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Adolescent Condom Use Consistency over Time: Global Versus Partner-Specific Measures

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Abstract

Background—The conundrum of measuring condom use consistency, particularly with adolescents, has left researchers with a cacophony of strategies, thereby limiting comparability and interpretation.

Objective—The aim of this analysis was to compare and contrast two measures of condom use consistency, global versus partner-specific, and their relationships with key covariates, using trajectory groups differentiated by stability of condom use consistency over three time-points.

Method—Using self-report data from sexually-active girls (ages 13-17 years) in a clinic-based intervention study aimed at lowering risk for early pregnancy, this analysis compared two measures of self-reported condom use consistency: 1) a global measure: overall condom use consistency in the past 6 months, and 2) a partner-specific measure: condom use consistency with the most recent sex partner in the last 6 months. Using a subjective rule-based approach, the adolescent girls in the study (N=151) were classified into trajectory groups representing their condom use consistency at three time-points (baseline, 6, and 12 months). Then, using bivariate methods, trajectory groups were compared on four baseline covariates (age, treatment condition, hormonal use in the last 6 months, number of sex partners in the last 6 months) and three time-

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varying covariates measured at baseline, 6, and 12 months (hormonal use stability, stability of primary sex partner, stability of number of sex partners).

Results—For the trajectory groups formed using the global measure of condom use consistency, stability of the primary sex partner differed significantly between trajectory groups. For the partner-specific trajectory groups, two baseline and one time-varying covariate relationships were significant: hormonal use in 6 months prior to baseline, number of sex partners in past 6 months (baseline), and stability of the primary sex partner (time-varying) with hormone use stability (time-varying) trending toward significance.

Discussion—The larger number of significant covariate relationships with the partner-specific trajectory groups suggests greater utility in assessing partner-linked behavior rather than a global measure. Despite limitations of the analytic strategy, this study sheds light on a measurement conundrum that has been an obstacle to comparing and contrasting indicators of condom use consistency during adolescence.

Self-reported condom use is a key variable in large scale surveys of health behaviors and in evaluation studies used to assess the impact of interventions focused on lowering health risk and improving sexual health outcomes. The importance of accurate condom use measurement within adolescent and young adult populations cannot be overstated, as information gleaned becomes a benchmark in setting public health goals, planning and evaluating programs, mobilizing advocacy efforts, and identifying resources for funding. In clinical settings, accurate condom use self-report is critical, as brief office interventions are tailored to information obtained from a young person's behavioral report.

Measurement of condom use encompasses a broad range of possibilities ranging from community and population-level activity (e.g. examining retail sales) to collecting individual biomarker data (e.g. detection of ejaculate, sexually transmitted infection in vaginal samples) (Catania, Gibson, Chitwood, & Coates, 1990; Rose et al., 2009). The most common mode for measuring condom use involves methods in which young people provide direct reports of their condom use through self-administered questionnaires (SAQ), computer-assisted self-interviews (CASI), daily health diaries, momentary sampling methods, and face-to-face interviews. Although adolescents are able to provide reliable self-reports of condom use and other sexual behaviors (Sieving et al., 2005; Younge et al., 2008), discordances in reporting are noted between modalities (McAuliffe, DiFranceisco, & Reed, 2007; Rose et al., 2009) and there is no consensus on which modality yields the most accurate data (Weinhardt, Forsyth, Carey, Jaworski, & Durant, 1998), As there is no gold standard with respect to validation of the self-report measurement approach, minimization of measurement error is essential (Catania et al., 1990; Sieving & Shrier, 2009; Younge et al., 2008).

From a measurement error perspective, the validity of adolescents' self-reported condom use may be affected by cognitive factors as well as by the situation in which assessment takes place. Adolescents' varying cognitive abilities can affect comprehension of self-report questions. In addition, the ability to recall sexual behaviors is affected by the length of the recall period, the frequency and complexity of behaviors, and the personal salience attributed to the behavior (Brener, Billy, & Grady, 2003; Catania et al., 1990; Geary, Tchupo, Johnson, Cheta, & Nyama, 2003). With solitary, infrequent, or salient experiences, such as first sexual intercourse, recall over a long period of time may be feasible. However, with increasing frequency of sexual activity, number of sexual partners, and variation in the type of sexual encounters, accurate recall of specific behaviors may be more difficult (Catania, et al., 1990; Brener et al., 2003). For example, sexually-active adolescents tend to be unreliable in their reporting of number of vaginal intercourse episodes over a 6-month period (Sieving et al., 2005).

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Young people's tendencies to distort self-report may be influenced by the adolescent respondent, the measurement instrument, and the interview context (Sieving & Shrier, 2009). Adolescents exist in a broad social structure stratified by age, gender, race, and class; these factors may be important mediators of self-presentation bias (Sieving & Shrier, 2009). Age likely affects self-presentation of behaviors in which social norms differ for younger versus older adolescents. Young people's concerns about investigator expectations, perceptions of peer behaviors, and sensitivity to social cues about acceptable behaviors may also influence self-report (Catania et al., 1990; Geary et al., 2003). Regarding instrumentation, questions about sensitive behaviors present particular challenges to honest self-disclosure and accurate self-presentation. Explaining terminology and framing questions using nonjudgmental and developmentally appropriate language may minimize bias (Catania, 1999; Sieving et al., 2005). Interview strategies, e.g., perceived lack of privacy, confidentiality, or anonymity, can pose substantial threats to honest self-disclosure. Evidence suggests that bias can be minimized using an interview mode, such as SAQ and CASI, that allows for more privacy than face-to-face interviewing (Catania et al., 1990; Brener et al., 2003; Sieving & Shrier, 2009). In sum, factors related to adolescents' cognition, study instrumentation, and data collection methods could result in under-reporting or over-reporting of sexual behaviors with subsequent misrepresentation of prevalence or change in these behaviors (Catania et al., 1990).

