.05 (0.99–1.10)	.0957	1.61 (1.24–2.10)	.0004	1.58 (1.42–1.77)	<.0001	<.0001	.0013	<.0001	.0088
Age	0.92 (0.91–0.93)	<.0001	1.03 (1.01–1.06)	.0027	0.87 (0.80–0.95)	.0020	0.94 (0.90–.99)	.0097	<.0001	.0003	<.0001	<.0001
Ethnic background	1.01 (0.96–1.06)	.7075	0.87 (0.82–0.92)	<.0001	1.19 (0.85–1.66)	.2978	0.87 (0.78–0.98)	.0178	<.0001	.0761	.0003	.0415
Family structure	0.88 (0.84–0.92)	<.0001	0.90 (0.85–0.95)	<.0001	0.78 (0.54–1.12)	.1856	0.97 (0.85–1.09)	.5820	.3224	-	-	-
Parental monitoring	1.19 (1.16–1.21)	<.0001	1.30 (1.27–1.33)	<.0001	1.10 (0.98–1.26)	.1091	1.06 (1.99–1.13)	.0766	<.0001	.0130	<.0001	.6424
In-school sexuality education	1.06 (1.04–1.09)	<.0001	1.08 (1.05–1.11)	<.0001	1.18 (1.02–1.34)	.0241	0.99 (0.94–1.05)	.8215	.0288	-	-	-
	Contraceptive use during last sexual intercourse or with last partner											
	Pooled Analysis Sample (n=33,590)		Brazil (n=25,176)		the Netherlands (n=2,006)		the United States (n=6,408)		Country-interaction Effects [b]			
	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value	Pooled	Br-NL	Br-US	NL-US
Psycho-social predictors [a]												
Gender	0.76 (0.72–0.80)	<.0001	0.72 (0.68–0.76)	<.0001	0.81 (0·63–1·04)	.0975	0.80 (0.68–0.94)	·0073	.3668	-	-	-
Age	1.05 (1.04–1.07)	<.0001	1.03 (1.01–1.06)	.0119	1.30 (1·20–1·42)	<.0001	1.07 (1.00–1.14)	·0424	.0382	-	-	-
Ethnic background	0.77 (0.73–0.82)	<.0001	0.83 (0.78–0.89)	<.0001	0.80 (0·40–0·86)	<.0001	0.56 (0.47–0.66)	<.0001	<.0001	.0084	.0002	.1581
Family structure	0.82 (0.78–0.87)	<.0001	0.96 (0.91–1.02)	.1182	1.01 (0·71–1·44)	.9313	0.84 (0.70–1.01)	.0641	.2918	-	-	-
Parental monitoring	1.22 (1.19–1.25)	<.0001	1.31 (1.28–1.35)	<.0001	1.05 (0·93–1·91)	.3949	1.02 (0.93–1.12)	.6969	<.0001	.0006	<.0001	.0262

Table 4: Logistic Regression Analyses Results for the Associations between Psycho-social Predictors and Adolescents' Sexual and Reproductive Outcomes (*continued*)

	Condom use during last sexual intercourse or with last partner											
	Pooled Analysis Sample (n=35,779)		**Brazil (n=27,365)**		**the Netherlands (n=2,006)**		**the United States (n=6,408)**		**Country-interaction Effects [b]**			
	OR (95% CI)	**P Value**	**OR (95% CI)**	**P Value**	**OR (95% CI)**	**P Value**	**OR (95% CI)**	**P Value**	**Pooled**	**Br-NL**	**Br-US**	**NL-US**
In-school sexuality education	1.08 (1.05–1.11)	<.0001	1.09 (1.06–1.12)	<.0001	1.04 (0·91–1·19)	.5337	1.08 (0.99–1.18)	·0785	.8234	-	-	-
	Teen Pregnancy (Girls)											
	Pooled Analysis Sample (n=18,800)		**Brazil (n=10,315)**		**the Netherlands (n=2,077)**		**the United States (n=6,408)**		**Country-interaction Effects [b]**			
	OR (95% CI)	**P Value**	**OR (95% CI)**	**P Value**	**OR (95% CI)**	**P Value**	**OR (95% CI)**	**P Value**	**Pooled**	**Br-NL**	**Br-US**	**NL-US**
Psycho-social predictors [a]												
Age	1.09 (1.07–1.11)	<.0001	1.70 (1.60–1.76)	<.0001	0.83 (0.67–1.03)	.0988	1.30 (1.21–1.40)	<.0001	<.0001	<.0001	<.0001	.0026
Ethnic background	2.07 (1.84–2.33)	<.0001	1.16 (0.98–1.37)	.0728	1.07 (0.45–2.53)	.8628	1.74 (1.46–2.08)	<.0001	.0033	.4832	.0001	.5401
Family structure	2.20 (1.96–2.46)	<.0001	1.19 (1.03–1.37)	.0176	2.66 (1.19–5.94)	.0168	1.85 (1.50–2.08)	<.0001	.2587	-	-	-
Parental monitoring	1.07 (1.02–1.12)	.0078	0.98 (0.92–1.05)	.6899	0.56 (0.38–0.82)	.0034	1.25 (1.11–1.39)	<.0001	<.0001	.0075	<.0001	<.0001
In-school sexuality education	0.99 (0.94–1.04)	.8034	0.95 (0.89–1.01)	.1549	1.11 (0.74–1.67)	.6097	0.97 (0.88–1.07)	.5554	.8212	-	-	-

Notes: A significance level of p<.01 was used to indicate significant effects. OR<1.00 indicates a lower odds of condom, and other contraceptives use, and teen pregnancy. OR>1.00 indicates a higher odds of condom, and other contraceptives use, and teen pregnancy.

[a] References groups are: Girls, European, Living with both biological parents.

[b] Significance levels of country-interaction effects (i.e., Country × Gender, Country × Age, Country × Ethnic background, Country × Family structure, Country × Parental monitoring, Country × In-school sexuality education) have been firstly tested in the pooled analysis sample. If a significant country-interaction effect was found in the pooled analysis sample, country-interaction effects were further tested in the subgroups of Brazil and the Netherlands (BR-NL), Brazil and the United States (BR-US), and the Netherlands and the United States (NL-US).

References

1. United Nations. *The Global Strategy For Women's, Children's, and Adolescents' Health (2016-2030)*. Geneva, Switzerland: United Nations (UN);2015:1–108
2. De Graaf H, Kruijer H, Van Acker JM. S. *Sex onder je 25e. Seksuele gezondheid van jongeren in Nederland anno 2012*. [Sex under 25. Sexual health of Dutch youth in 2012.] Delft, Netherlands: Uitgeverij Eburon; 2012
3. Bronfenbrenner U, Ceci SJ. Nature-nurture reconceptualized in developmental perspective: a bioecological model. *Psychol Rev*. 1994;101(4):568–586
4. Van de Bongardt D, Yu R, Deković M, Meeus WHJ. Romantic relationships and sexuality in adolescence and young adulthood: The role of parents, peers, and partners. *Eur J Dev Psychol*. 2015;12(5):497–515
5. Van de Bongardt D, de Graaf H, Reitz E, Dekovic M. Parents as moderators of longitudinal associations between sexual peer norms and Dutch adolescents' sexual initiation and intention. *J Adolesc Health*. 2014;55(3):388–393
6. Nogueira ASR, Van de Bongardt D, Baams L, Raat H. Bidirectional Associations Between Adolescents' Sexual Behaviors and Psychological Well-Being. *J Adolesc Health*. 2018;62(1):63–71
7. Nogueira ASR, Van de Bongardt D, Van de Looij-Jansen P, Wijtzes A, Raat H. Mother– and Father–Adolescent Relationships and Early Sexual Intercourse. *Pediatr*. 2016;138(6):e20160782
8. Nogueira ASR, Wijtzes A, Van de Bongardt D, Van de Looij-Jansen P, Bannink R, Raat H. Early Sexual Intercourse: Prospective Associations with Adolescents Physical Activity and Screen Time. *PLoS ONE*. 2016;11(8):e0158648
9. Boislard P MA, Poulin F. Individual, familial, friends-related and contextual predictors of early sexual intercourse. *J Adolesc*. 2011;34(2):289–300
10. Dittus PJ, Michael SL, Becasen JS, Gloppen KM, McCarthy K, Guilamo-Ramos V. Parental Monitoring and Its Associations With Adolescent Sexual Risk Behavior: A Meta-analysis. *Pediatr*. 2015;136(6):e1587-e1599
11. Widman L, Choukas-Bradley S, Noar SM, Nesi J, Garrett K. Parent-adolescent sexual communication and adolescent safer sex behavior: A meta-analysis. *JAMA Pediatr*. 2016;170(1):52–61
12. Zimmer-Gembeck MJ, Helfand M. Ten years of longitudinal research on U.S. adolescent sexual behavior: Developmental correlates of sexual intercourse, and the importance of age, gender and ethnic background. *Dev Review*. 2008;28(2): 153–224
13. Sandfort TG, Orr M, Hirsch JS, Santelli J. Long-term health correlates of timing of sexual debut: results from a national US study. *Am J Public Health*. 2008;98(1): 155–161

14. Madkour AS, De Looze M, Ma P, et al. Macro-Level Age Norms for the Timing of Sexual Initiation and Adolescents' Early Sexual Initiation in 17 European Countries. *J Adolesc Health*. 2014;55(1):114–121
15. Santelli JS, Kantor LM, Grilo SA, et al. Abstinence Only-Until-Marriage: An Updated Review of U.S. Policies and Programs and Their Impact. *J Adolesc Health*. 2017;61(3):273–280
16. Van de Bongardt D, Bos HMW, Mouthaan I. Sexual and relational education practices in the Netherlands: Evidence of a discourse of erotics? *J Stud Int Educ*. 2013; 7(Special Issue: "Engaging with Difference, Gender and Sexuality in Education"): 76–103
17. Weaver H, Smith G, Kippax S. School-based sex education policies and indicators of sexual health among young people: a comparison of the Netherlands, France, Australia and the United States. *Sex Educ*. 2005;5(2):171–188
18. Ferguson RM, Vanwesenbeeck I, Knijn T. A matter of facts… and more: an exploratory analysis of the content of sexuality education in The Netherlands. *Sex Educ*. 2008;8(1):93–106
19. Bearinger LH, Sieving RE, Ferguson J, Sharma V. Global perspectives on the sexual and reproductive health of adolescents: patterns, prevention, and potential. *The Lancet*. 2007;369(9568):1220–1231
20. Pilgrim NA, Blum RW. Protective and Risk Factors Associated with Adolescent Sexual and Reproductive Health in the English-speaking Caribbean: A Literature Review. *J Adolesc Health*. 2012;50(1):5–23
21. Mmari K, Sabherwal S. A Review of Risk and Protective Factors of Adolescent Sexual and Reproductive Health in Developing Countries: An Update. *Journal of Adolescent Health*. 2013:562–572
22. Ministério da Saúde Brasileiro. *Boletim Epidemiológico Sífilis 2016* [Syphilis Epidemiological Bulletin 2016]. Brasília, Distrito Federal: Secretaria de Vigilância em Saúde. Ministério da Saúde Brasileiro; 2016
23. UNAIDS. *Estatisticas Globais sobre HIV 2017* [Global Statistics on HIV 2017]. Available at: https://unaids.org.br/wp-content/uploads/2017/12/UNAIDSBR_FactSheet.pdf Accessed February 15, 2018.
24. Ministério da Saúde Brasileiro. *Uma análise da situação de saúde e das causas externas 2014* [An analysis of population health and external causes 2014]. Brasilia, Distrito Federal: Ministério da Saúde Brasileiro; 2015
25. De Graaf H, Vanwesenbeeck I, Meijer S. Educational Differences in Adolescents' Sexual Health: A Pervasive Phenomenon in a National Dutch Sample. *J Sex Res*. 2015;52(7):747–757

