Associations between Croatian Adolescents' Use of Sexually Explicit Material and Risky Sexual Behavior: A Latent Growth Curve Modeling Approach

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The Dynamics of Adolescents' Use of Sexually Explicit Material and Risky Sexual Behaviors: A Latent Growth Curve Modeling Approach [*]

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Abstract

Objectives. The aim of this bio-behavioral longitudinal study was to assess the association between dynamics of SEM use and risky sexual behavior among Croatian adolescents.

Methods. The data were collected during 2015-2018 period ($n = 577$). Controlling for sensation seeking, socioeconomic status and pubertal timing, latent growth curve modeling with three observation points was used.

Results. Male adolescents' initial SEM use was related to sexual risk taking growth in the following months. Among female adolescents, SEM use and sexual risk taking were related only at the initial point.

Conclusions. Our findings suggest different developmental phases when addressing the target relationship.

Key Words: Adolescents, Adolescent Sexuality, Pornography, Risky Sexual Behavior, Longitudinal Assessment, Testosterone

The Dynamics of Adolescents' Use of Sexually Explicit Material and Risky Sexual Behaviors: A

Latent Growth Curve Modeling Approach

During their transition to adulthood, adolescents' health and wellbeing are often

intertwined with various risk-taking behaviors. Sexual risk taking is among the main concerns

primarily, but not solely, because of adolescents' vulnerability to sexually transmitted infections

(STI) and unwanted pregnancy. Unprotected sexual intercourse at the age of 15-19 years was

ranked second among global health-related mortality risk factors (Mokdad et al., 2016). In

addition, World Health Organization (2011), Centers for Disease Control and Prevention (2017)

and the European Centre for Disease Prevention and Control (2010) have warned about the high,

and continuously increasing, prevalence rates of STIs among adolescents.

Increasing concerns among health experts, educators and general public have prompted

studies focused on psychosocial and sociocultural influences on adolescent sexual risk taking

(Dir, Coskunpinar, & Cyders, 2014; Kotchick, Shaffer, Forehand, & Miller, 2001; Zimmer-

Gembeck & Helfand, 2008). Pointing to links between the use of sexually explicit material

(SEM) and adolescents' sexual behavior, a number of researchers have suggested the need to

explore the role of SEM in young people's sexual risk taking (Harkness, Mullan, &

Blaszczynski, 2015; Koletić, 2017; Owens, Behun, Manning, & Reid, 2012; Peter &

Valkenburg, 2016).

Recent technological advancements and affordability of mobile internet platforms have

greatly facilitated access to SEM, making it also more accessible for adolescents. The increased

use of SEM among adolescents has been repeatedly observed, provoking health-related concerns

(Horvath et al., 2013; Martellozzo et al., 2016; Quadara, El-Murr, & Latham, 2017). Although

there is some evidence that SEM use and risky sexual behavior may be related in adolescence, but due to paucity of prospective (or retrospective) studies, little is known about the association between the dynamics of these constructs during the period from middle to late adolescence. This developmental period may be particularly important for at least two reasons. First, this is the time when most young people start to experiment with sexual behavior. Secondly, SEM use during this period may affect subsequent use by forming a long-lasting pattern (Willoughby, Young-Petersen, & Leonhardt, 2018)—which can lead to increased sexual risk taking in emerging adulthood (Braithwaite, Coulson, Keddington, & Fincham, 2015; Willoughby, Carroll, Nelson, & Padilla-Walker, 2014).

SEM Use and Sexual Risk Taking

The existing evidence for the association between SEM use and risky sexual behavior in adolescence is mixed. In addition, the majority of the studies were cross-sectional, which precluded a dynamic (longitudinal) and more robust assessment of the association between SEM use and risky sexual behavior. An older cross-sectional study conducted only among female adolescents (Wingood et al., 2001) and another study with a predominantly female sample (Braun-Courville & Rojas, 2009) found a positive relationship between SEM use and reporting multiple sexual partners. In contrast, a national probability-based study of Swiss adolescents (Luder et al., 2011) and a more recent convenience-based cross-sectional Australian study (Lim, Agius, Carrotte, Vella, & Hellard, 2017) study reported nonsignificant associations between SEM use and multiple sexual partners. A significant association between SEM use and not using a condom at most recent sexual intercourse was found among female adolescents (Wingood et al., 2001), as well as male adolescents (Luder et al., 2011), but was not corroborated in the Australian study (Lim et al., 2017). Two longitudinal studies assessed the association between

adolescents' SEM use and sexual risk taking. A two-wave study among a nationally representative sample of Dutch adolescents found no association between SEM use and casual sexual intercourse without using a condom (Peter & Valkenburg, 2011). A recent nationally representative three-wave longitudinal study found that adolescents who started using SEM early and regularly were more likely to report multiple sexual partners, compared to low frequency SEM users (Rasmussen & Bierman, 2018).