From a developmental perspective, a number of individual (e.g., self-efficacy, values, attitudes), relational (e.g., relationship duration, relationship type, partner communication), and contextual (e.g. access to condoms, adoption of hormonal contraceptive, substance use) factors may impact sexual behaviors and ultimately confound assessments of behaviors such as condom use. In a nationally representative sample of adolescents, Manlove, Ryan, and Franzetta (2007) identified several correlates of more consistent contraceptive use: prior contraceptive use, greater partner homogamy, more intimate and couple-like activities within a relationship, and better communication about sex with a partner. Perceptions of being in a romantic relationship have been negatively associated with contraceptive use consistency (Katz, Fortenberry, Zimet, Blythe, & Orr, 2001; Manlove et al., 2007). A more recent study found an array of relationship characteristics to be negatively associated with consistent condom use: controlling partner behavior, mistrust, jealousy, perceived partner inferiority, enmeshment, and perceived relationship importance in the context of increasing relationship duration (Manning, Flanigan, Giordano, & Longmore, 2009). Among adolescent women in clinic settings, condom use was found to be more likely in new versus established relationships (Fortenberry, Wanzhu, Harezlak, Katz, & Orr, 2002; Katz et al., 2000; Weimann et al., 2009). For those in first sexual relationships, having an older partner and a longer relationship have been associated with interruptions in contraceptive use (Manlove & Terry-Humen, 2007). Assessing only behaviors with a primary sex partner, Ott, Adler, Millstein, Tschann, and Ellen (2002) found adolescent females' condom use to be negatively correlated with hormonal contraceptive use and increasing age. In contrast, Crosby et al. (2007) did not see a reduction in condom use among adolescent girls using hormonal contraception.

As noted earlier, self-reported condom use can be obtained through different modalities. SAQ, the most common modality, is less expensive to use and may not feel as intrusiveness as face-to-face interviews (Catania et al., 1990; Sieving & Shrier, 2009). However, data quality may be limited by respondent literacy and investigator adeptness in using understandable terminology (Catania et al., 1990). Moreover, SAQ does not allow for follow-up on confusing responses (Catania et al., 1990; Weinhardt, Forsyth, Carey, Jaworski, & Durant, 1998). CASI, a now widely adopted survey method, increases privacy and allows for the use of branching; CASI with audio (audio-CASI or A-CASI) alleviates limitations of respondent literacy (Couper, Tourangeau, & Marvinet, 2009). Diaries permit

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collection of information over shortened time intervals, e.g. for each 24-hour time period, and behaviors may be recorded within hours of occurrence. Consequently, recall bias may be reduced with greater accuracy in the reported frequency and temporal sequence of specific behaviors, while also documenting greater detail regarding contexts for sexual behaviors (Catania et al., 1990; Katz et al., 2001). Keeping daily diaries requires effort and could involve recording sensitive information. Therefore, diary study participants may self-select and not represent a population of interest. Sexual behaviors may be reported with greater (Ramjee et al., 1999) or lesser (Coxon, 1999) frequency on diaries versus surveys. Respondents may fatigue from daily reporting, making inaccurate entries (Ramjee, Weber, & Morar, 1999). Face-to-face interviews can minimize non-response, and permit further probing of confusing or complex answers, correcting of misperceptions, and clarifying of meaning (Catania et al., 1990; Weinhardt et al., 1998). However, face-to-face interviews are more costly, less efficient, and may be influenced by respondent comfort or perceptions of interviewer characteristics (Catania et al., 1990; Weinhardt et al., 1998). Momentary sampling methods (e.g., cell phones, hand-held electronic devices), by permitting real time assessment of behaviors within a specific context, have significant advantage over traditional survey methods and daily diaries (Shrier, Shih, & Beardslee, 2005). Yet, momentary sampling has disadvantages. Frequent data collection increases respondent burden which may adversely affect retention and adherence. Moreover, it requires the purchase and maintenance of electronic data collection devices (Sieving & Shrier, 2009).

Within study modalities (e.g. SAQ, CASI, face-to-face interviews), assessments of condom use consistency vary. The most commonly used referents are condom use over a given time period (e.g., “How often in last [time period: 2 weeks, 2 months, 6 months] did you use a condom?”), condom use on specific occasions (e.g., use at first or last intercourse), measures of condom non-use (e.g., number of times condom is used subtracted from number of intercourse events), proportional measures of consistency of condom use (e.g., number of intercourse events with a condom divided by the number of intercourse events), and composite indices of condom use that combine absolute and proportional measures (Graham, Crosby, Sanders, & Yarber, 2005; Noar, Cole, & Carlyle, 2006). Assessments vary by length of recall period; strategies to improve respondent recall capabilities include use of cues and calendars (Graham et al., 2005).

With increasing recognition that consistency of condom use varies between partners, measuring condom use specific to each sex partner is becoming more common (e.g., condom use in reference to casual versus steady partners) (Graham et al., 2005). In a recent review, Noar et al. (2006) concluded that condom use measurement has improved in a number of ways, including better measurement types and recall periods, greater specificity to sexual acts, and increased assessment of test-retest reliability, social desirability, and condom use skills. However, use of varied methods presents challenges in comparing findings across studies, in deciphering which questions produce the most accurate answers, and in identifying interventions most likely to increase condom use and reduce sexual risk (Noar et al., 2006).

Although a significant body of literature documents varied approaches to assessing condom use, few studies have compared global versus partner-specific measures of condom use consistency and their relative ability to capture their associations with changes in related behaviors, such as changes in hormonal use, primary partner, and number of sex partners, that are so prevalent during adolescence. Using data from a clinic-based youth development intervention study designed to reduce health risk behaviors linked to early pregnancy in a high-risk sample of adolescent girls, the purpose of this study was to model condom use consistency across three waves of data using two self-report measures of condom use consistency. Using global (condom use consistency in the past 6 months) and partner-

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specific condom measures (condom use consistency in the past 6 months with most recent primary partner) to create trajectories of condom use consistency, we sought to answer the question: Is one measure versus the other more associated with variables expected to be related to condom use consistency? In demonstrating the capacity of a particular measure to capture changes in behavior over time, the groundwork is laid for better uniformity of adolescent condom use consistency measurement across observational and intervention studies as well as in clinical settings.

