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Factors associated with sexual arousal, sexual sensation seeking, and sexual satisfaction among African-American adolescent females

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Abstract

Sexuality-related constructs such as sexual arousal, sexual sensation seeking (SSS) and sexual satisfaction have been related to sexual behaviors that place one at risk for adverse consequences such as sexually transmitted infections (STIs), HIV, and unintended pregnancy. The biopsychosocial model posits an array of factors, ranging from social environmental factors, biological, and psychological predispositions that may be associated with these sexuality constructs in adolescent samples. African-American females aged 14-20 were recruited from reproductive health clinics for an HIV intervention. Baseline survey and follow-up DNA data (N=304) was used to assess biological, psychological and social environmental associations with the sexuality constructs of arousal, SSS, and sexual satisfaction. In multivariable linear regressions, a higher depressive symptom rating was associated with higher arousability while short serotonin allele(s) status was associated with lower arousability. Impulsivity and perceived peer norms supportive of unsafe sexual behaviors were associated with increased SSS, and short serotonin allele(s) status was associated with lower SSS. Higher social support was also associated with higher levels of sexual satisfaction while short serotonin allele(s) status was associated with lower satisfaction. The sexuality constructs were also significantly related to number of sex partners, frequency of vaginal sex, and number of unprotected vaginal sex acts in the past six months. These findings emphasize the importance of understanding biopsychosocial factors, including the role of serotonin as an indicator of natural variations in sexual inclination and behaviors, that influence sexuality constructs, which in turn are associated with sexual behaviors, to allow further refinement of sexual health clinical services and programs and promote the development of healthy sexuality.

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INTRODUCTION

There is increasing concern about the effects of HIV/AIDS among young adults between the ages of 15 to 24 in the United States. From 2006-2009, the Centers for Disease Control and Prevention (CDC) reported increases in HIV incidence rates among persons aged 15-19 and 20-24 (1). HIV transmission among young adults is primarily attributable to sexual contact (1-3). Although more young men who have sex with men are living with HIV, marked gender differences are observed in HIV incidence, with young women, compared to males, approximately seven times more likely to be heterosexually infected with HIV (4). Consequently, the CDC, the U.S. National HIV/AIDS Strategy, and the National Institutes of Health Office of AIDS Research have recommended that young adults, especially females and African-American females, be targeted as a high-priority population for HIV prevention (5).

To develop optimally efficacious HIV prevention interventions for young women, extensive research has focused on identifying a variety of individual, psychosocial and environmental factors which influence sexual behaviors that jeopardize sexual and reproductive health (e.g., unprotected vaginal sex and greater number of sex partners) (6,7). However, noticeably absent from public health research has been the potential role of sexuality-related constructs such as sexual arousal, sexual sensation seeking (SSS), and sexual satisfaction in the sexual decision making and behaviors of young women (8-10). These sexuality-related constructs are rarely examined in public health research with adolescent/young adult female samples, but have been found to influence sexual behaviors in the sexuality literature (11). Specifically, the dual-control model of sexual response indicates that individual variation in sexual response is based on the central nervous system processes of sexual excitation (e.g., sexual arousal) and sexual inhibition (12). Individuals differ in the extent to which they respond with sexual arousal and sexual inhibition in a given situation. Specifically, individual differences in sexual excitation and inhibition influence sexual behavior (13). For example, individuals' with an unusually high propensity for sexual excitation or a low propensity for sexual inhibition are more likely to engage in less responsible sexual behavior, and individuals with high propensity for sexual inhibition or a low propensity for sexual excitation are more likely to experience sexual problems (13).

There is limited research examining sexual arousal, SSS, and sexual satisfaction on sexual behaviors in adolescent and young adult women, but recent evidence suggests that these constructs may be important factors to consider when examining sexual behaviors. For instance, in heterosexual adult women, higher levels of sexual arousal have been found to predict women's lifetime number of sexual partners and condom use during the previous year (13,14). Further, adolescent females who had higher levels of SSS had higher numbers of sexual partners, more frequent vaginal sex, and poorer condom use (15, 16). Additionally, higher levels of sexual satisfaction (e.g., "pleasure from sex") has been associated with more frequent sexual intercourse and greater sexual experience across a range of sexual behaviors among older adolescent females (17).

