

Original article

Partner Age Not Associated with Recurrent *Chlamydia trachomatis* Infection, Condom Use, or Partner Treatment and Referral among Adolescent Women

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Abstract

Purpose: Among adolescent women, having older sexual partners has been associated with initial *Chlamydia trachomatis* (Ct) infection and high-risk behaviors. This study evaluates the role of older partners in the risk of three outcomes: recurrent Ct, lack of condom use, and nonadherence with partner management (PM) strategies.

Methods: Female participants aged 14 to 18 years enrolled in a randomized clinical trial of patient-delivered partner treatment (PDPT) with at least one follow-up visit were included in this secondary analysis. Patient- and partner-level data were collected at baseline, one, and four months follow-up. Generalized estimating equations (GEE) and logistic regression were used to examine unadjusted and adjusted associations.

Results: The majority of the 496 women were African-American (63.3%), aged 16 to 18 years (62.3%), and asymptomatic for Ct (66.7%). At baseline, all of the women had laboratory-demonstrated Ct and were treated; they had 622 partners during the last 60 days, 21.4% reported having more than one partner with a mean (SD) of 1.5 (.78) partners per woman, and 46.3% of the partners were at least three years older than the woman. Over follow-up, 16.1% of the women experienced Ct recurrence, in 41.9% of the partnerships a condom was not used at last sex, and 80.6% of women reported giving PM. After adjusting for confounders, having a partner at least three years older was not associated with increased risk of Ct recurrence, lack of condom use, or nonadherence to PM strategies.

Conclusions: Risk of Ct recurrence, lack of condom use, and nonadherence to PM strategies was not higher among adolescent women with older partners. © 2006 Society for Adolescent Medicine. All rights reserved.

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Recurrence rates of *Chlamydia trachomatis* (Ct) among adolescents are high, ranging from 6% to 21% within six months to a year after an initial Ct infection [1–14]. Repeat

infection with Ct is common and increases risk of sequelae (e.g., pelvic inflammatory disease, ectopic pregnancy). Several studies have identified index case risk factors that predispose to recurrent infections, including young age, black race, female gender, multiple or new sex partners, and poor adherence to treatment and condom use [3–8,10].

Older partner age has been considered a characteristic contributing to recurrent infection among adolescent women. A high proportion (7.4% to 53%) of adolescents

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attending sexually transmitted disease (STD) clinics, family planning clinics, and antenatal visits indicate that they have older sex partners (defined as ≥ 2 to ≥ 10 years older) [10,13,15–17]. Although several studies report that older partner age is associated with increased STD recurrence [7,10], this finding has not been consistent [8,14]. Methodological differences that may account for this lack of consistency include noncomparably defined age differences, inability to assess characteristics of sexual partners and partnership-level behavioral data, few data regarding characteristics of sex partners, sexual behaviors practiced with each partner or prospectively collected partner data [3,5–7,10]. In addition, the use of cross-sectional rather than longitudinal designs [8] may contribute to differences in findings. Cross-sectional studies [7,10] have found that older partner age is associated with a prevalent initial Ct, which may be due to incidence-prevalence bias. Unlike a cross-sectional study that includes prevalent as well as incident exposures (e.g., partner age) and outcomes (e.g., Ct recurrence), longitudinal studies assess subjects prospectively and allow focus on incident exposures and outcomes. Further, cross-sectional studies allow wider timeframes to be investigated; prevalent and incident infections and exposures are included rather than only incident ones. This study allowed comparison between cross-sectional (i.e., baseline) and prospective data to explore this discrepancy.

The purpose of this secondary analysis was to evaluate associations between older partner age (at least three years older) and three outcomes among a cohort of adolescent women participating in a study of partner management (PM): recurrent Ct, lack of condom use, and nonadherence to PM strategies (delivery of patient-delivered partner treatment [PDPT] or partner self-referral materials [SRM]). The hypotheses under study were that women with older partners would be more likely to have recurrent Ct, and less likely to use condoms or provide PM strategies to partners than those without older partners.

