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Project STARS (Studies on Trajectories of Adolescent Relationships and Sexuality): A longitudinal, multi-domain study on sexual development of Dutch adolescents

Ellen Reitz¹, Daphne van de Bongardt¹, Laura Baams¹, Suzan Doornwaard¹, Wieke Dalenberg², Judith Dubas¹, Marcel van Aken¹, Geertjan Overbeek³, Tom ter Bogt¹, Regina van der Eijnden¹, Ine Vanwesenbeeck¹, Saskia Kunnen², Greetje Timmerman², Paul van Geert², and Maja Deković¹

¹Utrecht University, Utrecht, The Netherlands

²University of Groningen, Groningen, The Netherlands

³University of Amsterdam, Amsterdam, The Netherlands

This study gives an overview of Project STARS (Studies on Trajectories of Adolescent Relationships and Sexuality), a four-wave longitudinal study of 1297 Dutch adolescents. First, the sample, measures and four sub-projects are described. Second, hierarchical regression analyses were conducted to examine how key variables from the individual domain (impulsivity), parent domain (parent–adolescent relationship quality), peer domain (involvement with peers) and media domain (time spent on social networking sites), and their interactions predict changes in the experience with sexual behaviour of adolescents across time. Results showed that higher levels of impulsivity, lower quality of relation with parents, more frequent involvement with peers and more time spent on social networking sites at baseline predicted increases in sexual experience of adolescents over a subsequent 1.5-year time period. No interaction effects among the domains were

Correspondence should be addressed to Ellen Reitz, Utrecht Centre of Child and Adolescent Studies, Utrecht University, Heidelberglaan 1, PO Box 80.140, 3508 TC Utrecht, The Netherlands. E-mail: E.Reitz@uu.nl

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found. The findings highlight the significance of a multi-domain approach to the study of adolescent sexual development.

Keywords: Experience sexual behaviour; Individual; Parents; Peers; Media; Adolescence.

As adolescents mature, they gradually engage in sexual behaviours of increasing intimacy, varying from kissing to sexual intercourse (De Graaf, Vanwesenbeeck, Meijer, Woertman, & Meeus, 2009). According to the biosocial model (Udry, 1988) and other ecological models (e.g., Bronfenbrenner, 1979), it is important to consider both individual and socio-contextual domains when investigating developments in adolescents' (sexual) behaviour. Project STARS (Studies on Trajectories of Adolescent Relationships and Sexuality; Deković, Van Aken, Ter Bogt, & Van Geert, 2010) is a prospective four-wave longitudinal study on romantic and sexual development of Dutch adolescents that builds on this ecological perspective. The study includes a focus on individual characteristics as well as proximal (parents, peers) and more distal (media) social domains that are relevant for predicting sexual development during adolescence. Furthermore, whereas most research on adolescent sexuality tends to focus on a narrow definition of sexuality (e.g., the age at first intercourse) with relatively little attention to the full range of behaviours involved in the development of sexuality (e.g., Santelli et al., 2004), Project STARS considers sexual behaviour broadly, ranging from kissing to intercourse. The present study provides an overview of the Project STARS study design and investigates the degree to which individual and social domains predict change in adolescents' experience with sexual behaviour.

PROJECT STARS

Project STARS is unique in its design, including four sub-projects that each address a specific domain that has a role in sexual development. Project 1 focuses on individual characteristics. The project examines for example pubertal development, personality and impulsivity (Baams, Overbeek, Dubas, & van Aken, 2014; Baams et al., 2014). Project 2 investigates parents and peers and interactions between them. The role of both general (e.g., relationship quality) and sexuality-specific (e.g., sexual communication) parenting dimensions is studied (e.g., Van de Bongardt, De Graaf, Reitz, & Deković, 2014). In addition, different types of sexual norms among peers (e.g., peer sexual behaviours and attitudes) are examined (Van de Bongardt, Reitz, Sandfort, & Deković, 2014). Project 3 focuses on both receptive [e.g., the use of sexually explicit Internet material (SEIM)] and interactive [e.g., social networking site use (SNS)] sex-related online behaviours in relation to adolescents' sexual development, as well as the personal and socio-contextual conditions in which these relations are embedded (Doornwaard, Moreno, Van den Eijnden, Vanwesenbeeck, & Ter Bogt, 2014; Doornwaard, Van den Eijnden, Overbeek, &