There are several possible explanations for the inconsistent and conflicting findings regarding SEM and adolescent sexual risk taking. First, there were notable differences in study samples in regard to age and gender. For example, a study by Lim at al. (2017) included 40% of adolescents, while other were young adults. The same study had less than 30% of male participants. Similar disproportion in gender was reported in Braun-Courville & Rojas's study (2009). Secondly, mixed findings may reflect different measurement approaches to risky sexual behavior ranging from one-item measures (Peter & Valkenburg, 2011) to nine-item composite risk index scores (Braun-Courville & Rojas, 2009). The timeframe used also differed, as some studies included measures of sexual risk taking in the past 6 months, others in the past 12 months. Third, only one study included an objective indicator of risky sexual behavior by collecting vaginal specimens and testing for STI (Wingood et al., 2001). Finally, the studies were conducted in liberally legislated and sexually permissive countries of the developed West. More empirical insight from diverse cultural settings would enable a more systematic assessment of the link between adolescents' SEM use and risk-taking behaviors and, potentially, a better understanding of culture-specific aspects of the target relationship.

Theoretical Framework

Acquisition, Activation, and Application Model ($_3$AM) of sexual media socialization (Wright, 2011) provides a conceptual framework for understanding possible socio-psychological mechanisms that underlie the association between adolescents' SEM use and risky sexual behavior. Based on the sexual scripting theory (Gagnon & Simon, 2005) and, more generally, the cultivation model (Grebner, Gross, Morgan, Signorielli, & Shanahan, 2002), the $_3$AM model posits that young people's sexual behavior is scripted (informed and oriented) and enacted—directly or indirectly—by SEM use. According to this model, SEM provides specific sexual scripts (i.e., symbolic guidelines), which can influence adolescents' sexuality and actual sexual behaviors. By being exposed to the specific portrayal of sex in contemporary SEM—focused on casual sex or recreational pairing, rigidly defined gender roles, pleasure-oriented, and mostly condomless sexual encounters (Brosius, Weaver, & Staab, 1993; Grudzen et al., 2009)—adolescents might perceive such practices as common and normative. In addition, SEM may encourage young people to experiment with multiple sexual partners (Braithwaite et al., 2015).

The Current Study

Given the need for a better understanding of the relationship between the dynamics of SEM use and adolescents' risky sexual behavior, the current study aimed to provide a robust longitudinal exploration of the target association. In addition, it included a biological component (assessment of testosterone levels) to contribute to a more comprehensive assessment by enabling insights into the role of maturation.

Informed by the existing research, we hypothesized that SEM use would be positively associated with risky sexual behavior among both male (Hypothesis 1) and female adolescents (Hypothesis 2). All analyses were carried out by gender due to different frequency of SEM use, different timing of first exposure to SEM and gender-specific sexual socialization (Doornwaard,

van den Eijnden, Overbeek, & Ter Bogt, 2015; Matković, Cohen, & Štulhofer, 2018). Taking into account that biological factors have been found to predict adolescent sexual activity and sexual risk taking (Baams, Dubas, Overbeek, & Van Aken, 2015; Halpern, Udry, & Suchindran, 1998), we controlled for both subjective and objective indicators of pubertal timing and maturation when examining the target association. Sensation seeking and socioeconomic status were also controlled for due to potential links with risky sexual behavior in adolescence (Langille, Hughes, Murphy, & Rigby, 2005; Luder et al., 2011; Peter & Valkenburg, 2011; Santelli, Lowry, Brener, & Robin, 2000).

Following recent recommendations (see Harkness et al., 2015; Koletić, 2017; Owens et al., 2012; Peter & Valkenburg, 2016), this study contributes to the body of literature on the association between adolescent's SEM use and risky sexual behavior in several important aspects. First, by using three-wave panel data and a within-individual trajectory of change approach (i.e., latent growth curve modeling (LGCM; Curran, Obeidat, & Losardo, 2010), we enabled insights into the associations between the dynamics of SEM use and risky sexual behavior. Second, in contrast to single-item measures of risky sexual behavior and informed by the trajectory-based research on adolescents' risky sexual behavior (Huang, Murphy, & Hser, 2012; Moilanen, Crockett, Raffaelli, & Jones, 2010), this study used a composite indicator of sexual risks, which provided a better assessment of measurement error. Third, this is the first longitudinal study of the link between adolescents' SEM use and risky sexual behavior to use both subjective and objective measures of biological maturation. Although biological measures are becoming more popular in adolescent health and sexuality research (Owens et al., 2012; Sales & Irwin, 2013; van Anders, Goldey, & Bell, 2014), we are unaware of a study similar to ours. Finally, by exploring the target association in a moderately socioeconomically developed

Southeastern European country characterized by a strong Roman Catholic tradition and relatively restricted norms about sexuality (Luijkx, Halman, Sieben, Brislinger, & Quandt, 2016; Štulhofer & Rimac, 2009), this study provides material for cross-cultural contextualization of the links between adolescents' use of SEM and risk-taking sexual behavior.

Considering its potential to inform targeted interventions, this study's findings are relevant for experts in adolescent reproductive and sexual health, media literacy specialists, as well as for educational policy makers. Taking into account recent increase in social concerns over SEM-related harms (Quadara et al., 2017), our findings may also be of relevance to the general public, parents in particular.

Method

Participants

Data for this study were collected as part of the PROBIOPS research project that focused on longitudinal assessment of sexualized media use among Croatian adolescents. Adolescents in their second year were recruited from 14 out of 22 secondary schools in Rijeka, the third largest city in Croatia. Seven schools with less than 50 students were omitted due to financial constraints related to field work and one larger school because of a recent arson and burglary. The initial survey took place in December 2015 and the following five waves were spaced approximately 6 months apart. At the baseline (T0), 1,287 students correctly completed the questionnaire (63% of the sophomore high-school student population; $M_{age} = 15.8$, $SD = 0.51$; 40.7% of male students). Analyses presented in this study were limited to the last three waves in which all indicators of risky sexual behavior were included. Number of participants in the last three waves were $n =$

1,176 (T3), $n = 931$ (T4) and $n = 892$ (T5), respectively. After the data cleaning[†], 577

participants completed a questionnaire at each wave and were eligible for the analyses.