26. Barnert ES, Dudovitz R, Nelson BB, Coker TR, Biely C, Li N, et al. How Does Incarcerating Young People Affect Their Adult Health Outcomes? *Pediatr*. 2017; 139(2):e20162624
27. Ministério da Saúde Brasileiro. Instituto Brasileiro de Geografia e Pesquisa. *Pesquisa Nacional de Saude do Escolar 2015* [National Students' Health Survey 2015]. Rio de Janeiro, RJ: Ministério da Saúde Brasileiro; 2016
28. Hosmer DW, Lemeshow S, May S. Applied Survival Analysis: Regression Modeling of Time-to-Event Data. *Wiley*. 2008:416
29. Sterne JAC, White IR, Carlin JB, et al. Multiple imputation for missing data in epidemiological and clinical research: Potential and pitfalls. *BMJ*. 2009;338: b2393. doi: 10.1136/bmj.b2393
30. SAS Institute Inc. 2008. SAS/STAT® 9.2 User's Guide. Cary, NC: SAS Institute Inc.
31. Harper CR, Steiner RJ, Lowry R, Hufstetler S, Dittus PJ. Variability in Condom Use Trends by Sexual Risk Behaviors: Findings from the 2003–2015 National Youth Risk Behaviors Surveys. *Sexually Transmitted Disease*. 2017.
32. Kreager DA, Staff J. The Sexual Double Standard and Adolescent Peer Acceptance. *Soc Psychol Q*. 2009;72(2):143–164
33. De Graaf H, Vanwesenbeeck I, Woertman L, and Meeus W. Parenting and adolescents' sexual development in Western societies: A literature review. *European Psychologist*. 2011;16:21–31. doi:10.1027/1016-9040/a000031
34. Shek DTL, Xie Q, Lin L. The impact of family intactness on family functioning, parental control, and parent–child relational qualities in Chinese context. *Frontiers in Pediatrics*. 2015:1–7. doi:10.3389/fped.2014.00149
35. De Graaf H, Borne M, Van den Nikkelen S, Twisk D, and Meijer S. *Seks onder je 25e: Seksuele gezondheid van jongeren anno 2017* [Sex under the age of 25: Sexual health of young people in the year 2017]. Delft: Eburon; 2017
36. Hagan JF, Shaw JS, PM D. Bright Futures Guidelines for Health Supervision of Infants, Children, and Adolescents. 2008. Available at: https://brightfutures.aap.org/materials-and tools/guidelines-and-pocket-guide/Pages/default.aspx. Accessed December 16, 2017

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries

Country	**Brazil**	**the Netherlands**	**United States**	**Pooled dataset**
Dataset	PeNSE-2015	Sex under the age of 25	Add Health	
Final analysis sample	101,950	5,789	14,539	122,278
Age Range	11.0–19.9 years	11.0–19.9 years	12.5–19.9 years	11.0–19.9 years
Mean Age (SD)	14.4 (1.03)	16.5 (2.18)	16.6 (1.56)	14.8 (1.44)
Predictors	**Measure & Response options**			**Overall measure**
Gender				
Missing values (%)	(0.0%)	(0.0%)	(0.0%)	
Original measure	What sex are you?	Are you a boy or a girl?	What sex are you? (wave I)	
	1=Male	1=Boy	1=Male 9=Multiple response	
	2=Female	2=Girl	2=Female	
Harmonized operationalization				Gender
	1 kept 1=Boys	1 kept 1=Boys	1 kept 1=Boys	0=Girls
	2 recoded to 0=Girls	2 recoded to 0=Girls	2 recoded to 0=Girls 9 Excluded	1=Boys
Age				
Missing values (%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Original measure	In which month and year you were born?	In which month and year you were born?	What is your birth date (month and year)? (wave I)	
	Example:	Example:	Example:	
	1=January 1=Before 1996	1=January 1=Before 1986	4/1974 and earlier	
	2=February 2=1996	2=February 2=1986	5/1974 until 8/1983 and later	
	3=March 10=2004 or later	3=March 15=1999	98=Don't know	

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

	99=Not informed 12=December	12=December 16=After 1999		
Harmonized operationalization				Age
	Age calculated based on date birth	Age calculated based on date birth	Age calculated based on date birth	Continuous
	Range:	Range:	Range:	(11.0–19.9 years)
	11.0–19.9 years	11.0–19.9 years	12.5–19.9 years	
	99 Excluded		98 Excluded	
Ethnic background				
Missing values (%)	(0.1%)	(0.0%)	(0.1%)	
Original measure	What is your skin color or race?	Where were you born?	What is your race? (wave I)	
	1=White	1=Dutch	1. White	
	2=Black	2=Turkish	2. Black or African American	
	3=Light brown	3=Moroccan	3. American Indian or Native American	
	4=Brown	4=Surinamese	4. Asian	
	5=Indigenous	5=Antillean	5. Others	
		6=Indonesian	0=Not marked 6=Refused	
		7=Other, namely (open)	1=Marked 8=Don't know	
		1 recoded to 0=European	9=Not applicable	
Harmonized operationalization				Ethnic Background
	1 recoded to 0=European	2–6 recoded to 1=Non-European	If white, 1 recoded 0=European	0=European
	2–5 recoded to 1=Non-European	7 recoded to 0=European or 1=Non-European, depending on specific country of birth	If - white, 2–5 recoded to 1=Non-European	1=Non-European
			6–9 Excluded	

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

Family structure			
Missing values (%)	(0.1%)	(2.3%)	(0.2%)
Original measure	1) Do you live with your mother?	1) Do you live with your mother?	1) The following questions are about the people with whom you live: (wave I)
	2) Do you live with your father?	2) Do you live with your father?	1=Continue with household listing
	1=Yes	0=No	2=Lives alone
	2=No	1=Yes	2) Is there anyone else?
			0=No 6=Refused
			1=Yes 7=Legitimate skip
			8=Don't know
			3) Is there anyone else?
			0=No 6=Refused
			1=Yes 7=Legitimate skip
			8=Don't know
			4) What is the relationship to you? Example:
			1=Wife or husband 96=Refused
			11=Father 97=Legitimate skip
			14=Mother 98=Don't know
			5) What is the relationship to you? Example:
			1=Wife or husband 96=Refused
			11=Father 97=Legitimate skip
			14=Mother 98=Don't know
			6) If father or mother: Which description best fits (name)'s relationship to you? Example:

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

			1=Biological father 12=Other	
			2=Step father 13=Legitimate skip	
			7=Biological mother 14=Don't know	
			7) If father or mother: Which description best fits (name)'s relationship to you? Example:	
			1=Biological father 12=Other	
			2=Step father 13=Legitimate skip	
			7=Biological mother 14=Don't know	
Harmonized operationalization				Family structure
	If both items=1, recoded to 0=Living with both biological parents	If both items=1, recoded to 0=Living with both biological parents	If item 6=1 (biological father) or 7 (biological mother) & item 7=1 (biological father) or 7 (biological mother), options 1 & 7 recoded to 0=Living with both biological parents	0=Living with both biological parents
	If at least one item=2, recoded to 1=Not living with both biological parents	If at least one item=0, recoded to 1=Not living with both biological parents	If item 4 or item 5, - 11 (father) or - 14 (mother), all options - 11 (father) or - 14 (mother), recoded to: 1 = Not living with both biological parents	1=Not living with both biological parents
	99 Excluded			
Parental monitoring				

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

Missing values (%)	(0.3%)	(0.2%)	(3.4%)	
Original measure	During the last 30 days, in which frequency your parents knew:	How much does your mother/father know of the following? (separate measures for mothers and fathers)	Do your parents let you make your own decisions about: (wave I)	
	1. What you were doing in your free time?	1. Who your friends are	1. The time you must be home on weekend nights?	
	2. Checked whether or not you have done your homework?	2. Where you are after school hours	2. The people that you hang around with?	
		3. What you do in your free time	3. What you wear?	
			4. How much television to watch?	
			5. Which television programs to watch?	
			6. What time you go to bed on week nights?	
	1=Never	1=My mother/father knows much	0=No	
	2=Rare	2=My mother/father knows a little	1=Yes	
	3=Sometimes	3=My mother/father knows nothing	6=Refused	
	4=Mostly		7=Legitimate skip	
	5=Always		8=Don't know	
	99=Not informed			
Harmonized operationalization				Parental monitoring
	1 recoded to 0=Never	1 recoded to 2=A lot	0 kept 0=No	Continuous (0–12)
	2 recoded to 1=Rare	2 recoded to 1=A little	1 kept 1=Yes	Standardized scales were used
	3 recoded to 2=Sometimes	3 recoded to 0=Never	6–8 Excluded	
	4 recoded to 3=Mostly			

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

	5 recoded to 4=Always			
	99 Excluded			
	Steps:	Steps:	Steps:	
	1) Sum scale score was computed. Higher scores on the scale (0–8) mean higher levels of parental monitoring	1) Sum scores were computed. Higher scores on the scale (0–12) mean higher levels of parental monitoring	1) Sum scores were computed. Higher scores on the scale (0–6) mean higher levels of parental monitoring	
Sexuality education at school				
Missing values (%)	(1.4%)	(2.5%)	(0.1%)	
Original measure	In your school: Have you received education on?	How much sexuality education did you receive at school?	Please, tell me whether you have learned about each of the following things in a school class: (wave I)	
	1. Prevention of pregnancy		1. Pregnancy	
	2. HIV transmission, and Aids / others STIs		2. Aids	
	3. Where & how to get condoms for free			
	1=Yes	0=None	0=No	
	2=No	1=A little	1=Yes	
	3=I don't know	2=Not many	6=Refused	
	99=Not informed	3=Pretty much	8=Don't know	
		4=A lot		
Harmonized operationalization				In-school sexuality education
	1 kept 1=Yes		0 kept 0=No	Continuous (0–4)

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

	2 recoded to 0=No		1 kept 1=Yes	Standardized scales were used
	3 & 99 Excluded		6 & 8 Excluded	
	Steps:	Steps:	Steps:	
	Sum scores on non-missing items were computed		Sum scores were computed	
	A higher score on the scale (0–3) means a higher level of sexuality education received in the school	A higher score (0–4) means a higher level of sexuality education received in the school	A higher scores on the scale (0–2) Means a higher level of sexuality Education received in the school	
Sexual intercourse experience				
Missing values (%)	(0.5%) on item 1 & (0.8%) on item 2	(4.4%) on item 1 & (1.7%) on item 2	(0.6%)	
Original measure	1) Have you ever had sexual intercourse?	1) Have you ever had sexual intercourse?	1) Have you ever had sexual intercourse? (wave II)	
	1=Yes	1=No	0=No	
	2=No	2=Yes	1=Yes	
	99=Not informed		6=Refused	
			8=Don't know	
	2) How old were you when you had your first sexual intercourse?	2) How old were you when you had your first sexual intercourse?	2) In what month and year did you have sexual intercourse for the very first time?	
	Example:	Open	Example:	
	-1=Not applicable	7.0–19.0 years	1=January 76=1976–1977	
	9=≤9 years		96=Refused 996=Refused	

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

	10=10 years		997=Legitimate skip	
	17=17 years		98=Don't know 998=Don't know	
	18=≥18 years		!=Missing !=Missing	
	99=Not informed			
Harmonized operationalization				
	Steps:	Steps:	Steps:	
	1) Sexual intercourse experience recoded:	1) Sexual intercourse experience recoded:	1) Sexual intercourse experience recoded:	
	1 kept 1=Yes	1 recoded to 0=No	0 kept 0=No	Time to first sexual intercourse
	2 recoded to 0=No	2 recoded to 1=Yes	1 kept 1=Yes	Continuous (9.0–19.9 years)
	99 Excluded		6–8 Excluded	Adolescents' age in the moment of the survey (If sexual intercourse=0=No)
	2) Age at first sexual intercourse clarified:	2) Age at first sexual intercourse clarified:	2) Age at first sexual intercourse clarified:	Adolescents' age of first sexual intercourse (If sexual intercourse=1=Yes)
	9 kept 9 =≤ 9.0 years	7–9 recoded to 9 =≤9.0 years	7–9 recoded to 9=≤9.0 years	

