Risk sexual behaviors in Uruguayan adolescents: the role of self-regulation and sex-gender

Abstract

During adolescence, there is an increase in romantic and sexual exploration that is part of humans' healthy development. However, in some circumstances, sexual behavior is associated with risky behaviors. Dual systems models of cognitive development posit that adolescents' risk behaviors are the result of a developmental imbalance between the socioemotional and the cognitive control systems. In this research we focus on the cognitive control system through the study of the association between self-regulation and risk sexual behaviors, and the modulation of sex-gender and socioeconomical status. A retrospective cross-sectional study was carried out in a sample of sexually active adolescents (M_{age} = 17.292, SD = 1.498), from Montevideo (Uruguay). Participants completed the Tower of London Task and the sociodemographic and sexual behavior questionnaires. We found an association between self-regulation and the probability of having had sex before age 15, the number of sexual partners and the inconsistency in the use of contraceptive methods (CM). Moreover, interactions between self-regulation and sex-gender were observed for the number of sexual partners and for the inconsistency in the use of CM. Our results contribute to understand the association between cognitive factors and risk sexual behaviors during adolescence in a socioeconomically diverse sample from a Latin American country.

Keywords: Adolescence; sexual behavior; self-regulation; sex-gender; contraceptive methods

Introduction

Adolescence main characteristics are physical, psychological and social changes (Steinberg, 2014; UNICEF, 2017). During this period, there is an increase in romantic and sexual exploration that is part of humans' healthy development. However, in some circumstances, sexual behavior is associated with risk behaviors that, eventually, could result in unplanned pregnancy and sexually transmitted diseases (STD), including HIV infection (Crandall et al., 2018). Several sexual behaviors have been identified as risky during adolescence, such as early sexual intercourse (before 15 years old) (Khurana et al., 2012; O'Donnell et al., 2001), multiple sexual partners (Birthrong & Latzman, 2014) and inconsistent or non-use of contraceptive methods in casual or non-monogamous relationships (Manlove et al., 2007; Manning et al., 2000).

The effects of risk sexual behaviors during adolescence are major health problems worldwide. In fact, adolescents and young adults make up 25% of the sexually active population, but signify almost 50% of all new acquired STDs (Da Ros & da Silva Schmitt, 2008) and adolescent pregnancy make up 11% of births (Todd & Black, 2020). Uruguay, a Latin American high-income country (World Bank, 2021), faces similar problems. Adolescents and young people (15 to 25 years old) represented 26.7% of new HIV cases in 2019 (MSP, 2020). Furthermore, adolescent pregnancy was a major health problem during several decades. Despite being in a relatively advantageous position with respect to the region, in 2019 Uruguay had a high adolescent fertility rate (32 per 1,000) compared with North America and Europe (13.2 per 1,000) (López-Gómez et al., 2021; WHO, 2021). Certainly, according to data from the Uruguayan Perinatal Informatics System, two thirds of pregnant adolescents stated that the pregnancy was unplanned (López-Gómez et al., 2021).

Several strategies on adolescent sexual and reproductive health were implemented worldwide. Traditional strategies have focused on changing individual behaviors by increasing the information about consequences of risky sexual behaviors (Plourde et al., 2016). However, adolescents are not irrational, unaware, or unconcerned about the potential harms of risk behaviors. Therefore, interventions designed to alter knowledge, attitudes, or beliefs have not been as effective as it was expected (Steinberg, 2007). Consequently, understanding risk sexual behavior in adolescence from a cognitive perspective might provide information to develop new intervention strategies to tackle the problem. Importantly, producing evidence in a Latin American country might add information to the existing literature that is mostly based

in samples from US and Western Europe (Banati & Lansford, 2018; Henrich et al., 2010; Kurtiş & Adams, 2018).

Cognitive development and risk sexual behaviors

Dual systems models of cognitive development posit that heightened risk taking during adolescence is the result of a temporal gap between the development of two cognitive systems: the socioemotional and the cognitive control (Steinberg, 2010). The former is especially sensitive to social and emotional stimuli, reward, novelty, and sensation seeking. This system develops faster during adolescence and follows an inverted-U pattern over development (similar to risky behaviors) (Duell et al., 2018). The latter includes psychological processes that facilitate self-controlled behavior such as planning, abstract reasoning, and impulse control. This system develops over the course of adolescence and young adulthood, following a lineal pattern, and it is independent from puberty. Importantly, it was proposed that this system develops slower than the socioemotional system (Steinberg, 2007). Therefore, due to this developmental imbalance, adolescents might be less able to control impulses, especially in emotionally arousing contexts such as sexual encounters (Shulman et al., 2016; Smith et al., 2013). In this research we focus on the cognitive control system through the study of the association between self-regulation and risk sexual behaviors.

Self-regulation is the ability to engage in behaviors that are in line with social and moral standards to reach long-term goals, suppressing inappropriate emotions, desires and actions opposite to that goal (Crandall et al., 2017; Morawska et al., 2019). This ability is governed by the prefrontal cortex, which develops during the first three decades of our life, being adolescence a key period. An inadequate self-regulation could be associated with substance abuse, violence, overspending, risk sexual behaviors, unintended pregnancies and STD (Griffin et al., 2011; Khurana et al., 2012; Watson & Milfont, 2017). Self-regulation has different composites such as planning, response inhibition, strategic problem solving, and flexible rule use (Albert & Steinberg, 2011b).

There is evidence that low self-regulation is associated with an increased likelihood and frequency of risk sexual behavior among adolescents and adults (Crockett et al., 2006; Demidenko et al., 2019; Knowles et al., 2020). Higher self-regulation has been associated with delayed sexual initiation; whereas lower self-regulation, with earlier onset of sexual intercourse (Magnusson et al., 2019; Moilanen, 2015; Wasserman et al., 2017). Lower self-regulation has also been associated with multiple sexual partners

(Crandall et al., 2018; Kalina et al., 2017; Moilanen, 2015; Raffaelli & Crockett, 2003) and sexual intercourse under the influence of alcohol or drugs (Kalina et al., 2017). Moreover, it was observed that greater self-regulation predicts less unprotected sex (Moilanen & Manuel, 2018; Quinn & Fromme, 2010); whereas lower levels of self-regulation predict greater involvement in unprotected sex (Kogan et al., 2011). Finally, some researchers have addressed the neural bases of the association between self-regulation and sexual behaviors, and they found a pattern of low activation in frontal regions during impulse control in adolescents who used less contraceptive methods (CM) (Goldenberg et al., 2013) and lower connectivity between frontal and subcortical areas associated with reward was observed in adolescents who used condoms less frequently (Lisdahl et al., 2013).

Moreover, sex-gender and socioeconomic status (SES) are associated with both sexual behaviors and self-regulation. It was observed sex-gender differences in the development of self-regulation. For example, it was proposed that adolescent girls develop more advanced executive functions one to two years earlier than boys, and boys have lower levels of impulse control and higher levels of sensation seeking (Magnusson et al., 2019). However, these differences are not only explained by biological factors. In fact, gender roles influence executive functions (Norvilitis & Reid, 2002) and could influence behavior through self-regulatory processes (Witt & Wood, 2010). Notably, self-regulation develops in a complex interplay between genetics and life experiences (Nachon et al., 2020). Therefore, SES might have an effect on self-regulation. Actually, there is evidence of a long-term effect of poverty and low SES on brain development, both structurally and functionally, which may be maintained in adolescence and adulthood (Crandall et al., 2018; Deater-Deckard et al., 2019).

