



Review article

Sexual Behavior and Health From Adolescence to Adulthood: Illustrative Examples of 25 Years of Research From Add Health

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A B S T R A C T

Due to its long-term longitudinal design, the National Longitudinal Study of Adolescent to Adult Health (Add Health) has provided numerous valuable insights into adolescent and young adult sexual behavior. Framed by a conceptual model of sexual behavior and health, I review research using Add Health data to study sexual behavior and health. In this paper, I review research examining both predictors (e.g., neighborhood, family, genetic, individual) and health outcomes (e.g., sexually transmitted infections, mental health) of sexual behavior in adolescents and young adults. Where possible, I focus on long-term longitudinal studies that make use of the unique strengths of the Add Health data. Existing Add Health research has provided considerable information about both the predictors and health consequences of adolescent and young adult sexual behavior. Factors ranging from neighborhoods to genetics predict whether adolescent and young adults engage in sexual behaviors. Findings on long-term outcomes of adolescent sexual behavior suggest that early sexual behavior predicts higher rates of sexually transmitted infections and pregnancy in young adulthood, but not long-term changes to mental health. Unique contributions of Add Health include the ability to examine multidimensional bio-ecological predictors of sexual behavior and to examine long-term effects of sexual behavior and how sexual behaviors and their correlates change across adolescence into adulthood. Future work can leverage these strengths, and in particular the long-term longitudinal nature of the data, to uncover new insights about the developmental course of sexual behavior and health.

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**IMPLICATIONS AND
 CONTRIBUTION**

Drawing from its long-term longitudinal design, research from the National Longitudinal Study of Adolescent to Adult Health (Add Health) has enabled researchers to examine multidimensional bioecological factors that are associated with adolescent and young adult sexual behavior, as well as physical, mental, and social health outcomes of sexual behavior.

Sexual behaviors are developmental, as their prevalence, predictors, and outcomes differ across age [1]. In adulthood, sexual behavior is viewed as part of healthy relationships; however, in adolescence, sexual behavior is often viewed from a risk perspective with a focus on negative outcomes [2].

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Adolescent sexual behavior is viewed as problematic due to perceptions of immaturity rather than inherent risk, making it important to also examine sexual behavior from a normative developmental perspective [3]. This approach necessitates the use of long-term longitudinal data. The National Longitudinal Study of Adolescent to Adult Health (Add Health) [4] is uniquely suited to understand sexual development across adolescence into adulthood. Add Health is a nationally representative U.S. study of individuals recruited from schools in the 7th–12th grades [5]. It includes five waves of survey data (WI: ages 12–20, 1994–1995; WII: ages 12–20, 1995–1996; WIII: ages 18–26, 2001–2002; WIV: ages 24–32, 2007–2008; and WV: ages 33–43, 2016–2018) as well genetic, biomarker, romantic partner,

contextual, and parent data [5,6]. It includes measures of sexual behavior and attitudes like perceived benefits and parent disapproval [7]. In this article, I highlight studies from Add Health that demonstrate research on predictors of sexual behaviors and how they are associated with health outcomes in adolescence and young adulthood.

Methods

Articles were selected as part of an unstructured literature review designed to find illustrative examples of the multiple topics and types of data used in studies of sexual behavior in Add Health. I selected articles for the review that fit with the topic areas specified by my model of sexual behavior and health (Figure 1) [8] and were relevant to the priorities of this special supplement, such as the role of social context, a biosocial framework, and use of longer-term longitudinal data. Note that this conceptual model is used to identify areas for review; however, the studies may not test all pathways in the exact ways indicated. These studies should not be viewed in a comprehensive review of all research using Add Health but instead were chosen to demonstrate the many ways these data have been used to study sexual behavior and health. Where possible, studies were chosen that made use of long-term longitudinal data, especially how factors from adolescent waves (WI–WII) were associated with outcomes in young adults (WIII–WIV) or adult (WV) waves, to demonstrate the unique potential of the design. However, in cases where only cross-sectional or short-term longitudinal studies (i.e., WI–WII) were available on a topic, these were included.