Demographic information about the study participants are presented in Table 1.

School absenteeism and errors in filling out a unique 5-digit code used to link

questionnaires across time were responsible for attrition. To address possible bias introduced by

attrition, multivariate logistic regression analysis was carried out with the dependent variable

representing those who participated in all three relevant data collection waves (participants

included in this study were coded 0) and those who did not (coded 1). Indicators used in this

study, measured at T3, served as independent variables. A single statistically significant

difference between the two groups was observed: Participants who were excluded from this

study were characterized by a less frequent SEM use at T3 SEM use compared to the participants

included ($OR = .79$, $p = .039$).

<center>*** TABLE 1 ABOUT HERE ***</center>

Procedure

Classroom-based self-administered paper and pencil surveying was used to collect data.

To enhance confidentiality, portable screens were placed between participants and study

coordinator remained in the classroom until the survey was completed. Informed consent

material was presented by the study coordinator and printed at the first page of the questionnaire

at each wave. A simple (unique) 5-letter identification code was used to link participants'

questionnaires. No incentives were used in the Rijeka panel. Contact information for an online

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[†] For example, participants who reported decreasing or highly inconsistent numbers of lifetime sexual partners in the

subsequent waves were excluded from the analyses ($n = 23$).

youth help service was provided at the end of each questionnaire. All study procedures were approved by the Ethical Research Committee of the **** blinded for anonymity ****.

Procedures and equipment for biological testing of testosterone (T) were pre-tested in May 2017 in a group of 40 18-year-old high-school students from a small urban setting. Recruitment leaflets for the main study were distributed in schools during the final data collection wave at the beginning of March 2018. Biological data collection was organized in a local youth club, Monday to Friday from noon to 2 PM. After informed consent was obtained, participants were asked to fill out a brief questionnaire about their behaviors in the past 24 hours and chronic conditions that could influence T-levels (e.g., sexual activity, hours of sleep, bleeding gums, etc.). Only participants of legal age who participated in at least two study waves (of the total of six) were eligible for the biological component. Biological data was linked to survey data using the same 5-digit alphanumerical code which participants would generate at each study wave. Participation was awarded with a 6.5€ ($7.5) shopping mall voucher.

In total, 252 saliva samples were collected—more than 80% of them between 1 and 3 PM—by passive drool using *Salimetrics*' Saliva Collection Aid and cryovials and stored at − 70°C until required for analysis. After thawing, each sample was centrifuged for ten minutes at 2245 g at least once to separate the mucins. Clear colorless supernatants were then tested. Salivary T levels were measured in triplicate using a commercial enzyme-linked immunosorbent assay (Testosterone free in saliva ELISA test kit #DES6622, *Demeditec*) according to manufacturer's instructions. The average intra-assay and inter-assay coefficients of variation for the T assay employed in the current study were 6,7% and 5,6% respectively. The range of the assay, as determined by manufacturer, was 10–1000 pg/ml. The lowest analytically detectable T

level (i.e., distinguishable from the Zero Calibrator) was 2.2 pg/ml at -/+ 2 *SD* limit. Certificates of quality control were provided for all ELISA kits.

Measures

Following the approach used in the 2005 population-based study of sexual risk taking among emerging Croatian adults (Štulhofer et al., 2009), we used a 6-item composite scale (the Index of Sexual Risk Taking; ISRT) to assess sexual risk taking. The scale included the following indicators: (1) condom use at most recent sexual intercourse (*Have you and/or your partner used a condom at most recent sexual intercourse?*), (2) one-night stand experience (*Have you ever had sexual intercourse with a person whom you had just met and knew very little of nothing about?*), (3) inconsistency of condom use (*Have you and your partner used condom at each and every sexual intercourse during last six months?*), (4 and 5) intoxication prior to sexual intercourse (*How often did you drink alcohol just before sexual intercourse?* and *How often were you under the influence of drugs during sexual intercourse?*)[‡], and (6) the number of sexual partners (*In total, with how many different people did you have a sexual intercourse*?). Following the literature on adolescents' sexual risk taking (Santelli, Brener, Lowry, Bhatt, & Zabin, 1998; Vasilenko & Lanza, 2014), the number of sexual partners was dichotomized into 0 = *One sexual partner* and 1 = *Two or more sexual partners*. The ISRT was computed at each study wave.

Pornography use was measured at each time point and defined in the questionnaire as *any material which openly (i.e., not censored) depicts sexual activity. Material which shows naked bodies but not sexual intercourse or other sexual activity does not belong to pornography as here defined.* The item (*How often have you used pornography during the last 6 months*)

[‡] Both questions had a 4-point scale (1 = *Never* to 4 = *Often*) to record answers. The indicators were dichotomized into 0 = *Never* and 1 = *At least once*).

included the following responses: 1 = *Never*, 2 = *Several times*, 3 = *Once a month*, 4 = *2-3 times a month*, 5 = *Once a week*, 6 = *Several times a week*, 7 = *Every day or almost every day* and 8 = *Several times a day*.