Ter Bogt, 2014). Project 4 uses semi-structured qualitative diaries to zoom in on adolescents' subjective perceptions of romantic and sexual behaviours in daily life. The focus is on an elaborated definition of sexuality that includes covert thoughts and fantasies and romantic topics, in addition to overt behaviours and explicit sex-related content (Dalenberg, Timmerman, Kunnen, & Van Geert, 2015; Dalenberg, Timmerman, Van Geert, & Kunnen, 2015). Combined, the aim of the four sub-projects is to examine the importance of individual characteristics and social domains in relation to adolescent sexual development both separately and in interaction with each other.

Design

Project STARS is a four-wave longitudinal study that began in the Fall of 2011 and followed a sample of adolescents an additional three times at 6-month intervals. Participants (1297 Dutch adolescents between 10 and 18 years (mean age = 13.67; SD = 1.36), 53.3% boys) were recruited from eight elementary ($n = 165$) and four secondary ($n = 1132$) schools in large cities and small municipalities throughout the Netherlands. The longitudinal sample represents five age cohorts of adolescents in five consecutive grades: the last year of elementary school (6th grade) and the first 4 years of secondary school (7th–10th grade). A total of 872 (67.2%) participants had complete data (four waves); 227 (17.5%) had data on three waves, and 154 (11.9%) had data on two waves. The majority of the sample had a Dutch (73.6%) or other Western (10.1%) ethnic background.

Before the first measurement, eligible adolescents and their parents received information describing the aims of the study, confidentiality safeguards and procedures for declining or ending participation. Of the approached adolescents, 9.2% decided not to participate or were not allowed by their parents to take part in the study. Adolescents completed a diverse battery of psychological and sociological measures designed to assess individual and relational characteristics of the adolescents as well as those of parents, peers, and Internet use.¹ Adolescents completed these questionnaires online using computers at their school, during regular school hours. Researchers and trained research assistants were present to supervise the data collection. Adolescents received book certificates of increasing values after each completed questionnaire.

In order to curb the length of the extensive online questionnaire, and to minimize potential data loss due to weariness, we limited the number of items for several concepts in the questionnaire with the use of a planned missingness design (Graham, Taylor, Olchowski, & Cumsille, 2006). In this design, participants were randomly assigned to one of three groups, which completed a different

¹For a complete list of measures, the Project STARS Scale book can be requested from the researchers.

combination of items from the original scale (e.g., for a six-item scale, three items were completed by all groups, and each group completed an additional randomly selected item). This design was used only at T1 and T2; at T3 and T4 all items in the questionnaire were assessed. Missing items were subsequently imputed using multiple imputation (MI; Schafer & Graham, 2002) or expectation-maximization estimation (EM; Dempster, Laird, & Rubin, 1977) in SPSS, version 20 (SPSS Inc., Chicago, IL), or using full information maximum likelihood (FIML) in Mplus (Los Angeles, CA, USA) (Muthén & Muthén, 1998–2012).

THE ROLE OF INDIVIDUAL AND SOCIAL DOMAINS ON THE EXPERIENCE WITH SEXUAL BEHAVIOUR OF ADOLESCENTS

Project STARS provides us with the opportunity to investigate predictors of adolescent sexual development from multiple domains. In this study, we investigated one key variable from each of the four domains that have been consistently related to adolescent sexual behaviour. Within the individual domain, impulsivity is a personality trait that affects various aspects of adolescents' functioning (Blaszczynski, Steel, & McConaghy, 1997) and is often studied in relation to sexual behaviour. For example, higher impulsivity is related with an earlier age of first sexual intercourse, a higher number of sexual partners, more unprotected sex and a higher risk of contracting a sexually transmitted infection (De Daas, Hafner, & De Wit, 2014).

Regarding the social domain, the parent and peer domains are two of the most proximal and influential social domains in youth's lives (e.g., Szapocznik & Coatsworth, 1999). As a general aspect of parenting, the quality of adolescents' relationship with their parents (i.e., the level of warmth, closeness and support) is widely examined in relation with adolescent sexual behaviour and is consistently related to delayed sexual activity (e.g., De Graaf, Vanwesenbeeck, Woertman, & Meeus, 2011; Lenciauskiene & Zaborskis, 2008). In the peer context, a high degree of peer involvement has often been linked to adolescents' sexuality. For example, adolescents who spent more time with peers tend to be more sexually active (e.g., Barnes, Hoffman, Welte, Farrell, & Dintcheff, 2007).