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

	10 kept 10=10.0 years	10 kept 10=10.0 years	10 kept 10=10.0 years
	11 kept 11=11.0 years	11 kept 11=11.0 years	11 kept 11=11.0 years
	12 kept 12=12.0 years	12 kept 12=12.0 years	12 kept 12=12.0 years
	13 kept 13=13.0 years	13 kept 13=13.0 years	13 kept 13=13.0 years
	14 kept 14=14.0 years	14 kept 14=14.0 years	14 kept 14=14.0 years
	15 kept 15=15.0 years	15 kept 15=15.0 years	15 kept 15=15.0 years
	16 kept 16=16.0 years	16 kept 16=16.0 years	16 kept 16=16.0 years
	17 kept 17=17.0 years	17 kept 17=17.0 years	17 kept 17=17.0 years
	18 kept 18=≥18.0 years	18–19 recoded to 18=≥18.0 years	18–19 recoded to 18=≥18.0 years
	! Excluded	Age at first sexual intercourse >19.0 Excluded	0 Excluded
	-1 & 99 Excluded	2 Excluded	96–98 Excluded 996–998 Excluded
Condom use			
Missing values (%)	(4.1%)	(6.5%)	(64.6%)
Original measure	Last sex: Have you or your partner used condom during the last time that you had sexual intercourse?	Have you used condom during vaginal intercourse with your last partner?	What method of birth control did you and your partner use? (wave II)
	-1=Not applicable	0=No	1=Condom
	3=I don't know	1=Yes	2=Withdrawal
	1=Yes		3=Rhythm (safe time)
	2=No		4=Birth control pills
	99=Not informed		5=Vaginal sponge
			6=Foam, jelly
			8=IUD

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

			9=Norplant	
			10=Ring	
			11=Depo Provera	
			12=Contraceptive film	
			13=Some other method	
			96=Refused	
			97=Legitimate skip	
			98=Don't know	
Harmonized operationalization				Condom use during last sexual intercourse, or with last partner
	1 kept 1=Yes	0 kept 0=No	0 kept 0=No	
	2 recoded to 0=No	1 kept 1=Yes	96–98 Excluded	
	-1, 3 & 99 Excluded			
			If birth control=1=Condom use, 1 kept 1=Yes	0=No condom used during last sex, or with the last partner
			If birth control - 1, 2–13 recoded to 0=No	1=Condom used during last sex, or with the last partner
Contraceptive use				
Missing values (%)	(11.8 %)	(2.7%)	(83.1%)	
Original measure	Have you or your partner used any method (- condom) to avoid pregnancy and/or STIs, during the last time that you had sex?	Have you or your last partner used any method (- condom) to avoid pregnancy?	What method of birth control did you and your partner use? (wave II)	

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

	-1=Not applicable	1. Pills	1=Condom	
	1=Yes	2. No ejaculation in the vagina	2=Withdrawal	
	2=No	3. Other contraceptive	3=Rhythm (safe time)	
	3=I don't know	4. Other method	4=Birth control pills	
	99=Not informed	0=No	5=Vaginal sponge	
		1=Yes	6=Foam, jelly	
Original measure			8=IUD	
			9=Norplant	
			10=Ring	
			11=Depo Provera	
			12=Contraceptive film	
			13=Some other method	
			96=Refused	
			97=Legitimate skip	
			98=Don't know	
Harmonized operationalization				Contraceptive (-than condom) use during last sexual intercourse, or with last partner
	1 kept 1=Yes	0 kept 0=No		
	2 recoded to 0=No	1 kept 1=Yes		
	-1, 3 & 99 Excluded		96–98 Excluded	

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

		If pills=0, & no ejaculation in the vagina=0, & other contraceptive=0, & other method=0, contraceptive coded 0 = No	If birth control=1=Condom use, 1–13 recoded to 0=No	0=No contraceptive use during last sexual intercourse, or with last partner
		If pills=1, or no ejaculation in the vagina=1, or other contraceptive=1, or other method=1,contraceptive coded 1=Yes	If birth control - 1=Condom use, 2–13 recoded to 1=Yes	1=Contraceptive use during last sexual intercourse, or with last partner
Number of sexual partners				
Missing values (%)	(0.6%)	(1.9%)	(80.6%)	
Original measure	So far, with how many people have you had sexual intercourse?	So far, with how many people have you had sexual intercourse?	With how many people, in total, including romantic relationship partners, have you ever had a sexual relationship? (wave II)	
	-1=Not applicable	Open	Open	
	1=1 person			
	2=2 persons		996=Refused	
	3=3 persons		997=Legitimate skip	
	4=4 persons		998=Don't know	
	5=5 persons			
	6=≥6 persons			
	99=Not informed			
Harmonized operationalization				Number of sexual partners

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

				1=1 sexual partner
				2=2 sexual partners
				3=3 sexual partners
				4=4 sexual partners
	1 kept 1=1 sexual partner	1 kept 1=1 sexual partner	1 kept 1=1 sexual partner	5=5 sexual partners
	6 kept 6=≥6 sexual partners	6 recoded to 6=≥6 sexual partners	6–8 recoded to 6=≥6 sexual partners	6=≥ 6 sexual partners
	-1 and 99 Excluded			
Teen pregnancy				
Missing values (%)	(0.1%)	(10.2%)	(0.1%)	
Original measure	Have you ever been pregnant? (For girls only)	Have you been pregnant in the past year, while this was not this intention? (For girls)	Have you ever been pregnant? (For girls only), (wave II)	
		Have you made a girl pregnant in the past year, while this was not your intention? (For boys)		
	-1=Not applicable	1=No	0=No	
	1=Yes	2=Yes, once	1=Yes	
	2=No	3=Yes, more than once	6=Refused	
	99=Not informed	4=I don't know	7=Legitimate skip	
			8=I don't know	
Harmonized operationalization				Teen Pregnancy
	2 recoded to 0=No	1 recoded to 0=No	0 kept 0=No	0=No

Supplementary Table 1: Harmonized characteristics of the analysis samples, predictors and SRH behaviors and outcomes across three countries (continued)

	1 kept 1=Yes	2–3 recoded to 1=Yes	1 kept 1=Yes	1=Yes
	-1, and 99 Excluded	4 Excluded	6–8 Excluded	
		Boys Excluded		

Chapter 7

General Discussion

General Discussion

Experiences with sexual behaviors (coital and non-coital) are a normative developmental aspects of adolescence.[1, 2] However, the experience with certain sexual behaviors (e.g., sexual intercourse) during early stages of adolescence (i.e., before 16 years) can have negative consequences for adolescents' sexual and reproductive health (SRH), such as the contraction of sexually transmitted infections (STIs) and unwanted teen pregnancies.[1-4] Knowledge regarding the risk factors and the protective factors with regard to a healthy development of adolescents' sexuality is relevant for the development of effective (public) health (preventive) interventions and policies.[6]

As stated in Chapter 1, the present thesis focused on five research questions:

1) How are various physical activity and screen time behaviors associated with subsequent early sexual intercourse initiation?
2) How is adolescents' psychological well-being associated with adolescents' subsequent experiences with early sexual behaviors, and–vice versa–how is adolescents' experiences with early sexual behaviors linked with their subsequent psychological well-being?
3) How are adolescents' relationships with mothers and fathers associated with subsequent early sexual intercourse initiation?
4) How is sexual communication with friends associated with adolescents' subsequent experiences with early sexual behaviors, and to what extent is this association explained by adolescents' perceptions of sexual peer norms?
5) What are the differences and similarities in adolescents' SRH behaviors and outcomes, and psychosocial predictors thereof, across the Netherlands, the United States, and Brazil?

Below, the results and implications of the five studies that correspond to each of the research questions are summarized and interpreted.

Physical Activity Behaviors, Screen Time Behaviors, and Adolescents' Early Sexual Intercourse Initiation

The first research question was: How are various physical activity and screen time behaviors associated with subsequent early sexual intercourse initiation? This question was addressed in Chapter 2, which described a two-wave longitudinal study that investigated the associations between physical activity and screen time behaviors with early sexual intercourse (i.e., ≤15 years old).

In relation to physical activity behaviors, adolescents who were members of a sports club at baseline (T1) were significantly more likely to have engaged in early sexual intercourse at follow-up (T2) than adolescents who were not members of a sports club. Be-

cause previous studies investigating the associations between physical activity behaviors and sexual intercourse yielded conflicting results,[7-10] we did not have a clear hypothesis for it. But a possible explanation for our finding is related to the fact that adolescents who play sports in the setting of a sports club may spend considerable unsupervised leisure time with peers, which may offer opportunities for interactions with potential sexual partners,[8] thus facilitating early sexual experiences.[11]

In relation to screen time behaviors , this study showed that, boys (but not girls) who watched TV ≥2 hours/day were significantly more likely to have had early sexual intercourse than boys who watched TV <2 hours/day. This finding was consistent with our hypothesis, and may be related to the fact that a greater exposure to sexual content on TV/DVDs may lead adolescents to believe that sexual intercourse is a normative part of everyday life, which could be a stimulus for sexual intercourse.[12, 13]

In addition, the results showed that girls (but not boys) who used a computer ≥2 hours/day were significantly more likely to have had early sexual intercourse than girls who used a computer <2 hours/day. This finding was consistent with our hypothesis, and may be related to a high exposure to internet use.[14] It has been suggested that girls who use internet frequently may be more likely to contact, and be solicited by potential sexual partners online in comparison with boys who are online frequently.[15] We do not know, however, what the reasons were for girls' computer use (e.g., homework, gaming, or viewing sexualized internet material).

Bidirectional Associations Between Adolescents' Sexual Behaviors and Psychological Well-Being

The second research question was: How is adolescents' psychological well-being associated with adolescents' subsequent experiences with early sexual behaviors, and–vice versa–how is adolescents' experiences with early sexual behaviors linked with their subsequent psychological well-being? This question was addressed in Chapter 3, which described a four-wave longitudinal study that investigated bidirectional associations between adolescents' experiences with various non-coital and coital early sexual behaviors (i.e., ≤16.0 years) and multiple dimensions of their psychological wellbeing (i.e., global self-esteem, physical self-esteem, and depression).

Our hypothesis that more optimal psychological well-being would be associated with less engagement in early sexual behaviors over time, and vice versa,[16-18] was not confirmed. A possible rationale underlying these findings could be related to socio-cultural aspects, as previous studies that have shown associations between early sexual experiences and subsequent suboptimal psychological well-being, were conducted in the United States,[16-18] and our study was conducted in the Netherlands. Generally, American society tends to be characterized by a relative disapproval of adolescent sexual behaviors, whereas Dutch society is characterized by more normalization of sexual behaviors in this

life stage.[19] Normalization of adolescent sexual behaviors in Dutch society may explain that early sexual activity in and of itself did not decrease psychological well-being over time, nor it was a result of suboptimal psychological well-being.

In addition, our study showed that having a higher–quality parent–adolescent relationship at baseline (T1) was associated with higher levels of global and physical self-esteem, and lower levels of depression over time. Higher–quality relationships between adolescents and their parents (mothers and fathers combined) may provide a positive environment that contributes to generate encouraging feelings, which may improve adolescents' confidence in themselves.[20-21] However, in this study, no direct link was found between higher–quality relationships and early sexual behaviors, nor was a buffering effect of higher–quality relationships found on the associations between psychological wellbeing and subsequent experiences with early sexual behaviors. These results are not in line with a previous longitudinal study conducted in the Netherlands showing a protective effect of higher–quality relationships on adolescents' experiences with sexual behaviors,[22] and thus, replication of our study is recommended.

Mother– and Father–Adolescent Relationships and Early Sexual Intercourse

The third research question was: How are adolescents' relationships with mothers and fathers associated with subsequent early sexual intercourse initiation? This question was addressed in Chapter 4, which described a two-wave longitudinal study that investigated the associations between mother– and father–adolescent relationship quality and early sexual intercourse (i.e., ≤16 years).

This study showed that only for girls, having a higher–quality relationship with mothers at baseline (T1) was related to a lower likelihood of early sexual intercourse at follow-up (T2). A possible explanation for this finding is that mothers are still the primary providers of sexuality education within families,[23] and also that mothers talk more often about sexuality with daughters than with sons.[24] Thus, having a high-quality relationship with mothers may contribute to more frequent parent–adolescent sexual communication,[24] which in turn has been associated with a lower likelihood of early sexual intercourse initiation, particularly for girls.[24]

We found no association between father–adolescent relationship quality and early sexual intercourse, neither for both boys, nor for girls. This is inconsistent with findings of previous studies that were conducted in the United States.[25, 26] A potential explanation may be related to specificities of the Dutch society.[27] Dutch fathers spend, on average, half as much time with their children compared to Dutch mothers.[28] In fact, of all Organisation for Economic Cooperation and Development Countries, Dutch fathers spend the least time with their children (except for Austria).[40] As a result, Dutch fathers share relatively few activities with their children,[29] which also may contribute to their reduced influence on the timing of adolescents' sexual initiation.