Control variables. Male adolescents' maturation was assessed by measuring their T-levels (*M* = 109,13; *SD* = 54,36). Higher T-levels indicate more advanced developmental status (Shirtcliff, Dahl, & Pollak, 2009). As biological testing was carried out only among male adolescents, retrospective self-assessment of relative pubertal timing at the final wave was used to estimate female participants' physical maturation (*Compared to your peers, would you say that you have entered puberty…*). The response scale ranged from 1 = *Much earlier than most of my peers* to 5 = *Much later*. The indicator, which has been shown to adequately measure relative onset of puberty (Michaud, Suris, & Deppen, 2006; Wichstrom, 2011), was dichotomized into 1 = early maturing adolescents (original categories 1 and 2; 21.6%) and 0 = others (categories 3-5). Family socioeconomic status was assessed at T3 by the Family Affluence Scale (FAS II), the recommended procedure for health-related research among adolescents (Boyce, Torsheim, Currie, & Zambon, 2006). Sensation seeking was measured with The Brief Sensation Seeking Scale (Stephenson, Hoyle, Palmgreen, & Slater, 2003). The 4-item measure was included in each study wave (Cronbach's α ranged from .80 to .83 and stability coefficients from .76 to .79).

Analytical Strategy

Confirmatory factor analysis of the ISRT was performed using a robust variant of diagonally weighted least squares estimator (WLSMV) separately for each time wave. This estimator was specifically chosen to account for dichotomous indicators in measurement models. Raw indicator values were weighted with corresponding factor loadings and averaged into wave-specific ISRT scores. Participants who did not report sexual intercourse in the past six months

were assigned an ISRT score of 0. Guttman's lower bound ISRT reliability for waves T3-T5 were $\lambda_{T3} = .53$, $\lambda_{T4} = .68$, $\lambda_{T5} = .73$.

The association between adolescents' SEM use and sexual risk score was analyzed using dual-domain (parallel) latent growth curve modeling (LGCM), an analytical method based on structural equation framework. It enables the assessment of between-person differences over time by estimating within-person latent trajectories of change (Curran et al., 2010; Duncan & Duncan, 2009). Advantages of this method include unproblematic handling of unequal measurement occasions and missing information (LGCM uses full information maximum likelihood estimation; Enders & Bandalos, 2001), as well as more robust treatment of non-normally distributed measures and bias introduced by attrition rate (Curran et al., 2010; Little, 2013).

Analyses were carried out in three steps. First, linear and an unspecified (cumulative) growth curves were specified and compared using the standard chi-square difference test separately for the frequency of SEM use and the ISRT. Following recommendations (cf. Little, 2013), equality constraints were placed on indicators' error terms, separately by construct. Latent slope weights were set to reflect unequal periods between measurement points (0, 1, 1.8). For both SEM use and ISRT, the more parsimonious (linear) curve was superior to the cumulative one.

Next, latent factors' means and variances were examined in an unconditional dual-domain model, separately by gender (see Table 2). With the exception of male participants' change in SEM use, all latent factor means and variances were significant, the latter pointing to substantial individual variation around group means. Due to the lack of significant growth in SEM use over time, the male model was reduced, following recommendations (Grimm, Ram, &

Estabrook, 2017), into an intercept-only model.[§] Compared to the full model, the intercept-only

model had undistinguishable fit ($\Delta\chi^2_{(5)} = 4.46$, $p = .485$).

In the final step we tested a conditional model by gender, in which pubertal timing and

family socioeconomic status were included as time-invariant and sensation seeking as time-

variant predictors of SEM and sexual risk taking.

*** TABLE 2 ABOUT HERE ***

To account for higher-level (classes) clustering effect, multilevel regression modeling

with maximum likelihood estimation was conducted.[**] We calculated intraclass correlation

(ICC) for SEM use and the ISRT separately by gender, using the intercept-only models. The

classroom level accounted for 3.0% of variance in male adolescents' SEM use and 7.1% of

variance in the ISRT. Proportions for female adolescents were 2.9% and 7.6%, respectively. Due

to low ICC, data nestedness was ignored in LGCM. All analyses were carried out using IBM

SPSS 25 and AMOS 23 statistical software packages.

Results

*** TABLE 3 ABOUT HERE ***

A small minority of male participants reported no use of SEM in the past six months

(11.3% at T3 and 7.1% at T5). Among their female peers, the respective proportions were 59.9%

and 57.5%. During the observed period, an increase in the prevalence of risky behaviors was

observed in both genders (see Table 2). Figure 1 presents the dynamics of average SEM use and

the ISRT scores. Unlike with SEM use, there was a consistent increase in the scores over time in

both genders. Some change in SEM use is observed between T3 and T4 in male adolescents and

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[§] This transformation rendered direct comparisons across gender (using multi-group analysis) impossible.

[**] Because of the small number of schools ($n = 14$) in the sample, only nestedness in classes was examined.

between T4 and T5 among their female peers. As presented in Table 4, significant positive

associations between SEM use and the ISRT scores, mostly of small size, were observed

consistently among female participants. In male participants, the associations were significant in

five of nine instances.