Methods

Study design

Data used in this secondary analysis were collected as part of a multicenter randomized controlled clinical trial to evaluate the efficacy of PDPT for Ct, the methods and findings of which have been detailed elsewhere [2]. Briefly, Ct-infected women aged 14 to 34 years were enrolled from five clinics in the United States at the time of a confirmed, uncomplicated urogenital chlamydial infection. All women were treated and then randomized to receive either PDPT or SRM for their sexual partners. Women in the PDPT arm were given single doses of azithromycin to deliver to up to four sex partners. Women randomized to receive SRM were asked to inform partners that they had been exposed to Ct and were given informational materials to deliver to sex

partners regarding how to get treatment. Women were evaluated for Ct infection by nucleic acid amplification test of urine (LCR or PCR) at one and four-month follow-up visits, and discontinued from study if found to have Ct at the one-month visit. At each visit, women provided clinical and sex partner-specific data for the interval since their last clinic visit. Data regarding PM given to partner(s) were obtained through self-report of the index woman; it was not possible to determine actual treatment status of partners.

Women aged 14 through 18 years at baseline who attended at least one follow-up visit and had at least one sexual partner within 60 days of enrollment were eligible for this analysis. Of the 677 age-eligible women in the parent clinical trial, three ($< 1\%$) were excluded due to an invalid birth or visit date and 131 (19.4%) were excluded because they had no follow-up. There were no significant differences between women with and without follow-up with respect to age, race, number of partners, or age difference between partners.

Three outcomes were evaluated: (a) recurrence with Ct, (b) self-report of condom use at last sex by sex partner, and (c) self-report of whether the woman complied with the PM strategy to which she was randomized (PDPT or SRM) by sex partner. For adherence to PM strategy, partners acquired after the baseline visit were excluded, as they would not have been given either PM strategy.

The primary predictor of interest for this secondary analysis was having a partner at least three years older than the woman. This age difference was selected from a review of literature [7,8,10,13–17]. Age differences of two, five, and 10 years were also analyzed for the recurrence outcome to evaluate possible effects that other cutoffs could have. Static baseline characteristics included in models were symptom status, arm to which randomized, woman's age, and residence in the South. Time-dependent covariates included in the models were partner age, partner race, partner race concordance, number of sex partners, new partners, and condom use at last sex; these were allowed to change at each visit. Sex partners were hand-matched over time using an algorithm that considered name, age, and race to match partners over the duration of follow-up.

The study protocol, informed consent documents, and analyses were approved by each institution's institutional review board.

Data analysis

Univariate and bivariate analyses were performed to describe the sample and identify confounders; multivariable methods were used to evaluate adjusted associations and predictive models. Chi-square analysis was done to assess unadjusted associations between having an older partner at baseline and outcomes of interest cross-sectionally. Generalized estimating equations (GEE) were used to assess associations between independent variables and the outcomes

Ct recurrence and condom use at last sex. Logistic regression was used to assess adherence to PM strategy. Ct recurrence was analyzed by woman; condom use at last sex and PM adherence were analyzed by partnership. GEE allowed analysis of associations between the primary predictor (older partner age) and Ct recurrence and condom use, after adjusting for confounders and the effect of time; it also allowed reduction in variance attributable to the intra-woman correlation between the three visit time-points [18–20]. Clustering was based on woman rather than partnership because the majority of women had only one partner, but all women had at least two visits, thus reducing more overall variance. An independent correlation structure and robust estimators of variance were used; parameter estimates were exponentiated to provide odds ratios (OR) and confidence intervals (CI). Exact time was used in the model as the time variable, as well as the risk at each visit. A χ^2 Goodness-of-Fit test was used ($\alpha = .15$) to evaluate the logistic regression model's fit.

Multivariable models were developed by conducting a bivariate screening procedure; variables that were moderately associated ($p < .25$) with the outcomes were eligible for inclusion in the model. A backward stepwise procedure was then used, with significant ($\alpha = .05$) variables as well as known confounders and predictors of interest left in the model. After the final models were selected, potential confounders were re-entered into the model and the model checked for alteration ($> 5\%$) in the coefficients, to ensure that residual confounding was not missed. All two-way interactions were assessed for significance. Stata Software, Version 8.0SE (Stata Corporation, College Station, Texas) was used for analysis.

