

# Weekly variations in feelings of trust predict incident STI within a prospective cohort of adolescent women from a US city

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## ABSTRACT

**Objectives** Feelings of intimacy, perceptions of partner concurrency (PPC) and perceptions of risk for an STD (PRSTD) are meaningful and dynamic attributes of adolescent sexual relationships. Our objective was to examine whether variations in these STI-associated feelings and perceptions predicted incident *Chlamydia trachomatis* and/or *Neisseria gonorrhoeae* infection within a prospective cohort of urban adolescent women.

**Methods** A cohort of clinic-recruited women aged 16–19 completed daily surveys on feelings and risk perceptions about each current sex partner on a smartphone continuously for up to 18 months. Urine was tested for *C. trachomatis* and *N. gonorrhoeae* every 3 months. Daily responses were averaged across the week. As overall means for trust, closeness and commitment were high, data were coded to indicate any decrease in feelings from the previous week. PRSTD and PPC were reverse coded to indicate any increase from the previous week. An index was created to examine the cumulative effect of variation in these feelings and perceptions. Generalised linear models were used to account for correlation among repeated measures within relationships.

**Results** For each week that there was a decrease in trust, there was a 45% increase in the risk of being infected with an STI at follow-up (relative risk (RR) 1.45, 95% CI 1.18 to 1.78,  $P=0.004$ ). Neither a decrease in closeness or commitment, nor an increase in PRSTD or PPC was associated with an STI outcome. Cumulatively, the index measure indicated that a change in an additional feeling or perception over the week increased the odds of an STI by 14% (RR 1.14, 95% CI 1.02 to 1.29,  $P=0.026$ ).

**Conclusions** A decrease in feelings of trust towards a main partner may be a more sensitive indicator of STI risk than PRSTD, PPC or commitment. The next generation of behavioural interventions for youth will need strategies to address feelings of intimacy within adolescent romantic relationships.

Romantic and sexual relationships contribute to healthy adolescent development, yet relationships also confer risk.<sup>1</sup> Relationships are a common context for transmission of the STIs that occur at high rates among adolescents and young adults.<sup>2</sup> In particular, perceptions of a partner's behaviours—such as believing the partner has

other partners—drives risk perception and protective behaviours such as condom use.<sup>3,4</sup> However, relationships are not exclusively focused on potential health risks, and relationship qualities such as feelings of intimacy are also key determinants of both adolescent risk perception and condom use.<sup>5</sup> Adolescents consider intimacy as an essential feature of an ideal romantic relationship.<sup>6,7</sup> Moving towards intimate relationships is a key developmental task of late adolescence<sup>1</sup> and having an intimate partner is highly valued by adolescents.<sup>8</sup>

Intimacy is most often characterised as containing elements of trust, closeness and commitment.<sup>9,10</sup> However, feelings of trust, closeness and commitment have been found to be inversely associated with condom use.<sup>11,12</sup> Adolescents report lower levels of condom use in partnerships characterised by trust and commitment.<sup>9,10</sup> Main partnership classifications (eg, boyfriend, steady partner, exclusive) signify the importance of the relationship and reflect levels of commitment and trust within the relationship.<sup>10,11,13</sup> Cessation of condom use within a relationship may signal advancing levels of intimacy in a relationship and serve to confirm intimacy by their absence.<sup>14</sup>

Despite its centrality in sexual and romantic relationships, adolescents' experiences of intimacy are not well understood. Intimacy is usually conceptualised as a static relationship quality,<sup>15</sup> rather than one subject to variability of feelings, interactions and circumstances. Using daily data collected from adolescent and young women, our prior work demonstrates that trust and closeness are dynamic and variable within adolescent relationships.<sup>16</sup> While adolescents overall report strong feelings of trust and closeness for a partner, there are significant day-to-day fluctuations in these feelings. In contrast, partner-specific perception of STI risk was found to be stable within a relationship. We hypothesised that fluctuations in feelings of intimacy are a more sensitive indicator of condom use and STI acquisition than a single static measure of intimacy.

The objective of this study, then, was to predict adolescent women's incident *Chlamydia trachomatis* or *Neisseria gonorrhoeae* infections based on daily variations in intimacy, perceptions of partner concurrency and STI risk perception. We hypothesised that changes in feelings of trust and closeness for a partner would more strongly predict



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incident STI than changes in perceptions of partner concurrency or STI risk perception. In order to capture the true extent of the variability, we used daily reports of partner-specific STI risk perception, perception of partner concurrency and feelings of trust, closeness and commitment.