Methods

Setting and Sample

All the adolescent girls in the sample were enrolled in a clinic-based youth development intervention trial, called *Prime Time*, aimed at precursors of teen pregnancy including sexual risk behaviors, violence involvement, and school disconnection (Sieving, Resnick et al., in press). *Prime Time* was conducted in two community-based clinics and two school-based clinics in Minneapolis and St. Paul, Minnesota. The multifaceted intervention strategy involved one-on-one case management, peer leadership, and service learning over an 18-month period. Sexually-active 13-17 year-old girls who met one or more of five risk criteria were invited to participate in the study. These criteria included: clinic visit involving a negative pregnancy test, clinic visit involving treatment for sexually transmitted disease, high risk sexual and contraceptive behaviors, violent behaviors, and/or behaviors indicating school disconnection. Behavioral risk criteria were assessed through a 20-item self-report screening instrument (Sieving, Resnick et al., in press). Girls who were married, pregnant, or parenting were excluded from this study. Of the 1,434 girls who completed the screening tool, 571 (39%) met eligibility criteria; of these, 253 (44%) agreed to participate and provided written informed consent (Sieving, McMorris et al., in press). The Institutional Review Boards of the University of Minnesota and participating clinics approved all study protocols.

After obtaining consent, baseline data were gathered using A-CASI methods and girls were randomized to study conditions; the current analysis used those assigned to both intervention (n=126) and control (n=127) groups. At baseline, 6 months, and 12 months, girls completed surveys with questions about demographics, sexual behavior, and contraceptive use. Attrition was minimal, retaining 96% of the eligible sample by the 12-month survey (Sieving, McMorris et al., in press).

To be included in the current analysis, girls had to have completed self-report A-CASI surveys at baseline, 6 months, and 12 months, answered items about condom use consistency, and been sexually active at all three time-points. A total of 185 girls (73% of the original sample of 253) met these criteria. This initial sample of 185 represented diverse race/ethnicity groups; the highest number (43%) were Black/African/African American followed by those reporting multiple races/ethnicities (21%), Asian/Asian American/Pacific Islander (14%), White/European American (10%), Hispanic/Latina (10%), or American Indian (2%). At baseline, nearly two-thirds (64%) had lived in the same home for the 6 months prior; almost half (47%) lived with one parent only and 42% lived with both parents. Close to half (47%) indicated that their families were receiving public assistance. Almost one in five (19%) had changed schools within the past year (not related to transitions between elementary, middle, and senior high school) and another 17% had changed school ≥ 2 times in the previous year. Only 4% (n=8) were not in school at baseline.

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Measures

All data were provided by answering questions on A-CASI. Research staff trained in A-CASI administration oriented study participants to the computer survey with several non-sensitive trial items. To minimize self-disclosure bias, data were collected in locations offering privacy and research staff routinely assured participants of the confidentiality of their responses. Reliability of each of the condom use consistency measures described below has been detailed elsewhere (Sieving et al., 2005).

Global condom use consistency—Dichotomizing condom use consistency is an approach recommended by Noar and colleagues (2006) in a review of condom use measurement across 56 studies of sexual risk behavior. In this study, global condom use consistency was a girl's estimate of the frequency with which condoms were used during sexual intercourse with all partners over the 6-month period prior to data collection. All girls were asked: "How often in the past 6 months did you use a condom?" Five response options were used: 1 = *never*, 2 = *less than half the time*, 3 = *half the time*, 4 = *more than half the time*, and 5 = *every time*. Responses were dichotomized to reflect little/no use (responses 1-3) versus most/every time use (responses 4-5) at baseline, 6-month, and 12-month time-points.

Partner-specific condom use consistency: Respondents also indicated whether or not they used a condom in the previous 6 months with their most recent partner and then subsequently answered questions about frequency of use with this sexual partner. Information for each of the prior 6 months was collected using a monthly calendar embedded in the A-CASI instrument. For each month, responses were 1 = *never*, 2 = *some of the time*, 3 = *most of the time*, and 4 = *every time*. The number of months a participant reported using condoms most of the time or every time (responses 3-4) she had sex with her most recent partner were counted. The total 6-month count was divided by the number of months the participant reported having sex with this partner, resulting in a U-shaped distribution ranging from 0 to 1, reflecting the proportion of months in which girls used condoms consistently. Using an empirical approach described by Crosby et al. (2004), we compared the small number of girls reporting inconsistent use with their most recent partner (the bend in the U-shaped distribution) to non-users and consistent users and determined that inconsistent users looked similar to girls who reported no condom use on a range of descriptive variables (i.e., age, race/ethnicity, attitudes towards birth control, number of male sex partners in the past 6 months, length of sexual relationship with most recent partner, condom use self-efficacy, sexual communication with partner). Therefore, a dichotomous variable was created in which 1 = *consistent condom use with most recent partner* (or, proportion = 1) and 0 = *consistent nonuse of condoms with most recent partner* (proportion < 1). Thus, the partner-specific measure was directly comparable to the global condom measure.

In identifying covariates, we first considered group assignment, i.e., treatment or control group, and participant age at the time of the baseline survey. Second, we examined relationships with several key variables conceptually related to condom use consistency, as described above. The set of covariates employed in this study included both measures that may associate with condom use consistency at study baseline (referred to as baseline covariates) as well as measures that may predict stability (or change) in condom use consistency over the three survey time-points (referred to as time-varying covariates).

Hormonal use (baseline and time-varying)—The first of two measures of hormonal use, *baseline hormonal use*, was a dichotomous indicator contrasting whether or not a participant used some method of hormonal birth control (i.e., birth control pills, the Depo-

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Provera shot, Orthro Evra, or the Nuva-Ring) during the past 6 months as reported on the baseline survey. The second measure, *hormonal use stability* (a time-varying covariate), represented whether girls used some form of hormonal contraception in the 6 months prior to *each* of the three survey points.