Results

Of the 496 women included in this analysis, the majority were African-American (63.3%), 16 to 18 years old (62.3%), and asymptomatic at baseline (66.7%). The mean age for women at study entry was 16.8 years (SD 1.17, range 14 to 18 years). At baseline, 19.2% reported a previous Ct infection, 8.1% reported a previous *Neisseria gonorrhoeae* infection, and 1.8% reported a previous case of clinical pelvic inflammatory disease.

Baseline characteristics of partners and partnerships

Characteristics of partners and partnerships are displayed in Table 1. The 496 women reported 622 male partners over the previous 60 days and 21.4% reported having more than one partner (mean [SD] partners per woman of 1.5 [.78]). The majority of partners were African-American (68.9%) and of concordant race (72.8%). The mean age for partners at baseline was 19.50 years (median 19 years, SD = 2.99, range 14 to 39 years) and the mean age differences between women and their partners was 2.77 years (SD = 2.75, range -2 to 22 years); 46.3% of the partnerships were between

subjects and partners at least three years their senior. Women reported that a condom was not used at last sex in 41.9% of the partnerships. During follow-up, 15.1% of the women acquired at least one new partner.

Looking only at cross-sectional baseline data, women who already had at least one older partner at baseline differed from their counterparts at baseline in that they were more likely to have had a prior Ct infection (24.6% vs. 16.4%, $p < .05$), to be concerned about violence in the partnership (5.9% vs. 2.9%, $p < .05$), to acquire another older partner during follow-up (63.9% vs. 7.7%, $p < .001$), and to characterize baseline relationships as steady (85.6% vs. 59.5%, $p < .001$).

Recurrence

During follow-up, 16.1% of the women experienced at least one Ct recurrence. Approximately 9% of women were infected with Ct at one-month follow-up and, of those negative at one-month follow-up who returned at four months, 14.9% were infected. Table 2 displays unadjusted comparisons between women with and without a recurrent Ct infection over the duration of follow-up. Having a partner at least three years older at baseline was not associated with any of the outcomes after adjusting for confounders in multivariable analyses, as indicated below.

Table 3 displays unadjusted and adjusted findings for the outcome of Ct recurrence. Having a partner at least three years older was not significantly associated with recurrence in either unadjusted or adjusted models. After adjusting for woman's age, partner race, symptomatic status at baseline, condom use, number of sex partners, and region, being a younger woman (OR 1.94, 95% CI 1.08–3.46) and time (OR 1.85, 95% CI 1.02–3.34) were associated with increased risk of recurrence. Partner-subject age differences of two, five, and 10 years were also assessed, with no associations found.

Condom use at last sex

Older partner age was not associated with condom use on bivariate or multivariable analyses. Women reported using condoms at 56.7% of their last sexual encounters (55.8% at baseline and 57.6% reported during follow-up period). Baseline reports of condom use at last sex were similar among partnerships with and without older partners, 55.9% vs. 55.7%, respectively ($p > .90$). Table 4 displays findings for the outcome of self-reported condom use at last sex. Having a partner at least three years older at baseline or over follow-up was not significantly associated with condom use in either unadjusted or adjusted models. After adjusting for partner and index age, partner and index race, and time, variables associated with condom use included having a new partner (OR 1.82, 95% CI 1.20–2.76), having more than one sex partner (OR 1.82, 95% CI 1.04–3.18), and living in the South (OR 1.84, 95% CI 1.05–3.21), whereas being symptomatic at the baseline visit