Articles discussed here focus on the prevalence of various sexual behaviors, their predictors, and their health outcomes. Several different sexual behaviors are measured in Add Health and used in the research reviewed here. First, many studies examine occurrence of vaginal intercourse, either in the past-year or lifetime. Second, research often focuses on sexual behaviors that carry more risk for sexually transmitted infections (STIs), unintended pregnancy, or mental health outcomes, such as sex with multiple past-year partners, early timing of first intercourse, and sex with a nonrelationship partner [9,10]. Third, while not measured for all participants in the adolescent waves, Add Health has some information about nonintercourse sexual behaviors, such as retrospective reports of occurrence and timing of oral and anal sex (WIV) and occurrence of earlier sexual and romantic relationships within relationships (e.g., kissing, touching; WI–WII). Finally, Add Health also contains measures of protective behaviors like condoms and hormonal contraception. All of these types of sexual behaviors are a focus of this review; however, as it is not an exhaustive review, I do not discuss whether each of these types of behaviors have been the focus of a particular area of study, but instead provide illustrative examples of broader concepts as described above.

Prevalence of sexual behaviors across age

Add Health is one of several national studies of adolescent sexual behavior in the 1990s; estimates of sexual activity differed across studies, with Add Health generally having intermediate prevalence compared to the others [11]. These differences may be due to study design; Add Health used an at-home computer-

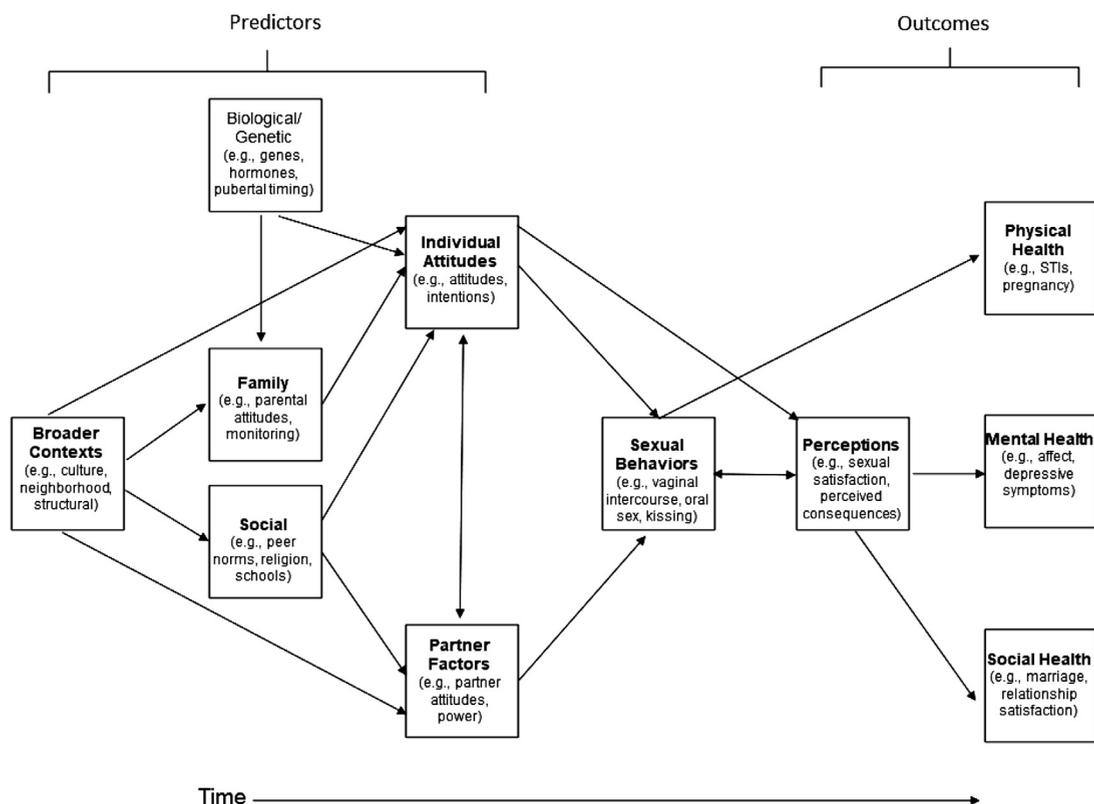


Figure 1. Conceptual model of sexual behavior and health. Adapted from Vasilenko, Lefkowitz, and Welsh, 2014.