Sexual behaviors are also modulated by sex-gender and SES. Actually, in the field of sexual and reproductive health, the study of sex-gender modulation is key. Women, compared to men, are more likely to contract HIV due to sociocultural factors such as unequal distribution of power in negotiating safe sexual practices and gender-based violence (Kovensky et al., 2021). For example, there are discrepancies in the use of condoms by men and women. In general, the most used contraceptive method by men is the condom, while for women it is the most used only in the first sexual intercourse. Women more frequently use birth control pills as a regular method (ENCOR, 2017; O'Sullivan & Thompson, 2014). Importantly, adolescent girls are more likely to engage in unprotected sex than adolescent boys and adult women. In many cultures adolescent girls have less power to insist that their partner use a condom and limited direct control over safe sex practices (Cherry & Dillon, 2014). This is underpinned

by gender roles that foster significant power inequalities that make it difficult for women to negotiate (Lemley et al., 2018). Certainly, women face disproportionate health consequences of risk sexual behaviors (Kovensky et al., 2021).

Furthermore, socioeconomic status affects sexual behaviors through the social norms of the community. For example, it has been suggested that in high SES social norms may be less permissive with respect to sexual behaviors such as the number of partners (Warner et al., 2011), and low SES and low parental educational level are associated with higher likelihood of early sexual intercourse (Crockett et al., 2003) and lower likelihood of using CM than middle and high socioeconomic levels (Cherry & Dillon, 2014; Slater & Robinson, 2014; Woolley & Macinko, 2019).

Although the association between self-regulation and sexual behavior in adolescents was studied, its associations with each risk sexual behavior, using a behavioral task that measures planning and impulse control, have not been estimated. Certainly, previous research in Uruguay has focused on social and economic factors associated with sexual and reproductive health, using survey data and qualitative studies. Therefore, it was pointed out the need for research on cognitive, emotional, and social aspects associated with sexual decision making in adolescents (López Gómez & Varela, 2016). Moreover, understanding the interactions between cognitive and socioeconomic factors is vital to grasp this phenomenon in the Uruguayan population. Hence, in this study we aimed to investigate the association between self-regulation and several risk sexual behaviors, and the interactions with sex-gender and SES in sexually active adolescents. Considering these aims, the following hypotheses were tested: 1) lower impulse control and worse planning skills (composites of self-regulation) are associated with a higher probability of an early sexual debut, inconsistent use of Contraceptive Methods and higher number of sexual partners; 2) a modulation of sex-gender and socioeconomic status will be observed in the association of self-regulation with the probability of an early sexual debut, inconsistent use of Contraceptive Methods, and the number of sexual partners.

Methods

Participants and procedure

All procedures were in accordance with the Declaration of Helsinki and were approved by the local Research Ethics Committee. The researchers obtained written consent from participants or their parent or guardian for minor-aged adolescents.

To assess the association between self-regulation and risk sexual behaviors, and the interactions with sex-gender and SES, a retrospective cross-sectional study was carried out in a sample of sexually active adolescents between 15 and 20 years old from Montevideo, the capital of Uruguay. This is the largest city in the country with around 1.3 million inhabitants. The exclusion criteria were: in the case of minors, not having the consent of the parent or legal guardian; in the case of adults, not giving their consent; residence outside Montevideo; and conditions that would hinder the performance of the behavioral task (e.g.: daltonia).

In order to obtain a heterogeneous sample of adolescents from different socioeconomic backgrounds, the participants were recruited by two procedures. First, the National Institute of Statistics (INE) provided a database with households from all neighborhoods of Montevideo in which at least one adolescent resided. These households were contacted by phone or in person to invite adolescents to participate. If contact was possible and they agreed to participate, a researcher went to the household, or the adolescent was invited to the University. Second, the research team contacted public high school authorities and several territory-based social organizations in different neighborhoods. If the institutions agreed to collaborate, information about the research was delivered to adolescents, parents, or legal guardians. In this case, data was collected in the institutions.

Data was collected using a computer assisted self-interview (CASI) system in laptops that allowed automatic data collection without the intervention of the researcher. Also, this system allows confidential data storage and logfiles were encrypted. Participants completed the Matrix of reasoning in WASI (Wechsler, 2011) to produce an estimate of nonverbal intellectual ability (control variable), the Tower of London Task, and the sociodemographic and sexual behavior questionnaires. The procedure lasted between 30 and 50 minutes. The tasks were programmed using PsychoPy 1.7/1.8 (Peirce, 2007, 2008) while the questionnaires were carried out in html language. All participants received the same reward (a cinema ticket).

After discarding incomplete cases (those with the sexual behavior questionnaire incomplete) and WASI outliers (1.5 Interquartile Range), the final sample consisted of 168 sexually active adolescents (M_{age} = 17.292, SD = 1.498). View Table 3 in results for further details.

Instruments

A computerized version of the Tower of London (ToL) task (Shallice, 1982) was used to generate measures of self-regulation (for a description see: Albert and Steinberg 2011b; Botdorf et al. 2017). Spanish version of ToL was the same used in a study in Colombia (Steinberg et al., 2017). Participants had to solve 20 problems divided in five sets, beginning with problems that could be solved in three moves and progressing to those that required a minimum of seven moves. From this task the following measures were calculated: a) impulse control (IC_RT) is the reaction time to first movement (Albert & Steinberg, 2011c), longer reaction times to first movement are associated with greater cognitive control (Steinberg et al., 2008); b) the mean of extra move (EM) from all trials for each subject (Newman, Greco, & Lee, 2009), more EM are associated with worse planning skills; c) the ratio of planning time (reaction time to the first movement) over solving time (RPT/ST) for all trials (Luciana et al., 2009), higher RPT/ST is associated with better planning skills. Before calculating these variables, trials with a solving time greater than 60 seconds were discarded.

Sociodemographic and sexual behavior questionnaires were completed after the task. From the first one, we extracted sex-gender and socioeconomical status (SES). For sex-gender, participants were asked if they were "female" or "male". For the measurement of the socioeconomic level (SES), we adapted the short version of the Socioeconomic Level Index (INSE) that includes neighborhood of residence, family composition, housing status, level of household comfort, and that has a high correlation with the real income level of Uruguayan households (Perera & Cazulo, 2016).

The sexual behavior questionnaire collected information about the age of first sexual intercourse, number of sexual partners in the last three months and use of contraception. Some of the questions and response type/scales from the sexual behavior questionnaire were: "How old were you when you had your first sexual intercourse?", response: age in years; "In the last three months, with how many people have you had sexual intercourse?", response options: 1, 2, 3, 4, 5, 6 or more; "Have you used some contraceptive method (CM) in your first sexual intercourse / during the last 6 months / in your last sexual intercourse?", response options were yes or no for each situation. Using this information, we constructed a variable addressing the inconsistency in the use of CM with two levels: "Always have used CM" and "Sometime have not used CM". Participants answered all questions and performed the task in Spanish.

Data analysis

Data analysis was performed with RStudio version 1.3.1. First, to center the variables, they were transformed to z scores. Binomial and Poisson logistic regression models were fitted to estimate the association between self-regulation variables and sexual behavior variables. Binomial logistic regression allows us to explore the effects associated with a set of predictor variables (x) when working with a dichotomous outcome variable (y). This type of regression models the probability of occurrence of the event of interest dependent on the set of variables considered in each model. Poisson regression is a type of generalized linear modeling used when the phenomenon of interest (y) corresponds to a count variable. The value of the coefficients is interpreted as the change in the outcome variable, per additional unit of the predictor interval variable (x) or with respect to the reference group when it is a nominal variable (e.g., sex-gender) (Cohen et al., 2003; Fox, 2016, 2019). Table 1 shows the type of regression fitted for each response variable and the reference level (if applicable).