Communication About Sexuality With Friends And Adolescents' Experiences With Early Sexual Behaviors: Indirect Over-Time Associations Through Sexual Peer Norms

The fourth research question was: How is sexual communication with friends associated with adolescents' subsequent experiences with early sexual behaviors, and to what extent is this association explained by adolescents' perceptions of sexual peer norms? This question was addressed in Chapter 5, which described a three-wave longitudinal study that investigated the over-time association between adolescents' sexual communication with friends (face-to-face and online) and changes in early sexual behaviors (non-coital and coital) between T1–T3. In addition, this study examined whether this association was explained by three types of sexual peer norms: adolescents' perceptions of their peers' sexual behaviors (i.e., descriptive norms), peers' approval of sexual behaviors (i.e., injunctive norms), and peer pressure to have sex.

Consistent with our hypothesis,[30] the study showed that more frequent sexual communication with friends at baseline (T1) was significantly associated with an increase in adolescents' experiences with early sexual behaviors between T1–T3, for both boys and girls. Furthermore, also confirming out hypothesis, this association was partially explained by the three types of sexual peer norms. Possibly, during talks on the topic of sexuality, friends exchange information on their own sexual behaviors or acceptance thereof. If this would be the case, this might contribute to the perception of adolescents that their friends and peers are already sexually active.[30, 31] Such perceptions may stimulate adolescents' own sexual behaviors by mechanisms of role modeling or peer pressure.[30, 31]

We also found that the indirect effect of sexual peer norms on the association between sexual communication with friends at T1 and their experiences with early sexual behaviors between T1–T3 was stronger for girls than for boys. In general, girls may be more susceptible to social influences than boys, and more sensitive to peers' social evaluations than boys.[32] Thus, adolescents' perceptions of their peers' sexual behaviors, peers' approval of sexual behaviors, and peer pressure to have sex may affect girls more strongly than boys.[31]

Adolescents' Sexual and Reproductive Health (SRH): A Comparison Across the Netherlands, the United States and Brazil

The fifth research question was: What are the differences and similarities in adolescents' SRH behaviors and outcomes, and psychosocial predictors thereof, across the Netherlands, the United States, and Brazil? This question was answered in Chapter 6. Three cross-sectional datasets were used to compare adolescents' SRH (i.e., timing of first sexual intercourse, number of sexual partners, condom use, contraceptive use, and teen pregnancy), and five psychosocial predictors thereof.

In all three the countries, boys were more likely than girls to have more sexual partners, more condom use, and less of other contraceptives. A possible rationale underlying these results may be related to the culture of sexual double standards.[33] Accordingly, boys are encouraged to prove their masculinity, and girls are encouraged to constrain their sexuality.[33] As a result, boys are often incentivized, and praised for having more sexual partners, whereas girls are often incentivized not to have sexual partners, being negatively judged when they do so.[33]

Also, in all three countries, living with both biological parents was associated with later sexual intercourse initiation, fewer sexual partners, more condom and contraceptive use, and lower rates of teen pregnancies. The presence of both biological parents rather than one may generate a positive environment with more sources of support, which may promote more responsible sexual decision-making, and contribute to more optimal SRH.[11, 20] Family structure (i.e., not living with both biological parents) may be considered non-modifiable risk factor of adolescents' SRH. However, the family structure can be still relevant for educational practices. For instance, it may be important to target health education to adolescents who do not live with both biological parents.

The associations between parental monitoring and adolescents' SRH behaviors and outcomes, however, differed between the countries. In Brazil and in the Netherlands (where the overall levels of parental monitoring were higher compared to the US), parental monitoring was associated with more optimal SRH outcomes than in the US. These findings may also be explained by the observed differences in family structure (i.e., prevalence of single-parent families) between the countries, because living with both biological parents may be linked with more parental monitoring.[34]

Finally, in all three countries, having received more in-school sexuality education was associated with fewer sexual partners, more condom use, and more contraceptive use. So, comprehensive education seems to be a universal promotor of healthy sexual behaviors.[35]

Methodological Considerations

Study Design

As discussed in the Introduction (Chapter 1), in this thesis we have applied longitudinal study designs (Chapters 2 to 5) in addition to cross-sectional study designs (Chapter 6). Longitudinal studies allowed us to assess the associations between baseline factors (e.g., predictors in these studies) and subsequent outcomes that are relevant for adolescents' SRH.[36] However, it should be noted that, in our studies, participants were followed-up for a maximum of two years. We recommend future studies to apply longer follow-up periods (See next paragraph).

Moreover, in Chapter 3, we used a longitudinal design to assess the bi-directionality of the association between adolescents' experiences with early sexual behaviors and their psychological well-being. Most studies only assessed one direction of the over-time associations between ecological predictors and subsequent adolescents' SRH.[20, 24] However, bidirectional associations may be possible (e.g., alcohol use linking to subsequent early sexual behaviors, and early sexual behaviors linking to subsequent alcohol use).[37]

Despite the longitudinal design that was employed in Chapters 2 to 5, it is important to note that we should be cautious before drawing causal conclusions, because of the observational nature of our studies.[38] Since it is generally not feasible to employ experimental research designs, such as randomized controlled trials (RCT) in the field of research on adolescent sexuality, other, non-experimental approaches may be developed to evaluate the likelihood of causality when statistical associations are present.[39-41] For example, Schelvis et al. have suggested alternative approaches for the RCT design, such as the use of 'propensity scores' to infer causal inference in observational studies.[40] Such approaches may contribute to the evaluation of the presence of causality in longitudinal studies by minimizing potential bias.[41] In the propensity score technique, for example, an individual propensity score is calculated to indicate the probability of someone have a certain outcome, conditional on potential confounding variables.[41] The score is then used to adjust for confounding effects in subsequent analyses.[41] We recommend future studies to consider such alternative approaches when further investigating the associations between ecological factors and adolescents' SRH (See next paragraph).

Participation and Non-Participation at Follow-Up

Typically in longitudinal studies, it should be considered that selective participation may occur in research on adolescent sexuality.[36] In the study described in Chapters 2 and 4, the initial participation rate was relatively high, i.e., 95.0%. In the study described in Chapters 3 and 5 the initial participation rate was also high, i.e., 93.0%. In the three cross-sectional studies described in Chapter 6, the initial participation rates were 99.0%, 93.0% and 81.3%, respectively.

In addition to non-participation at the start of the studies, there was drop-out or non-participation at follow-up (Chapters 2 thru 5). Non-response analyses may be done to compare the characteristics of participants included in the sample for analysis with the characteristics of those who were excluded; this was done in Chapters 2 and 4. For example, in the studies described in Chapters 2 and 4, significant differences were found with regard to sociodemographic characteristics (e.g., excluded adolescents more often had low educational level at T1). Therefore, bias may have occurred; the results should be interpreted with caution.

Missing Data

Missing data frequently occurs in large cohort studies,[36] but they can be handled in different ways, including complete case analysis, and multiple imputation.[42, 43] Missing data was also present in the questionnaires applied in our studies (See Chapter 2–6).

In the studies described in Chapter 2 and 4, the percentage of missing data was relatively small (<10.0%); Greenland et al. suggest that percentages of missing values up to 10.0% are not likely to affect the results.[42, 43] Thus, in Chapter 2 and 4, a complete case analysis was applied.

In the studies described in Chapters 3, 5, and 6, the percentage of missing data for some variables was >10.0%. As proposed by Sterne et al., we applied multiple imputation by imputing missing values across five sets in these studies.[43] Advantages of multiple imputation, as described by Sterne et al., include the likelihood of more accurate (i.e., unbiased) results, even when missing values are not at random.[43] With regard to the studies described in Chapters 3 and 5 we performed sensitivity analyses to assess whether the results from the analyses performed with and without multiple imputation differed; the results of the analyses with and without multiple imputation were similar.

Self-Report Questionnaires

Another issue to note is that the variables in the studies in this thesis were all assessed by adolescent self-report questionnaires.[45, 46] Self-reports are the most common method to collect data on sexual behaviors. However, the validity of self-reports about sexual behaviors may be questioned.[45, 46] Adolescents may not provide valid information about their sexual behaviors; for example because of a fear of embarrassment or social sanctions.[46] Thus, results should be interpreted with caution. Longitudinal designs, however, allow researchers to check for inconsistencies in adolescents' reports over time.[36] In future studies, other approaches of measurement may be used, such as the use of 'daily or weekly diaries' or 'Ecological Momentary Assessment'.[47, 48] (See next paragraph).

Diversity

In the majority of the studies described in this thesis (Chapters 2–5), adolescents in the analysis samples were mostly from a Dutch ethnic background. Thus, the generalizability of the results to adolescents from other ethnic backgrounds, not only within the Netherlands, but also in other countries, are limited.[49] We recommend to repeat the studies in other, large, varied populations (See next paragraph).

Implications for Future Research

Study Design, Measurements and Study Setting

The total time by which adolescents have been followed-up in our studies was two years. Therefore, we recommend future studies to follow-up participants for longer periods (e.g., 5 to 10 years).[36] This approach will enable us to assess various factors that may be associated with adolescents' developmental sexual trajectories.[36] This means that we could assess, for instance, how ecological factors in early stages of life (e.g., childhood) link to subsequent adolescents' SRH during early stages of adolescence (e.g., pre-puberty) and beyond (i.e., middle and late adolescence). Similarly, we could also assess how ecological factors in early adolescence play a role in SRH later in life (e.g., young adulthood). It is difficult to infer causality in observational studies.[38, 39] Therefore, as suggested by Richmond et al.,[39] and by Schelvis et al.,[40] we recommend future research to explore the feasibility to infer causality by applying alternative techniques, such as the use of 'propensity scores'.

To improve potential issues related to self-report questionnaires (e.g., under or over report related to experiences with sexual behaviors),[45] we recommend future studies to explore the feasibility, reliability and validity of alternative approaches of measurement regarding adolescents' sexual behaviors. For example, the use of daily or weekly diaries may be explored as well as the use of 'Ecological Momentary Assessment'.[47, 48] By collecting data using a smartphone app, for example, such methods allow the assessment of 'instantaneous measures' in order to capture individual fluctuations in everyday thoughts and experiences with sexual behaviors. [47, 48] Thus, as experiences with sexual behaviors are reported in a real time (e.g., once a day), these reports are likely to be more accurate than self-reports measures reported using traditional pencil questionnaires.[47]

As stated above, in almost all studies described in this thesis, the majority of adolescents were from a Dutch ethnic background. Previous research has shown that subgroups with a specific ethnic background (e.g., Surinamese, Moroccan) may be particularly 'at risk' for 'negative' SRH behaviors and outcomes (e.g., unprotected sex, and teen pregnancy).[50] Thus, replication of our studies in large and varied populations is recommended.

Specific Topics for Future Research

We recommend four specific topics for future research. First, the role of participation in sports outside school with regard to the (sexual) development of adolescents requires further research.[8-10] For example, we still need to understand what happens in sport club settings (e.g., more interaction with potential sexual partners, alcohol consumption),[8-10] which may drive adolescents to initiate sexual intercourse. We recommend that future studies also apply a qualitative approach (e.g., focus groups) that can help us to under-

stand this type of question.[51] In addition, we recommend that future research evaluates whether different features of sports (e.g., individual versus collective), other physical activity settings (e.g., gyms), and overall physical health, play a role in adolescents' emerging experiences with sexual behaviors. This may provide more understanding regarding the role of specific types of sports in early initiation into sexual intercourse.

Second, we recommend further research regarding the distinct roles of both fathers and mothers in adolescents' sexual and reproductive health in various countries. The role of fathers regarding adolescents' sexual behaviors is generally understudied. Also, the role of fathers with regard to their children's sexual development may be related to socio-cultural differences.[23-28]

Third, we recommend future research to focus on LMICs, and on cross-country comparisons. Our study (Chapter 6) included only one middle-income country (i.e., Brazil). In addition, cross-country comparisons on adolescents' SRH and predictors thereof, specifically among adolescents are scarce.[52] Moreover, the data regarding the United States were old, which requires a new measurement to evaluate changes in behaviors over time. In addition to cross-sectional designs, we propose longitudinal study designs in the future in order to evaluate the directionality of the associations between ecological predictors and adolescents' SRH behaviors and outcomes in distinct countries and cultures. Also, in future studies, we propose harmonization of the measurements of both predictors and outcomes of adolescents' SRH across countries. The use of standard measurements across countries will facilitate international comparisons.