According to the World Health Organization (WHO), sexual health is a state of physical, emotional, mental and social well-being in relation to sexuality and is not simply disease control or prevention. Based upon this definition, many "sexual health approaches" acknowledge that pleasure and other more positively valenced dimensions of sexuality are important for understanding and promoting sexual health. In line with this comprehensive definition of sexual health, sexuality-related studies have recently begun to identify a broad range of personality (e.g., impulsivity), abuse history (e.g., physical and sexual abuse), psychosocial (e.g., depression), and sociocultural factors (e.g., peer norms supportive of unsafe sex) associated with various dimensions of sexuality, including arousal, sensation

seeking, and sexual satisfaction among adult women (17-21). However, because the vast majority of research on female adolescent sexuality is focused on the adverse consequences of sexual behavior we know very little about factors related to other fundamental dimensions of female adolescents' sexuality. The biopsychosocial model posits that social environmental factors as well as existing psychosocial predispositions and biological factors interact to influence behavior, especially those seen as risky such as adolescent sex (6). Further research utilizing a comprehensive framework such as the biopsychosocial model (6) is needed to understand the array of factors, ranging from social environmental factors (i.e., history of abuse, social support, and peer norms for unsafe sex), psychological predispositions (i.e., impulsivity and depressive symptoms), and biological factors (e.g. neurohormones), that may be associated with these sexuality constructs in adolescent samples.

While often omitted in public health research, biological influences on sexual behaviors, such as the neurohormones dopamine and serotonin, appear to play an important role in sexual experience and have been well described in sexual behaviors of rodents, particularly male rodents (22-26). When neurons containing dopamine or serotonin are stimulated, they release their respective neurohormone into the synaptic cleft where it is able to travel and bind to receptors on the postsynaptic neuron. The binding of neurohormones to receptors allows them to have their effect on the brain. These neurohormones are then cleared from the synaptic cleft through degradation by enzymes or by transporters that move the neurohormones back into the presynaptic neuron. In animal and human literature, the release of dopamine has been associated with motivation and reward related behaviors (27) and higher levels of dopamine increase sexual motivation and engagement in sexual behaviors among male rodents (23, 24, 28). In contrast, the release of serotonin has an inhibitory influence on sexual behaviors, and increased serotonin levels leads to decreased engagement in sexual behaviors among males (22-26). The role of dopamine and serotonin in female sexual behavior is less understood. Female rodents generally receive the sexual advances of males, making the study of biological underpinnings of female sexual behavior more more challenging (25) while also highlighting the importance of studying female sexual behaviors uniquely and separately from males (22).

For ethical and practical reasons, much of the study of biological influences on sexual behaviors, such as changes in neurohormone concentration in discrete areas of the brain, is limited to animal studies. However, it is plausible to consider whether variations in genes encoding the receptors and transporters, responsible for sensing the presence of a neurohormone and for clearing its presence thus reducing its effect, respectively, could account for some of the natural variations in human sexual behavior and experience. Indeed, this question has begun to be explored in humans by identifying associations between dopamine and serotonin genetics and self-reported sexual behavior and sexuality-related constructs (29-35). Every individual has two alleles for each gene, one from each parent. The gene for the D4 subtype of the dopamine receptor, DRD4, is located on chromosome 11 and contains a region with a variable number of repeats, commonly 2, 4 or 7+ (36). Binding of dopamine to the DRD4 receptor results in an inhibitory signal, and the DRD4 7+ variant is thought to have decreased binding and thus a decreased level of inhibition compared to the other variants (37, 38). This lower level of inhibition is thought to result in an overall heightened response, which is supported by a recent imaging study showing that DRD4 7+ individuals exhibited a heightened response to reward-related activities (39). In addition, studies have indicated an association between the DRD4 7+ allele and sensation-seeking and impulsivity (40-43), as well as initial reports of greater sexual desire, arousability, or engagement in sexual behaviors (29, 30, 44). However, results have been mixed (31, 34), suggesting the importance of evaluating specific contexts for gene-environment interactions (45).