*** FIGURE 1 ABOUT HERE ***

*** TABLE 4 ABOUT HERE ***

Dynamics of SEM Use and Risky Sexual Behavior

In the male sample, unconditional dual-domain model had excellent fit ($\chi^2_{(16)} = 11.41$,

CFI = .99, RMSEA = .016, 90% CI = .000-.043). We found a significant association between the

baseline levels and subsequent growth in the ISRT scores ($r = .31$, $p = .029$), pointing that

individuals who reported higher sexual risk taking at T3 were characterized by a higher growth

in risk taking over time (Figure 2). Importantly, initial frequency of SEM use was positively

associated with change in sexual risk taking ($r = .26$, $p = .022$). Male adolescents who used SEM

more frequently at baseline reported steeper increase in the ISRT scores.

The conditional model was characterized by good fit ($\chi^2_{(34)} = 49.48$, CFI = .98, RMSEA =

.046, 90% CI = .009-.072). The addition of the three control variables resulted in no substantial

change in either the association between sexual risk taking factors ($r = .34$, $p = .023$) or the

relationship between initial SEM use and growth in the ISRT scores ($r = .25$, $p = .027$). Of the

controls, only T-levels were significantly associated with baseline sexual risk taking ($\beta = .26$, $p =$

.009).

*** FIGURE 2 ABOUT HERE ***

Unconditional model in the female sample had satisfactory fit ($\chi^2_{(11)} = 26.60$, CFI = .98,

RMSEA = .058, 90% CI = .037-.088). Comparably to their male peers, initial levels and

subsequent growth in female participants' sexual risk taking were positively associated ($r = .32$, $p < .001$). We also observed a significant and positive relationship between baseline levels in the key constructs ($r = .37$, p = .002), pointing that female adolescents who initially reported higher SEM use also reported higher sexual risk taking (Figure 3).

The inclusion of the control variables improved the model fit ($\chi^2_{(27)} = 45.42$, CFI = .99, RMSEA = .043, 90% CI = .019-.065). The pattern of significant associations observed in the unconditional model remained unchanged, with the correlations attenuated by 1-3 percentage points. Pubertal timing was significantly related to baseline SEM use ($\beta = .23$, $p < .001$), as well as to initial levels of sexual risk taking ($\beta = .20$, $p < .001$). Compared to other female adolescents, early maturing adolescents used more SEM and reported higher levels of sexual risk taking at T3.

*** FIGURE 3 ABOUT HERE ***

Discussion

In the current morally-charged climate over young people's SEM use, the link between adolescents' risky sexual behavior and SEM use has received very limited attention in terms of methodologically robust longitudinal studies. To contribute to a better understanding of this association, we explored changes in the frequency of SEM use and risky sexual behavior over time. Using the three-wave panel data and the composite indicator of sexual risk taking, we applied dual-domain latent growth curve modeling to assess the target relationship.

According to Hypotheses 1 and 2, SEM use was expected to be positively related to the ISRT scores in both male and female adolescents. In the case of adolescent men, we found that more frequent SEM use at baseline significantly predicted subsequent growth in the composite sexual risk taking scores. Among female adolescents, the analysis revealed a positive

relationship only between baseline SEM use and the ISRT scores. After controlling for T (in the

male sample only), pubertal timing (in the female sample only), sensation seeking and

socioeconomic status, we found no substantial change in the association between key constructs

in either gender.

We found no growth in SEM use among male adolescents in the period under

observation, which precluded any dynamic relationship with sexual risk taking. However, higher

baseline frequency of SEM use predicted steeper increase in the ISRT scores in the subsequent

10 months. The finding might have been expected due to higher rates of SEM use (Doornwaard

et al., 2015) and sexual risk taking among male adolescents (Kotchick et al., 2001; Štulhofer et

al., 2009), compared to female adolescents. From the $_3$AM perspective, SEM use in an earlier

developmental period might have provided sexual scripts that portray sexual practices as risk-

free, thus decreasing the likelihood of responsible intentions ("I will use a condom when having

sex") and, ultimately, of safer sex. This is suggested by Rasmussen and Bierman (2018) who

found that adolescents who reported an early initiation into SEM use and regular onward use

were more likely to report multiple sexual partners. Similarly, a study of emerging Croatian

adults found an association between the timing of first exposure to SEM and risky sexual

behavior, with participants who were exposed to SEM at an earlier age reporting higher sexual

risk taking score than their peers (Sinković, Štulhofer, & Božić, 2013). Overall, it is plausible

that SEM-related scripting process during the period of early to middle adolescence contributes

to the development of a pattern of sexual risk taking in late adolescence.

We found no evidence for a dynamic relationship between SEM use and sexual risk

taking in female adolescents. The observed growth in sexual risk taking in the observed period

was unrelated to the growth in SEM use. However, the significant association at the initial

measurement does not allow us to rule out their dynamic interplay in an earlier developmental

period. If so, there appears to be a gender-specific difference in the process. While earlier

scripting appears to have ramifications for male sexual risk taking in late adolescence, in

adolescent women the (possible) effect does not seem to continue into late adolescence.

Alternatively, the baseline association between SEM use and ISRT scores in adolescent women

may be a spurious relationship caused by a variable not included in this study.