Finally, for future studies we also propose to enhance the proper assessment of the quantity and quality of in-school sexuality education in the distinct countries (e.g., "comprehensive" versus "abstinence until marriage" sex education). For this, more randomized controlled trials (RCTs) are needed to find evidence of *what* works, in sexuality education, *how*, and for *whom*.[53]

Implications for Practice

The studies in this thesis describe the predictors of (optimal and suboptimal) sexual behaviors of adolescents, such as early sexual behaviors and condom use. The studies did not evaluate specific (preventive) interventions to promote healthy sexual behaviors. Yet, the results provide insights that may be used to develop health promotion interventions in the clinical setting, in the public health setting, or in other settings, such as at home or in schools. We recommend the development of effective (preventive) interventions that use an ecological approach and involve adolescents, parents, schools, and health professionals to promote a healthy development of adolescents regarding sexuality.[54]

To highlight one example, given the association between parent–adolescents relationship quality and a healthy and positive sexual development, we recommend developing and evaluating interventions that support parents to maintain a high-quality

relationship with their adolescents, characterized by high levels of warmth, closeness, and support.[54] In the meantime, pediatricians and other health professionals should be able to explain to parents that early sexual initiation can be associated with negative health outcomes, such as the contraction of STIs, but that parents play an important role in promoting healthy sexual behaviors of their children.[55] It has been suggested that by cultivating a high–quality relationship with their child, parents can contribute to create a healthy developmental environment that may help adolescents to develop responsible decision-making skills, which may positively affect their sexual health and psychological wellbeing.[54]

Conclusion

Experiences with sexual behaviors and intimate relationships typically start during adolescence.[1] These experiences are a normative and integrated part of overall development, yet they may have consequences for adolescents' SRH and psychological wellbeing.[1-4] In the current thesis, we applied a holistic approach to understanding adolescent sexuality (ecological systems theory).[54] The studies described in this thesis illustrate the relevance of factors from diverse levels, from individual to social. Overall, our findings support that various stakeholders (e.g., parents, health professionals, and schools), and adolescents themselves, can contribute to a positive sexual development.

References

1. UN, WHO. Every Woman Every Child The Global Strategy For Women's, Children's, and Adolescents' Health (2016-2030). 2015; Geneva, Switzerland
2. WHO. Sexually Transmitted Infections among Adolescents The Need for Adequate Health Services. 2005; Geneva, Switzerland
3. Sandfort TG, Orr M, Hirsch JS, Santelli J. Long-term health correlates of timing of sexual debut: results from a national US study. *Am J Public Health*. 2008;98(1): 155-161
4. Kaestle CE, Halpern CT, Miller WC and Ford CA. Young age at first sexual intercourse and sexually transmitted infections in adolescents and young adults. *Am J Epidemiol*. 2005;161(8): 774-80
5. UNAIDS. *Estatisticas Globais sobre HIV 2017* [Global Statistics on HIV 2017]. Available at: https://unaids.org.br/wp-content/uploads/2017/12/UNAIDSBR_FactSheet.pdf Accessed February 15, 2018
6. Guilamo-Ramos V, Bouris A, Lee J, et al. Potential for Using Online and Mobile Education with Parents and Adolescents to Impact Sexual and Reproductive Health. *Prevention Science*. 2015; 6:53–60
7. Habel MA, Dittus PJ, De Rosa CJ, Chung EQ, Kerndt PR. Daily Participation in Sports and Students' Sexual Activity. *Perspect Sex Reprod Health*. 2010; 42(4): 244–50. doi:10.1363/4224410 PMID: 21126300
8. Faurie C, Pontier D, Raymond M. Student Athletes Claim to Have More Sexual Partners than Other Students. Evolution and Human Behavior. 2004; 25(1):1–8.
9. Page RM, Hammermeister J, Scanlan A, Gilbert L. Is School Sports Participation a Protective Factor against Adolescent Health Risk Behaviors? Journal of Health Education. 1998; 29(3):186–92
10. Nelson MC, Gordon-Larsen P. Physical Activity And Sedentary Behavior Patterns Are Associated With Selected Adolescent Health Risk Behaviors. Pediatrics. 2006; 117(4):1281–90. PMID: 16585325
11. Dittus PJ, Michael SL, Becasen JS, Gloppen KM, McCarthy K, Guilamo-Ramos V. Parental Monitoring and Its Associations With Adolescent Sexual Risk Behavior: A Meta-analysis. *Pediatrics*. 2015;136(6):e1587-e1599
12. Collins RL, Elliott MN, Berry SH, Kanouse DE, Kunkel D, Hunter SB, Miu A. Watching sex on television predicts adolescent initiation of sexual behavior. Pediatrics. 2004; 114(3):e280–9. PMID: 15342887
13. Parkes A, Wight D, Hunt K, Henderson M, Sargent J. Are sexual media exposure, parental restrictions on media use and co-viewing TV and DVDs with parents and friends associated with teenagers' early sexual behaviour? J Adolesc. 2013; 36(6): 1121–33. doi:10.1016/j.adolescence.2013.08.019 PMID: 24215959

14. Sung J, et al. Associations between the Risk of Internet Addiction and Problem Behaviors among Korean Adolescents Korean. J Fam Med. 2013; 34(2) 115–22
15. Winetrobe H, Holloway IW, Montoya J, Plant A, Kordic T. Cell Phone Internet Access, Online Sexual Solicitation, Partner Seeking, and Sexual Risk Behavior Among Adolescents. Arch Sex Behav. 2015; 44(3):755–63. doi:10.1007/s10508-014-0366-3 PMID: 25344027
16. Meier AM. Adolescent first sex and subsequent mental health. Am J Sociol 2007; 112:1811–47
17. Sabia JJ, Rees DI. The effect of adolescent virginity status on psychological well-being. J Health Econ 2008;27:1368–81
18. Hallfors DD, Waller MW, Bauer D, et al. Which comes first in adolescence—sex and drugs or depression? Am J Prev Med 2005;29:163– 70
19. Schalet AT. Not under my roof: Parents, teens, and the culture of sex. Chicago (IL): University of Chicago Press; 2011
20. De Graaf H, Vanwesenbeeck I, Woertman L, and Meeus W. Parenting and adolescents' sexual development in Western societies: A literature review. *European Psychologist*. 2011;16:21–31. doi:10.1027/1016-9040/a000031
21. Gecas V, Schwalbe ML. Parental behavior and adolescent self-esteem. *Journal of Marriage and Family*. 1986;48:37-46. doi:10.2307/352226
22. Van de Bongardt D, Reitz E, Deković M. Indirect over-time relations between parenting and adolescents' sexual behaviors and emotions through global self-esteem. *Journal of Sex Research*. 2016;53(3):273–285
23. Rose A, Koo HP, Bhaskar B, Anderson K, White G, Jenkins RR. The influence of primary caregivers on the sexual behavior of early adolescents. J Adolesc Health. 2005;37:135–144
24. Widman L, Choukas-Bradley S, Noar SM, Nesi J, Garrett K. Parent-adolescent sexual communication and adolescent safer sex behavior: a meta-analysis. *JAMA Pediatrics*. 2016;170(1):52–61
25. Regnerus MD, Luchies LB. The parent child relationship and opportunities for adolescents' first sex. J Fam Issues. 2006;27(2):159–183
26. Rink E, Tricker R, Harvey SM. Onset of sexual intercourse among female adolescents: the influence of perceptions, depression, and ecological factors. J Adolesc Health. 2007;41(4):398–406
27. Keizer R, Lucassen N, Jaddoe V, Tiemeier H. A prospective study on father involvement and toddlers' behavioral and emotional problems: are sons and daughters differentially affected? Fathering. 2014;12(1):38–51
28. Portegijs W, Keuzenkamp S. Nederland deeltijdland. [Netherlands part-time country.] The Hague, Netherlands: SCP; 2008

29. Fatherhood Institute. The Fatherhood Report 2010-11. The Fairness in Families Index. Abergavenny, UK: Fatherhood Institute; 2010
30. Busse P, Fishbein M, Bleakley A, & Hennessy M. The role of communication with friends in sexual initiation. *Communication Research*. 2010;37:239-255. doi: 10.1177/0093650209356393
31. Van de Bongardt D, Reitz E, Sandfort T, Deković M. A meta-analysis of the relations between three types of peer norms and adolescent sexual behavior. *Personality and Social Psychology Review*. 2015;19:203-234. doi:10.1177/1088868314544223
32. Rudolph KD, Conley CS. The socioemotional costs and benefits of social-evaluative concerns: do girls care too much? J Pers. 2005;73:115–138. doi: 10.1111/j.1467-6494.2004.00306.x
33. Kreager DA, Staff J. The Sexual Double Standard and Adolescent Peer Acceptance. *Soc Psychol Q*. 2009;72(2):143–164
34. Shek DTL, Xie Q, Lin L. The impact of family intactness on family functioning, parental control, and parent–child relational qualities in Chinese context. *Frontiers in Pediatrics*. 2015:1–7. doi:10.3389/fped.2014.00149
35. Weaver H, Smith G, Kippax S. School-based sex education policies and indicators of sexual health among young people: A comparison of the Netherlands, France, Australia and the United States. Sex Educ 2005;5:171–88
36. Caruana AJ, Roman M, Hernández-Sánchez J, Solli P. Longitudinal Studies. Journal of Thoracic Disease. 2015;7(11):537–540
37. O'Hara RE, Cooper ML. Bidirectional associations between alcohol use and sexual risk-taking behavior from adolescence into adulthood. *Arch Sex Behav*. 2015;44(4):857–871
38. Hill AB. The environment and disease: association or causation? 1965. J R Soc Med. 2015;108:32-37
39. Richmond RC, Al-Amin A, Smith GD, Relton CL. Approaches for drawing causal inferences from epidemiological birth cohorts: a review. Early Hum Dev. 2014;90: 769-780
40. Schevis RMC, Oude Hengel KM, Burdorf A, Blatter BM, Strijk JE, van der Beek AJ. Evaluation of occupational health interventions using a randomized controlled trial: challenges and alternative research design. *Scand J Work Environ. Health*. 2015;41(5):491–503
41. Lanza ST, Moore JE, Butera NM. Drawing causal inferences using propensity scores: A practical guide for community psychologists. *Am J Community Psychol*. 2013;52:380–392
42. Greenland S, Finkle WD. A critical look at methods for handling missing covariates in epidemiologic regression analyses. *Am J Epidemiol*. 1995;142(12):1255-1264

43. Sterne JAC, White IR, Carlin JB, Spratt M, Royston P, Kenward MG, Wood AM and Carpenter JR. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. BMJ 2009:338
44. SAS Institute Inc. 2008. SAS/STAT® 9.2 User's Guide. Cary, NC: SAS Institute Inc.
45. Siegel, D. M, Aten, M. J, Roghmann, K. J. (1998). Self-reported honesty among middle and high school students responding to a sexual behavior questionnaire. *Journal of Adolescent Health*, *23*, 20-28. doi:10.1016/S1054-139X(97)00274-7
46. Brener, N. D., Billy, J. O., & Grady, W. R. (2003). Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: Evidence from the scientific literature. Journal of Adolescent Health, 33, 436-457. doi: 10.1016/S1054- 139X(03)00052-1
47. Dalenberg WG, Timmerman MC, Van Geert PLC, Kunnen ES. Young Dutch people's everyday experiences of romance and sexuality: A mixed-method approach. *Cogent Social Sciences*. 2016;2(1):1242269
48. Shiffman S, Stone AA, Hufford MR. Ecological momentary assessment. *Annu Rev Clin Psychol*. 2008;4:1–32
49. De Graaf H, Kruijer H, Van Acker JM. S. *Sex onder je 25e. Seksuele gezondheid van jongeren in Nederland anno 2012*. [Sex under 25. Sexual health of Dutch youth in 2012.] Delft, Netherlands: Uitgeverij Eburon; 2012
50. De Graaf H, Vanwesenbeeck I, Meijer S, Woertman L, Meeus W. Sexual trajectories during adolescence: relation to demographic characteristics and sexual risk. Arch Sex Behav. 2009;38(2):276–282
51. Jick TD. Mixing qualitative and quantitative method: Triangulation in action. *Administrative Science Quarterly*. 1979; 24:602–611
52. Madkour AS, De Looze M, Ma P, et al. Macro-Level Age Norms for the Timing of Sexual Initiation and Adolescents' Early Sexual Initiation in 17 European Countries. *J Adolesc Health*. 2014;55(1):114–121
53. Free C, Roberts IG, Abramsky T, Fitzgerald M, Wensley F. A systematic review of randomized controlled trials of interventions promoting effective condom use. J Epidemiol Community Health. 2011;65:100–110
54. Bronfenbrenner U, Ceci SJ. Nature-Nurture Reconceptualized in Developmental Perspective: A Bioecological Model. *Psychol Rev*. 1994; 101(4):568–586. PMID: 7984707
55. Hagan JF, Shaw JS, PM D. Bright Futures guidelines for health supervision of infants, children, and adolescents. 2008. Available at: https://brightfutures.aap.org/Pages/default.aspx. Accessed March 20, 2018

Summary, Samenvatting (Summary in Dutch) & Sumário (Summary in Portuguese)

Summary

In the present thesis, we departed from three gaps in the literature of adolescent sexuality. (1) There is a lack of studies regarding the (potential) predictors of adolescents' sexual and reproductive health (SRH). (2) There is only little research with regard to SRH among adolescents from low- and middle-income countries (LMICs) and cross-country comparisons. (3) More longitudinal research is needed.