Table 1
Characteristics of Chlamydia-infected adolescent women (n = 496), partners and partnerships (n = 622) at baseline

	n (%)
Demographic characteristics of adolescent women at baseline (n = 496)	
Race	
African-American	314 (63.3)
White	109 (22.0)
Hispanic	22 (4.4)
Other (Asian/Pacific Islander, American Indian, Don't know or refused)	51 (10.3)
Age	
14 to ≤ 16 years	187 (37.7)
> 16 to 18 years	309 (62.3)
Mean age (SD)	16.8 (1.17)
Location	
New Orleans	164 (33.1)
Seattle	155 (31.3)
Birmingham	81 (16.3)
Southern California	61 (12.3)
Indianapolis	20 (4.0)
Arm to which randomized	
Partner self-referral materials (SRM)	267 (53.8)
Patient-delivered partner treatment (PDPT)	229 (46.2)
Clinical characteristics of adolescent women at baseline (n = 496)	
Symptomatic for Chlamydia	185 (37.3)
Previous Chlamydia (self-report)	95 (19.2)
Previous gonorrhea (self-report)	40 (8.1)
Previous PID (self-report)	9 (1.8)
Behavioral characteristics of adolescent women at baseline (n = 496)	
Number with > 1 partner last 60 days	106 (21.4)
Mean number of sex partners reported in last 60 days (SD)	1.5 (0.78)
Had at least one steady partner at baseline	342 (68.9)
Ever had new partner during follow-up	75 (15.1)
Follow up by visit	
1 month	347 (70.0)
4 month	241 (48.5)
Characteristics of partners at baseline (n = 622)	
Race	
African-American	422 (67.8)
White	82 (13.2)
Hispanic	63 (10.1)
Other (Asian/Pacific Islander, American Indian, don't know or refused)	55 (8.8)
Race	
African-American	422 (68.9)
Non-African-American	200 (32.1)
Race of partner same as woman	453 (72.8)
Partner's age	
≤ 18 years	369 (59.3)
> 18 years	253 (40.7)
Mean partner age (SD)	19.5 (2.99)
Range of age (years)	14 to 39
Age difference between partners and women	
< 3 years difference	334 (53.7)
≥ 3 years difference	288 (46.3)
Mean age difference years (SD)	2.77 (2.75)
Range of age difference (years)	-2 to 22
No condom use last sex act	261 (41.9)

Table 1
Continued

	n (%)
Characteristics of relationship (collected only at baseline)	
Steady	441 (70.9)
Live with partner	49 (7.9)
Have a child with partner	49 (7.9)
Married to partner	3 (.5)
Hard to talk about medication with partner	210 (33.8)
Concerned relationship will change	150 (24.1)
Self-reported giving PM (at visit 2 only)	295 (80.6)
Concerned about violence	40 (6.4)

was associated with decreased reporting of condom use (OR .61, 95% CI .39–.95). There was no change in self-reporting of condom use over time.

Adherence to partner management strategies

Partner age was not associated with adherence to PM strategy on bivariate or multivariable analyses. Women with older partners were similar to those without older partners with respect to reporting that they carried out the PM strategy (77.7% vs. 83.4%, $p > .16$). African-American women carried out their assigned PM strategy more than non-African-American women (85.2% vs. 74.9%, $p < .05$), and women with concordant race partners carried out their assigned PM strategy more than women with discordant race partners (84.5% vs. 70.6%, $p < .01$). Women with more than one sex partner at baseline were less likely to report having conducted the assigned PM strategy (56.4% vs. 84.8%, $p < .001$), as were women who had recurrence at the one-month follow-up visit (67.7% vs. 81.9%, $p < .05$). Women who reported using a condom at last sex at baseline were less likely to report that they adhered to PM strategy (76.4% vs. 86.9%, $p < .02$). Results from the multivariable analysis are displayed in Table 4. After adjusting for partner age and time, having more than one sex partner (OR .28, 95% CI .19–.65), condom use at last sex (OR .49, 95% CI .22–.94), and getting a new sex partner (OR .14, 95% CI .07–.28) were associated with decreased reporting that the assigned PM strategy had been conducted.