assisted survey for questions about sexual behavior, which may have given adolescents a greater feeling of privacy compared to other surveys which used interviews or surveys in classrooms [11]. Despite the differences in prevalence estimates, similar patterns by factors like gender and race/ethnicity were found across studies, suggesting commonalities across these data [11]. Add Health data show that sexual behavior prevalence is developmental; only about 10% of individuals engaged in sexual intercourse in the past year at age 14, whereas about 90% did so by their early 20s [2]. Rates of sex with multiple past-year partners increased from adolescence through young adulthood, although the percentage of sexually active individuals having multiple partners remained relatively constant [2,12]. By WIV (ages 24–32), only 3% of participants reported never engaging in either oral, vaginal, or anal sexual behavior [13]. At age 31, the mean number of lifetime sexual partners was nine for women and 14 for men [14]. Although most research focuses on vaginal intercourse, studies using person-centered approaches to uncover patterns of multiple behaviors demonstrate the multidimensionality of sexual behavior. A study of adolescents found that 40% were abstinent, 10% engaged in oral sex only, 25% were sexually active but engaged in relatively low-risk behavior, 12% had multiple partners past year and a normative age (16 years or more) at first intercourse, and 13% had multiple partners and an early initiation of sexual intercourse [15]. Another found about half of individuals followed a pattern of sexual initiation in which they first engaged in vaginal intercourse, followed by initiation of another behavior at least one year later. However, 32% of individuals initiated both vaginal intercourse and another behavior within a year in adolescence, whereas less than 10% of individuals belonged to classes marked by engaging in only vaginal intercourse, delaying sex until young adulthood, or early initiation of sexual behaviors, including oral sex [16].

Sexual behaviors differ by demographic subgroup. Male participants were more likely to have multiple past-year partners compared to female participants between ages 25 and 29 years [12]. Until age 20 for males and age 28 for females, Black participants were more likely to engage in past-year intercourse compared to other groups; however, after age 24 White males were most likely (Vasilenko, et al, Unpublished, 2022). Black participants were more likely to have multiple partners at most ages but more likely to use condoms when sexually active (Vasilenko, et al, Unpublished, 2022). Although Black, White, and Latina young adult women all had patterns of sexual behavior marked by low, moderate, and high-risk sexual behaviors, the behaviors differed by race. Black women in the moderate risk class were unlikely to have oral sex and more likely to use condoms, whereas Latina women in the moderate risk class were monogamous but had high rates of STIs due to partner risk factors [17]. Sexual minority adolescents and young adults also follow distinct patterns of initiation, with fewer initiating only vaginal sex and more initiating other behaviors compared to heterosexuals [18].

Predictors of sexual behavior

Drawing from bioecological models, my model suggests that there are numerous complex, dynamic, and interacting multi-level factors that may influence sexual behavior [19,20]. In this section, I highlight how Add Health data have informed research on multidimensional predictors of sexual behavior, including

broader contextual factors, biological and genetic factors, relationship factors, and individual attitudes.