This thesis contributes to the literature (1) by investigating three potentially relevant individual and social factors that may be associated with adolescents' SRH (i.e., adolescents' experiences with early sexual behaviors, timing of first sexual intercourse, number of sexual partners, condom use, contraceptive use, and teen pregnancy), (2) by a cross-country comparison of predictors of adolescents' SRH between two high-income countries (HICs) that differ with regard to adolescents' SRH (the Netherlands and the US) and a LMIC (Brazil), and (3) by employing longitudinal study designs, assessing bidirectional over-time associations between ecological factors and adolescents' sexual behaviors, and investigating explanatory factors of adolescents' sexual behaviors through mediation analyses.

Five central research questions were explored:

1) How are various physical activity and screen time behaviors associated with subsequent early sexual intercourse initiation?
2) How is adolescents' psychological well-being associated with adolescents' subsequent experiences with early sexual behaviors, and–vice versa–how is adolescents' experiences with early sexual behaviors linked with their subsequent psychological well-being?
3) How are adolescents' relationships with mothers and fathers associated with subsequent early sexual intercourse initiation?
4) How is sexual communication with friends associated with adolescents' subsequent experiences with early sexual behaviors, and to what extent is this association explained by adolescents' perceptions of sexual peer norms?
5) What are the differences and similarities in adolescents' SRH behaviors and outcomes, and psychosocial predictors thereof, across the Netherlands, the United States, and Brazil?

These research questions were addressed in five empirical studies using five large-scale datasets (three longitudinal; two cross-sectional).

1. How are various physical activity and screen time behaviors associated with subsequent early sexual intercourse initiation?

The results of Chapter 2 showed that the only significant predictor of early sexual intercourse over a 2-year period was sports club membership, whereas the other physical activity behaviors (i.e., sports participation outside school, sports club membership, cycling to school, time cycling to school) were not. In addition, this study showed that boys (but not girls) who watched TV ≥2 hours/day were significantly more likely to have had early sexual intercourse than boys who watched TV <2 hours/day. Further, we found that girls (but not boys) who used a computer ≥2 hours/day were significantly more likely to have engaged in early sexual intercourse than girls who used a computer <2 hours/day.

2. How is adolescents' psychological well-being associated with adolescents' subsequent experiences with early sexual behaviors, and–vice versa–how is adolescents' experiences with early sexual behaviors linked with their subsequent psychological well-being?

The findings of Chapter 3 revealed that adolescents' experiences with early sexual behaviors and psychological well-being were not associated over time, in either direction, for both boys and girls. Further, this study indicated that a higher–quality of the relationship between adolescents and their parents at baseline (T1) predicted more optimal levels of adolescents' psychological well-being (i.e., higher levels of global self-esteem and physical self-esteem, and lower levels of depression) over time (T1–T4), for both boys and girls.

3. How are adolescents' relationships with mothers and fathers associated with subsequent early sexual intercourse initiation?

Chapter 4 showed that for the subgroup girls (not boys) that having a higher quality relationship with mothers was prospectively associated with a lower likelihood to initiate sexual intercourse at an early age. In this study, the association between father–adolescent relationship quality and early sexual initiation was not significant, neither for boys nor for girls.

4. How is sexual communication with friends associated with adolescents' subsequent experiences with early sexual behaviors, and to what extent is this association explained by adolescents' perceptions of sexual peer norms?

In Chapter 5 we found that that more frequent sexual communication with friends at T1 predicted a significant increase in experiences with sexual behaviors between T1–T3, for both boys and girls. Mediation analyses showed that this association was partially explained by the three sexual peer norm perceptions at T2, with a stronger total indirect effect for girls than for boys. That is, more sexual communication with friends predicted adolescents' subsequent perceptions of 1) more sexual behaviors, 2) more approval

towards sex, and 3) more peer pressure to have sex among their peers, which, in turn, predicted an increase in their own experiences with sexual behaviors between T1–T3.

5. What are the differences and similarities in adolescents' SRH behaviors and outcomes, and psychosocial predictors thereof, across the Netherlands, the United States, and Brazil?

The results of Chapter 6 showed that in each of the three countries: 1) boys were more likely than girls to have more sexual partners, more condom use, and less of other contraceptives, 2) living with both biological parents was associated with later sexual intercourse initiation, fewer sexual partners, more condom and contraceptive use, and lower rates of teen pregnancies, 3) having received more in-school sexuality education was associated with fewer sexual partners, more condom use, and more contraceptive use.

In Chapter 7, methodological considerations were discussed, as well as implications for research and practice. The types of sexual behaviors that young adolescents engage in, their cognitive and emotional evaluation of these experiences, and the relational context in which sexual behaviors take place are important to investigate further. These are also factors to focus on for educators, health care professionals and parents

In conclusion, experiences with sexual behaviors and intimate relationships typically start during adolescence. These experiences are a normative and integrated part of overall development. Yet, they may have consequences for adolescents' SRH and psychological wellbeing. In the current thesis, we applied a holistic approach to understanding adolescent sexuality. The studies described in this thesis illustrate the relevance of factors from diverse levels, from individual to social. Our findings support that various stakeholders (e.g., parents, health professionals, and schools), and adolescents themselves, can contribute to a positive sexual development.

Samenvatting (Summary in Dutch)

Het vertrekpunt van deze scriptie zijn de volgende drie hiaten in de onderzoeksliteratuur van de sexualiteit van adolesenten; (1) Er is een tekort aan onderzoek betreffende de (potentiele) voorspellers van sexuele en reproductieve gezondheid (SRG) van adolescenten. (2) Er is slechts beperkt onderzoek uitgevoerd ten aanzien van SRG onder adolescenten in landen met een laag-en middeninkomen en vergelijkingen tussen landen onderling. (3) Meer longitudinal onderzoek is noodzakelijk.

Deze scriptie beoogd de bestaande literatuur te ondersteunen (1) door drie potentiele, individuele en sociale factoren te onderzoeken welke geassocieerd zouden kunnen zijn met adolescente SRG (i.e., adolescente ervaringen met vroeg sexuele ervaringen, het moment van de eerste geslachtsgemeenschap, het aantal sexuele partners, condoom gebruik, gebruik van voorbehoedsmiddelen en tiener zwangerschappen), (2) door een inter-nationaal vergelijk van voorspellers van de SRG van adolescenten tussen twee landen met hoge inkomens (HIC's) welke zich onderscheiden voor wat betreft de SRG van adolescenten (Nederland en de Verenigde Staten) en een land met een laag-en middeninkomen (Brazilië), en (3) door het gebruik van een longitudinale onderszoeksopzet, welke bidirectioneel over de tijd, associaties onderzoekt tussen ecologische factoren en adolescent sexueel gedrag, als tevens verklarende factoren van adolescent sexueel gedrag door mediatie-analyse.

Vijf centrale onderzoeksvragen zijn onderzocht:

1) Hoe zijn diverse fysieke activiteiten en schermtijd (kijk)gedrag geassocieerd met vroege geslachtsgemeenschapsinitiatie?
2) Hoe is het psychologische welzijn van adolescenten geassocieerd met opvolgende ervaringen op het vlak van vroeg sexueel gedrag, en –vice versa– hoe zijn de ervaringen van adolescenten met vroeg sexueel gedrag gekoppeld met hun psychologisch welzijn?
3) Hoe zijn de relaties van adolescenten met hun moeder en vader geassocieerd met vroege geslachtsgemeenschapsinitiatie?
4) Hoe is communicatie betreffende sexualiteit met vrienden geassocieerd met opvolgende ervaringen van adolescenten op het vlak van vroeg sexueel gedrag, en in welke mate kan deze associatie verklaard worden door de percepties van adolescenten van de normen van sexuele gelijken ('peers')?
5) Wat zijn de verschillen en de overeenkomsten in SRG gedrag en resultaten van adolescenten, en de psychosociale voorspellers ervan, in Nederland, de Verenigde Staten en Brazilië?

Deze onderzoeksvragen zijn geadresseerd in vijf empirische studies gebruik makend van vijf grote schaal datasets (drie longitudinaal; twee cross-sectional).

1. Hoe zijn diverse fysieke activiteiten en schermtijd (kijk)gedrag geassocieerd met vroege geslachtsgemeenschapsinitiatie?

De resultaten uit hoofdstuk 2 geven aan dat de enige significante voorspeller van vroege geslachtsgemeenschap over een periode van 2 jaar is, een lidmaatschap bij een sport club, terwijl andere fysieke activiteiten (i.e. buitenschoolse deelname aan sport, naar school fietsen, tijdsduur voor het naar school fietsen) dit niet waren. Daarbij toont dit onderzoek aan dat jongens (geen meisjes) die meer dan 2 uur per dag televisie keken, significant hogere waarschijnlijkheid hebben op vroege geslachtsgemeenschap, dan jongens die minder dan 2 uur per dag televisie keken. Tevens vonden we dat meisjes (geen jongens) die meer dan 2 uur per dag een computer gebruikten een significant hoger waarschijnlijkheid hadden op het hebben van vroege geslachtgemeenschap dan meisjes die minder dan twee uur per dag een computer gebruikten.

2. Hoe is het psychologische welzijn van adolescenten geassocieerd met opvolgende ervaringen op het vlak van vroeg sexueel gedrag, en –vice versa– hoe zijn de ervaringen van adolescenten met vroeg sexueel gedrag gekoppeld met hun psychologisch welzijn?

De bevindingen in hoofdstuk 3 tonen aan dat ervaringen van adolescenten met vroegtijdig sexueel gedrag en psychologisch welzijn niet geassociateerd zijn over tijd, eender in welke richting, voor zowel jongens als meisjes. Tevens toont deze studie dat een hogere kwaliteit van de relatie tussen de adolescent en zijn ouders op de baseline (T1) een hoger niveau van psychologisch welzijn bij adolescenten voorspelt (i.e., hoger niveau van globaal zelfvertrouwen en fysiek zelfvertrouwen, en lagere depressie niveau's) over de tijd (T1–T4), voor zowel jongens als meisjes.

3. Hoe zijn de relaties van adolescenten met hun moeder en vader geassocieerd met vroege geslachtsgemeenschapsinitiatie?

Hoofdstuk 4 geeft aan dat voor de subgroep meisjes (geen jongens) een hogere kwaliteit van relatie met de moeder een voorspellende associatie geeft met een lagere likelihood tot het initieren van geslachtgemeenschap op een jonge leefdtijd. In dit onderzoek is geen significante associatie gevonden tussen de kwaliteit van de vader-adolescent relatie en de initiatie van geslachtgemeenschap op een jonge leefdtijd, niet voor jongens noch voor meisjes.