## MATERIALS AND METHODS

A detailed description of methods and cohort characteristics for the Perceived Risk for Sexually Transmitted Diseases (PRSTD) study has been published previously.<sup>16</sup> The study procedures are described briefly below.

### Study population

A prospective cohort of adolescent women was recruited from a hospital-based adolescent medicine clinic, a public STD clinic and community venues in Baltimore, Maryland, USA. Adolescent women were enrolled between December 2009 and August 2010. Eligibility criteria included age 16 to 19 years, sexually active defined as having vaginal or anal intercourse with an opposite sex partner in the preceding 3 months, English-speaking and residence in the Baltimore metropolitan area. Sixty-two per cent (122/196) of eligible women agreed to participate. There were no differences in demographic or behavioural characteristics between participants and non-participants, with the exception of lifetime number of sex partners. Non-participants reported a greater mean lifetime sexual partners than participants (5.5 vs 2.0, respectively,  $P < 0.05$ ). The Johns Hopkins University Institutional Review Board approved the study protocol (NA\_00017298).

### Procedures

Participants completed an audio computer-assisted self-interview (ACASI) at baseline and every 3 months. Daily questionnaires were completed using a Palm Centro smartphone continuously for 18 months. Every day, adolescents reported on their partner-specific feelings and perceptions. Participants entered the nickname or initials of each of their current sex partners. Partner initials were confirmed at regular intervals to ensure the same partner was followed over time. Participants' urine samples were collected at each quarterly follow-up interview and tested for *C. trachomatis* and *N. gonorrhoeae* using nucleic acid amplification test (NAAT).<sup>17</sup> Participants received a voice and text plan as remuneration for completing the daily diaries and US\$25 for each ACASI interview.

### Measures

For each partner named on a given day, participants were asked, "How close do you feel toward him today?", "How much do you trust him today", "How committed do you feel to him today?" and "If you were to have sex with him today without using a condom, how likely are you to get an STD from him?". Possible responses were not at all, not very, somewhat and very, which we quantified on an ordinal scale represented from 1 (low) to 4 (high). PRSTD response options were a five-item Likert scale (not at all likely, not very likely, somewhat likely, very likely, extremely likely). Our measure of perceived partner concurrency (PPC) was "How certain are you about whether he has other sex partners?" with response of extremely, very, a little and not much. If participants reported having sex with this partner on a given day, they were then asked "Did you use a condom?" with response of yes or no.

### Statistical analysis

Incident STI, defined as testing positive for either *C. trachomatis* and/or *N. gonorrhoeae* at each quarterly follow-up visit, was the primary outcome of interest for this analysis. Cumulative incidence was determined by calculating the proportion of participants who tested positive for an STI out of the total number of participants who remained in the study and were tested at each quarterly follow-up period. Daily responses were averaged across the week. As means for feelings of trust, closeness and commitment were high in these relationships, data were coded to indicate any decrease in feelings from the previous week. PRSTD and PPC were reverse coded to indicate any increase in feelings from the previous week. In order to examine the cumulative effect of variation in these feelings and perceptions, we created an index measure by adding all the aforementioned variables together. Generalised linear models, specifically log-binomial regressions, were used to calculate risk ratios while accounting for the correlation among repeated measures within relationships.<sup>18</sup> These models are robust to both unbalanced and missing data.<sup>19</sup> All analyses were conducted using SAS (V.9.2; SAS Institute, Cary, North Carolina, USA).

## RESULTS

Participants completed a total of 4969 partner-specific diary entries. Participants completed daily diaries on a mean (SD) of 2.6 (2.4) unique sex partners over the 18 months of data collection.<sup>16</sup> Participant characteristics at baseline are shown in table 1. Participants were on average (SD) 18.4 (1.1) years old; 92% were African American. The mean (SD) age at first sex was

**Table 1** Baseline demographic and relationship characteristics of 122 female participants

Characteristic	Total sample	STI negative* (n=95)	STI positive* (n=22)	P value
Age in years, mean (SD)	18.4 (1.1)	18.4	18.4	0.94
African-American race, n (%)	112 (92)	93%	91%	0.78
Age at first sex, mean (SD)	13.9 (3.3)	13.8	14.0	0.80
Maternal education <high school, n(%)	79 (65)	67%	64%	0.74
Lifetime no of sexual partners, mean (SD); median	8 (11); 5	7.6	7.3	0.91
No of sexual partners in the past 3 months, mean (SD); median	2 (3); 1	2.0	1.9	0.86
Condom use at first sex with partner, n (%)	83 (73)	72%	81%	0.42
Condom use at last sex with partner, n (%)	53 (47)	44%	57%	0.27
STD history, n (%)	67 (55)	53%	68%	0.19
Length of relationship in months, mean (SD); median	17.5 (20.0); 13	17.8	17.5	0.97

\*Participants were tested for *C. trachomatis* and *N. gonorrhoeae* at baseline.