Table 1 Fitted regression type for each outcome variable

Behavior (outcome variable)	*Reference level (if applicable)*	*Type of regression*
Early sexual intercourse	After 15. The probability of the occurrence of "Before 15" is modeled.	Binomial
Number of partners in last 3 months	-	Poisson
Inconsistent use of CM	Sometime did not use CM Estimate the probability of "Always used CM"	Binomial

The stepwise method was used to select the most appropriate model for each variable. Within the stepwise method, we used the forward direction strategy (Fox, 2016). We fitted seven models for each predictor variable (IC_RT, EM, and RPT/ST) with each response variable (sexual behavior: having the first sexual intercourse before the age of 15, number of sexual partners in the last three months, and inconsistent use of CM). Table 2 shows the specification of the models fitted following the stepwise - forward method.

Table 2 Specification of the models fitted

Model	*Main effect*	*Main Effect*	*Main effect*	*Interaction*	*Interaction*
M1	PV				
M2	PV	SES			
M3	PV	Sex-gender			
M4	PV	SES	Sex-gender		
M5	PV	SES		PV * SES	
M6	PV	Sex-gender		PV * Sex-gender	
M7	PV	SES	Sex-gender	PV * SES	PV * Sex-gender

Note: PV: Predictor Variable (ToL: IC_RT, EM y RPT/ST)

We used the AIC (Akaike information criterion) method to select the model. Therefore, the most parsimonious model will be the one that has the best fit with the fewest predictors. The model that records the minimum value in AIC is selected (Cohen et al., 2003; Fox, 2016). Subsequent to model selection, ANOVAs were performed on the models to test whether the model terms were significant. In this case, the ANOVA allows to analyze the variance/deviance of the model, compared to a full model (Fox, 2016, 2019). In the results section we reported only the models with significant main effects and/or interactions in the ANOVA. Finally, for interactions, we used the *lstrends* function of RStudio to estimate and compare model slopes with a confidence level of 0.95 and the Tukey HSD fitting method (Lenth, 2016).

Results

Descriptive statistics

Table 3 depicts descriptive statistics for sociodemographic characteristics and sexual behavior variables.

Table 3 Demographic characteristics and sexual behavior variables

Variables	# (%) Mean (SD)
Demographic characteristics	
Sex-gender (# in category (%))	
Female	94 (55.95)
Male	74 (44.04)
SES (# in category (%))	
Low	33 (19.64)
Medium	104 (61.90)
High	31 (18.45)
Race/ethnicity (# in category (%))	
Black	20 (11.90)
Indigenous	23 (13.69)
White	105 (62.50)
Other	20 (11.90)
Sexual behavior variables	
Age at first sexual intercourse (mean (SD))	15.2 (1.76)
Sexual intercourse before 15 years old (# in category (%))	52 (32.5)
Sexual partners in the last three months (mean (SD))	1.309 (2.153)
Inconsistent use of CM (# in category (%))	
Always have used CM	137 (81.55)
Sometime have not used CM	31 (18.45)

SD standard deviation, CM contraceptive methods. SES socioeconomic status. SES national cutting points are used here.

Regression models results

In this section we present the models with significant main effects of a ToL variable and/or the interactions with sex-gender and/or SES in the ANOVA. Therefore, we present five models. There was

not significant interaction between a ToL variable and SES in either of the models selected by the method presented before.

Early sexual intercourse (before age 15)

In a Model 1 (only the ToL variable), we observed a positive main effect of ME (extra movements) on the probability of having had sex before age 15 was observed (X^2 (1, N = 156) = 3.914, p = 0.048) (Fig. ***1***a). Extra movements in the ToL imply difficulties in efficiency during plan execution (Berg et al., 2010). Likewise, in a Model 3 (ToL variable and sex-gender main effects) we observed a negative main effect of RPT/ST (ratio between planning time and solving time) on the probability of having initiated sex early (X^2 (1, N = 156) = 6.468, p = 0.011) (Fig. ***1***b). RPT/ST implies a relationship between impulse control for making the plan and the time in which the subject executes the plan (Luciana et al., 2009). The complete models can be found in Table 4 from supplementary information.

Fig. 1 (a) Predicted probabilities for a binomial logistic model using the *ggpredict* function, that predicts values for all possible levels and values from a model's predictors. Predictor variable: EM ToL (z-scores). Outcome variable: Sexual intercourse before 15 years old. (b) Predicted probabilities for a binomial logistic regression model using the *ggpredict* function. Predictor variable: Ratio planning time/solving time (RPT/ST) for all trials in ToL (z-scores). Outcome variable: Sexual intercourse before 15 years old. The shaded area represents the 95% confidence bands.

Number of sexual partners in the last three months

In a Model 7 (ToL variable, SES, sex-gender and interactions) shows a positive main effect of ME (X^2 (1, N = 158) = 1.562, p<0.001) (Table 5). Also, an interaction between EM and sex-gender was observed (X^2 (1, N = 158) = 12.826, p<0.001). According to the Tukey HSD comparison the slope for women (trend = -0.286, ES = 0.126, CI [-0.533,-0.039]) is negative and significantly lower than the slope for men (trend = 0.259, ES = 0.086, CI [0.090,0.428]) (p<0.001). Moreover, the main effect of "being female" on the number of sexual partners is negative. Therefore, women have fewer sexual partners than men. Similarly, in a Model 6 (predictor variable, sex-gender and interactions), we observed an interaction between RPT/ST (ratio between planning time and solving time) and sex-gender (X^2 (1, N = 158) = 4.432, p = 0.035) for the number of partners in the last three months; the slope for men (trend = -0.004, ES = 0.086, CI [-0.172,0.165]) is negative and significantly lower than the slope for women (trend = 0.262, ES =

0.091, CI [0.081,0.443]) (p = 0.035) (Table 7). The interactions with SES were not significant in the ANOVA test; therefore, it is not discussed.

Table 5 Model 7: Extra movements for the number of sexual partners (last three months) and Model 6: Ratio planning time / solving time for the number of sexual partners

	M7	M6
(Intercept)	0.430 ** (0.143)	
EM	0.510 *** (0.150)	
SES_medium	-0.147 (0.184)	
SES_high	0.208 (0.169)	
Sex-gender_female	-0.510 *** (0.151)	-0.451 ** (0.142)
EM:SES_medium	-0.407 * (0.177)	
EM:SES_high	-0.347 * (0.172)	
EM:Sex-gender_female	-0.545 *** (0.152)	
RPT/ST		-0.004 (0.086)
RPT/ST:Sex-gender_female		0.266 * (0.126)
N	158	158
AIC	648.093	654.610
BIC	672.594	666.860
Pseudo R2	0.182	0.101

Model coefficients (standard error) *** p < 0.001; ** p < 0.01; * p < 0.05.