Broader contextual factors

Broader contexts, such as neighborhoods, influence adolescent sexual behavior. Compared to those in upper middle class White suburbs, adolescents in working class White rural neighborhoods and poor Black rural neighborhoods had a higher likelihood of vaginal intercourse and more sexual partners, whereas adolescents from middle class Hispanic/Asian suburbs, working class mixed race urban, and poor Hispanic urban areas had fewer partners by young adulthood [21]. Individuals in neighborhoods with more permissive sexual attitudes had more partners than those in areas with less permissive attitudes [21]. Neighborhood context also moderates the effect of other factors; for example, parental restriction of activities was associated with a lesser likelihood of initiation for adolescents in disadvantaged neighborhoods but a greater likelihood in advantaged neighborhoods [22]. Although Add Health focused primarily on contextual factors directly impacting adolescents than cultural or societal factors, findings from Add Health suggest how structural factors, such as structural racism, may influence sexual behavior. For example, having parents who were incarcerated is associated with sexual risk behaviors and STIs in early adulthood [23]; due to racial bias in policing and incarceration, these findings suggest a potential structural mechanism for health disparities in STIs.

Family

While most studies examining family factors focused on adolescence, some studies have used long-term longitudinal data to examine whether effects last through young adulthood. Parent–adolescent relationship quality was associated with lower likelihood of initiation of intercourse and unprotected sex in adolescence and STIs in young adulthood [24]. Closer relationship to father in adolescence was associated with delay of intercourse in cross-sectional analyses (W1) but was no longer significant in young adulthood (W3) [25]. However, family closeness and parental behavioral control in adolescence predicted the number of partners in early adulthood, both directly and through early intercourse [26]. Perceiving stronger parental disapproval of sex and more family warmth in adolescence predicted fewer partners in adolescence and slower growth in the number of partners across young adulthood [27,28].

Other social influences

Peers and schools. Add Health studies have suggested that peers and school factors influence adolescent sexual behavior. For example, teacher support was associated with lesser likelihood of sexual initiation among adolescents [29]. In addition, a study using the peer network data found that having 10% more friends who have initiated vaginal intercourse was associated with increased probability of vaginal sex initiation and multiple partners [30]. However, longer-term longitudinal research suggests that adolescents who were closer to their peers were less likely to engage in sexual intercourse in adolescence, but there were no differences in young adult behavior [25]. However, peer norms about sexual behavior may play an important role; one study found that feeling that peers were more accepting of sexual behavior were associated with more partners in

adolescence and greater growth in number of partners through young adulthood [27]. Individuals who attend a school with a higher percentage of sexually experienced students have more sexual partners but do not experience greater growth in number of partners through young adulthood [27].

Religion. Greater religiosity predicts a lesser likelihood of adolescent sexual initiation, and this association may be mediated by sexual attitudes [31,32]. Religiosity continues to play an important role through adulthood; individuals who attend religious services regularly in adolescence are less likely to have engaged in oral, vaginal, or anal sex by ages 24–32 [16]. Among Black adults, frequent religious service attendance was associated with fewer lifetime partners and feeling religion is important was associated with fewer partners and lower sexual frequency [33]. A study of patterns of religiosity in adolescence found that nearly half of adolescents endorsed multiple indicators of religiosity and about one-quarter had a primarily private religiosity. A smaller number were not religious, had only an affiliation, or engaged only in public activities [34]. Adolescents endorsing multiple dimensions of religiosity had a lower prevalence of nonrelationship sex than those with other patterns in both adolescence and young adulthood [34].

Partner influence

Although many social relationships influence sexual behavior, understanding partner or romantic relationship influences is crucial due to the partnered nature of sexual behaviors. Adolescents who are dating or are in a romantic relationship are more likely to engage in intercourse than those who are not in a relationship [32], although lifetime nonrelationship sex is common [35]. Adolescents who were friends with their partner prior to the relationship were less likely to engage in intercourse, more likely to discuss STIs or contraception, and more likely to use birth control consistently with that partner [36]. Several studies have used dyadic data to understand how male and female partners' characteristics predict sexual behavior. For example, dating young adult couples with discordant or low levels of intimacy were more likely to use condoms and those in relationships with longer duration were more likely to use hormonal contraception [37]. Both male and female adolescents' sexual intentions and female partners' delinquent behaviors predicted intercourse [38]; however, male partners' contraceptive attitudes played a stronger role in predicting the dyad's condom use [39]. One study categorized types of couples based on multiple factors associated with sexual behavior for male and female partners and found that the most common pattern was marked by contexts with more permissive sexual attitudes for male compared to female partners. In addition, couples where both partners intended to have sex were more likely to engage in intercourse [40].