Number of sex partners (baseline and time-varying)—For *number of sex partners at baseline*, girls were asked how many males they had vaginal sex with during the last 6 months on the baseline survey. A second time-varying measure was created to reflect having one partner (albeit not necessarily same partner) at all three survey time-points, i.e., *stability of number of sex partners*. Girls who reported only having one male sex partner at each time-point were coded as 1; all others were coded as 0.

Stability of primary sex partner (time-varying)—*Stability of primary sex partner* was the consistency with which a respondent named the same primary sexual partner at multiple waves of data collection. Respondents provided initials for the first and last names of their primary sexual partner in the previous 6 months, as well as age of partner, dates of first and last intercourse, and type of relationship with the partner. Coding of primary partner stability was based on matching this identifying information across time periods. Primary partner stability was scored 1 when identifying information for the primary partner matched at all three periods and was scored 0 otherwise.

Data Analysis

Processes for determining trajectory analysis approach—Trajectory of condom use consistency is the pattern of reported consistency as determined at multiple time-points. Two approaches are available for the creation of trajectory groups: statistical modeling and subjective classification rules. Statistical modeling, completed within programs such as SAS or M*Plus*, uses a formal statistical structure to determine the placement of individuals into groups based on patterns of change over time. To create trajectory groups using subjective classification rules, researchers place individuals into groups based on identifiable, pre-determined characteristics. Both methods were considered during the analytic process and the decision to use subjective classification rules to determine our trajectory groups was based on several factors.

First, the sample size was relatively small with only three points in time with which to observe change. Second, condom use consistency, for both measures, was conceptualized and operationalized as a dichotomous variable rather than continuous, interval, or ordinal. This strategy captured our conceptualization of condom use consistency as a “type” or group of girls who are consistent versus inconsistent and/or non-users (the creation of these groups is detailed below) rather than a continuum of use or a compilation, over time, of a single, repeated behavior. Although software programs have the capability of modeling trajectories of categorical outcomes, the availability of only three time-points and a small sample size limited our ability to determine multiple distinct trajectory groups. Only a finite number of trajectories are possible when a dichotomous outcome is measured at three time-points (2^3 = 8 trajectory groups).

One other factor determined our final analytic plan. Initial analysis revealed considerable lack of within-person variability in condom use consistency among our study participants, whether measured globally or specific to the most recent partner. Most likely this stability in our outcome variables, along with all the factors detailed above (dichotomous outcomes, small number of time-points, and small sample) contributed to model convergence problems when trying growth curve-based statistical approaches to identify latent groups.

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Formation of trajectory groups—Considering the constraints detailed above, subjective classification rules were used to create trajectory groups based on self-reported measures of global and partner-specific condom use consistency at three data collection points, i.e., baseline, 6 months, and 12 months. Study participants were classified into five trajectory groups for each of the condom use consistency measures, i.e., global and partner-specific. With "1" representing condom use every or most of the time and "0" representing no or little use, the following groups were created: stable use (1,1,1; baseline, 6 months, 12 months, respectively); stable non-use (0,0,0), change toward use (0,0,1 or 0,1,1); change toward non-use (1,0,0 or 1,1,0), and an unstable change group (1,0,1 or 0,1,0). The number and percent in each of these five trajectory groups varied, depending on whether the global measure or the partner-specific measure was used to assign participants to groups. Table 1 shows the distribution of participants in the five trajectory groups as a cross-tabulation between the two measures of condom use consistency. For 65% (n = 120) of girls, trajectory group assignment did not vary by measure used for classifying participants (bolded cells; e.g., 26 girls were classified in the stable use trajectory group on both measures). The remaining 65 girls (36%) were assigned to different trajectory groups based on their self-reported condom use consistency for the global measure versus their most recent partner, at any of the three time-points.

As noted in Table 1, when group assignment was determined by the global measure, 13 participants were classified as having *unstable change* (1,0,1 or 0,1,0) over time; for partner-specific group assignments, 28 showed unstable change over time. Seven participants were classified in the unstable change group for *both* of the two outcome measures – global and partner-specific. However, because the two trajectory patterns defined as unstable (1,0,1 or 0,1,0; V or inverted V for the dichotomous outcome measures -- a common distribution for condom use measures as reported by Crosby, et al., 2005) represent distinct patterns of behavior, it would be difficult to discern patterns of relationships between the covariates and these *unstable change* trajectory groups. [Note: Empirically comparing the groups with these two patterns, using a screening analysis laid out by Crosby et al. (2004), it was found that they were too heterogeneous to combine into one group representing unstable change for either variable. In addition, there were too few of these girls, especially as measured by global condom use, to include as separate groups of unstable desirable and unstable undesirable change.] Therefore, this 5th group classified as *unstable change* in condom use consistency was omitted from bivariate analyses to eliminate the possibility of confounding relationships. This elimination reduced the final sample to 151 participants.

Final analytic plan: The goal was to determine, for which measure of condom use consistency (global versus partner-specific), were covariates better able to distinguish between patterns of change and stability in this behavior over three time-points. Tests for significant relationships between baseline and time-varying covariates and condom use consistency trajectory groups were conducted using Pearson's Chi-square for cross-tabulations and F-test for ANOVAs. SPSS v.14.0 was used for the analysis. Nominal p-values of .05 were used.

Results

Descriptive Findings

Table 2 provides descriptive statistics for the covariates for the 151 girls in the final sample. The mean age for participants was 15.7 years, SD = 1.05. With random group assignment, equal sized treatment and control groups were expected. Close to two-thirds of the girls used hormones at baseline, however, over time, 61% changed hormone use status (from use to non-use or non-use to use) at each consecutive wave of data collection. In terms of

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consistency of primary sexual partner at each point in time, two-thirds named a different primary partner in consecutive waves. Although the range of number of sexual partners in the 6 months prior to baseline varied from 1 to 7 (girls reporting no sexual partners were ineligible to participate in the study), the majority (63%) reported only one sexual partner. However, at least once during the three waves of data collection, 60% reported that they had more than one sexual partner in the previous 6 months.