Inconsistent use of contraceptive methods

In a Model 6, we observed a positive and significant main effect of impulse control (reaction time) (IC_RT) (X^2 (1, N = 164) = 4.399, p = 0.036); the higher the IC_RT, the higher the probability of having always used CM (Fig. **2**a). This ToL variable is related to impulse control, inhibition of immediate and automatic response, and the ability to sustain this inhibition to achieve an optimal solution (Albert & Steinberg, 2011c). Moreover, in the same model, we observed an interaction between IC_RT and sex-gender (X^2 (1, N = 164) = 4.565, p = 0.033) on the probability of having always used CM. According to the Tukey HSD comparison, the slope for women (trend = -0.134, SE = 0.264, CI [-0.6518,0.384]) is negative and significantly lower than the slope for men (trend = 1.400, SE = 0.668, CI [0.092,2.709]) (p = 0.033) (Fig. **2**b). The complete model can be found in Table 6 from supplementary information

Fig. 2 (a) Predicted probabilities for a binomial logistic model using the ggpredict function, that predicts values for all possible levels and values from a model's predictors. Predictor variable: *IC_RT* ToL (z-scores). Outcome variable: consistent use of CM. The shaded area represents the 95% confidence bands. (b) IC_RT by sex-gender and CM use. Error bars reflect ± 2 standard error mean (SEM)

Discussion

Self-regulation is a crucial construct to understand risk behaviors during adolescence. Poor self-regulation was linked to substance abuse (Wills et al., 2003), crime and violence, overspending (Baumeister et al., 2007) and risk sexual behavior (Crandall et al., 2018; Griffin et al., 2011; Knowles et al., 2020), among others. Our study advances on the association between self-regulation and sexual behavior in adolescents, using a computerized version of the Tower of London task (ToL) to measure the time individuals expend on planning (impulse control / reaction time – CI_RT), the proportion of that time in the whole execution (ratio planning time/solving time - RPT/ST) and the result of the plan (extra moves – EM) in a socioeconomically diverse sample from a Latin American country. We hypothesized that lower impulse control and worse planning skills are associated with a higher probability of an early sexual debut, inconsistent use of Contraceptive Methods and higher number of sexual partners. Also, we expected a modulation of sex-gender and socioeconomic status in the association of self-regulation with the probability of an early sexual debut, inconsistent use of Contraceptive Methods and the number of sexual partners.

First, self-regulation was associated with less risk sexual behaviors. Particularly, there was an association between self-regulation and the probability of having had sex before the age of 15, the number of sexual partners and the consistency in the use of contraceptive methods. Our results are congruent with previous research showing that greater self-regulation and greater impulse control are associated with delayed sexual initiation. Whereas lower self-regulation is associated with earlier sexual debut (Knowles et al., 2020; Kogan et al., 2011; Magnusson et al., 2019; Moilanen, 2015; Moilanen & Manuel, 2018; Quinn & Fromme, 2010; Wasserman et al., 2017). In the same vein, Khurana et al. (2012) found that impulsivity was positively correlated with early onset of sexual intercourse and other authors found that was associated with increased likelihood of casual sex, more lifetime sexual partners, inconsistent or non use of contraceptive methods, and risk of chlamydia (Charnigo et al., 2013; Dir et al., 2014; Kahn et al., 2002; Knowles et al., 2020). Furthermore, our results are in line with previous studies that also show that lower self-regulation and lack of planning is associated with multiple sexual partners (Crandall et al., 2018; Kahn et al., 2002; Kalina et al., 2017; Moilanen, 2015; Raffaelli & Crockett, 2003).

The main effects we have observed, along with previous literature, can be explained within the framework of the Dual Systems Model. This model proposes that risk taking during adolescence is due to

a developmental imbalance between the socioemotional and the cognitive control systems. The latter is still developing during adolescence and might not be strong enough to modulate the socioemotional system. Moreover, the connectivity between both systems is still improving (Albert & Steinberg, 2011a, 2011b). Importantly, sexual activity is highly rewarding (Victor & Hariri, 2016). In fact, the ventral tegmental area (part of the mesolimbic system, with important projections of dopaminergic neurons) is involved in sexual motivation and anticipation of sexual reward (Frohmader et al., 2010). Moreover, the rewards associated with sexuality are diverse in nature, e.g. physical pleasure, tension release, emotional expression, and closeness with a partner (Tolman & Diamond, 2014).

Interactions with sex-gender

Interactions between self-regulation and sex-gender were observed for the number of sexual partners and for the inconsistency in the use of CM. First, in these models the main effect of "being a woman" on the number of sexual partners is negative; then, women have fewer sexual partners than men. Regarding the interaction between EM and sex-gender, as this ToL variable represents difficulties in efficiency during plan execution (Berg et al., 2010), the expected effect would be that the greater the EM, the greater the number of sexual partners in the last three months. However, the slope is negative for women. On the other hand, in the interaction between RPT/ST and sex-gender the slope for men is negative. In this case, higher levels of the variable imply greater planning (Luciana et al., 2009). Therefore, the effect is expected to be negative (higher RPT/ST, lower number of partners), as observed in men. However, we observed that for women both effects (EM and RPT/ST) are contrary to what is expected in theory. Similarly, when we looked the interaction between IC_RT and sex-gender on the probability of having always used CM, the slope for women is negative. In that model, the main effect of IC_RT is positive; the higher the IC_RT, the higher the probability of having always used CM, which is expected theoretically. These results provide evidence of the modulation exerted by gender role socialization, guiding what is expected for men and women, especially in behaviors such as the number of sexual partners, which has variations and different social expectations for each gender. Certainly, the interpretation of the interactions between the ToL variables and sex-gender should be carried out with caution since the differences between men and women, in many cases, have been used to support the thesis that men are superior to women (Cala Carrillo & Barberá Heredia, 2009). In the following paragraphs we will discuss these results.

First, our results show that the number of sexual partners is lower for women. This result is congruent with previous studies that have observed that men have a higher number of sexual partners (Blanc Molina & Rojas Tejada, 2018; Lonczak et al., 2002; Sok et al., 2020). This difference has been explained based on gender norms, which are tacit norms that determine the attributes and behaviors that are valued and accepted for men and women (Greene & Patton, 2020). In this sense, there is cultural pressure for men to prove their virility and women are expected to repress their sexual behaviors (Bearinger et al., 2007). Likewise, the Gender Schema Theory (Bem, 1981) states that children learn what it means to be a "man" or a "woman" for their culture from the early stages of development. This impacts children's behavior (Lorist, 2018) and how they process information (Hyde & DeLamater, 2007). In fact, previous studies have observed that females report having more beliefs about the potential social risk of risky sexual behaviors (Dir et al., 2014). Therefore, girls might have greater social pressure to regulate their impulses linked to sexual behaviors (Shulman et al., 2015). Actually, in the case of the number of sexual partners, a sexual double standard is observed, a set of divergent expectations for males and for females in terms of sexual behavior (Lorist, 2018). Women are expected to have a feminine sexuality, with reproductive purposes, and limited to the sphere of marriage or cohabiting couple; while men are expected to have a masculine sexuality, with pleasurable purposes, in the public sphere (López Gómez, 2005).

Although adolescents have a higher risk propensity and lower self-regulation than adults, this effect differs between males and females. Males have higher risk propensity (Duell et al., 2018; Gowen et al., 2019; Trofimova, 2015) and lower self-regulation (Dir et al., 2014; Kuhn, 2015; van Tetering et al., 2020) than females. In addition, previous studies have shown that males with poor self-regulation are more likely to engage in risky behaviors than females (Kalina et al., 2017). Importantly, some authors have proposed that adolescent girls use more top-down processing, whereas boys use mainly bottom-up processing (Kuhn, 2015).