Biological and genetic factors

Behavioral genetic research suggests that genetically influenced traits predispose some individuals toward early sexual activity [41]. Sibling studies have found that genetic factors in pubertal timing predicted age of first vaginal intercourse, but environmental factors related to perceived pubertal timing also played an independent role [42]. Similarly, sibling research has suggested heritability in adolescents' sexual attitudes and young

adult sexual behaviors [43]. However, genetic influences were stronger among individuals who did not experience adversity like low socio-economic status or father absence [44]. In addition, molecular genetic studies have found genes associated with adolescent sexual behavior, including that the 3R genotype in the DRD4 gene was associated with sexual initiation and the VNTR polymorphism in the DAT1 gene was associated with more sexual partners in White male adolescents [45,46]. However, molecular genetic studies also suggest that environmental factors moderate genetic effects, with protective effects of the 9R/9R genotype on number of partners not present in schools with many students initiating early [46].

Individual attitudes

Guided by theories of behavior change (e.g., Theory of Planned Behavior; Theory of Reasoned Action [47,48]), numerous Add Health studies have examined how sexual attitudes are associated with sexual behaviors, commonly using measures of perceived costs and benefits of sex. Although too many to fully review here, considerable Add research has linked adolescent sexual attitudes to adolescent sexual behavior, with those who believe sexual behavior will have more negative consequences less likely to initiate or engage in riskier behaviors [49,50]. Less research has examined the role of sexual attitudes into adulthood, but some findings suggest a lasting influence. One study found that men and women who perceived greater benefits of sex as adolescents reported a greater number of lifetime sexual behaviors in young adulthood, while women who perceived more costs of sex had fewer lifetime partners [51].

Summary of findings on predictors

Add Health data have demonstrated many factors that predict sexual behavior, allowing for unique contributions that span a breadth of bioecological factors and whether adolescent influences extend into young adulthood. A particular contribution of these data on multiple levels of influence is the ability to detect interactions of multiple factors, such as how neighborhoods moderate family effects [22] and how environmental factors moderate genetic effects [44].

Outcomes of sexual behavior

My model focuses on how sexual behaviors are associated with physical, mental, and social health outcomes, drawing from the World Health Organization's definition of health [8]. This includes how sexual behavior may be directly associated with physical outcomes like pregnancy or STIs and indirectly associated with mental and social health outcomes through their perceptions of their behavior.

Physical health

Extensive Add Health research has examined STIs and unintended pregnancy. For example, early initiation and risky behaviors in adolescence are associated with STIs in young adulthood [10,52–54], although other research has not found these associations into young adulthood [55]. Black and American Indian young adults are more likely to contract STIs, although these disparities are not fully explained by sexual behavior and may reflect network factors, such as race-specific

assortative mating [56,57]. In addition, there are differences in young adult STIs by sexual orientation, with bisexual women and bisexual and gay-identified men who have sex with both men and women at a particular risk [58]. Experiencing more adverse life experiences and having more permissive friend attitudes in adolescence were associated with greater odds of unintended pregnancy by young adulthood [59,60]. Rates of unintended pregnancy are generally higher among ethnic minority women [59]. Most research on physical consequences has focused on negative outcomes. However, some research has examined prevalence of orgasm, finding that the vast majority of men reported orgasm on all or nearly all occasions of sexual behavior, whereas less than half of women did and that individuals in more committed relationships reported experiencing orgasm more regularly [61].