In addition to these proximal domains, another domain that is highly relevant for adolescents' developing sexuality is the Internet. Social networking sites such as Facebook and Twitter are very popular among adolescents (Lenhart, Purcell, Smith, & Zickuhr, 2010) and they aid not only in creating an identity but also in forming romantic relationships and the development of a sexual self (Doornwaard et al., 2014). Sexual content is part of many adolescents' social networking profiles (Moreno et al., 2009), and these sites may function as a media "superpeer", promoting (sexual) behavioural norms among other adolescents (Strasburger & Wilson, 2002). It might therefore be expected that adolescents who spent much time on social networking sites would also show high levels of experience with sexual behaviour.

Although many studies link either the individual domain or social domains to sexual behaviour of adolescents, only a limited number of studies examined how multiple domains operate together to either promote or delay sexual behaviour (e.g., Boislard & Poulin, 2011; Friedlander, Connolly, Pepler, & Craig, 2007). These studies usually included two or three domains such as the individual, parent and peer domain, without consideration of the role of media/Internet. To the best of our knowledge, only one study has previously examined multiple domains, including religion, parents, peers, school and mass media, in predicting sexual intention and behaviour (L'Engle, Brown, & Kenneavy, 2006). The strongest predictor was peer sexual behaviour, although parental relationship quality and media use were also significant. In this study, however, mass media included television, CDs, movies and magazines, but not Internet use. Thus, despite increasing research on the role of Internet use in adolescent sexual development, this domain has not yet been compared to other domains in a comprehensive model. The present study is unique in that it includes the individual, parent, peer as well as the Internet domain.

In this study we examined how each of these domains predicted changes in experience with sexual behaviour over the course of 18 months. We expected that higher levels of impulsivity, involvement with peers, and time spent on social networking sites and a poorer relation with parents would be associated with more experience with sexual behaviour. On the basis of previous research (Boislard & Poulin, 2011; Friedlander et al., 2007; L'Engle et al., 2006), we expected that the individual and peer domain would be particularly strongly linked to experience with sexual behaviour.

In addition to the relative strength of different domains, ecological models posit that individual and contextual domains interact with each other in influencing behaviour (e.g., Bronfenbrenner, 1979). In this study, we tested all six possible interactions among domains. Although studies investigating interactions between different domains on adolescent sexual behaviour are scarce, some studies exhibit interactions between parents and peers in predicting adolescent sexual behaviour, showing that parents can buffer the effects of peers (Fasula & Miller, 2006; Whitaker & Miller, 2000). On the basis of these studies, we expected that a high quality of the parent–adolescent relationship would decrease the effect of involvement of peers on experience with sexual behaviour. Taking into account the novelty of testing interaction effects regarding sexual behaviour, we consider the other interactions to be exploratory.

METHOD

Participants

For this study, we selected adolescents who were attending secondary school ($n = 1132$), as the questionnaire for the younger elementary school children did not include all investigated instruments. Table 1 presents the demographic

TABLE 1
 Descriptives of demographic variables of the present study at Time 1

<i>Demographics</i>	<i>Present study</i>
<i>N</i>	1132
Mean age (SD)	13.96 (1.18)
Age range	11–18
% Boys	52.7
Ethnic background	
% Dutch	79.2
% Western	11.0
% Non-Western	9.8
Educational level	
<i>n</i> lower education ^a	430
<i>n</i> higher education ^b	640

^aPreparatory secondary vocational education programmes.

^bHigher general continued or preparatory scientific education programmes.

characteristics of this sample. Data from the first and last waves were used in the analyses (1.5 years in between).

Instruments

Experience with sexual behaviour. To assess experience with sexual behaviour, adolescents were first asked two questions: “Have you ever French kissed somebody?” and “Have you ever had sex with another person? With sex we mean everything from touching or caressing to intercourse”, answered with 0 = *no* or 1 = *yes*. Adolescents who indicated *yes* on the second question received follow-up questions about their experience with different sexual behaviours: naked touching or caressing, performing or receiving manual sex, performing or receiving oral sex and vaginal or anal intercourse (0 = *no*; 1 = *yes*). These items were combined into one variable measuring the level of adolescents’ experience with sexual behaviour, ranging from 0 = *no experience with any behaviours* to 5 = *experience with all behaviours* ($\alpha_{\text{Time1}} = .78$; $\alpha_{\text{Time4}} = .86$).