The serotonin transporter moves serotonin from the synaptic cleft back into the presynaptic neuron, in effect decreasing serotonin's presence and ability to bind to postsynaptic receptors. The promoter region of the serotonin transporter gene (5-HTTLPR) has two common variants, the l (long) and s (short) alleles. The s-allele results in less transcription, and thus reduced production, of the serotonin transporter (46). Therefore, those with the s-allele have reduced rates of serotonin clearance and increased serotonin presence in the synaptic cleft. In animals, male rodents with the functional equivalent of the s-allele were found to have reduced initiation and engagement in sexual behaviors (25), though findings were less conclusive for females (47). In humans, blockade of the serotonin transporter by selective serotonin reuptake inhibitors (SSRIs), a commonly used treatment for depression, result in increased serotonin presence in the synaptic cleft. However, numerous concerns have arisen regarding the well-known side effect of decreased sexual desire and orgasm among those taking SSRIs (48-51). This side effect points to the potential role of serotonin in human sexual behaviors, yet associations between allelic variants of the serotonin transporter and human sexuality have not been well explored (34, 52, 53). Furthermore, while current research has provided general support for both dopamine and serotonin's role in human sexual experience, when explored, results have been less conclusive for females (33,34), emphasizing the need for further research on biological aspects of female sexual experience and how they may influence behavior.

In summary, the small body of empirical research connecting sexuality-related constructs to sexual behavior among young women indicates that these dimensions of sexual health are indeed related to sexual behaviors that place one at risk for adverse consequences such as sexually transmitted infections (STIs), HIV, and unintended pregnancy. However, we know very little about factors associated with sexual arousal, SSS, and sexual satisfaction among adolescent females. Consistent with the comprehensive WHO definition of sexual health, the biopsychosocial model, which posits that social environmental, psychosocial, and biological factors interact to influence behavior (6), provides the framework for the combined exploration of the associations between social environmental factors (i.e., history of abuse, social support, and peer norms for unsafe sex) and existing biological (i.e., age, 5-HTTLPR status, DRD4 status), and psychological predispositions (i.e., impulsivity and depressive symptoms) as they relate to sexuality constructs and sexual behavior. Thus, the aim of the current study was to examine the relationship between biological, socioenvironmental and psychosocial factors and sexual arousal, SSS, and sexual satisfaction. A secondary aim was to demonstrate the association between these sexuality constructs and reported sexual behavior in an adolescent female sample. Increased understanding of factors influencing sexuality constructs, which in turn influence sexual behaviors, may allow us to further refine and tailor sexual health programs to address and consider the broader sexual health needs of adolescent females, especially among African-American adolescent females who are heightened risk for HIV.

METHODS

Setting and study sample.

From July, 2005 to June, 2007, African-American adolescent females were recruited from reproductive health clinics in Atlanta, GA, to participate in an STI/HIV prevention trial. Adolescents were approached in clinic waiting areas by a female African-American recruiter who assessed study eligibility. Eligibility criteria included: age 14-20 years, at least one episode of vaginal sex without a condom in the past 6 months, not married, and not pregnant. Written informed consent was obtained from all adolescents with parental consent waived for those younger than 18 years. Of those eligible, 94% (N=701) enrolled in the study. Participants were compensated \$75 for baseline assessments.

DNA sample collection was a supplemental study to the main trial's data collection, thus not every participant enrolled in the main trial was invited to provide a sample. Those who were not invited to participate in this supplemental study were participants who 1) had already completed the trial, or 2) did not return for the 24-month follow-up assessment when the DNA sample collection occurred. In total, 363 participants were invited to provide a sample as part of the supplemental study, and only 31 declined. This study and its analyses report on data from 304 participants who participated in the main trial, and who, in addition to the baseline assessment, consented and provided a valid saliva sample for DNA analysis (28 samples were not of sufficient quality to yield results). The Emory University Institutional Review Board approved all study protocols.

Procedures and measures.