Perceptions of sexual behaviors

My model posits that an individual's sexual behaviors may impact their mental and relationship health through the way they perceive or feel about their sexual behavior [8]. This can include positive and negative feelings, like guilt, shame, or sexual satisfaction. While perceptions have been studied infrequently, some Add Health research has examined sexual enjoyment. One study of young adults found that men reported greater sexual enjoyment compared to women and that women reported greater sexual enjoyment when they had greater autonomy, higher self-esteem, and more empathy [61]. Another found that young adults' sexual enjoyment was higher for those with more equitable relationships and a higher relationship commitment [62].

Mental health

There has been considerable research on early sexual behavior and mental health. Studies of WI–WII found that early (before age 16) initiation of sexual intercourse predicts depressive symptoms a year later for adolescent girls but not boys [9,63,64]. The association between past-year sexual intercourse and depressive symptoms differed across adolescence and young adulthood; intercourse was associated with higher depressive symptoms before age 16 for male and before age 20 for female adolescents [2]. However, studies of long-term impacts provide additional nuance. Some research suggests that individuals who initiated vaginal intercourse earlier had higher depressive symptoms in young adulthood; however, this association may be explained by other factors [54,65]. For example, a causal inference study did not find associations between early initiation and young adult depressive symptoms [53]. Associations between adolescent sexual behavior and depressive symptoms may depend on the relationship with sexual partners. In a study of sibling pairs, the association between adolescent sexual behavior within a romantic relationship and depressive symptoms could be explained by genetic and family environmental confounds, while sex outside of a romantic relationship predicted greater depressive symptoms, even when controlling for these other factors [66].

Social/relationship health

Because sexual behavior is partnered, sexual behaviors may have implications for romantic relationships. Several studies

have examined how adolescent sexual behavior is associated with young adult relationships. Engaging in first intercourse at a later age was associated with a lower likelihood of cohabitation, lower relationship dissatisfaction, and fewer lifetime romantic partners by young adulthood; however, there were no differences in likelihood of marriage [67]. Early oral sex was associated with lower relationship satisfaction in young adulthood for women, although this may be due to a higher likelihood of forced sex or STIs [68]. Sexual behavior in adolescent romantic relationships was associated with greater odds of both marrying and cohabiting in young adulthood, whereas nonromantic sexual behavior predicted cohabiting only [69]. Other studies have examined how patterns of sexual behaviors predict later relationship outcomes. For example, having more lifetime sexual partners was associated with lower sexual satisfaction for individuals with a pattern of sexual initiation in which they first engaged in vaginal intercourse, followed by initiation of another behavior at least one year later, but not other patterns of initiation [70]. Adolescents who had relationships that did not include sexual behavior and those who had committed relationships were the most likely to marry by young adulthood compared to other patterns [71].

Summary of findings on outcomes

The Add Health data have contributed to the study of health outcomes of sexual behavior. The longitudinal design allows researchers to understand how adolescent behavior is associated with longer-term outcomes. Findings suggest early sexual behavior and are associated with physical health outcomes like STIs; however, there is limited evidence of long-term effects of adolescent behavior on mental health outcomes and associations with relationship health are complex.

Limitations

Although Add Health has contributed immensely to the study of sexual behavior and health, there are caveats. The adolescent data were collected in the mid-90s. While such a lag is necessary for long-term longitudinal data, it raises questions about the relevance to adolescents today, as research has suggested declines in prevalence of sexual intercourse among adolescents across the 2010s compared to the 1990s and 2000s [72]. In addition, Add Health data may not fully reflect many issues receiving recent attention, including adolescent sexual orientation and gender identity, nonmonogamy, and asexuality. It is also difficult to examine nonconsensual sex or wantedness of sex, as this information was not available for behaviors like first intercourse, which is a limitation in studies of first intercourse and mental health [63]. Thus, although Add Health has made and will continue to make many contributions, it is also important to include measures of sexual behavior in future nationally representative studies, such as the Adolescent Brain and Cognitive Development study [73]. In addition, Add Health only collected data in the United States and did not focus on cultural factors; thus the ability to examine the role of culture is limited.