Impulsivity. Impulsivity was measured with the Eysenck Impulsiveness Scale (Vitaro, Arseneault, & Tremblay, 1997). Adolescents reported on five items (e.g., “Mostly I do or say things without thinking about it”) to which extend they agreed with it or not, ranging from 1 = *completely not agree* to 5 = *completely agree*. Higher scores indicated higher levels of impulsivity ($\alpha_{\text{Time1}} = .74$). For this scale a planned missingness design was used and missing values were imputed using MI.

Relationship quality with parents. The quality of adolescents' relationship with their parents was measured with the Network of Relationship Inventory (NRI; Furman & Buhrmester, 2009). Adolescents chose to complete items for their mother ($n = 1065$) or father ($n = 151$), based on their selection of which parent spent most time with them and had most caring tasks for them. Answers for mothers and fathers were then combined in one parent variable. The scale consisted of six items that measured levels of satisfaction (three items: e.g., "How satisfied are you with your relationship with your [choice parent]?") and conflict (three items: e.g., "How often do you and your [choice parent] argue with each other?") within the relationship. Answers ranged from 1 = *none* to 5 = *the most*. The correlation between the two scales was $r = .40$. Items from the conflict scale were recoded and the two scales were combined to create a total parent–adolescent relationship quality scale, in which higher scores indicated a higher quality ($\alpha_{\text{Time1}} = .85$).

Involvement with peers. The degree of involvement with peers was measured with five items based on several studies (Kandel & Davies, 1982; Simpson & McBride, 1992; Sieving, Eisenberg, Pettingell, & Skay, 2006). Adolescents were asked to indicate on a six-point scale, ranging from 1 = *never* to 6 = *very often*, how often they: meet their friends after school, meet at a friend's house, go to a party with friends, talk with friends about their problems and talk with friends on the phone. Higher scores indicated more frequent involvement with peers ($\alpha_{\text{Time1}} = .74$). For this scale a planned missingness design was used and missing values were imputed using MI.

Time spent on social networking sites. To assess the time spent on social networking sites, adolescents were first asked whether they have a social networking site or profile page, which could be answered with 0 = *no* or 1 = *yes*. Adolescents who indicated *yes* (86.6%) received a follow-up question asking how much time per day they spend on this social networking site, with answers ranging from 1 = *less than 15 min* to 6 = *more than 4 h*. Adolescents who answered the first question with *no* (6.7%) received a score of "0" on this variable. Higher scores indicated more time spent on social networking sites.

Analyses

Given that sexual behaviour is related to age, gender, educational level and ethnicity, these variables were included as control variables in the analyses. To test our hypothesis that each domain (individual, parent, peer and media) at Time 1 would uniquely predict experience with sexual behaviour of adolescents at Time 4, hierarchical regression analyses were performed. On the first step, Time 1 experience with sexual behaviour was entered along with the control

variables. On the second step, impulsivity, parent–adolescent relationship quality, peer involvement and time spent on social networking sites were entered. On the third step, the six interaction terms were entered. Because planned missingness was used for several variables in the project, the items from these scales were imputed with MI (across five sets). Only pooled B-values were given in the regression analyses (not betas). Because B-values are dependent on the measurement scale, all variables were standardized before inclusion in the regression analyses, making comparisons between variables possible.

RESULTS

Our longitudinal design allowed us to check over-time inconsistencies regarding adolescents' reports on experience with sexual behaviour. A total of 16 adolescents were excluded from the analyses (e.g., adolescents scoring “2” on T1, “4” on T2, “3” on T3, and “1” on T4), whereas a total of 47 adolescents with a missing value on T1 or T4 were additionally included on the basis of their longitudinal scores (e.g., adolescents who had a missing value on T1 and a “0” on all other waves. The missing value on T1 was replaced with “0”).