**Table 2** Unadjusted\* risk ratio (95% CI) of condom use and STI

	Risk ratio of condom use		Risk ratio of STI†	
	95% CI	P value	95% CI	P value
Trust	0.96 (0.84 to 1.11)	0.587	1.45 (1.18 to 1.78)	0.0004
Closeness	0.90 (0.77 to 1.05)	0.168	1.38 (0.98 to 1.96)	0.067
Commitment	0.92 (0.79 to 1.06)	0.229	1.23 (0.92 to 1.64)	0.159
Perceived partner concurrency	0.83 (0.67 to 1.01)	0.069	1.10 (0.86 to 1.40)	0.459
Perceived risk for STDs	0.93 (0.79 to 1.11)	0.419	1.33 (0.80 to 2.20)	0.274
Index	0.95 (0.88 to 1.02)	0.154	1.14 (1.02 to 1.29)	0.026

\*Inferences did not change after controlling for index concurrency or partner age difference >2 years.

†*C. trachomatis* and/or *N. gonorrhoeae* infection.

13.9 (3.3) years old. Sixty-five per cent of participants reported that their mother had less than or equal to a high school education. The mean (SD) number of sexual partners in the 3 months preceding the baseline interview was 2 (3), the mean (SD) number of lifetime sexual partners was 8 (11) and 55% of the sample reported ever having had an STD. Condom use at first and last sex with most recent main partner was 73% and 47%, respectively. The mean (SD) length of these relationships at baseline was 17.5 (20.0) months (median, 13 months) and ranged from 0 to 97 months. The period of time observed for each relationship (based on diary data) was on average (SD) 26.6 (21.0) weeks long and ranged from 1 to 79 weeks or average days=186 (SD 147); range, 2–550 days. There were no differences in demographic or relationship characteristics between participants who tested positive for *C. trachomatis* and/or *N. gonorrhoeae* infection at baseline (table 1), nor between those who tested positive at the 3-month follow-up visit (data not shown).

Table 2 presents the unadjusted risk ratio for the association between weekly changes in feelings of trust, closeness, commitment, perceived partner concurrency, perceived risk for an STI and condom use at next sex. There were no statistically significant associations between trust, closeness, commitment, perception of partner concurrency or perceived risk for an STI and condom use at next sex. Inferences did not change after controlling for index concurrency or partner age difference of greater than 2 years.

The STI incidence (*C. trachomatis* and/or *N. gonorrhoeae* infection combined) was 16% at 3 months, 17% at 6 months, 8% at 9 months, 13% at 12 months, 13% at 15 months and 4% at 18 months. Table 2 presents the unadjusted risk of having an incident STI at each quarterly follow-up visit. For each week that there was a decrease in trust, there was a 45% increase in the risk of being infected with an STI at follow-up (relative risk (RR) 1.45, 95% CI 1.18 to 1.78,  $P=0.004$ ). For each week that there was a decrease in closeness, there was a 38% increase in the risk of being infected with an STI at follow-up (RR 1.38, 95% CI 0.98 to 1.96,  $P=0.067$ ); however, this did not reach significance at  $P < 0.05$ . Neither an increase in PRSTD or PPC nor a decrease in commitment was associated with an incident STI outcome. The index measure created to examine the cumulative effect of variation in these feelings and perceptions found that a change in an additional feeling or perception that week increased the risk of an STI by 14% (RR 1.14, 95% CI 1.02 to 1.29,  $P=0.026$ ).

## DISCUSSION

Subjective relationship experiences have significant public health relevance, at least in terms of STI risk. Results of this study support our hypothesis that a decrease in feelings of trust towards a main partner was a more sensitive predictor of incident *N. gonorrhoeae* and *C. trachomatis* infection than STI risk

perception, PPC or relationship commitment. While aspects of intimacy (ie, trust, closeness, commitment) are related, we found that they are also distinguishable qualities. Weekly variations in trust emerged as the strongest predictor of incident STI infection; however, the data suggested that changes in feelings of closeness are also informative.