As noted in Table 3, the largest trajectory group reported "little or no" condom use at all three waves (0,0,0; 36% and 42%, respectively, for global and partner-specific trajectory groups). The second largest trajectory group reported condom use "every/most" of the time at all three waves (27% and 21%, respectively, for global and partner-specific trajectory groups).

Bivariate Findings

Relationships between condom use consistency trajectory groups and the continuous covariates measured at baseline are presented in Table 3. Relationships between trajectory groups and dichotomous covariates are presented in Figures 1-4.

Global condom use consistency trajectory groups—Six of the bivariate relationships for the trajectory groups classified using the global condom use consistency measure were non-significant: 1) baseline covariates including age, intervention group, number of sexual partners in the last 6 months (Table 3), and hormonal use in the last 6 months (Figure 1), and 2) time-varying covariates including hormonal use stability (Figure 2) and stability of number of sex partners (Figure 4), i.e., having only one sex partner at baseline, 6 months, and 12 months. The only significant relationship with global condom use consistency trajectory groups was the time-varying covariate, stability of primary sex partner, i.e., having the same primary sexual partner at baseline, 6 months and 12 months (p =.023). Smaller percentages of girls in the *stable use* and *change to use* trajectory groups reported the same primary sex partner at the three time-points as compared to percentages in the *change to non-use* and *stable non-use* groups (Figure 3). In other words, staying with the same primary partner over time was significantly associated with trajectories leading to condom non-use.

Partner-specific condom use consistency trajectory groups—Most bivariate relationships between the covariates and the partner-specific trajectory groups were significant, as shown in Table 3 and Figures 1-4. As anticipated, both age and the intervention group (treatment or control) covariates were non-significant. However, three of the covariates expected to be related to condom use consistency were significant: number of sex partners in the past 6 months (reported at baseline; p=.023), baseline hormonal use (*p*=. 034), and the time-varying covariate, stability of primary sex partner (p=.007). An additional covariate trended towards significance: hormonal use stability (p=.088). Specifically, groups reporting consistency of condom use at baseline (*stable use* and *change to non-use*) had the highest number of baseline sexual partners (Table 3; M = 1.69 and 2.0 partners, respectively, versus M = 1.47 and 1.32 partners for groups reporting non-use at baseline). In addition, smaller percentages of girls in the *stable use* and *change to use* trajectory groups reported using hormonal methods in the 6 months prior to baseline as compared to percentages in the *change to non-use* and *stable non-use* groups (Figure 1). In addition, a greater percentage of girls in the *change to non-use* trajectory group reported hormonal use at each of the three survey points (i.e. hormonal use stability) as compared to other trajectory groups (Figure 2). A smaller percentage of girls in the *change to use* group reported the same primary sex partner at the three time-points as compared to other trajectory groups (Figure 3). The only

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covariate for which significance was anticipated but not found was having only one sex partner at baseline, 6 months, and 12 months (Figure 4).

Discussion

This analysis of two measures for assessing condom use consistency (global and partner-specific) among a group of sexually active 13-17 year olds afforded the opportunity to examine the strength of relationships between theoretically-selected baseline and time-varying covariates with patterns of consistency of condom use over time (baseline, 6, and 12 months). Based on reported condom use consistency at three points in time for each of two measures (global- and partner-specific), trajectories of condom use consistency were created using a subjective rule-based approach. All bivariate analyses utilized four condom use consistency trajectory groups as the outcome variable: *stable use; stable non-use; change to use*; and *change to non-use.*

Covariate Relationships

Based on extant evidence and consistent with current understanding about sexual behavior in adolescents, all covariates, with the exception of treatment group and age, were expected to be significantly associated with condom use trajectories. The near equal number of girls in the treatment and control groups reflects the success of random assignment in the intervention trial from which these data were drawn and assures that it did not confound the other bivariate relationships examined in this analysis. Likewise, age of study participants at baseline did not confound other bivariate relationships in this study. Condom use at most recent intercourse generally declines with age (Centers for Disease Control and Prevention [CDC], 2010). Also consistently documented is that the younger the adolescent at sexual debut, the less apt they are to use any contraceptive method (Mosher & Jones, 2010; Ford, Sohn, & Lepkowski, 2001). In contrast, condom use is highest among those who are ages 16-17 at sexual debut (Mosher & Jones, 2010; Manlove et al., 2007). In this analysis, rather than examining relationships between age, age at sexual debut, and condom use consistency reported at one point in time, we focused on age and longitudinal trajectories of condom use consistency. Age of the adolescent girls was not related to stability of condom use consistency over time.

Two hormonal use covariates were analyzed in relation to condom use consistency trajectory groups: baseline use and stability of use over time. Only for the partner-specific trajectory groups were relationships with these measures of hormonal use significant or trending towards significance. Among adolescents, the adoption of a hormonal method typically corresponds with reduction in condom use (Ott et al., 2002; Bearinger & Resnick, 2003; Sieving, et al., 2007). Findings for the partner-specific trajectory groups supported this dynamic, i.e., girls in the *stable use* and *change to use* trajectory groups were least likely to report hormone use at baseline while girls in trajectory groups leading to non-use of condoms over time were most likely to report hormone use at baseline. Similarly, those who reported a decrease in condom use consistency use over time, in regard to their most recent sex partner, were most likely to report stable hormonal use over time.

Across adolescence, the stability of a relationship with a primary sex partner is a powerful influence on condom use decision-making with that partner as well as with any concurrent sex partners (Fortenberry et al., 2002; Manlove & Terry-Humen, 2007; Manning et al., 2009; Weimann et al., 2009; Macaluso et al. 2000). Operationalized as a dichotomous variable, i.e., girls who nominated the same primary sex partner at each of three time-points versus those who did not, our findings showed a significant relationship between primary sex partner stability and condom use consistency trajectory groups as determined by both the global and the partner-specific measures. In that this is one of the most reoccurring patterns

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in the literature, it might be expected that this covariate would be associated with both measures of condom use consistency. The significant relationship between stability of a primary partner and global condom use consistency trajectories suggests the powerful impact of primary partner stability on all aspects of decision-making about condom use, beyond the primary sex partner.