Table 2 shows intercorrelations and means of the key variables. The rank-order stability of adolescent sexuality was high across the 18-month period. Adolescents' levels of experience with sexual behaviour increased significantly from T1 to T4 ($t(894) = 16.44, p = .000$). All domains were significantly related to experience with sexual behaviour, both cross-sectionally and longitudinally. Specifically, higher levels of impulsivity, more frequent involvement with peers and more time spent on social networking sites were related to more experience with sexual behaviour, whereas a higher parent–adolescent relationship quality was related to less experience with sexual behaviour. The four domains showed relatively low intercorrelations (r s ranging between .24 and .30), suggesting that

TABLE 2
Intercorrelations, means, and standard deviations (SD) of assessed variables

	1	2	3	4	5	6
1. Sexual behaviour T1	–					
2. Sexual behaviour T4	.70***	–				
3. Impulsivity T1	.14***	.22***	–			
4. Relationship parents T1	–.16***	–.23***	–.24***	–		
5. Involvement peers T1	.33***	.34***	.11**	–.00	–	
6. Time spent SNS T1	.22***	.30***	.23***	–.17***	.30***	–
Means	0.62	1.14	2.67	4.63	3.66	2.63
SD	1.10	1.60	.79	.72	.93	1.50

Notes: SNS = social networking site. N ranges from 924 to 1075.

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

they were rather independent from each other. Regarding the mean values observed, adolescents were—on average—initially sexually inexperienced (0.62 on a 0 to 5 scale), enjoyed very good relationships with their parents (4.63 on a 1 to 5 scale), were moderately involved with their peers (3.66 on a 1 to 6 scale) and spent a moderate amount of time on social networking sites (2.63 on a 0 to 6 scale).

Table 3 (Model a) reports the results of the hierarchical regression analysis that includes the covariates and the main effect of the four domains. As expected, the previous level of experience with sexual behaviour was the strongest predictor of subsequent sexual experience. Moreover, age and educational level were significant covariates: older adolescents and adolescents with lower educational levels reported more experience with sexual behaviour at T4 than younger adolescents and adolescents with higher educational levels. Gender and ethnicity did not significantly account for differences in experience with sexual behaviour.

TABLE 3
Linear regression analyses predicting experience with sexual behaviour (T4) from individual, parenting, peer, and media domains (T1)

Step		Sexual behaviour T4			
		Model a		Model b	
		B	ΔR^2	B	ΔR^2
1	<i>Control variables</i>		.52***		.52***
	Gender ^a	.00		.00	
	Age	.11***		.11***	
	Education	-.03**		-.03**	
	Ethnicity ^b	.06		.05	
	Sexual behaviour T1	.62***		.62***	
2	<i>Domains</i>		.05***		.05***
	Impulsivity T1	.07*		.07*	
	Relationship parents T1	-.09**		-.08**	
	Involvement peers T1	.12***		.13***	
	Time spent SNS T1	.11***		.11***	
3	<i>Interactions among domains</i>				.00
	Impulsivity × Relationship parents			-.00	
	Impulsivity × Involvement peers			.02	
	Impulsivity × Time spent SNS			-.01	
	Relationship parents × Involvement peers			-.02	
	Relationship parents × Time spent SNS			-.04	
	Involvement peers × Time spent SNS			.02	

Notes: Model a includes only the first two steps in the analysis, whereas Model b also includes interactions among domains. SNS = social networking site.

^a0 = boys, 1 = girls. ^b0 = Western, 1 = non-Western.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Regarding the substantive multi-domain predictors, higher levels of impulsivity, more frequent involvement with peers and more time spent on social networking sites at T1 predicted increases in experience with sexual behaviour from T1 to T4, whereas higher levels of parent–adolescent relationship quality at T1 predicted fewer changes in experience with sexual behaviour from T1 to T4.

In the next step, we added the six two-way interaction effects between the four domains in predicting adolescents' experience with sexual behaviour (see Table 3, Model b). The results showed that none of these interactions were significant ($p > .05$).