Regarding the inconsistency in the use of contraceptive methods (CM), it could be argued that poor self-regulation may be a greater risk factor in the use of CM for women than for men due to the unequal power relations when negotiating the use of methods. In this regard, previous research has observed that impulsivity is a greater risk factor for females in risk sexual behaviors (Dir et al., 2014). More assertive negotiation strategies are associated with greater condom use. However, adolescent girls are at a disadvantage due to their age, gender role inequalities, and inexperience related to negotiating safe sex. These factors are deepened by developmental stage-specific difficulties, especially in making decisions

about long-term outcomes, as brain regions involved in impulsive and reward-driven decision making develop earlier than the prefrontal cortex, which is associated with self-regulation (Lemley et al., 2018).

Finally, our results, together with the dual systems models of cognitive development (Steinberg, 2010) and previous studies, point out the relevance of early intervention (Gavin et al., 2010). Self-regulation has a direct impact on health, income, interpersonal relationships, and social opportunities. Furthermore, self-regulation is considered a buffer between other factors and risk behaviors (Quinn & Fromme, 2010). Moreover, adolescence, as childhood, offers a sensitive window in the brain (due to neuroplasticity) that is unique for learning and changing habits (Crone & Dahl, 2012), also called the Second window of opportunity (UNICEF, 2017). Therefore, it would be relevant to create interventions that enhance the development of self-regulation of individuals in early childhood (Schweinhart et al., 2005), school age and early adolescence (Lipina & Segretin, 2015). Self-regulation stands as an area of intervention as it has effects on several risk behaviors. Furthermore, taking our results regarding gender differences into account, it is important to mention that females and males might benefit from comprehensive sex education intervention and prevention strategies (Dir et al., 2014).

Limitations and future research

Due to the cross-sectional nature of the data, interpretation of the findings must be cautious. Participants reported behaviors that happened several years before our study; therefore, memory biases must be considered. In order to understand the causal link of the phenomena and account for the memory biases, a longitudinal design with several data collection moments is needed. Also, the sample was not probabilistic; consequently, the results are not representative of the population of adolescents living in Montevideo. Finally, the sample size is a limitation of the study.

Although it is possible to conclude that self-regulation, through its composites (planning time and plan performance), is associated with risk sexual behaviors, our study is unable to evaluate self-regulation in an emotional heightened situation, such as sexual intercourse. Therefore, the role of self-regulation in risk behavior in adolescence should be investigated in a more ecological way.

Furthermore, our study uses only a behavioral task to measure self-regulation composites because there are few antecedents with the Tower of London and sexual behaviors. Future research should incorporate a self-regulation scale and develop a self-regulation composite measure with behavioral and self-reported measures.

Moreover, we evaluated specific sexual behaviors such as first sexual intercourse, number of sexual partners, and the use and type of contraceptive methods. Even though these measures are important to understand sexual behavior, it would be interesting to look for sexual trajectories, starting in pre-adolescence. This would allow us to better understand sexual initiation and, maybe, risk behaviors.

Conclusions

In line with previous research, we found that self-regulation was associated with a lower probability of engaging in risky sexual behaviors. Moreover, we found interactions between self-regulation and sex-gender that add information about the role of gender norms in the association between a cognitive variable and sexual behaviors.

More research is needed to gain a better understanding of the phenomenon. Future research should be conducted with larger samples, which would allow testing more interactions between variables of interest. Also, tasks that assess "hot" executive functions should be incorporated since risky behaviors often occur in emotionally challenging situations. Finally, it would be interesting to have longitudinal studies that can investigate how the development of these variables affects risk behaviors.

Additionally, our study was developed in a Latin American country. Most research about the association between cognition and sexual behavior was carried out in US and Western Europe. Summing up, our study contributes to the understanding the association between cognitive factors and risk sexual behaviors during adolescence in a socioeconomically diverse sample from a Latin American country.

References

Albert, D., & Steinberg, L. (2011a). Peer Influences on Adolescent Risk Behavior. En *Inhibitory Control and Drug Abuse Prevention* (pp. 211–226). Springer New York. https://doi.org/10.1007/978-1-4419-1268-8_11

Albert, D., & Steinberg, L. (2011b). Judgment and Decision Making in Adolescence. *Journal of Research on Adolescence*, *21*(1), 211–224. https://doi.org/10.1111/j.1532-7795.2010.00724.x

Albert, D., & Steinberg, L. (2011c). Age Differences in Strategic Planning as Indexed by the Tower of London. *Child Development*, *82*(5), 1501–1517. https://doi.org/10.1111/j.1467-8624.2011.01613.x

Banati, P., & Lansford, J. E. (2018). Introduction: Adolescence in a Global Context. En J. E. Lansford & P. Banati (Eds.), *Handbook of Adolescent Development Research and Its Impact on Global Policy* (pp. 1–23). Oxford University Press.

Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007). The Strength Model of Self-Control. *Current Directions in Psychological Science*, *16*(6), 351–355. https://doi.org/10.1111/j.1467-8721.2007.00534.x

Bearinger, L. H., Sieving, R. E., Ferguson, J., & Sharma, V. (2007). Global perspectives on the sexual and reproductive health of adolescents: patterns, prevention, and potential. *The Lancet*, *369*(9568), 1220–1231. https://doi.org/10.1016/S0140-6736(07)60367-5

Bem, S. L. (1981). Gender schema theory: A cognitive account of sex typing. *Psychological Review*, *88*(4), 354–364. https://doi.org/10.1037/0033-295X.88.4.354

Berg, W. K., Byrd, D. L., McNamara, J. P. H., & Case, K. (2010). Deconstructing the tower: Parameters and predictors of problem difficulty on the Tower of London task. *Brain and Cognition*, *72*(3), 472–482. https://doi.org/10.1016/j.bandc.2010.01.002

Birthrong, A., & Latzman, R. D. (2014). Aspects of impulsivity are differentially associated with risky sexual behaviors. *Personality and Individual Differences*, *57*, 8–13. https://doi.org/10.1016/j.paid.2013.09.009

Blanc Molina, A., & Rojas Tejada, A. J. (2018). Uso del preservativo, número de parejas y debut sexual en jóvenes en coito vaginal, sexo oral y sexo anal. *Revista Internacional de Andrología*, *16*(1), 8–14. https://doi.org/10.1016/j.androl.2017.02.009

Botdorf, M., Rosenbaum, G. M., Patrianakos, J., Steinberg, L., & Chein, J. M. (2017). Adolescent risk-taking is predicted by individual differences in cognitive control over emotional, but not non-emotional, response conflict. *Cognition and Emotion*, *31*(5), 972–979. https://doi.org/10.1080/02699931.2016.1168285

Cala Carrillo, M. J., & Barberá Heredia, E. (2009). Evolución de la perspectiva de género en Psicología. *Revista Mexicana de Psicología*, *26*, 91–101. https://www.redalyc.org/articulo.oa?id=243016317009

Charnigo, R., Noar, S. M., Garnett, C., Crosby, R., Palmgreen, P., & Zimmerman, R. S. (2013). Sensation Seeking and Impulsivity: Combined Associations with Risky Sexual Behavior in a Large Sample of Young Adults. *The Journal of Sex Research*, *50*(5), 480–488. https://doi.org/10.1080/00224499.2011.652264

Cherry, A. L., & Dillon, M. E. (Eds.). (2014). *International Handbook of Adolescent Pregnancy. Medical, Psychosocial, and Public Health Responses*. Springer US. https://doi.org/10.1007/978-1-4899-8026-7

Cohen, J., Cohen, P., West, S. G., & Aiken, L. (2003). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences* (3erd ed.). Lawrence Erlbaum Associates, Inc., Publishers.