Furthermore, developmental influences, such as psychophysiological maturation, are

evident in the finding that T-levels in male adolescents and timing of the onset of puberty in

female adolescents were significantly related to the ISRT scores. This is expected, because

adolescents in more advanced pubertal stages are generally more prone to sexual risk taking

(Baams et al., 2015). Maturation process is associated with sexual risk taking both

"endogenously" and "exogenously". In the former case, the process of endocrinological and

psychosocial maturation increases curiosity about sexuality and sexual interest. In the latter case,

bodily manifestations of the maturation process are signals of sexual maturity to potential

partners. If they are older and more sexually experienced, they may have more power in sexual

decision making (including the use of protection) and are also more likely to be infected with an

STI. Although mostly indirectly, our findings underline the importance of including the

indicators of adolescent maturing in research on adolescent sexual behavior.

The associations between adolescent SEM use and sexual risk taking observed in this

longitudinal study speak in favor of specific educational interventions. Some school-based media

literacy and comprehensive sexuality education programs have been found to reduce risks related

to the use of sexualized media (Jones, 2018; Vandenbosch & van Oosten, 2017). By assisting

young people in making sense of overt and covert media messages and the implicit norms (and

behavioral standards) that they often convey, such programs may reduce vulnerability to risk

taking and other adverse outcomes.

Limitations and Future Directions

Several study limitations should be considered. Three available data collection waves

spanning over a 10-month period rendered a more precise estimation of latent trajectories in the

key constructs impossible. Consequently, our assessment may have missed some developmental

nuances. Future research should include more measurement occasions over a longer period of

time to allow for more comprehensive and (developmentally) precise modeling of latent

trajectories. Another limitation is the attrition bias, which may have affected the strength of the

associations. As previously noted, the participants excluded from our analyses reported a less

frequent baseline use of SEM compared to their included peers. It should be noted, however, that

if this selection bias affected our findings, it likely overestimated rather than underestimated the

target association. Finally, culture-specific character of our findings cannot be ruled out.

Future researchers should consider other potential confounders of the target association,

such as impulsivity and sociosexuality (Charnigo, Noar, Garnett, Crosby, & Zimmerman, 2015;

Dir et al., 2014). Taking into account that both SEM use and risky sexual practices may be

relationship-specific, adolescents' involvement in and beliefs about romantic relationships

should also be considered (Fortenberry, Tu, Harezlak, Katz, & Orr, 2002). Whenever possible,

researchers should employ non-invasive biological measures. For example, urine-based

Chlamydia trachomatis testing may be used to provide an objective indicator of sexual risk

taking (Božičević et al., 2011; Wingood et al., 2001). Finally, considering that links between

adolescents' SEM use and sexual risk taking are no longer of concern only in developed Western

countries (see Arulogun, Ogbu, & Dipeolu, 2016), the field would greatly benefit from systematic cross-cultural comparisons.

Conclusions

There is a growing public and professional concern about the link between adolescents' SEM use and their health-related vulnerability (Martellozzo et al., 2016; Quadara et al., 2017). To contribute to a better understanding of the relationship between adolescent SEM use and sexual risk taking, which has been hampered by a paucity of prospective assessments, this study explored the target association using longitudinal bio-behavioral data and a latent growth modeling approach. Our findings, which suggested a developmentally-specific association between SEM use and sexual risk taking in both genders, point to the importance of interventions aiming at increasing young people's skills to discern between the reality and its sexualized media portrayals.

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Table 1

Demographic Information about the Study Participants at the Baseline (*n = 1,287*) *and*

Participants Included in the Analyses (*n = 577*)

	Participants at baseline	Participants included in the analyses
	n (%)	*n* (%)
Gender		
Male	524 (40.7)	212 (36.7)
Female	763 (59.3)	365 (63.3)
School type		
Gymnasium	379 (29.4)	214 (37.1)
Other	908 (70.6)	363 (62.9)
Family type		
Intact	987 (76.7)	419 (81.2)
Other	300 (23.3)	97 (18.8)
Mother's education		
College	480 (37.5)	212 (41.3)
High school or less	799 (62.1)	301 (58.7)
Father's education		
College	441 (35.1)	190 (37.4)
High school or less	816 (64.9)	318 (62.6)
	M (SD)	*M (SD)*
Age	15.8 (0.51)	17.3 (0.47)
First year average grade	3.59 (0.60)	3.73 (0.56)

Table 2

Baseline Levels and Latent Growth in Dual-domain Model of Adolescent SEM Use and the Index

of Sexual Risk Taking

	Male participants (n = 212)		Female participants (n = 365)	
	M (*SE*)	σ^2 (*SE*)	*M* (*SE*)	σ^2 (*SE*)
SEM use				
Latent intercept	4.90 (.14)***	2.99 (.41)***	1.93 (.08)***	1.82 (.17)***
Latent slope	.11 (.06)	.03 (.11)	.04 (.03)	.10 (.04)**
ISRT				
Latent intercept	.04 (.01)***	.01 (.00)***	.05 (.01)***	.02 (.01)***
Latent slope	.02 (.01)***	.01 (.00)***	.03 (.01)***	.01 (.00)***