Procedures

Audio computer-assisted self-interview.: As part of the baseline data collection for the main trial, prior to randomization and participation in the HIV prevention program, all participants completed a 60-minute baseline survey via audio computer-assisted self-interviewing (ACASI) technology. Questions included demographics, sexual behaviors, personality (i.e., impulsivity), abuse history (e.g., history of physical, sexual abuse, or emotional abuse), psychosocial (i.e., depressive symptoms, social support), sociocultural (i.e., peer norms), and sexuality-related constructs. Additionally, all participants provided self-collected vaginal swabs to test for Chlamydia, gonorrhea, and trichomoniasis.

Genotyping.—DNA was obtained using Oragene™ DNA kits (Genetek; Calgary, Alberta, Canada). Participants rinsed their mouths with tap water and then deposited 4 ml of saliva in the Oragene vial. The vial was sealed, inverted, and shipped via courier to a central laboratory in Iowa City, where samples were prepared according to the manufacturer's specifications. Genotype at 5-HTTLPR and DRD4 was determined for each sample as previously described (55, 56). For 5-HTTLPR, of the sample, 8.0% were homozygous for the short allele (*ss*), 32.8% were heterozygous (*sl*), and 53.8% were homozygous for the long allele (*ll*). Genotyping results were used to form two groups of participants: those homozygous for the long allele (0) and those with either 1 or 2 copies of the short allele (1). Based on prior findings indicating an association between 5-HTTLPR and behavioral inhibition tendencies in general (57), we hypothesize that possessing at least one copy of the short (S) allele will be inhibitory for sexuality-related factors (25, 26, 34). For DRD4, DRD4 genotypes were grouped as 7R- (both alleles less than 7-repeats) (0) or 7R+ (at least one allele 7-repeats or longer) (1); the 7R+ genotype was present in 46.5% of the sample. Based on prior findings, we hypothesize that those in the 7R+ group should report higher levels of sexuality-related constructs (29, 30).

ACASI Measures

Demographic Items—Participants reported age in years. Family receipt of federal assistance for living expenses was assessed by four questions. Response choices were yes (1) or no (0). Participants respond yes/no to “In the past 12 months, did you or anyone you live with receive any money or services from”: a) “Welfare (including TANF (Temporary Assistance to Needy Families) or SSI)?”; b) “food stamps?”; c) “WIC (Women, Infants and Children)?” and d) “Section 8 housing (housing subsidies)?” A total score was obtained by summing the number of “yes” responses.

Sexuality-Related Measures

Sexual Arousal: We utilized the Sexual Excitation/Sexual Inhibition Inventory for Women and Men (SESI-W/M) to assess arousability (a dimension of sexual excitation) (38). The

data collected yielded adequate score reliability and convergent and discriminant validity (13). Arousalability was comprised of 5 items, rated from 1 (strongly disagree) to 4 (strongly agree), assessing propensity for arousal to various sexual stimuli (e.g., being physically close to a partner, thinking about sex). Examples of items from this subscale include: “If I am very attracted to someone, I don’t need to be in a relationship with that person to become sexually aroused” and “Just talking about sex is enough to put me in a sexual mood.” Higher scores indicate that the individual is more easily aroused. Cronbach’s alpha in this sample was .73.

Sexual satisfaction: Three self-developed separate items assessed separate aspects of sexual satisfaction: physical, emotional, and relational pleasure or satisfaction from sex. Physical sexual satisfaction was assessed by asking participants, “How much physical pleasure or satisfaction do you get from sexual intercourse with your main partner or boyfriend?” Emotional sexual satisfaction was assessed by asking, “How much emotional pleasure or satisfaction do you get from sexual intercourse with your main partner or boyfriend?” Relational sexual satisfaction was assessed by asking, “How much relational pleasure or satisfaction do you get from sexual intercourse with your main partner or boyfriend?” All three questions were answered on a 4-point scale ranging from 1 (none) to 4 (a great deal). Scores were summed to create an overall sexual satisfaction score, with higher scores indicating higher levels of sexual satisfaction. Cronbach’s alpha was .87.

Sexual sensation seeking: SSS was assessed by a 9-item sexual sensation seeking scale (59). Sample items include, “When it comes to sex, I’m willing to try anything,” and “Stopping to use a condom during sex takes the fun out of sex.” Participants rated each item from 1 (strongly disagree) to 4 (strongly agree), with higher scores indicating higher levels of SSS. Cronbach’s alpha was .72.