Crandall, A., Magnusson, B. M., & Novilla, M. L. B. (2018). Growth in Adolescent Self-Regulation and Impact on Sexual Risk-Taking: A Curve-of-Factors Analysis. *Journal of Youth and Adolescence*, *47*(4), 793–806. https://doi.org/10.1007/s10964-017-0706-4

Crandall, A., Magnusson, B. M., Novilla, M. L. B., Novilla, L. K. B., & Dyer, W. J. (2017). Family Financial Stress and Adolescent Sexual Risk-Taking: The Role of Self-Regulation. *Journal of Youth and Adolescence*, *46*(1), 45–62. https://doi.org/10.1007/s10964-016-0543-x

Crockett, L. J., Raffaelli, M., & Moilanen, K. L. (2003). Adolescent Sexuality: Behavior and Meaning. En G. R. Adams & M. D. Berzonsky (Eds.), *Blackwell handbooks of developmental psychology. Blackwell handbook of adolescence* (pp. 371–392). Blackwell Publishing.

Crockett, L. J., Raffaelli, M., & Shen, Y.-L. (2006). Linking Self-Regulation and Risk Proneness to Risky Sexual Behavior: Pathways through Peer Pressure and Early Substance Use. *Journal of Research on Adolescence*, *16*(4), 503–525. https://doi.org/10.1111/j.1532-7795.2006.00505.x

Crone, E. A., & Dahl, R. E. (2012). Understanding adolescence as a period of social–affective engagement and goal flexibility. *Nature Reviews Neuroscience*, *13*(9), 636–650. https://doi.org/10.1038/nrn3313

Da Ros, C. T., & da Silva Schmitt, C. (2008). Global epidemiology of sexually transmitted diseases. *Asian Journal of Andrology*, *10*(1), 110–114. https://doi.org/10.1111/j.1745-7262.2008.00367.x

Deater-Deckard, K., Li, M., Lee, J., King-Casas, B., & Kim-Spoon, J. (2019). Poverty and Puberty: A Neurocognitive Study of Inhibitory Control in the Transition to Adolescence. *Psychological Science*, *30*(11), 1573–1583. https://doi.org/10.1177/0956797619863780

Demidenko, M. I., Huntley, E. D., Martz, M. E., & Keating, D. P. (2019). Adolescent Health Risk Behaviors: Convergent, Discriminant and Predictive Validity of Self-Report and Cognitive Measures. *Journal of Youth and Adolescence*, *48*(9), 1765–1783. https://doi.org/10.1007/s10964-019-01057-4

Dir, A. L., Coskunpinar, A., & Cyders, M. A. (2014). A meta-analytic review of the relationship between adolescent risky sexual behavior and impulsivity across gender, age, and race. *Clinical Psychology Review*, *34*(7), 551–562. https://doi.org/10.1016/j.cpr.2014.08.004

Duell, N., Steinberg, L., Icenogle, G., Chein, J., Chaudhary, N., Di Giunta, L., Dodge, K. A., Fanti, K. A., Lansford, J. E., Oburu, P., Pastorelli, C., Skinner, A. T., Sorbring, E., Tapanya, S., Uribe Tirado, L. M., Alampay, L. P., Al-Hassan, S. M., Takash, H. M. S., Bacchini, D., & Chang, L. (2018). Age Patterns in Risk Taking Across the World. *Journal of Youth and Adolescence*, *47*(5), 1052–1072. https://doi.org/10.1007/s10964-017-0752-y

ENCOR. (2017). *Encuesta Nacional de Comportamientos Reproductivos*. https://uruguay.unfpa.org/es/publications/encuesta-nacional-de-comportamientos-reproductivos

Fox, J. (2016). *Applied regression analysis and generalized linear models* (3rd ed.). SAGE Publications.

Fox, J. (2019). *An R Companion to Applied Regression* (3rd ed.). SAGE Publications.

Frohmader, K. S., Pitchers, K. K., Balfour, M. E., & Coolen, L. M. (2010). Mixing pleasures: Review of the effects of drugs on sex behavior in humans and animal models. *Hormones and Behavior*, *58*(1), 149–162. https://doi.org/10.1016/j.yhbeh.2009.11.009

Gavin, L. E., Catalano, R. F., David-Ferdon, C., Gloppen, K. M., & Markham, C. M. (2010). A Review

of Positive Youth Development Programs That Promote Adolescent Sexual and Reproductive Health. *Journal of Adolescent Health*, *46*(3), S75–S91. https://doi.org/10.1016/j.jadohealth.2009.11.215

Goldenberg, D., Telzer, E. H., Lieberman, M. D., Fuligni, A., & Galván, A. (2013). Neural mechanisms of impulse control in sexually risky adolescents. *Developmental Cognitive Neuroscience*, *6*, 23–29. https://doi.org/10.1016/j.dcn.2013.06.002

Gowen, R., Filipowicz, A., & Ingram, K. K. (2019). Chronotype mediates gender differences in risk propensity and risk-taking. *PLOS ONE*, *14*(5), e0216619. https://doi.org/10.1371/journal.pone.0216619

Greene, M. E., & Patton, G. (2020). Adolescence and Gender Equality in Health. *Journal of Adolescent Health*, *66*(1), S1–S2. https://doi.org/10.1016/j.jadohealth.2019.10.012

Griffin, K. W., Scheier, L. M., Acevedo, B., Grenard, J. L., & Botvin, G. J. (2011). Long-Term Effects of Self-Control on Alcohol Use and Sexual Behavior among Urban Minority Young Women. *International Journal of Environmental Research and Public Health*, *9*(12), 1–23. https://doi.org/10.3390/ijerph9010001

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, *33*(2–3), 61–83. https://doi.org/10.1017/S0140525X0999152X

Hyde, J. S., & DeLamater, J. D. (2007). *Understanding Human Sexuality*. McGraw-Hill Education.

Kahn, J., Kaplowitz, R., Goodman, E., & Emans, S. (2002). The association between impulsiveness and sexual risk behaviors in adolescent and young adult women*1. *Journal of Adolescent Health*, *30*(4), 229–232. https://doi.org/10.1016/S1054-139X(01)00391-3

Kalina, O., Orosová, O., Kriaucioniene, V., & Lukács, A. (2017). The role of self-regulation and life-optimism in sexual risk behaviour in university students from Hungary, Lithuania and Slovakia. *Health Problems of Civilization*, *3*(3), 180–189. https://doi.org/10.5114/hpc.2017.70009

Khurana, A., Romer, D., Betancourt, L. M., Brodsky, N. L., Giannetta, J. M., & Hurt, H. (2012). Early adolescent sexual debut: The mediating role of working memory ability, sensation seeking, and impulsivity. *Developmental Psychology*, *48*(5), 1416–1428. https://doi.org/10.1037/a0027491

Knowles, A., Rinehart, J. K., Steinberg, L., Frick, P. J., & Cauffman, E. (2020). Risky Sexual Behavior

among Arrested Adolescent Males: The Role of Future Expectations and Impulse Control. *Journal of Research on Adolescence*, *30*(S2), 562–579. https://doi.org/10.1111/jora.12499

Kogan, S. M., Brody, G. H., Chen, Y.-F., & DiClemente, R. J. (2011). Self-regulatory Problems Mediate the Association of Contextual Stressors and Unprotected Intercourse among Rural, African American, Young Adult Men. *Journal of Health Psychology*, *16*(1), 50–57. https://doi.org/10.1177/1359105310367831