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

Table 3

Reported Risky Sexual Behaviors in the Rijeka Panel by Gender and Wave

	T3		T4		T5	
	n	%	*n*	%	*n*	%
Male participants (*n* = 212)						
Reported 2 or more sexual partners	29	13.7	42	19.8	55	25.9
Did not use a condom at most recent sexual intercourse	9	4.2	20	9.4	25	11.8
Experienced one-night stand	15	7.1	32	15.1	28	13.2
Consumed alcohol prior to sexual intercourse	18	8.5	37	17.5	51	24.1
Consumed drugs prior to sexual intercourse	8	3.8	12	5.7	16	7.5
Did not use a condom consistently	17	8.0	28	13.2	39	18.4
Female participants (*n* = 365)						
Reported 2 or more sexual partners	47	12.9	65	17.8	92	25.2
Did not use a condom at most recent sexual intercourse	36	9.9	56	15.3	74	20.3
Experienced one-night stand	5	1.4	19	5.2	19	5.2
Consumed alcohol prior to sexual intercourse	53	14.5	81	22.2	103	28.2
Consumed drugs prior to sexual intercourse	8	2.2	11	3.0	11	3.0
Did not use a condom consistently	61	16.7	83	22.7	106	29.0

Table 4

Descriptive Information about and Cross-Correlations between the Key Indicators

| | Cross-Correlations | | | | | | *M* (*SD*) | |
	1	2	3	4	5	6	Male	Female
(1) SEM use T3		.78**	.74**	.30**	.24**	.25**	4.87 (2.08)	1.95 (1.52)
(2) SEM use T4	.70**		.79**	.27**	.21**	.23**	5.06 (2.04)	1.93 (1.52)
(3) SEM use T5	.70**	.70**		.28**	.22**	.27**	5.06 (2.07)	2.03 (1.58)
(4) ISRT T3	.11	.08	.07		.75**	.66**	0.04 (0.09)	0.05 (0.09)
(5) ISRT T4	.15*	.17*	.10	.63**		.79**	0.06 (0.11)	0.08 (0.12)
(6) ISRT T5	.18**	.19**	.18**	.56**	.74**		0.08 (0.13)	0.09 (0.13)

Notes. Zero-order correlation coefficients in the male sample are shown below the main

diagonal, while coefficients in the female sample are presented above it; weighted ISRT scores
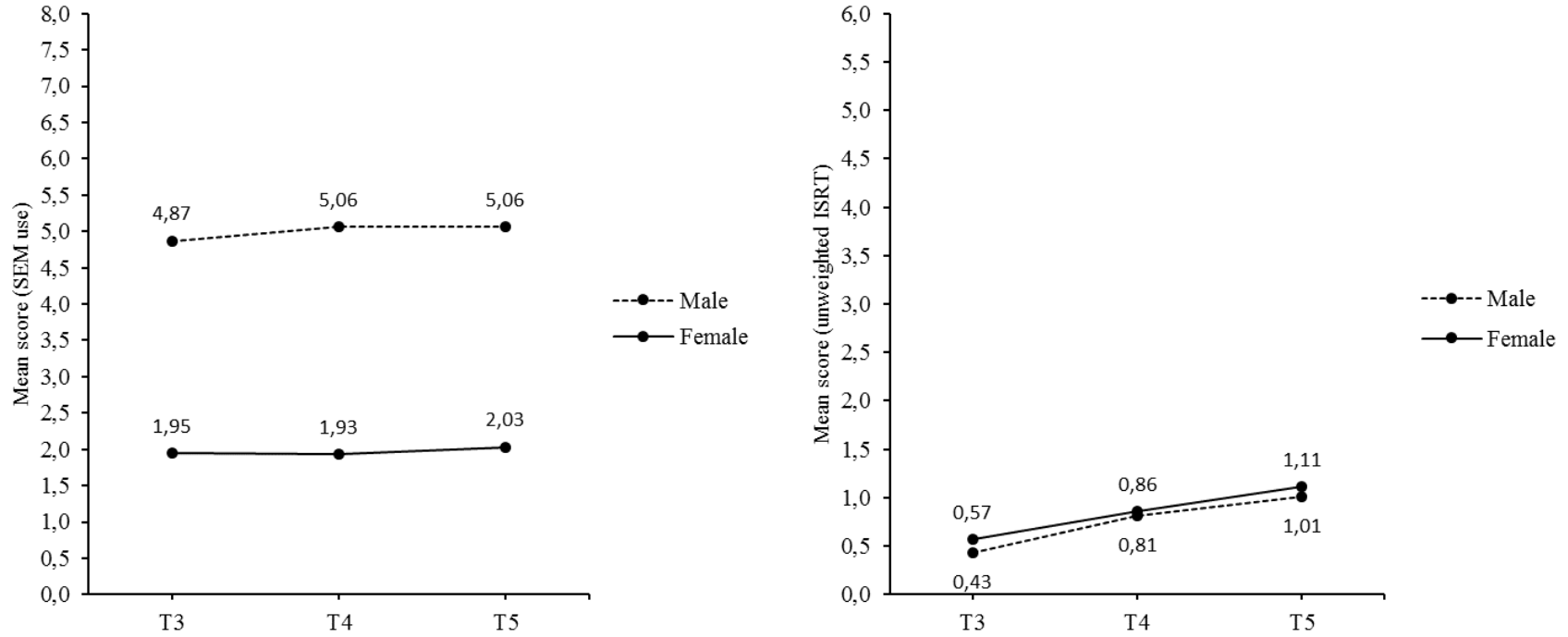
are presented; * $p < .05$. ** $p < .01$.