Possible Correlates of Sexuality-Related Measures

Impulsivity: Impulsivity was assessed using a 15-item impulsivity scale (60), with higher scores indicating higher levels of impulsivity. Sample scale items include “I like to do things as soon as I think about them”, and “I act on the spur of the moment”. Participants responded from 1 (never) to 5 (always). Cronbach’s alpha was .76.

History of abuse: Lifetime experience of abuse was conceptualized as an index comprising four forms of abuse; emotional, physical, forced vaginal sex or forced anal sex. Abuse history was assessed by asking four questions, “Have you ever been emotionally abused (threatened or called names)”, “Have you ever been physically abused (hit, kicked, slapped, punched)?”, “Has anyone ever forced you to have vaginal sex when you didn’t want to?”, and “Has anyone ever forced you to have anal sex when you didn’t want to?”. Response choices were yes (1) and no (0). Consistent with the definition used in national surveillance studies (41), a dichotomous composite variable was created in which participants who indicated yes on any of the four items were determined to have a history of abuse, and those who answered no on all items were determined to have no history of abuse.

Depressive symptomatology: Depressive symptoms were assessed with the 8-item Center for Epidemiological Studies-Depression (CES-D) scale (62). Participants were asked how frequently during the past week they experienced depressive symptoms from 1 (less than one day) to 4 (5-7 days). A sample item was “I felt sad.” The CES-D has been shown to be a valid measure of depressive symptoms in African-Americans (63). Higher scores indicate more depressive symptoms in the recent past. Cronbach’s alpha was .91.

Social support: Social support was assessed with a 12-item Likert scale (64). Sample items include, “my family really tries to help me” and “I can count on my friends when things go wrong.” Participants rated each item from 1 (strongly disagree) to 4 (strongly agree). Higher scores reflected higher levels of perceived social support. Cronbach’s alpha was .90.

Perceived peer norms supportive of unsafe sexual behavior: Five items assessed perceived peer norms supporting unsafe sexual behavior (65). Using a five-point scale from 1 (none) to 5 (all), participants were asked to report the number of same age peers who engaged in each unsafe sexual behavior (e.g., “have sex with someone you just met”). Higher scores indicated greater perceived peer norms supporting these sexual behaviors. Cronbach’s alpha was .76.

Sexual Behaviors—Frequency of vaginal sex in the past 6 months was assessed by asking, “In the past 6 months, how many times have you had vaginal sex?” Frequency of unprotected vaginal sex in the past 6 months was determined by subtracting the number of times a condom was used during penile-vaginal sex in the past 6 months from the number of reported penile-vaginal sexual episodes in the same time period. Number of recent vaginal sex partners was assessed by asking, “In the past 6 months, how many guys have you had vaginal sex with?”

Data Analysis Plan—All analyses were limited to the baseline assessment and the results of the genotyping. Descriptive statistics summarized study variables. In addition, analyses examined bivariate associations (assessed by Pearson correlations) between potential correlates and arousability, SSS, and sexual satisfaction. Separate multivariable linear regressions were conducted for arousability, SSS, and sexual satisfaction to ascertain factors remaining as significant predictors when adjusting for other factors in the model. Specifically, factors significantly associated with each sexuality-related construct in bivariate analyses were entered into the model for that construct. Significant associations were also examined between arousability, SSS, sexual satisfaction and reported sexual behaviors. Data analyses were conducted using SPSS 20.0.

RESULTS

Sample Description

Descriptive statistics are presented in Table 1 for all study measures. The majority was still in high-school or had only completed some high-school at enrollment (51.9%). One quarter had a job, and many reported living with their mother only (41.1%) or mother and father (16.1%). Condoms were used, on average, 48% of the time during vaginal sex in the 6 months prior to baseline assessment and 27% tested positive for one of three STIs (Chlamydia, gonorrhea, or trichomoniasis) at baseline.