4. Hoe is communicatie betreffende sexualiteit met vrienden geassocieerd met adolescenten opvolgende ervaringen op het vlak van vroeg sexueel gedrag, en in welke mate kan deze associatie verklaard worden door de percepties van adolescenten van de normen van sexuele gelijken ('peers')?

In hoofdstuk 5 vonden we dat veelvuldig sexuele communicatie tussen vrienden op tijdstip T1 een significante verhoging van sexueel gedrag voorspelt tussen T1-T3, zowel voor jongens als voor meisjes. Mediatie-analyse toont aan dat deze associatie deels wordt verklaard door de drie sexuele 'peer' norm percepties op T2, met een sterker totaal indirect effect voor meisjes dan voor jongens. I.e., meer sexuele communication tussen vrienden voorspelt adolescente percepties van 1) meer sexuele gedragingen, 2) meer goedkeuring van sex, en 3) hogere 'peer' (groeps)druk om sex te hebben met 'peers', welke op zijn beurt, een toename van eigen ervaringen voor wat betreft sexueel gedrag tussen T1–T3 voorspelt.

5. Wat zijn de verschillen en de overeenkomsten in SRG gedrag en resultaten van adolescenten, en de psychosociale voorspellers ervan, in Nederland, de Verenigde Staten en Brazilië?

De resultaten uit hoofdstuk 6 wijzen uit dat in elk van deze drie landen: 1) jongens een hogere waarschijnlijkheid hebben dan meisjes op meer sexuele partners, meer condoom gebruik, en minder gebruik van andere typen voorbehoedsmiddelen, 2) het samenwonen met beide biologische ouders geassocieerd is met latere geslachtsgemeenschapsinitiatie, minder sexuele partners, meer condoom en voorbehoedsmiddelen gebruik, en een lagere mate van tienerzwangerschappen, 3) het ondergaan van meer sexuele voorlichting op school is geassociateerd met minder sexuele partners, meer condoom gebruik, en meer gebruik van andere typen anticonceptie.

In hoofdstuk 7, zijn de methodologische overwegingen besproken, als ook verdere implicaties voor onderzoek en de praktijk. De typen sexueel gedrag welke jonge adolescenten vertonen, hun cognitieve en emotionele evaluatie van hun ervaringen, als ook de relationele context in welke de sexuele gedragingen plaatsvonden zijn belangrijk voor verder onderzoek. Dit zijn tevens aandachtspunten voor onderwijs, zorgspecialisten en ouders.

Tot conclusie, ervaringen met sexueel gedrag en intieme relaties starten gebruikelijk gedurende de adolescentie. Deze ervaringen zijn een normatief en integratief onderdeel van algemene ontwikkeling. Echter, zij kunnen consequenties hebben voor de sexuele en reproductieve gezondheid van adolescenten en psychologisch welzijn. In deze scriptie, hebben we een holistische aanpak toegepast voor het ontwikkelen van begrip in adolescente sexualiteit. De onderzoekingen beschreven in deze scriptie tonen de relevantie van factoren van diverse niveau's, van individueel tot sociaal. Onze bevindingen ondersteunen dat diverse stakeholders (e.g., ouders, zorgprofessionals en scholen), en adolescenten zelf, kunnen bijdragen tot een positieve sexuele ontwikkeling.

Sumário (Summary in Portuguese)

Na presente tese, nós partimos de três lacunas na literatura sobre sexualidade adolescente. (1) Faltam estudos sobre os (potenciais) preditores da saúde sexual e reprodutiva dos adolescentes (SSR). (2) Existem poucas pesquisas com relação à SSR em adolescentes de países de baixa e média renda e comparações entre países. (3) Pesquisas longitudinais são necessárias.

Esta tese contribui para a literatura pela (1) investigação de três fatores individuais e sociais potencialmente relevantes que podem estar associados à SSR dos adolescentes (ou seja, experiências de adolescentes com comportamentos sexuais precoces, tempo da primeira relação sexual, número de parceiros sexuais, uso de preservativo), uso de outros contraceptivos e gravidez na adolescência), (2) por uma comparação entre os preditores de SSR de adolescentes entre dois países de alta renda (HICs) que diferem em relação à SSR dos adolescentes (Holanda e EUA) e LMIC (Brasil) e pelo (3) emprego delineamentos de estudos longitudinais, avaliando associações bidirecionais ao longo do tempo entre fatores ecológicos e comportamentos sexuais de adolescentes, e investigando fatores explicativos do comportamento sexual de adolescentes através de análises de mediação.

Cinco questões centrais de pesquisa foram exploradas:

1) Como vários comportamentos relacionados à atividade física e ao tempo de tela estão associados ao início precoce da relação sexual?
2) Como o bem-estar psicológico dos adolescentes está associado às experiências subsequentes dos adolescentes com comportamentos sexuais precoces, e vice-versa– como as experiências dos adolescentes com comportamentos sexuais precoces estão ligadas ao seu bem-estar psicológico subsequente?
3) Como os relacionamentos dos adolescentes com mães e pais estão associadas ao início subseqüente das relações sexuais precoces?
4) Como a comunicação sexual com amigos está associada às experiências subsequentes de adolescentes com comportamentos sexuais precoces, e até que ponto esta associação é explicada pela percepção dos adolescentes sobre normas sexuais dos pares?
5) Quais são as diferenças e semelhanças nos comportamentos e resultados de SSR dos adolescentes e seus preditores psicossociais entre Holanda, Estados Unidos e Brasil?

Estas questões de pesquisa foram abordadas em cinco estudos empíricos utilizando cinco conjuntos de dados de grande escala (três longitudinais; dois transversais).

1. Como vários comportamentos relacionados à atividade física e ao tempo de tela estão associados ao início precoce da relação sexual?

Os resultados do Capítulo 2 mostraram que o único preditor significativo de relações sexuais precoces durante um período de dois anos foi a associação a clubes esportivos, enquanto entre os outros comportamentos físicos (isto é, participação em esportes fora da escola, associação a clubes esportivos, ciclismo até a escola, tempo gasto de bicicleta até a escola) não foram encontradas associações. Além disso, este estudo mostrou que os meninos (mas não as meninas) que assistiram TV ≥2 horas/dia foram significativamente mais propensos a ter relações sexuais precoces do que os meninos que assistiram TV <2 horas/dia. Além disso, descobrimos que as meninas (mas não os meninos) que usavam um computador ≥2 horas/dia foram significativamente mais propensas a ter relações sexuais precoces do que as meninas que usavam um computador <2 horas/dia.

2. Como o bem-estar psicológico dos adolescentes está associado às experiências subsequentes dos adolescentes com comportamentos sexuais precoces, e vice-versa– como as experiências dos adolescentes com comportamentos sexuais precoces estão ligadas ao seu bem-estar psicológico subsequente?

As conclusões do Capítulo 3 revelaram que as experiências dos adolescentes com comportamentos sexuais precoces e bem-estar psicológico não foram associadas ao longo do tempo, em ambos os sentidos, tanto para meninos quanto para meninas. Além disso, este estudo indicou que uma melhor qualidade dos relacionamentos entre adolescentes e seus pais no início do estudo (T1) previu níveis mais ideais de bem-estar psicológico dos adolescentes (ou seja, níveis mais altos de auto-estima e auto-estima física, e níveis mais baixos de depressão) ao longo do tempo (T1-T4), tanto para meninos quanto para meninas.

3. Como os relacionamentos dos adolescentes com mães e pais estão associadas ao início subseqüente das relações sexuais precoces?

O Capítulo 4 mostrou que, para as meninas somente (não para os meninos), um relacionamento de melhor qualidade com as mães foi associado prospectivamente a uma menor probabilidade de iniciar a relação sexual em idade precoce. Neste estudo, a associação entre a qualidade do relacionamento pai-adolescente e a iniciação sexual precoce não foi significativa, nem para meninos nem para meninas.

4. Como a comunicação sexual com amigos está associada às experiências subsequentes de adolescentes com comportamentos sexuais precoces, e até que ponto esta associação é explicada pela percepção dos adolescentes sobre normas sexuais dos pares?

No Capítulo 5, descobrimos que a comunicação sexual mais frequente com amigos no T1 previu um aumento significativo nas experiências dos adolescents com comportamentos sexuais entre T1 e T3, tanto para meninos quanto para meninas. Análises de

mediação mostraram que essa associação foi parcialmente explicada pelas percepções das três normas sexuais dos pares no T2, com um efeito indireto total mais forte para as meninas do que para os meninos. Ou seja, mais comunicação sexual com amigos previu percepções subsequentes dos adolescentes sobre 1) mais comportamentos sexuais, 2) mais aprovação em relação ao sexo e 3) mais pressão dos colegas para fazer sexo entre seus pares, o que, por sua vez, previu um aumento em seus relacionamentos. próprias experiências com comportamentos sexuais entre T1-T3.

5. Quais são as diferenças e semelhanças nos comportamentos e resultados de SSR dos adolescentes e seus preditores psicossociais entre Holanda, Estados Unidos e Brasil?

Os resultados do Capítulo 6 mostraram que em cada um dos três países: 1) os meninos foram mais propensos do que as meninas a ter mais parceiros sexuais, usar mais preservativos e usar menos de outros contraceptivos; 2) viver com ambos os pais biológicos foi associado à iniciação sexual, menos parceiros sexuais, mais uso de preservativos e outros contraceptivos e menores taxas de gravidez na adolescência, 3) ter recebido mais educação sexual na escola foi associado a menos parceiros sexuais, mais uso de preservativo e mais uso de outros contraceptivos.

No Capítulo 7, considerações metodológicas foram discutidas, assim como implicações para pesquisa e prática. Os tipos de comportamentos sexuais em que os jovens adolescentes se envolvem, as avaliações cognitiva e emocional dessas experiências e o contexto relacional em que os comportamentos sexuais ocorrem são importantes investigar em pesquisas futuras. Esses também são fatores a serem enfocados pelos educadores, profissionais de saúde e pais.

Em conclusão, experiências com comportamentos sexuais e relacionamentos íntimos geralmente começam na adolescência. Essas experiências são uma parte normativa e integrada do desenvolvimento geral. No entanto, elas podem ter consequências para a SSR e o bem-estar psicológico dos adolescentes. Na presente tese, aplicamos uma abordagem holística para entender a sexualidade adolescente. Os estudos descritos nesta tese ilustram a relevância de fatores de diversos níveis, do individual ao social. Nossos resultados confirmam que várias partes interessadas (por exemplo, pais, profissionais de saúde e escolas) e os próprios adolescentes podem contribuir para um desenvolvimento sexual positivo.

Appendices

About the Author

Raquel Nogueira Avelar e Silva was born on January 25th 1985, in Carmo do Cajuru, in the state of Minas Gerais, Brazil. In 2010 she graduated from the Faculty of Nursing of the Federal University of Juiz de Fora (UFJF) with a BSc in nursing sciences. During her bachelor studies, Raquel participated in various international and national projects, both academic and community led by the Faculties of Nursing, Medicine, and Social Sciences.

Raquel worked on "Medical Mission 2004", which involved her closely assisting an international team of doctors and nurses with performing clinical exams among school aged children in public schools in a poor, rural setting, in Brazil. In 2006, Raquel collected data on elderly people for one year, for the "Characteristics of Population Aging" project at the National School of Public Health, Fiocruz, Rio de Janeiro. In 2007, she participated in a multidisciplinary project "Speak Woman", at which topics such as sexual and reproductive health (SRH) rights were discussed with female patients in the University Hospital of the UFJF. In the same year, she wrote a "Rondon" project that has been funded by the Brazilian Ministry of Defense. For this project, multidisciplinary teams provided health-related workshops (e.g., prevention of diarrhea among children under 5 years) for citizens of a poor city in the Northeast of Brazil. For the next two years, Raquel participated in other research projects.