Discussion

This study found that although adolescent women with older partners were more likely to report a history of Ct anytime before study enrollment, they were no more likely than women with similar-aged partners to become reinfected with Ct prospectively. In addition, adolescent women with older partners at the baseline visit were neither more nor less likely to report condom use, or to carry out the assigned PM strategy for their partners. Although women with older partners were more likely to report a previous Ct infection cross-sectionally, when longitudinal data were examined, these women did not have a higher likelihood of Ct

Table 2
Unadjusted characteristics associated with Chlamydia recurrence among adolescent women at least once over duration of follow up (n = 496)

	Ct recurrence	
	No n = 416 n (%)	Yes n = 80 n (%)
Characteristics of woman		
Reported partner ≥ 3 more years than woman at baseline		
No	258 (81.6)	58 (18.4)
Yes	158 (87.8)	22 (12.2)
Ever had partner ≥ 3 more years than woman over follow up		
No	275 (82.1)	60 (17.9)
Yes	141 (87.6)	20 (12.4)
Race		
African-American	266 (84.7)	48 (15.3)
Non-African-American	150 (82.4)	32 (17.6)
Age		
14 to ≤ 16 years	153 (81.8)	34 (18.2)
> 16 to 18 years	263 (85.1)	46 (14.9)
Symptomatic for Chlamydia		
No	251 (81.8)	56 (18.2)
Yes	161 (85.3)	24 (14.7)
Live in the South (New Orleans or Birmingham site)		
No	207 (82.4)	44 (17.6)
Yes	209 (85.3)	36 (14.7)
In steady relationship at baseline		
No	78 (85.7)	13 (14.3)
Yes	337 (83.6)	66 (16.4)
Reported > 1 partner last 60 days at baseline		
No	338 (86.7)	52 (13.3)
Yes	78 (73.6)	28 (26.4)**
Any partner same race as woman		
No	96 (76.8)	29 (23.2)
Yes	320 (86.3)	51 (13.7)*
Ever had new partner over follow-up		
No	349 (83.1)	71 (16.9)
Yes	67 (89.3)	8 (10.7)
Ever reported no condom use		
No	288 (83.2)	58 (16.8)
Yes	128 (85.3)	22 (14.7)
One or more partners with whom it was hard to talk		
No	329 (83.5)	65 (16.5)
Yes	87 (85.3)	15 (14.7)
One or more partners with whom subject concerned relationship will change		
No	328 (82.8)	68 (17.2)
Yes	78 (86.7)	12 (13.3)
One or more partners with whom subject was concerned about violence		
No	405 (83.5)	80 (16.5)
Yes	11 (100.0)	0 (0.0)

* $p < .05$; ** $p < .01$.

Table 3
Unadjusted and adjusted ORs (95% CI) between selected characteristics and recurrence of *C. trachomatis* (n = 496)

	Unadjusted OR ^a (95% CI)	Adjusted OR ^b (95% CI)
Partner's age		
< 3 years older	1.00	1.00
≥ 3 years older	.85 (.71–1.02)	.85 (.49–1.44)
Woman's age		
> 16 to 18 years old	1.00	1.00
14 to 16 years old	1.25 (1.03–1.53)*	1.94 (1.08–3.46)*
Partner's race		
White	1.00	1.00
African-American	1.27 (1.03–1.56)*	1.91 (.96–3.77)
Race of partner dyad		
Discordant	1.00	—
Concordant	.94 (.76–1.17)	—
Symptomatic at baseline		
No	1.00	1.00
Yes	2.84 (2.08–3.86)**	1.60 (.81–3.17)
Number of sex partners		
One	1.00	1.00
More than one	2.05 (1.49–3.86)**	2.13 (1.05–4.34)*
New partner		
No	1.00	—
Yes	.89 (.51–1.57)	—
Condom use last sex act		
No	1.00	1.00
Yes	.89 (.71–1.12)	.64 (.37–1.09)
Arm to which randomized		
SRM	1.00	—
PDPT	1.15 (.95–1.38)	—
Provided PM to partner		
No	1.00	—
Yes	.59 (.26–1.35)	—
Live in the South (New Orleans or Birmingham site)		
No	1.00	—
Yes	1.18 (.99–1.42)	—
Visit ^c		
Visit 2 (1 month)	1.00	1.00
Visit 3 (4 month)	2.39 (1.51–3.81)**	1.85 (1.02–3.34)*

^a Analysis was conducted using GEE, 496 women, with 1293 visits (range 2–3 per subject), reporting a total of 622 baseline plus 198 new partnerships, for a total of 820 partnerships over study follow-up. Independent correlation matrix used. Clustered on woman, with unit of analysis as the partnership.