One survey item was used to create two covariates relating to the number of vaginal sex partners of study participants. The first covariate tested the relationship between number of sex partners reported in the 6 months prior to baseline and the trajectory groups; the relationship was significant for the partner-specific but not the global trajectory group. Those in the *stable use* group had a higher number of partners at baseline than those in the *stable non-use* group. However, those in the *change to non-use* group had a greater number of partners at baseline than any other group. The second covariate using this item examined the impact of the stability of number of sex partners over time, i.e., those who indicated only one partner in the 6 months prior to each of the survey time-points were compared to those who indicated more than one partner at any of the study intervals. There are several possibilities as to why this stability covariate was non-significant for both trajectory groups. Perhaps the actual difference in number of partners between the two groups (those with only one partner vs. those with more than one at each of three time-points) was not enough to 'activate' the dynamic by which teens are more likely to change their condom use in response to having a greater number of partners. In the sample for this study, the mean number of sex partners in the 6 months prior to the baseline survey was 1.58 with an SD of 1.06, and although the range was 1-7 partners, only 9 of the 151 girls had ≥ 4 partners. Or, it is possible that, during the 6-month time-period assessed by this item, there were two or more sex partners in serial monogamy. In such a case, each successive partner relationship might have been perceived to be in an established relationship and, therefore, low risk (Fortenberry et al., 2002). Finally, in that condom use decisions vary by partner, it could be that with a greater number of partners there is more opportunity to inconsistently use condoms (Manlove et al., 2007).

Global versus Partner-Specific Measures

A comparison of significant covariate relationships with the two trajectory groups formed by classifying study participants according to responses to global and partner-specific measures provides an opportunity to interpret the relative merits of the two methods for measuring condom use consistency in an adolescent population. For the global trajectory groups, only one covariate relationship was significant: the stability of a primary sex partner over the three time points. In contrast, four of the covariates had relationships with the partner-specific trajectory groups that were significant or trended towards significance: hormonal use in the last 6 months (baseline); hormonal use stability (time-varying); stability of primary sex partner (time-varying); and number of sex partners in the last 6 months (baseline). Similar to the work of Wiebe et al. (2003) who examined the "comparative responsiveness of generic versus specific quality-of-life instruments," our findings suggest greater capacity of the partner-specific measure to tap into a behavior, condom use consistency, hypothesized to be associated with variables expected to change that behavior, i.e., stability of partner, number of sexual partners, and hormonal use.

The implications for these findings are three-fold. First, the analysis provides insight regarding decisions around measurement strategies for assessing condom use consistency, whether for purposes of evaluating a health promotion intervention or determining country-level changes in adolescent sexual behavior. Particularly when the need is to observe change in a behavior such as condom use, in which multiple factors are simultaneously influencing decisions and actions, there is great value in using the most responsive measure. Second, these implications are applicable to clinical practice in which brief, focused patient

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assessments should ideally pursue interview questions most apt to identify risk or threats to health. Based on these findings, adolescents should be queried on their condom use consistency with a specific partner rather than being asked about their use of condoms in general. Third, in this analysis, the simultaneous testing of these two measures, assessed over three time-points, permitted the formation of parallel trajectory groups. Thus the analysis was able to offer insight into the capacity of these measures for use in studies seeking to evaluate health promotion interventions focused on improving condom use consistency. In each of these applications, our findings suggest that focusing on partner-specific behavior, rather than a global measure of condom use consistency, will more accurately assess change and determine stability.

Limitations

Several aspects of the dataset limited analysis. As detailed above, the small sample with data from only three time-points combined with limited within-person variability of condom use consistency over time for both global and partner-specific measures narrowed analytic options. The total number of adolescent girls in the *Prime Time* randomized intervention trial was 253 youth; for this analysis, the full sample was narrowed to 185 based on inclusion criteria and completion of all items related to key variables. Finally, elimination of the unstable trajectory groups resulted in a final sample of 151. Consequently, bivariate analysis using a subjective rule-based approach to identifying condom use consistency trajectory groups as compared to a statistical approach may have constrained potential analyses and interpretation. A larger sample with more time-points and great within-person variability in the outcome measures would have made this feasible.

Implications for trajectory approaches to understanding condom use consistency

One of the core aims of health promotion research is to capture the process of change – before, during, and after an intervention. Thus, methodological approaches for examining change must incorporate multiple waves of data and use measures sensitive to changes in the behavior being observed. Together, they are the *sin qua non* of intervention research. Given these two essential elements, the opportunity for modeling trajectories follows. In this analysis, the sample size, limited number of data collection points, and lack of within-person variability in condom use consistency meant that we could not utilize statistical modeling to form trajectory groups, yet the findings inform next steps for examining change in condom use consistency. Significance of key covariates in this analysis affirms that reliable relationships found in studies employing a single outcome point apply when trajectories of condom use consistencies are the focus. Moreover, this study, tests the responsiveness of global versus partner-specific measures of condom use consistency as the basis for forming trajectory groups, albeit derived with a subjective rule-based approach. The next step in confirming optimal measures of condom use consistency for understanding change would be the use of statistical modeling to form trajectory groups. Doing so would allow for moving beyond bivariate analysis to simultaneously test covariates in ways that account for measurement error. In other words, the statistical modeling approach adds a capacity for describing patterns of repeated observations, in our case, self-report of condom use consistency, while incorporating coefficients, a kind of latent variable, that together assess the fit of a model to the data (Fitzmaurice, Laird & Ware, 2004). This level of sophistication in modeling self-reported behaviors in adolescent populations characterized by change will advance the capacity to understand processes by which adolescents adopt safer sexual behaviors. Furthermore, such a statistical modeling approach would improve capacity to examine the impact of health promotion interventions designed to reduce sexual risk outcomes such as pregnancy or sexually transmitted infections during adolescence.