There are other limitations to this article. First, it is not comprehensive and should be viewed as a demonstration of the many types of research using Add Health. In addition, there are areas outside of the scope of the article. Space limitations preclude fully comparing research examining adolescent versus young adult outcomes or comparing results from Add Health and

other data. In addition, space constraints meant that although I present examples of areas in which research has found demographic differences in sexual behavior and its outcomes, I am not able to discuss explicitly whether or not these differences were measured for all topics.

Future directions

This article demonstrates the breadth of questions related to sexual behavior and health that have been examined using Add Health. However, given the unique features of the data, there are still many areas that could make use of the longitudinal nature of this rich dataset.

Prior research has suggested that multilevel factors predict sexual behavior; however, few studies have examined multiple types of risk and protective factors simultaneously. One such study [49] found that individual, family, and neighborhood factors were associated with a cumulative sexual risk index and number of nonromantic partners during adolescence, providing information about which factors has an influence over and above that of others. In addition, one study examining the interaction of parent and neighborhood factors found that the impact of parental restriction of adolescent activities on sexual behavior was different depending on whether the adolescent lived in an advantaged or disadvantaged neighborhood, suggesting the importance of studying these factors together [22]. Person-centered methods like latent class analysis may be used to identify unique patterns of risk factors, as my collaborator and I have done in a recent article [74]. Seeing how profiles of risk factors are associated with later sexual behavior could help us understand the complex interplay of factors that influence sexual behavior and help to determine which groups of adolescents to target in intervention programs or public health initiatives.

Drawing from a normative developmental perspective [75], it is important to investigate positive outcomes, which have been less commonly studied than risk-focused outcomes. For example, there is a lack of discussion of pleasure in sexual and reproductive health research [76]. The young adult interviews in Add Health include topics like sexual enjoyment and satisfaction, liked sexual activities, orgasm, and relationship satisfaction. As reviewed above, several studies used these variables; however, there remains much to be understood about positive sexual experiences.

Another important area is understanding how characteristics of romantic relationships influence sexual behavior and physical, mental, and social health outcomes, as sexual behavior typically includes a partner. Research like that reviewed above has shown that relationship factors are important in predicting more positive perceptions and mental health outcomes linked to sexual behavior. Add Health has extensive data about individuals' romantic partners, including dyadic data from WI and WIII. However, relatively few studies have used these dyadic data to understand the intersections of couple characteristics and sexual behavior. These data are available to researchers who complete the process for obtaining contractual data. In addition, researchers can gain information on using and analyzing dyadic data from a number of sources including books [77] and tutorial papers on popular methods like the actor-partner interdependence model [78–81] and more novel methods like dyad-centered analyses [40].

Some Add Health studies have examined differences in sexual behaviors and their correlates by race and ethnicity. However, it

is important to expand on this work documenting between-group disparities and better understand heterogeneity within groups. Examining sexual behavior in racial and ethnic minority groups from a normative developmental perspective is of particular importance. One example is a pair of studies by Thorpe in which she and her colleagues have examined normative sexual experiences, such as expectations of pleasure and experiencing orgasm among Black women, a population whose sexuality has often been approached from a perspective of risk or deficiency [82,83]. Instead, her work has demonstrated how Black women's sexual relationships are marked by sexual agency and pleasure.

Add Health WV data are available in contractual and public use versions and include data on married, cohabiting, dating and sexual partners, sexual frequency, sexual satisfaction, and concurrent partnerships. Although these topics have been examined, few datasets have long-term prospective data that can examine early influences on adult sexuality or changes over the lifespan. Analyses that capitalize on repeated measurements over time could offer new insights. For example, I applied the time-varying effect model [84] to examine how correlates of sexual behaviors may differ across adolescence and young adulthood, finding that associations between substance use and multiple sexual partners were stronger earlier in adolescence [12]. Add Health data are well suited for this type of analysis because of the continuous coverage across a large age range (12–42 years). Such findings can inform public health efforts intended to target specific risk factors at different ages [85]. Building on this base of multiwave analysis will allow new insights into the developmental nature of sexual behavior and health.

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