Bivariate associations among study variables

Bivariate associations are presented in Table 2. Several factors were significantly correlated with sexual arousability. Specifically, age ($r = .12, p = .03$), history of abuse ($r = .14, p = .02$), and depressive symptoms ($r = .18, p = .001$), were each positively correlated with higher arousability. Having one or more copies of the serotonin short allele was significantly associated with lower levels of sexual arousability ($r = -.12, p = .03$). For SSS, impulsivity ($r = .20, p = .001$), history of abuse ($r = .17, p = .002$), depressive symptoms ($r = .12, p = .03$), and perceived peer norms supportive of unsafe sexual behavior ($r = .20, p = .001$), were each positively associated with higher levels of SSS. Higher social support ($r = -.11, p = .05$) and possessing one or more copies of the short allele ($r = -.12, p = .04$) were significantly associated with lower SSS. Specific to sexual satisfaction, higher social support was related

to higher levels of satisfaction ($r = .20, p = .001$) and possessing one or more copies of the short allele was associated with lower satisfaction scores ($r = -.19, p = .001$).

Regressions predicting sexuality-related measures

Factors significantly associated at the bivariate level with each sexuality-related measure were entered as predictors for that construct in a multivariable linear regression model. The three regression models are presented in Table 3. Among the four variables entered in the regression model predicting level of sexual arousability, having one or more copies of the serotonin short allele was significantly associated with lower levels of sexual arousability and higher self-reported depressive symptoms was associated with higher levels of sexual arousability. Among the six variables entered in the regression model predicting level of SSS, having one or more copies of the serotonin short allele was significantly associated with lower levels of SSS while higher impulsivity scores and peers norms supportive of unsafe sexual behaviors were associated with higher levels of SSS. Specific to the regression model predicting sexual satisfaction, both variables entered in the model were significant such that having one or more copies of the serotonin short allele was significantly associated with lower levels of sexual satisfaction and higher levels of social support was associated with higher levels of sexual satisfaction.

Sexuality-related measures and sexual behavior

The three sexuality-related constructs were significantly correlated with sexual behaviors (See Table 4). Specifically, higher arousability and sexual sensation seeking levels were significantly associated with having more vaginal sex partners in the past 6 months. Higher sexual sensation seeking and higher sexual satisfaction were significantly associated with more frequent vaginal sex and more episodes of unprotected vaginal sex in the past 6 months.

DISCUSSION

Corroborating prior research, adolescent females with higher levels of arousability, SSS, and satisfaction from sex reported higher levels of unsafe sexual behaviors. Further, consistent with the limited research exploring factors associated with these sexuality-related constructs among women, select demographic, personality, life history, psychosocial, and sociocultural factors were related to higher levels of these sexuality-related constructs. However, extending this literature, we found that a biological factor related to having suboptimal serotonin clearance (i.e., short serotonin transporter alleles which result in suboptimal transport of serotonin back into the neuron that released it, referred to as reuptake, an action that is intended to clear serotonin's presence and thus reduce its effect) was the only factor significantly related to lower levels of all three sexuality-related constructs. This finding is consistent with the behavioral literature indicating that possessing a short serotonin transporter allele is associated with greater behavioral inhibitions (57), and the physiological literature which postulates that when serotonin mechanisms are abnormal or altered the sexual arousal response may be disrupted (54). This is further supported by the well-described side effect of decreased sexual desire and orgasm that results among those using selective serotonin reuptake inhibitors (SSRIs) (66-68). SSRIs are generally used to treat anxiety and depression and function by blocking the serotonin transporter, in effect reducing the clearance of serotonin (due to a reduced ability to reuptake or transport serotonin back into the neuron that released it) and prolonging serotonin's effect, similar to the proposed mechanism of the short serotonin allele. In sum, our study identified multiple factors ranging from biological to sociocultural (i.e., peer norms) associated with multiple sexuality-related constructs in this sample of African-American adolescent females thereby demonstrating the array of influences on these lesser studied dimensions of adolescent females' sexual health.