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Conclusion

Examining two longitudinal approaches for measuring condom use consistency in relation to a set of empirically related covariates in a multi-wave sample of sexually active adolescent girls provided a unique opportunity for analyzing the relative merits of global versus partner-specific measures. Some covariates revealed significant associations with condom use trajectories, others did not. However, significant bivariate relationships demonstrated overall greater responsiveness of the partner-specific measure of condom use consistency. Despite its limitations, this analysis sheds light on a measurement conundrum that has been an obstacle to comparing and contrasting indicators of condom use consistency during adolescence when change epitomizes their development, their behavior, and their relationships.

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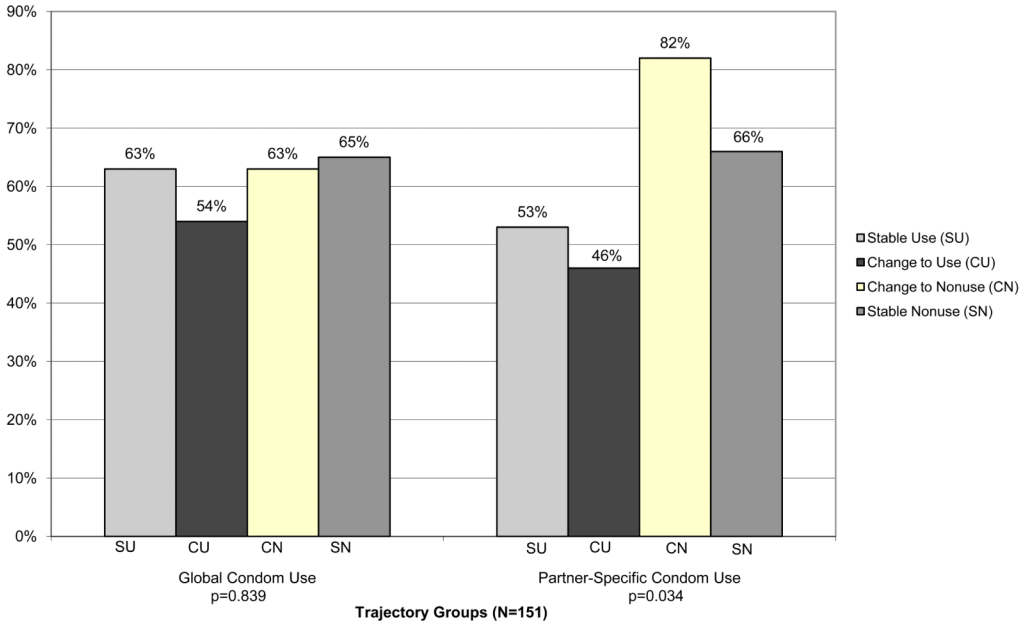

Figure 1. Baseline Hormonal Use

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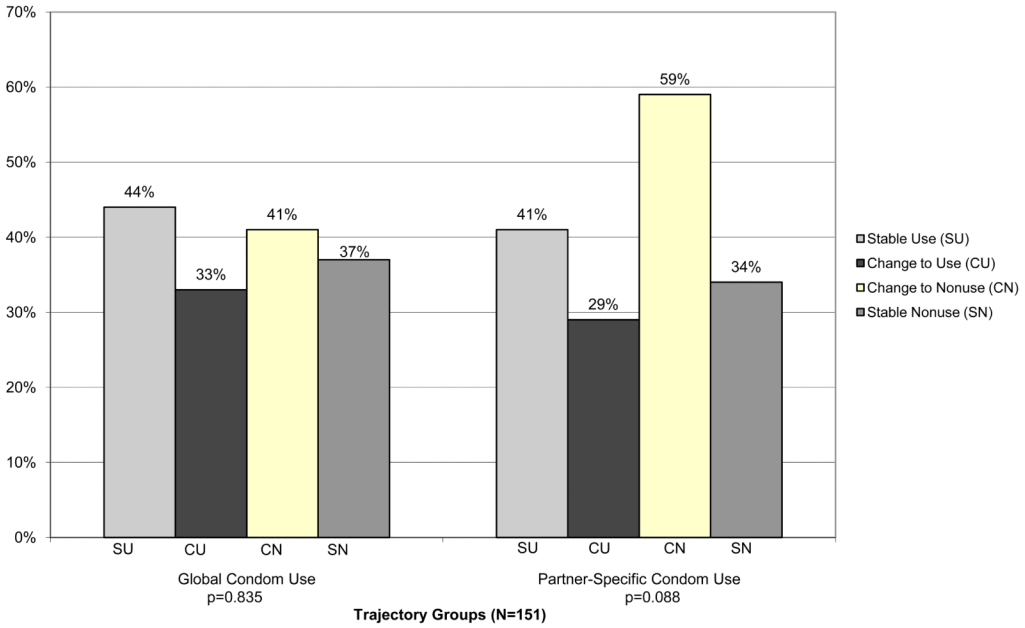