Kovensky, R., Khurana, A., Guyer, S., & Leve, L. D. (2021). Childhood Adversity, Impulsivity, and HIV Knowledge as Predictors of Sexual Risk Outcomes in At-Risk Female Youth. *Adolescents*, *1*(1), 56–69. https://doi.org/10.3390/adolescents1010006

Kuhn, C. (2015). Emergence of sex differences in the development of substance use and abuse during adolescence. *Pharmacology & Therapeutics*, *153*, 55–78. https://doi.org/10.1016/j.pharmthera.2015.06.003

Kurtiş, T., & Adams, G. (2018). Gender and Sex(ualities). En N. Dess, J. Marecek, & L. Bell (Eds.), *Gender, Sex, and Sexualities: Psychological Perspectives* (Vol. 1). Oxford University Press. https://doi.org/10.1093/oso/9780190658540.003.0005

Lemley, S. M., Jarmolowicz, D. P., Parkhurst, D., & Celio, M. A. (2018). The Effects of Condom Availability on College Women's Sexual Discounting. *Archives of Sexual Behavior*, *47*(3), 551–563. https://doi.org/10.1007/s10508-017-1040-3

Lenth, R. V. (2016). Least-Squares Means: The R Package lsmeans. *Journal of Statistical Software*, *69*(1). https://doi.org/10.18637/jss.v069.i01

Lipina, S. J., & Segretin, M. S. (2015). 6000 días más: evidencia neurocientífica acerca del impacto de la pobreza infantil. *Psicología Educativa*, *21*(2), 107–116. https://doi.org/10.1016/j.pse.2015.08.003

Lisdahl, K. M., Gilbart, E. R., Wright, N. E., & Shollenbarger, S. (2013). Dare to Delay? The Impacts of Adolescent Alcohol and Marijuana Use Onset on Cognition, Brain Structure, and Function. *Frontiers in Psychiatry*, *4*. https://doi.org/10.3389/fpsyt.2013.00053

Lonczak, H. S., Abbott, R. D., Hawkins, J. D., Kosterman, R., & Catalano, R. F. (2002). Effects of the Seattle Social Development Project on Sexual Behavior, Pregnancy, Birth, and Sexually Transmitted Disease Outcomes by Age 21 Years. *Archives of Pediatrics & Adolescent Medicine*,

156(5), 438. https://doi.org/10.1001/archpedi.156.5.438

López-Gómez, A., Graña, S., Ramos, V., & Benedet, L. (2021). Desarrollo de una política pública integral de prevención del embarazo en adolescentes en Uruguay. *Revista Panamericana de Salud Pública*, *45*, 1. https://doi.org/10.26633/RPSP.2021.93

López Gómez, A. (Ed.). (2005). *Adolescencia y sexualidad. Prácticas, acciones y discursos en Uruguay. Montevideo*. Facultad de Psicología, UdelaR.

López Gómez, A., & Varela, C. (2016). *Maternidad en adolescentes y desigualdad social en Uruguay*. UNFPA; UdelaR.

Lorist, J. (2018). *Gender transformative approaches. Knowledge file*. Rutgers.

Luciana, M., Collins, P. F., Olson, E. A., & Schissel, A. M. (2009). Tower of London Performance in Healthy Adolescents: The Development of Planning Skills and Associations With Self-Reported Inattention and Impulsivity. *Developmental Neuropsychology*, *34*(4), 461–475. https://doi.org/10.1080/87565640902964540

Magnusson, B. M., Crandall, A., & Evans, K. (2019). Early sexual debut and risky sex in young adults: the role of low self-control. *BMC Public Health*, *19*(1), 1483. https://doi.org/10.1186/s12889-019-7734-9

Manlove, J., Ryan, S. J., & Franzetta, K. (2007). Contraceptive Use Patterns Across Teens' Sexual Relationships: The Role of Relationships, Partners, and Sexual Histories. *Demography*, *44*(3), 603–621. https://doi.org/10.1353/dem.2007.0031

Manning, W. D., Longmore, M. A., & Giordano, P. C. (2000). The Relationship Context of Contraceptive Use at First Intercourse. *Family Planning Perspectives*, *32*(3), 104. https://doi.org/10.2307/2648158

Moilanen, K. L. (2015). Short- and Long-Term Self-Regulation and Sexual Risk-Taking Behaviors in Unmarried Heterosexual Young Adults. *The Journal of Sex Research*, *52*(7), 758–769. https://doi.org/10.1080/00224499.2014.959881

Moilanen, K. L., & Manuel, M. L. (2018). Mechanisms Linking Self-Regulation and Sexual Behaviors in Never-Married Young Adults. *The Journal of Sex Research*, *55*(1), 120–133. https://doi.org/10.1080/00224499.2017.1330394

Morawska, A., Dittman, C. K., & Rusby, J. C. (2019). Promoting Self-Regulation in Young Children:

The Role of Parenting Interventions. *Clinical Child and Family Psychology Review*, *22*(1), 43–51. https://doi.org/10.1007/s10567-019-00281-5

MSP. (2020). *Informe epidemiológico - Día Nacional del VIH/SIDA 2020*. https://www.gub.uy/ministerio-salud-publica/comunicacion/publicaciones/informe-epidemiologico-dia-nacional-del-vihsida-2020

Nachon, J., Segretin, M. S., & Lipina, S. J. (2020). Conceptual and methodological approaches to the study of Self-Regulation: An inquiry within Developmental Science. *Revista Argentina de Ciencias del Comportamiento*, *12*(3), 13–31.

Newman, S. D., Greco, J. A., & Lee, D. (2009). An fMRI study of the Tower of London: A look at problem structure differences. *Brain Research*, *1286*, 123–132. https://doi.org/10.1016/j.brainres.2009.06.031

Norvilitis, J. M., & Reid, H. M. (2002). Evidence for an Association between Gender-Role Identity and a Measure of Executive Function. *Psychological Reports*, *90*(1), 35–45. https://doi.org/10.2466/pr0.2002.90.1.35

O'Donnell, L., O'Donnell, C. R., & Stueve, A. (2001). Early Sexual Initiation and Subsequent Sex-Related Risks among Urban Minority Youth: The Reach for Health Study. *Family Planning Perspectives*, *33*(6), 268. https://doi.org/10.2307/3030194

O'Sullivan, L. F., & Thompson, A. E. (2014). Sexuality in adolescence. En *APA handbook of sexuality and psychology, Vol. 1: Person-based approaches.* (pp. 433–486). American Psychological Association. https://doi.org/10.1037/14193-015

Peirce, J. W. (2007). PsychoPy--Psychophysics software in Python. *Journal of neuroscience methods*, *162*(1–2), 8–13. https://doi.org/10.1016/j.jneumeth.2006.11.017

Peirce, J. W. (2008). Generating stimuli for neuroscience using PsychoPy. *Frontiers in Neuroinformatics*, *2*. https://doi.org/10.3389/neuro.11.010.2008

Perera, M., & Cazulo, P. (2016). *Índice de Nivel Socioeconómico*. http://ceismu.org/site/wp-content/uploads/inse-informe-final-28032016.pdf

Plourde, K. F., Fischer, S., Cunningham, J., Brady, K., & McCarraher, D. R. (2016). Improving the paradigm of approaches to adolescent sexual and reproductive health. *Reproductive Health*, *13*(1),

72. https://doi.org/10.1186/s12978-016-0191-3

Quinn, P. D., & Fromme, K. (2010). Self-regulation as a protective factor against risky drinking and sexual behavior. *Psychology of Addictive Behaviors*, *24*(3), 376–385. https://doi.org/10.1037/a0018547