The terms “adolescent” or “youth” are often used broadly in the STI/HIV and reproductive health literature, and can include persons 10 through 24 years of age. The World Health Organization (WHO) defines “adolescents” as individuals 10-19 years of age, and “youth” as 15-24 years of age. Regardless of the definition, the development of healthy sexuality is a critical developmental task of adolescence. Thus, understanding how factors either enhance or diminish dimensions of sexuality, such as sexual arousal, SSS, and satisfaction, among adolescent females is needed to develop appropriate strategies to foster optimal sexual health. This is especially important given our finding suggesting that certain individuals may have a genetic susceptibility associated with lower arousal and sexual satisfaction during the early stages of their sexual lives, which could persist into adulthood. In contrast, we found having a more supportive network, which could lead to enhanced self-esteem and self-efficacy, was associated with higher levels of sexual satisfaction. Also, higher depressive symptoms were associated with higher arousal levels, which is counter-intuitive and needs further investigation. However, depression has been associated with engaging a variety of sexual health endangering behaviors, such as having unprotected sex, among adolescent females and very little is known about the mechanisms underlying this well-documented association (69). Thus, further research is needed to thoroughly explore the mechanisms behind the associations identified in this study in order to guide future efforts to support optimal sexual development among adolescents. In addition to enhancing our empirical understanding, increasing the number of studies focusing on optimizing sexual development of adolescents may also help “normalize” positive dimensions of adolescent sexuality such as arousal and satisfaction. Increasing awareness that adolescent sexuality is a normal aspect of development will be a necessary first step for the adoption of a sexual health framework in the U.S. Normalization of adolescent sexuality should be reinforced through education in schools, in our approach to health care for youth, as well as supported by public policy in order to promote responsible sexual development and the overall health of our youth.

For adolescent females, the conceptualization that they have sexual desires and experience pleasure from sexual experiences is rarely acknowledged in studies of their sexual behaviors, or in HIV prevention programs designed specifically for adolescent females (17, 70, 71). Indeed, a normalized approach to adolescent female sexuality is lacking in education in schools, our health care system, and our public policies pertaining to sexual health in the U.S. Our findings support the assumptions outlined in the CDC’s “green paper” A Public Health Approach for Advancing Sexual Health in the United States (72), and indicate that acknowledging and addressing sexuality-related constructs such as arousal, SSS, and satisfaction within the context of sexual health education for adolescent females is needed and may add to the efficacy of such programs. For instance, HIV prevention programs for adolescent females may benefit from increasing their awareness of situations when they are aroused, or in which they may feel sexually impulsive, in order to help them develop strategies to ensure they are able to protect themselves in those instances. Though enhancing sexual satisfaction among young women is one goal in enhancing optimal sexual health, it is noteworthy that participants higher in sexual satisfaction engage in more frequent sex, and unprotected sex. Interventions which incorporate aspects of pleasure, and how to enhance the pleasurable aspects of safer sex, may address this link between a positive sexual experience and potentially negative sexual outcomes.

Limitations

This study is not without limitations. First, the sample consisted of adolescents who were seeking services at sexual health clinics, who met eligibility criteria for the parent study, and who attended the follow-up visit when the genetic sample was collected. Therefore results may not generalize to individuals who do not access similar clinics, who would not meet the eligibility criteria, which included having recent unprotected sex, or who are not likely to

return for follow-up. Further, the SESII-W/M has not been validated with a minority sample. Additionally, we employed an African-American sample so findings may not necessarily generalize to other racial/ethnic groups. Also, due to the goals of the parent study, our evaluation of peer norms was focused around unsafe sexual behaviors however, future studies should also evaluate peer norms around healthy sexual experiences and how these play a role in promoting the development of healthy sexuality and sexual satisfaction. Further, the self-report data are all cross-sectional, making it difficult to assess causal relationships. Finally, because the genetic data was collected as a supplemental study later in the trial, our sample size was relatively small and under powered for rigorously testing the role of genetic variation on the study outcomes, thus the analysis presented in the paper are exploratory and should be interpreted as preliminary until rigorous testing and replication in future studies confirms the associations. Related, this study is limited by its use of multiple statistical tests, and it does not control for Type I error risk.

Conclusion.