Figure 2. Hormonal Use Stability

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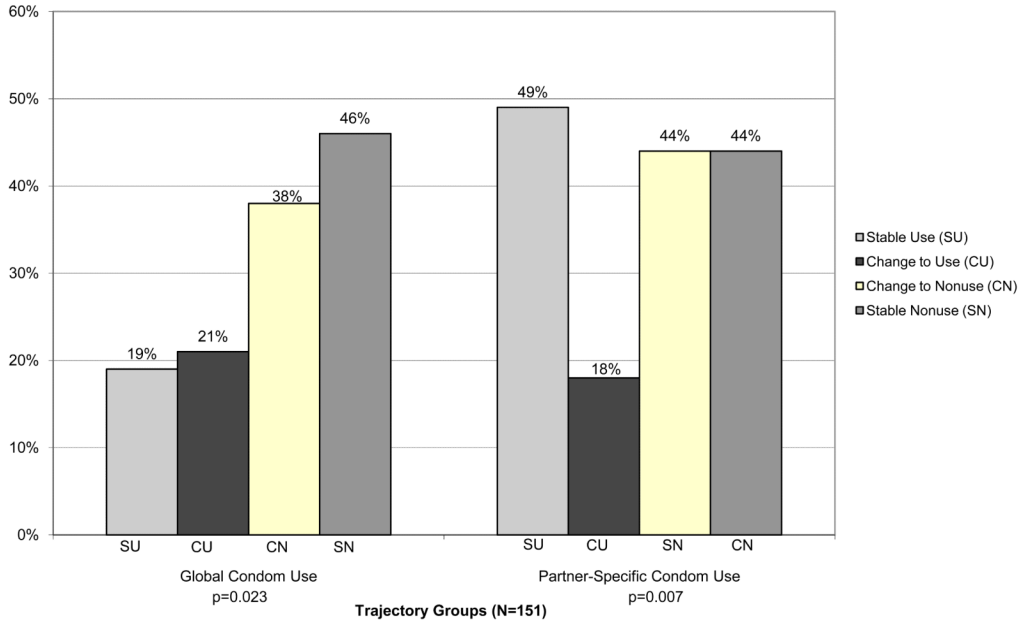

Figure 3. Primary Partner Stability

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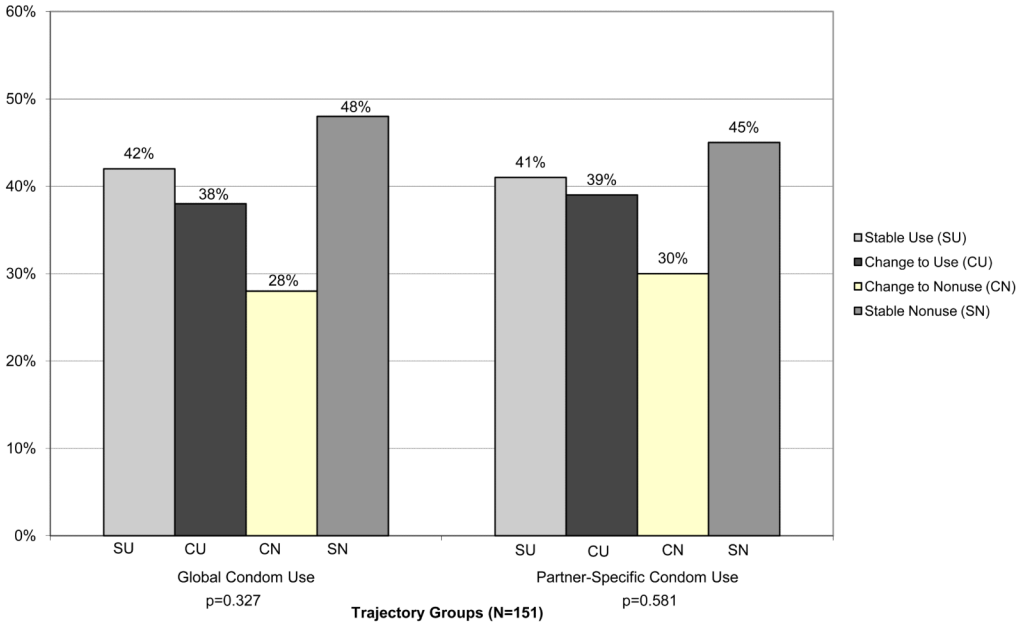

Figure 4. Stability of Number of Sex Partners

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Table 1

Trajectory Groups Defined by Condom Use Consistency (N = 185)

	Global Condom Use					
Partner-Specific Condom Use	**Stable use**	**Stable non-use**	**Change to use**	**Change to non-use**	**Unstable change**	**Total**
Stable use	**26**	0	4	2	1	33
Stable non-use	3	**50**	2	9	1	65
Change to use	9	1	**17**	1	4	32
Change to non-use	3	3	1	**20**	0	27
Unstable change	5	0	2	14	**7**	28
Total	46	54	26	46	13	185

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Table 2
Descriptors of Final Analytic Sample (N=151)

Covariate Measures	N	%
Intervention condition (baseline measure)		
Treatment	74	49
Control	77	51
Age (baseline measure)		
13 years	1	1
14 years	22	15
15 years	39	26
16 years	47	31
17 years	42	28
Hormonal use in last 6 months (baseline measure)	94	62
Hormonal use stability		
Used hormonal method at baseline, 6, and 12 months	59	39
Did not use hormonal method at baseline, 6, and/or 12 months	92	61
Same primary sex partner at baseline, 6, and 12 months	50	33
Number of sex partners in last 6 months (baseline measure)		
1 partner	95	63
2 partners	28	18
3 partners	19	13
4 partners	5	3
5 partners	1	1
6 partners	1	1
7 partners	2	1
One sex partner at baseline, 6, and 12 months	61	40

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Table 3

Relationships between Continuous Baseline Covariates and Trajectory Groups

Baseline Covariates	Condom Use Consistency Trajectory Groups (N=151)									
	Global Use					Partner-specific Use				
	Stable use	Stable non-use	Change to use	Change to non-use	P value	Stable use	Stable non-use	Change to use	Change to non-use	P value
Trajectory group assignment: n(%)	41(27%)	54(36%)	24(16%)	32(21%)		32(21%)	64(42%)	28(19%)	27(18%)	
Age					0.606					.260
Mean age in years	15.59	15.83	15.79	15.59		15.47	15.86	15.54	15.81	
Standard deviation	0.99	1.02	1.22	1.04		1.05	0.97	1.23	1.00	
Number of sexual partners in last 6 months					0.656					.023
Mean number of partners	1.59	1.71	1.44	1.47		1.69	1.47	1.32	2.00	
Standard deviation	0.97	1.36	0.71	0.78		0.87	0.84	0.58	1.80	