DISCUSSION

This study described Project STARS, the first large-scale longitudinal study in the Netherlands that examines sexual development during adolescence in relation to multiple domains. Consistent with previous studies, adolescents who were more impulsive (De Daas et al., 2014) reported a lower relationship quality with their parents (De Graaf et al., 2011; Lenciauskiene & Zaborskis, 2008), and spent more time with their peers (Barnes et al., 2007) showed more increases in experience with sexual behaviour (i.e., reported experience with more different sexual behaviours) over time. Moreover, results confirmed our expectation that more time spent on social networking sites increased experience with sexual behaviour. Although studies indicated that the individual and peer domains might be better predictors of adolescent sexual activity compared to the parent domain (Boislard & Poulin, 2011; Friedlander et al., 2007) or the media domain (L'Engle et al., 2006), the present study shows that all four domains were relevant. To the best of our knowledge, this study is the first that incorporates multiple domains with the inclusion of adolescents' Internet use. The finding that both involvement with peers and time spent on social networking sites were related to increases in experience with sexual behaviour suggests that peers are important socializing agents, both offline and online. Peer norms play an important role in adolescents' own sexual behaviour (e.g., Van de Bongardt et al., 2014), and social networking sites provide opportunities to convey these peer norms online. This seems to support the suggestion that social networking sites can act as a “superpeer” in shaping sexual behaviour (Strasburger & Wilson, 2002). Thus, it seems important to study not only relations with peers offline but also online.

None of the tested interactions were significant. Owing to their exploratory nature, only one hypothesis was formulated: we expected that parents would decrease the effects of peers on experience with sexual behaviour, in line with previous studies (Fasula & Miller, 2006; Whitaker & Miller, 2000). An explanation for the fact that moderating effects were not found in the present study might be that we used only general parent and peer measures instead of sexuality-specific measures. Studies that investigated sexuality-

specific measures showed moderating effects of mother's responsiveness during sex discussions on the relationship between peer sexual activity and sexual intercourse (Fasula & Miller, 2006), and moderating effects of parental communication about sex/condoms on the relationship between peer norms for sexual activity/condom use and sexual behaviour (Whitaker & Miller, 2000). This suggests that it seems important for future studies to explore interactions between general and sexual-specific measures or between sexual-specific measures only to examine their effect on sexual behaviour.

The present study is the first that longitudinally examined how multiple domains predict changes in experience with sexual behaviour using a large sample of adolescents with a broad age range. Nonetheless, findings have to be interpreted with a number of limitations in mind. First, despite our efforts to include adolescents with different ethnic backgrounds, the secondary school sample consists of a fairly large group of Western adolescents (90.2%) compared to the general Dutch population (84%) (Statistics Netherlands, 2013), which does not allow us to generalize results to adolescents with different ethnic backgrounds. Furthermore, the Project STARS sample is a relatively homogeneous sample with, due to their young age, low levels of sexual experience. Also, the sample is highly satisfied with their relationship with their parents, moderately involved with peers and spent a moderate amount of time on social networking sites, imposing limits on the generalizability of the findings.

Second, all measures examined in this study were derived from adolescent self-reports. Although adolescents may not provide accurate reports about their experience with sexual behaviour (Brenner, Billy, & Grady, 2003), adolescent self-reports seem the best method to collect data on sexual behaviour, considering the private nature of this behaviour. Our longitudinal design allowed us to check the over-time validity of the self-reported sexual behaviours and to exclude adolescents ($n = 16$) with inconsistent reports about their sexual behaviour. Regarding the parent-adolescent relationship quality, adolescents' perceptions of parenting have been found to be more predictive of their sexual behaviour than parent reports (Jaccard, Dittus, & Gordon, 1998). In addition, the level of contact with peers is difficult to determine without asking adolescents themselves, because most contact with peers usually happens outside of direct adult supervision (Laird, Pettit, Dodge, & Bates, 1999). Finally, adolescents have easy online access through multiple devices throughout the day, and are most capable in estimating the time they spent on social networking sites themselves.

Notwithstanding these limitations, the results highlight the significance of a multi-domain approach to the study of adolescent sexual development, in line with ecological models (e.g., Bronfenbrenner, 1979). Findings showed that experience with sexual behaviour is part of a broader context, and that knowledge of this broader context is significant for a better understanding of youth' sexuality. Taking such a multi-domain perspective is important for three reasons. First, it contributes to a more detailed theoretical understanding of sexual

development during adolescence. Second, it guides future studies on adolescent sexual development in their design and focus. Third, it aids in the development and improvement of prevention and intervention strategies that are aimed at promoting a healthy sexual development. Project STARS provides the opportunity to take this perspective and, in addition, the four sub-projects each provide more in-depth knowledge in the importance of the different domains in which adolescent sexuality develops.

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