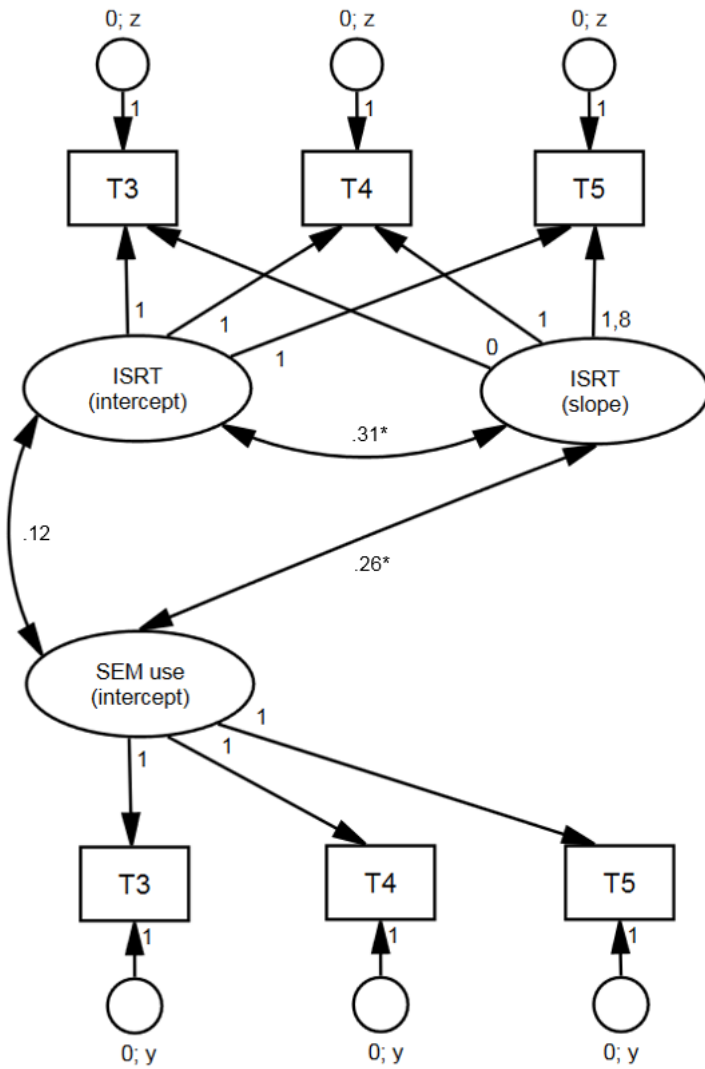Figure 1. Dynamics of SEM Use and the Index of Sexual Risk Taking among Adolescents

Figure 2. Latent Growth in Male Adolescents' SEM use and the Index of Sexual Risk Taking (*n* = 212).
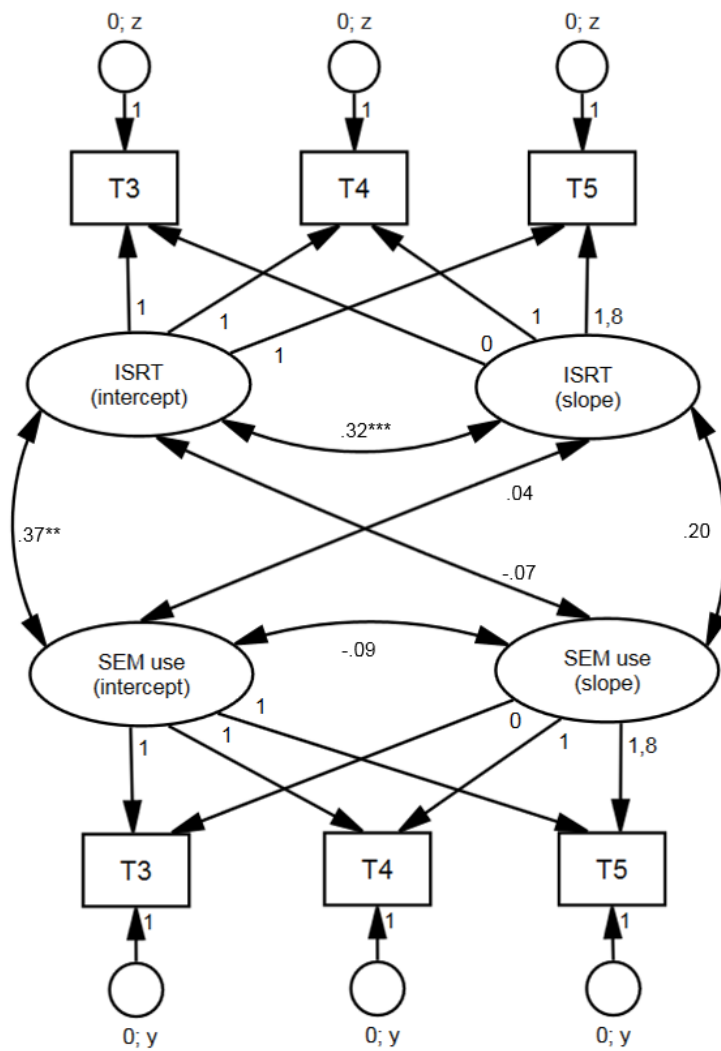
Note. * *p* < .05. ** *p* < .01.

Figure 3. Latent Growth in Female Adolescents' SEM use and the Index of Sexual Risk Taking

($n = 365$).

Note. * $p < .05$. ** $p < .01$.