^b Adjusted for all other variables listed in column.

^c For the analysis of the outcome of recurrence, visit 2 was used as a reference group rather than baseline, because all women were infected at baseline. Exact time of visit was used in the model, but is represented here as the associated visit. Note that risk between visit 2 and 3 represents a 3-month risk, not risk from baseline.

* $p < .05$; ** $p < .001$.

SRM = self-referral materials; PDPT = patient-delivered partner treatment; PM = partner management; GEE = generalized estimating equations.

Table 4

Unadjusted and adjusted ORs^a (95% CI) between selected characteristics and condom use at last sex (n = 622) and self-report of partner management strategy implementation (n = 347)

	Condom use at last sex (n = 622) ^a		Providing PM (n = 347) ^c	
	Unadjusted OR (95% CI)	Adjusted OR ^b (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI) ^b
Partner's age				
< 3 years older	1.00	1.00	1.00	1.00
≥ 3 years older	.95 (.74–1.22)	.81 (.55–1.18)	.69 (.41–1.15)	.85 (.46–1.58)
Woman's age				
> 16 to 18 years old	1.00	1.00	1.00	—
14 to 16 years old	1.13 (.86–1.47)	1.19 (.81–1.75)	.79 (.44–1.39)	—
Woman's race				
White	1.00	1.00	1.00	—
African-American	1.76 (1.35–2.28)***	1.39 (.68–2.84)	1.94 (1.12–3.36)*	—
Partner's race				
White	1.00	1.00	1.00	—
African-American	1.67 (1.27–2.19)***	1.38 (.71–2.66)	1.23 (.71–2.12)	—
Race of partner dyad				
Discordant	1.00	—	1.00	1.00
Concordant	1.45 (1.08–1.96)*	—	2.27 (1.26–4.09)**	2.04 (.96–4.34)*
Symptomatic at baseline				
No	1.00	1.00	1.00	—
Yes	.71 (.55–.91)**	.61 (.39–.95)*	.91 (.42–1.96)	—
Number of sex partners				
One	1.00	1.00	1.00	1.00
More than one	1.18 (.89–1.56)	1.82 (1.04–3.18)*	.23 (.12–.46)***	.28 (.19–.65)**
New partner				
No	1.00	1.00	1.00	1.00
Yes	1.99 (1.35–2.93)***	1.82 (1.20–2.76)**	.17 (.09–2.29)***	.14 (.07–.28)***
Arm to which randomized				
SRM	1.00	—	1.00	1.00
PDPT	.89 (.69–1.16)	—	.53 (.29–.95)*	.45 (.22–.94)*
Live in the South (New Orleans or Birmingham site)				
No	1.00	1.00	1.00	1.00
Yes	1.52 (1.17–1.98)**	1.84 (1.05–3.21)*	.53 (.29–.95)*	.59 (.31–1.13)
Condom use at last sex				
No	—	—	1.00	1.00
Yes	—	—	.49 (.27–.86)*	.49 (.22–.94)*
Visit				
1 (baseline)	1.00	1.00	1.00	1.00
2 (1 month) ^d	1.67 (.83–1.37)	1.14 (.83–1.57)	2.38 (1.31–4.33)**	1.64 (.73–3.70)
3 (4 month) ^c	1.09 (.82–1.45)	.92 (.67–1.49)	—	—

SRM = self-referral materials; PDPT = patient-delivered partner treatment; GEE = generalized estimating equations.

^a Analysis was conducted using GEE, 496 women, with 1293 visits (range 2–3 per subject), reporting a total of 622 baseline plus 198 new partnerships, for a total of 820 partnerships over study follow-up. Independent correlation matrix used. Clustered on woman, with unit of analysis as the partnership.

^b Adjusted for all other variables listed in the column.

^c Analysis was conducted using unadjusted logistic regression, clustered on woman, with unit of analysis as the partnership.

^d Provision of PM only collected at study visit 2.

* $p < .05$; ** $p < .01$; *** $p < .001$.

recurrence over time. Our findings echo those of others [13,14] who have found that older partner age is not associated with incident Ct infection in prospective studies.