Further research focused on replicating these associations as well as identifying and understanding additional factors contributing to these lesser studied dimensions of sexuality among adolescent females is needed. These findings could facilitate the development of more comprehensive sexual health promotion programs, as well as inform the provision of clinical services that promote sexual health for adolescent females, a population disproportionately impacted by STIs and HIV. Healthy sexuality and sexual behavior, whether assessed by physiologic, behavioral, or affective measures, are essential to individual health and well-being across the lifespan. Ultimately, the transition from a focus on sickness and disease to a focus on prevention and wellness in order to support the sexual development and health of our youth will require education, action, and coordination at the individual, family, community, and societal levels.

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Table 1

Descriptive statistics of the study sample on study variables (N =304).

	Mean	SD	Possible Range
<u>Sociodemographic</u>			
Age	18.09	1.40	14-20
Family Aid	.86	1.02	0-4
<u>Possible Correlates</u>			
Impulsivity	38.43	7.21	15-75
History of abuse ^a	197	64.8	0-1
Depressive symptoms	14.86	6.61	8-32
Social support	35.99	5.80	12-48
Peer norms for unsafe sexual behavior	10.19	3.64	6-30
<u>Sexuality-related measures</u>			
Sexual arousal	12.96	2.75	5-20
Sexual sensation seeking	19.60	4.25	9-36
Sexual satisfaction	10.23	2.17	3-12
<u>Sexual behaviors</u>			
Number times vaginal sex (6 months)	33.26	58.45	
Unprotected vaginal sex (6 months)	23.30	55.96	
Number of partners (6 months)	2.33	3.3	

Note:

^a Rather than means and standard deviations, frequency and percent is displayed.

Table 2

Bivariate associations between predictor variables and sexuality-related constructs (N = 304).

	Sexual Arousability	Sexual Sensation Seeking	Sexual Satisfaction
<u>Sociodemographic</u>			
Age	.12 [*]	.08	-.02
Family Aid	.08	.01	.03
<u>Possible Correlates</u>			
5-HTT Status	-.12 [*]	-.12 [*]	-.19 ^{**}
DRD4 Status	.01	-.04	-.02
Impulsivity	.08	.20 ^{**}	-.08
History of abuse	.14 [*]	.17 ^{**}	-.02
Depressive symptoms	.18 ^{**}	.12 [*]	-.06
Social support	-.01	-.11 [*]	.20 ^{**}
Peer norms for unsafe sexual behavior	.07	.20 ^{**}	.05

Note:

+p .10

*
p .05,**
p .01,

Table 3

Multivariable linear regressions predicting sexuality-related constructs (N = 304).

	B	95% CI	SE B		t	p value
<i>Sexual Arousability</i>						
Age	.21	-.01 - .43	.11	.11	1.93	.06
5-HTT status	-.67	-1.28 - -.06	.31	-.12	-2.16	.03
History of Abuse	.43	-.26 - 1.12	.35	.08	1.23	.22
Depressive symptoms	.06	-.01 - .43	.03	.15	2.39	.02
Adjusted R ² = .053						
<i>Sexual Sensation Seeking</i>						
5-HTT status	-1.13	-2.06 - -.21	.47	-.13	-2.41	.02
Impulsivity	.11	.04 - .17	.03	.18	3.21	.001
History of Abuse	.88	-.19 - 1.96	.55	.10	1.62	.11
Depressive symptoms	.02	-.06 - .09	.04	.03	.41	.68
Social Support	-.04	-.13 - .04	.04	-.06	-1.06	.29
Peer norms	.18	.05 - .31	.07	.15	2.68	.01
Adjusted R ² = .091						
<i>Sexual Satisfaction</i>						
5-HTT status	-.75	-1.23 - -.27	.24	-.17	-3.06	.002
Social Support	.07	.03 - .11	.02	.18	3.26	.001
Adjusted R ² = .062						

Table 4

Associations between sexuality-related constructs and sexual behaviors (N = 304).

Sexuality Constructs	Sexual Behaviors		
	Number of sex partners	Frequency of sex	Number of unprotected sex episodes
Sexual arousability	.11 *	.07	.05
Sexual sensation seeking	.14 *	.21 **	.19 **
Sexual satisfaction	-.09	.15 **	.13 *

Note:

* p .05,

** p .01