Raffaelli, M., & Crockett, L. J. (2003). Sexual risk taking in adolescence: the role of self-regulation and attraction to risk. *Developmental psychology*, *39*(6), 1036–1046. https://doi.org/10.1037/0012-1649.39.6.1036

Schweinhart, L. J., Montie, J., Xiang, Z., Barnett, W. S., Belfield, C. R., & Nores, M. (2005). *Lifetime Effects: The High/Scope Perry Preschool Study Through Age 40*. https://nieer.org/wp-content/uploads/2014/09/specialsummary_rev2011_02_2.pdf

Sergeant, J. A., Geurts, H., & Oosterlaan, J. (2002). How specific is a deficit of executive functioning for Attention-Deficit/Hyperactivity Disorder? *Behavioural Brain Research*, *130*(1–2), 3–28. https://doi.org/10.1016/S0166-4328(01)00430-2

Shallice, T. (1982). Specific Impairments of Planning. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *298*(1089), 199–209. https://doi.org/10.1098/rstb.1982.0082

Shulman, E. P., Harden, K. P., Chein, J. M., & Steinberg, L. (2015). Sex Differences in the Developmental Trajectories of Impulse Control and Sensation-Seeking from Early Adolescence to Early Adulthood. *Journal of Youth and Adolescence*, *44*(1), 1–17. https://doi.org/10.1007/s10964-014-0116-9

Shulman, E. P., Smith, A. R., Silva, K., Icenogle, G., Duell, N., Chein, J., & Steinberg, L. (2016). The dual systems model: Review, reappraisal, and reaffirmation. *Developmental Cognitive Neuroscience*, *17*, 103–117. https://doi.org/10.1016/j.dcn.2015.12.010

Slater, C., & Robinson, A. J. (2014). Sexual health in adolescents. *Clinics in Dermatology*, *32*(2), 189–195. https://doi.org/10.1016/j.clindermatol.2013.08.002

Smith, A. R., Chein, J., & Steinberg, L. (2013). Impact of socio-emotional context, brain development, and pubertal maturation on adolescent risk-taking. *Hormones and Behavior*, *64*(2), 323–332. https://doi.org/10.1016/j.yhbeh.2013.03.006

Sok, S., Pal, K., Tuot, S., Yi, R., Chhoun, P., & Yi, S. (2020). Health Behaviors among Male and Female

University Students in Cambodia: A Cross-Sectional Survey. *Journal of Environmental and Public Health*, *2020*, 1–10. https://doi.org/10.1155/2020/6740236

Steinberg, L. (2007). Risk Taking in Adolescence. *Current Directions in Psychological Science*, *16*(2), 55–59. https://doi.org/10.1111/j.1467-8721.2007.00475.x

Steinberg, L. (2010). A dual systems model of adolescent risk-taking. *Developmental Psychobiology*, *52*(3), 216-224. https://doi.org/10.1002/dev.20445

Steinberg, L. (2014). *Age of Opportunity: Lessons from the New Science of Adolescence*. Houghton Mifflin Harcourt.

Steinberg, L., Albert, D., Cauffman, E., Banich, M., Graham, S., & Woolard, J. (2008). Age differences in sensation seeking and impulsivity as indexed by behavior and self-report: Evidence for a dual systems model. *Developmental Psychology*, *44*(6), 1764–1778. https://doi.org/10.1037/a0012955

Steinberg, L., Icenogle, G., Shulman, E. P., Breiner, K., Chein, J., Bacchini, D., Chang, L., Chaudhary, N., Giunta, L. Di, Dodge, K. A., Fanti, K. A., Lansford, J. E., Malone, P. S., Oburu, P., Pastorelli, C., Skinner, A. T., Sorbring, E., Tapanya, S., Tirado, L. M. U., … Takash, H. M. S. (2017). Around the world, adolescence is a time of heightened sensation seeking and immature self-regulation. *Developmental Science*, e12532. https://doi.org/10.1111/desc.12532

Todd, N., & Black, A. (2020). Contraception for Adolescents. *Journal of Clinical Research in Pediatric Endocrinology*, *12*(1), 28–40. https://doi.org/10.4274/jcrpe.galenos.2019.2019.S0003

Tolman, D. L., & Diamond, L. M. (2014). Sexuality theory: A review, a revision and a recommendation. En *APA handbook of sexuality and psychology, Vol. 1: Person-based approaches.* (pp. 3–27). American Psychological Association. https://doi.org/10.1037/14193-001

Trofimova, I. (2015). Do Psychological Sex Differences Reflect Evolutionary Bisexual Partitioning? *The American Journal of Psychology*, *128*(4), 485. https://doi.org/10.5406/amerjpsyc.128.4.0485

UNICEF. (2017). *The Adolescent Brain: A second window of opportunity. A compendium* (N. Balvin & P. Banati (Eds.)). Office of Research – Innocenti.

van Tetering, M. A. J., van der Laan, A. M., de Kogel, C. H., de Groot, R. H. M., & Jolles, J. (2020). Sex differences in self-regulation in early, middle and late adolescence: A large-scale cross-sectional study. *PLOS ONE*, *15*(1), e0227607. https://doi.org/10.1371/journal.pone.0227607

Victor, E. C., & Hariri, A. R. (2016). A neuroscience perspective on sexual risk behavior in adolescence and emerging adulthood. *Development and Psychopathology*, *28*(2), 471–487. https://doi.org/10.1017/S0954579415001042

Warner, T. D., Giordano, P. C., Manning, W. D., & Longmore, M. A. (2011). Everybody's doin' it (right?): Neighborhood norms and sexual activity in adolescence. *Social Science Research*, *40*(6), 1676–1690. https://doi.org/10.1016/j.ssresearch.2011.06.009

Wasserman, A. M., Crockett, L. J., & Hoffman, L. (2017). Reward Seeking and Cognitive Control: Using the Dual Systems Model to Predict Adolescent Sexual Behavior. *Journal of Research on Adolescence*, *27*(4), 907–913. https://doi.org/10.1111/jora.12321

Watson, S. J., & Milfont, T. L. (2017). A short-term longitudinal examination of the associations between self-control, delay of gratification and temporal considerations. *Personality and Individual Differences*, *106*, 57–60. https://doi.org/10.1016/j.paid.2016.10.023

Wechsler, D. (2011). *WASI-II: Wechsler abbreviated scale of intelligence*--. Psychological Corporation.

WHO. (2021). *Global Health Observatory data repository. Adolescent birth rate. Data by UN region*. https://apps.who.int/gho/data/view.main.1610AUNREGION?lang=en

Wills, T. A., Gibbons, F. X., Gerrard, M., Murry, V. M., & Brody, G. H. (2003). Family Communication and Religiosity Related to Substance Use and Sexual Behavior in Early Adolescence: A Test for Pathways Through Self-Control and Prototype Perceptions. *Psychology of Addictive Behaviors*, *17*(4), 312–323. https://doi.org/10.1037/0893-164X.17.4.312

Witt, M. G., & Wood, W. (2010). Self-regulation of Gendered Behavior in Everyday Life. *Sex Roles*, *62*(9–10), 635–646. https://doi.org/10.1007/s11199-010-9761-y

Woolley, N. O., & Macinko, J. (2019). Association between sociodemographic characteristics and sexual behaviors among a nationally representative sample of adolescent students in Brazil. *Cadernos de Saúde Pública*, *35*(2). https://doi.org/10.1590/0102-311x00208517

World Bank. (2021). *Data for High income, OECD members, Upper middle income*. https://data.worldbank.org/?locations=XD-OE-XT