The difference in findings between this study and previous cross-sectional studies may be attributable to study design. This study suggests that associations between older partner age and Ct infection in cross-sectional studies may be an artifact of incidence-prevalence bias and not a true association between partner age and recurrence. In this study, the baseline visit

reflects a cross-sectional evaluation of women attending clinics and suggests that, cross-sectionally, women with older partners may differ from those without when looking at combined prevalent and incident exposures and outcomes. This may reconcile the discrepancy between the findings of Kissinger et al [14] and Begley et al [7]. Women with older partners may be more likely to seek care in a clinic or require antenatal care, resulting in the finding that women with older partners are more likely to be infected with Ct. Prospectively, however,

women with older partners were no more likely to have Ct recurrence than those with same-age partners.

Within the limited age range we studied (14 to 18 years), young age (14 to 16 years) was associated with an increased risk of Ct recurrence. This is consistent with those of other investigators; explanations for the association between incident Ct infection and young age include the biologic susceptibility of younger women to Ct due to cervical ectopy [1,3–5,9,12], increased rates of sex partner change, and lower rates of correct and consistent condom use.

This study has several limitations. We were unable to link 19.9% of partners over time. Women not reporting partner data may be more likely to be reinfected by older partners, although there were no significant differences on known variables between women with and those without missing partner data. Selection bias is a potential problem. Women who attended at least one follow-up visit may represent a different group of patients than those who did not return for any follow-up; the latter group may be at increased risk of infection and may also be more likely to have older partners. Although we found no difference in women with and without follow-up with respect to partner age at baseline, it is possible that those who dropped out were more likely to subsequently acquire older partners and had higher rates of recurrence, which we could not assess. Unfortunately, this bias is unavoidable, as the outcome of interest could only be measured among women with follow-up. Our study did not allow distinction between new and persistent infections because some women did not have an interval visit at which they could be documented to be uninfected. However, because persistence is not likely to be associated with having an older partner, this is not likely to be a confounder. One key limitation is this study's short follow-up time. This study was intended to answer the parent randomized controlled trial's research question and not the question of partner age, and thus did not extend to a time frame, such as six months, that would have better answered this research question [1–14]. Other limitations include the exclusion of women who attended the baseline visit with their partners (which may mean that women least likely to adhere were included in a nonrepresentative fashion) and use of self-report to assess partner age and the behavioral outcomes of interest, including most notably whether or not the partner was treated for Ct. These limitations are also unavoidable, as the study was designed to examine short-term reinfection from original sex partner, and self-report was the only practical way to measure condom use and communication of information to sex partners. As these data are from a randomized controlled clinical trial, the treatment status of the women was analyzed and treated as other covariates. Because this is an observational sample selected on criteria other than that of the parent clinical trial, the resulting sample represents nonrandom allocation of treatment. Due to these limitations, results should not be used to evaluate the originally randomized treatment and

should be interpreted with caution. Findings from this study may not be generalizable to the population of women who would not meet the eligibility requirements of the study.

This study has several strengths, including its prospective design and use of GEE, which incorporates repeated evaluations of patients, time-dependent covariates, and changes in partners. That demographic, clinical, and behavioral data were collected on both the patient and partner levels at each of three time-points makes this study especially strong in evaluating the associations of interest. This study had 80% power to detect a 1.6-fold or higher difference in risk of recurrence attributable to having a partner at least three years older, suggesting that it is unlikely we missed an association due to small sample size.

This study explored the role of older partners in recurrent Ct among adolescent women. Although it does not appear that having older partners predisposes adolescent women to recurrent Ct or negative health behaviors, this age group remains particularly vulnerable to Ct and other STDs. Systematic counseling about the importance of STD screening, adherence to treatment, empowering and teaching women to use condoms, and partner referral and treatment continue to be essential. The Centers for Disease Control Treatment Guidelines [21] recommend repeat screening among women diagnosed with a Ct infection. Although our findings suggest that young women with older partners are no more or less likely to be infected at repeat screening, it is essential to promote partner treatment and continued screening for individuals of all ages at risk for Ct.

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