After completing two years of clinical internships, Raquel started a Masters in Nursing in 2011. Between 2011 and 2013, she investigated clinical evidences of peripheral vascular trauma among children hospitalized in a University Hospital pediatric ward. In 2011, she also started working as a nurse manager in a primary health care clinic. During two years of clinical practice, Raquel performed prenatal consultations, in which she provided prenatal care, including too many adolescents. These experiences led to Raquel choosing adolescents' SRH as the topic of her PhD. In 2013, she wrote a PhD proposal on adolescents' SRH that has been funded by the Coordination for the Improvement of Higher Education Personnel (Capes). At the end of 2013, she left her job to pursue her PhD in the Netherlands.

From 2014 to 2018, Raquel was a PhD candidate at the Department of Public Health of the Erasmus Medical Center, in Rotterdam, the Netherlands. Here she has developed her PhD project on adolescents' SRH, under the supervision of Professor Hein Raat, and Dr. Daphne van de Bongardt. During her amazing PhD journey, Raquel has received a great deal of support from both of her supervisors, who have constantly encouraged her not only to write scientific articles, but also to engage in diverse academic activities.

For her scientific publications, Raquel has worked with five large datasets, including national (e.g., Project STARS) & international (e.g., Add Health). During her PhD, she has written five scientific articles and she has published in high impact journals in the fields of public health and pediatrics.

In addition, Raquel engaged in other academic activities, such as teaching, international research visits, and peer-review. During 2016–2017, she was an assistant in the Biostatistical practical master classes of the Netherlands Institute of Public Health (NIHES). In 2016, she organized an international symposium entitled "Sexual Development during Adolescence: A Positive Perspective". In 2017, she visited the Department of Psychology of the University of Texas at Austin, USA, for two months. This was a valuable opportunity to build international collaborations and develop a study comparing adolescents' SRH and predictors thereof across the Netherlands, the United States, and Brazil. In 2018, she visited the Department of Public Health and Primary Care of the University of Cambridge, to work on a large cohort study investigating risk factors associated with non-communicable diseases in a slum setting in Dhaka, Bangladesh. For this study, Raquel has contributed by reviewing the protocol for submission to the Institutional Review Board of a university hospital, in Dhaka, Bangladesh. She has also made content-related contributions, such as the inclusion of children and adolescents, and the inclusion of new variables in the study on family environment and psychological health. Raquel's scholarship in the University of Cambridge has been extended until August, 2018. After that, she would like to continue in academia as a postdoctoral scholar.

Scientific Publications

English Peer-Reviewed

[*]**Nogueira Avelar e Silva R,** Van de Bongardt D, Baams L, Raat H. Bidirectional Associations Between Adolescents' Sexual Behaviors and Psychological Wellbeing: A Longitudinal Study. Journal of Adolescent Health. 2018; 62(1):63-71.

[*]**Nogueira Avelar e Silva R,** Van de Bongardt D, Van de Looij-Jansen P, Wijtzes A, Raat H. Mother– and Father–Adolescent Relationships and Early Sexual Intercourse. Pediatrics. 2016; 138(6):e20160782.

[*]**Nogueira Avelar e Silva R,** Wijtzes A, Van de Bongardt D, Van de Looij-Jansen P, Bannink R, Raat H. Early Sexual Intercourse: Prospective Associations with Adolescents Physical Activity and Screen Time. PLoS ONE. 2016; 11(8):e0158648.

[*]**Nogueira Avelar e Silva R,** Van de Bongardt D, Plat M, Reitz E, Deković M, Raat H. Longitudinal Associations between Sexual Communication with Friends and Early Sexual Behaviors through Perceived Sexual Peer Norms. Under review.

[*]**Nogueira Avelar e Silva R,** Van de Bongardt D, Paige Harden K, De Graaf H, Meijer S, Raat H. Adolescents' Sexual and Reproductive Health: A Comparison across the Netherlands, the US, and Brazil. Submitted for publication.

[*]The manuscript with an asterisk are included in this dissertation.

Portuguese Peer-Reviewed

Nogueira Avelar e Silva R, Arreguy-Sena C**.** Trauma vascular periférico em crianças: fatores relacionados pelo método de regressão logística. [Peripheral Vascular Trauma in Children: Related Factors by the Logistic Regression Method]. Revista Eletrônica de Enfermagem. 2014; 16(1):117-24.

Nogueira Avelar e Silva R, Arreguy-Sena C**.** Survey of Clinical Manifestations of Peripheral Vascular Trauma in Children Admitted to Pediatric Wards. Online Brazilian Journal of Nursing. 2013; 12(2):451-61.

Arreguy-Sena C, Krempser P, **Nogueira Avelar e Silva R,** Vilela Oliveira D. Punção de Vasos e Paleta Cromática: Subsídio para Pesquisa e Prática Clínica de Enfermeiros. [Puncture of Vessels and Color Palette: Subsidy for Research and Practice of Nurses]. 2013; 3(1):488-97.

Other Publications

Nogueira Avelar e Silva R, Arreguy-Sena C**.** Validação clínica do diagnóstico "trauma vascular periférico em crianças" de 6 meses a 12 anos. 2012. [Clinical Validation of the Diagnosis "Peripheral Vascular Trauma" in Children Aged 6 Months to 12 Years]. **Master's Dissertation.** Master of Science in Nursing Sciences. Universidade Federal de Juiz de Fora (UFJF). 2012.

PhD Portfolio

PhD candidate:	Raquel Nogueira Avelar e Silva
Department:	Public Health, Erasmus Medical Center, Rotterdam
Research School:	Netherlands Institute for Health Sciences (NIHES), Rotterdam
PhD period:	January 2014–June 2018
Promoter:	Prof. dr. H. Raat
Co-promoter:	Dr. D. van de Bongardt

	Year	Workload (ECTS)
1. PhD Training		
Master of Science (MSc) in Health Sciences, NIHES, Rotterdam, the Netherlands	2014-2015	
General Courses		
Principles of Research in Medicine	2014	0.7
Methods of Public Health Research	2014	0.7
Introduction to Global Public Health	2014	0.7
Methods of Health Service Research	2014	0.7
Primary and Secondary Prevention Research	2014	0.7
Social Epidemiology	2014	0.7
Logistic Regression	2015	1.4
Causal Mediation Analysis	2015	0.7
Study Design	2014	4.3
Biostatistical Methods I: Basic Principles	2014	5.7
Biostatistical Methods II: Classical Regression Models	2014	4.3
Public Health Research Methods	2014	5.7
International Comparison of Health Care Systems	2014	1.4
Site Visit to Municipal Health Service Rotterdam	2015	0.3
Integration Module	2014	0.3
Advanced Courses		
Women's Health	2014	0.9
Intervention Research and Clinical Trials	2014	0.9
Principles of Epidemiologic Data-analysis	2014	0.7
Maternal and Child Health	2014	0.9
From Problem to Solution in Public Health	2014	1.1
Public Health in Low and Middle Income Countries	2014	3.0

	Year	Workload (ECTS)
Skills Courses		
English Language	2015	1.4
Introduction to Medical Writing	2015	1.1
Research		
Development Research Proposal	2015	2.5
Oral Research Presentation	2015	1.4
Research Period	2015	29.6
General Academic Courses		
Endnote, Medical Library, Erasmus Medical Center	2014	0.3
Systematic Literature Search, Medical Library, Erasmus Medical Center	2014	0.6
Research Integrity	2016	2.0
Seminars and Workshops		
Seminars Public Health, the University of Cambridge	2018	1.0
Seminars, Public Health, Erasmus Medical Center	2014-2018	1.0
Study Group in Statistics, Public Health, Erasmus Medical Center Organized	2015-2016	0.5
Gender Innovation, Leiden University	2015	0.5
Seminars, Public Health, Erasmus Medical Center. Oral Presentation	2015	0.5
Seminars, Public Health, Erasmus Medical Center. Oral Presentation	2016	0.5
Rotterdam Global Health Initiative	2017	1.0
International Conferences		
16th Biennial Meeting of the Society for Research in Child Development (SRCD), the United States. *Organized Symposia*	2017	1.4
16th Biennial Meeting of the Society for Research in Child Development (SRCD), the United States. *Oral Presentation*	2017	1.4
10th Conference of the Global Network of WHO Collaborating Centers for Nursing and Midwifery, Portugal. *Oral Presentation*	2014	1.4
Scholarships and Grants		
The University of Cambridge, the United Kingdom	2018	
Stichting Fonds Catharine van Tussenbroek, the Netherlands	2017	
Erasmus Medical Center, the Netherlands	2017	
Sciences Without Borders. PhD Grant, Brazil	2014-2017	

	Year	Workload (ECTS)
2. Teaching Activities		
Teaching Assistant: Cardiovascular Disease and Diabetes Epidemiology Module, MSc in International Health, Charité–Institute of Tropical Medicine and International Health, Berlin, Germany	2017	0.5
Teaching Assistant: SPSS Practical Classes, Biostatistics I Module, MSc in Health Sciences–Netherlands Institute of Health Sciences (NIHES), Erasmus Medical Center, Rotterdam, the Netherlands	2016	0.5
Teaching Assistant: SPSS Practical Classes, Biostatistics I Module, MSc in Health Sciences–Netherlands Institute of Health Sciences (NIHES), Erasmus Medical Center, Rotterdam, the Netherlands	2015	0.5
3. Other Activities		
Peer review for scientific Journal BMC Public Health	2017	0.5
Research Visits		
An international six-month research visit in the Department of Public Health and Primary Care of the University of Cambridge, the United Kingdom.	2018	2.0
An international two-month research visit in the Department of Psychology of the University of Texas at Austin, the United States.	2017	2.0

4. Popular-Scientific Dissemination Activities (Media)

1) Reuters (international newspaper): Telephone interview for article about the study "Mother– and Father–Adolescents Relationships and Early Sexual Intercourse" (2016). Link: https://www.reuters.com/article/us-health-kids-parenting/girls-may-wait-longer-for-sex-when-theyre-close-to-their-mothers-idUSKBN13N1ZI

2) NOS (Dutch newspaper): Telephone interview for article about the study "Mother– and Father–Adolescents Relationships and Early Sexual Intercourse" (2016). Link: http://nos.nl/artikel/2145468-tienermeisjes-hebben-later-seks-als-band-met-moeder-goed-is.html

3) ND (Dutch newspaper): Telephone interview for article about the study "Mother– and Father–Adolescents Relationships and Early Sexual Intercourse" (2016). Link: https://www.nd.nl/nieuws/wetenschap/hoe-beter-band-met-ouders-hoe-later-seks.2384860.lynkx

4) NRC (Dutch newspaper): Telephone interview for article about the study "Mother– and Father–Adolescents Relationships and Early Sexual Intercourse" (2016). Link: https://www.nrc.nl/nieuws/2016/11/28/mama-helpt-bij-wachten-met-seks-5559524-a1533969

5) NU (Dutch newspaper): Telephone interview for article about the study "Mother– and Father–Adolescents Relationships and Early Sexual Intercourse" (2016). Link: http://www.nu.nl/gezondheid/4357202/tieners-goede-band-met-ouders-hebben-beginnen-later-seks.html

6) AD (Dutch newspaper): Telephone interview for article about the study "Mother– and Father–Adolescents Relationships and Early Sexual Intercourse" (2016). Link: http://www.ad.nl/dossier-nieuws/tiener-begint-later-met-seks-als-band-met-ouders-goed-is~a90b4e83/

7) Rijnmond (Dutch radio): Article about the study "Mother– and Father– Adolescents Relationships and Early Sexual Intercourse" (2016). Link: http://www.rijnmond.nl/nieuws/149090/Meisjes-hebben-later-seks-bij-goede-band-met-moeder

8) Erasmus Medical Center (university press release): Telephone interview for article about the study "Mother– and Father– Adolescents Relationships and Early Sexual Intercourse" (2016). Link: http://www.erasmusmc.nl/corp_home/corp_news-center/2016/2016-11/later.seks.goede.band.ouders/

	Year	Workload (ECTS)
9) Standard (international newspaper): Article about the study "Mother– and Father– Adolescents Relationships and Early Sexual Intercourse" (2016). Link: http://www.standaard.be/cnt/dmf20161129_02597839		
10) Smart parenting (international magazine). Article about the study "Mother– and Father– Adolescents Relationships and Early Sexual Intercourse" (2016). Link: http://www.smartparenting.com.ph/parenting/tweens-teens/teen-girls-strong-bond-with-mom-may-help-delay-sex-a00041-20170119		

Words of Gratitude

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