We did not find an association between weekly variation in trust, closeness, commitment or STI risk perception and condom use. Ewing and Bryan similarly did not find an association between trust and condom use.<sup>20</sup> These findings are not surprising given our understanding of how condoms are abandoned in main relationships.<sup>21</sup> Previous research has found that young women's decisions to have sex with a partner is based on trust and not health risks.<sup>14</sup> Finding that an increase in perceived partner concurrency was not associated with condom use may seem in contrast to expectations; however, it may support what some adolescents have reported in interviews that engaging in unsafe sex is used as a strategy to hold on to non-monogamous partners and reinforce intimacy in their relationship.<sup>22 23</sup>

Adolescents and young adults place great value on being in an intimate relationship.<sup>8 10 24</sup> Feelings of trust and closeness are associated with fidelity. If the goal is to maintain an intimate partnership, then there exists a real tension between the intimacy brought about by abandoning condom use within a relationship and the knowledge and awareness that a partner has other sex partners. Sex without a condom reinforces the trust, closeness and commitment to the relationship.<sup>25</sup> Preserving intimacy in the relationship may overshadow concerns for STI risk, as resuming condom use with a partner implies infidelity.<sup>26</sup>

However, the broader context in which these relationships take place move considerations of health behaviour beyond expectations of monogamy. In socioeconomically disadvantaged settings, adolescent and young adult women do not have the luxury of monogamy.<sup>22 23 25 27</sup> These young women have to reconcile their romantic ideal within a context of constrained resources, specifically, having to share partners because partners themselves are a limited resource. Young women adapt to these circumstances by trusting that their main partner will be respectful enough to hide side partners as well as use condoms with side partners.<sup>28</sup> In settings with limited resources, adolescents do not have many things to exchange, thus, it is logical that trust becomes a highly symbolic gesture and foundational for the maintenance of relationships. By extension, condoms become a physical symbol of this monogamy narrative, where use of condoms acknowledges a partner having other partners.<sup>22</sup> In these ways, trust represents both relationship security, where there is no risk to having unprotected sex, and a symbolic practice, where not requesting condom use avoids threatening the relationship.<sup>15</sup>

Much of our understanding on the role of trust, closeness and commitment on condom use comes from qualitative interviews with

adolescents. While trust has become a more prevalent construct in the literature with regard to STI testing and concurrency, it is rarely examined. The current study begins to quantify how feelings of trust and closeness are a barometer of both health behaviour and risk. A strength of this study is the longitudinal design, which provides the temporal ordering of feelings and perceptions and subsequent infection. Specifically, the daily data allowed us to quantify how variations in trust within a relationship are associated with STI risk. While there are many strengths to this study, findings should be interpreted in light of several limitations. A single item indicator was used to measure trust; however, we know that trust is multidimensional.<sup>29</sup> Future work would be well served to further unpack trust, with a particular eye towards understanding how adolescents come to understand the currency of trust despite limited relationship experience. Our intensive within-relationships data collection was balanced by a smaller sample size, which may have resulted in less precise effect estimates as well as limited our ability to stratify the data. While these are preliminary findings, they support a foundation, which establishes the importance of feelings of intimacy when designing STI/HIV prevention programmes for adolescents. Lastly, these data are from a clinic sample of women who tend to be at higher risk for STI compared with school-based or other non-care-seeking samples. However, we do not have reason to believe there are systematic differences in the association between feelings of intimacy and STI incidence for care-seeking versus non care-seeking youth. Our sample represents the population who bear the greatest burden of STI, African-American adolescents and young adults. We do not mean to suggest that our findings will be generalisable to suburban or rural African Americans or to youth of other race/ethnicities; however, our findings should be relevant to other African-American urban populations.

These data illustrate the importance of emotional aspects of adolescent relationships and that feelings of trust for a partner cannot be underestimated. These findings underscore the importance of understanding the context of adolescent romantic relationships and how the intrinsic value of relationships may undermine intervention and prevention efforts. The next generation of behavioural interventions should consider strategies that leverage these positive relationship attributes.

### Key messages

- ▶ Adolescents' experiences of intimacy are of great importance in their sexual and romantic relationships, but they are not well understood.
- ▶ A change in feelings of trust for a partner predicted incident STIs.
- ▶ The next generation of behavioural interventions should consider strategies that leverage positive relationship qualities.

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**Contributors** PAM and JME collaborated on the research question and study design. PAM, JME and SC chose the main directions for data analysis and interpreted results. PAM prepared the manuscript. SC performed the statistical analyses. CAG conducted the laboratory testing. JDF added to the interpretation of results and edited the manuscript. All authors commented on drafts and approved the final manuscript.

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