

Concurrent sexual partnerships facilitate the transmission of STDs. However, social and population determinants of concurrent partnerships are not well-understood. Using data from the U.S. National Longitudinal Survey of Adolescent Health (Add Health), this project explores relationships between local sex ratios and concurrent sexual partners. More specifically, we test whether school and neighborhood sex ratios: (i) affect the likelihood of concurrent partnerships; (ii) help account for race and gender differences in concurrent partnerships; and (iii) have varying associations with concurrent partnerships depending on respondents' race or gender.

Background: Number of sexual partners is a clear risk factor in contraction and transmission of STDs. However, holding number of partners constant, concurrent, rather than sequential (i.e., serially monogamous), relationships pose special risks for transmission. With no time lag between partners, an individual infected by one partner may immediately infect another partner. Additionally, with sequential relationships, partners prior to contraction are not at risk of infection. However, when relationships overlap, earlier concurrent partners do not have this protection.¹

There are several reasons to expect associations between local sex ratios and concurrent partnerships. From a numerical perspective, members of the smaller gender group have more potential partners, so, all else equal, they should be more likely to have multiple partners at one time. Guttentag (1983) argues that skewed sex ratios change expectations and balances of power within relationships.² More alternative potential relationships may raise one's relationship expectations. Members of the smaller gender group may then be less satisfied with their current partner and seek out additional partners. For the larger gender group, fewer alternative potential relationships may lead to a greater dependency on, and lower expectations for, their relationships, potentially contributing to a higher tolerance of their partners' infidelities.

In national studies of the U.S., skewed sex ratios are positively associated with factors that are likely to be related to concurrency, such as lower marriage rates and more sexual partners.³ Evidence from Africa shows associations between skewed sex ratios and men's extra-marital sex.⁴ Qualitative evidence from the U.S. suggests that sex ratios are perceived,

¹ Kelley, S. et al. 2003. "The Role of Sequential and Concurrent Relationships in the Risk of Sexually Transmitted Diseases Among Adolescents." *Journal of Adolescent Health*. 32: 296-305.

² Guttentag, M. 1983. *Too Many Women? The Sex Ratio Question*. Sage Publications.

³ Pouget, ER. 2010. "Associations of Sex Ratios and Male Incarceration Rates with Multiple Opposite-Sex Partners." *Public Health Reports*. 125: 70-80.

⁴ Benefo, KD. 2008. "Determinants of Zambian Men's Extra-Marital Sex: A Multilevel Analysis." *Archives of Sexual Behavior*. 37: 517-529.

particularly among Black women, as a determinant of Black men's concurrent partnerships.⁵ However, it remains unclear whether there are actual, quantitative associations between local sex ratios and concurrent partnerships for the U.S. as a whole and for race-gender subgroups.

Sex ratios are intertwined with structural inequality. Most notably, skewed ratios among Black Americans result from Black men's higher mortality and incarceration rates, which are associated with economic disadvantage and discrimination. Additionally, whether outnumbered gender groups can turn their scarcity into power within relationships depends on their structural positions. For instance, Guttentag (1983) argues that men can more effectively translate sex ratios skewed in their favor into power within relationships because of their more privileged positions within larger society. In the following analysis, we take an initial step toward sorting out these complex relationships by running step-wise models stratified by race-ethnicity and gender.

Data and Methods: Data for this analysis come from the Add Health, which is a longitudinal study of a school-based national probability sample. The survey was conducted in 1994 and 1996 when the respondents were high school students, and was re-administered in 2001-2002 when they were ages 18-26. In each wave, respondents report on multiple past and current sexual partnerships, including the month and year of their first and last/most recent sexual encounter. We use these questions to construct our main dependent variable, the number of overlapping partnerships that a respondent reports.

Table 1 shows descriptive information on wave 1 and 2 respondents' sexual partnerships (wave 3 data will be added soon). Since concurrency is only possible for respondents with two or more partners, respondents with fewer partners will be excluded from our main analysis. Table 1 shows that, in waves 1 and 2, substantial proportions of respondents will be excluded for this reason. (In wave 3, when respondents are 18-26, many more of them are likely to report two or more partners, so we expect to exclude fewer cases because of partner number in wave 3). This distribution makes the important point that concurrency, a behavior that increases risk of disease transmission to one's partners, is only possible among individuals who (all else equal) are more likely to be infected because they have more partners. We plan to conduct supplemental analyses in order to understand how various factors, including sex ratios, determine number of partners and, consequently, inclusion in the analysis. Depending on the availability of instrumental variables, it may be possible for us to use a Heckman selection model to account for differential selection into the analysis based on partner number. Among respondents with two or more partners, substantial portions have had at least

⁵ Adimora et al. 2002. "Contextual Factors and the Black-White Disparity in Heterosexual HIV Transmission." *Epidemiology and Society*. 13: 707-712.

one set of overlapping relationships, with the largest percentage among Black males and the lowest among White females.

Our main predictor is a sex-specific measure of the number of opposite sex individuals for each same-sex individual in the area. For all three waves, we calculate these measures at the census tract-level, including only residents in the same age-range as the respondent. In waves 1 and 2, when the respondents are still high school students, we also construct these measures for respondents' schools. Given strong assortative pairing within race-ethnicity in the U.S., we will work with both general and race-ethnicity-specific ratios. Table 1 shows average school-level sex ratios (tract-level ratios will be constructed soon). While the average school sex ratio for the total sample is very balanced (1.00), the average Black respondent is in a school where Black females outnumber Black males, while the average Hispanic respondent is in a school where Hispanic males outnumber Hispanic females.

Since sex ratios are often more skewed in disadvantaged areas, controls for local socioeconomic and racial-ethnic composition are particularly critical in this project. Fortunately, the Add Health offers a particularly rich source of contextual measures. Our school/census tract controls include socioeconomic composition (e.g., poverty rates, average education levels, unemployment etc), racial-ethnic composition, age structure, the size of the school/tract population, and the degree of age and racial-ethnic assortative pairing in the area. Individual-level control variables include age, gender, race-ethnicity, number of partners, education, and income.⁶

For this analysis, we use a step-wise modeling strategy. We begin with a gender-specific model predicting concurrency that includes all individual and contextual-level covariates, except for sex ratios. We then add the measure for school or census tract sex ratio and see (i) whether being part of a smaller gender group within a school/tract is associated with more concurrent partnerships, as theory suggests; and, (ii) whether adjusting for local sex ratios attenuates associations between concurrency and other individual-level and contextual-level covariates. Of particular interest here is whether variations in sex ratios may partially account for individual-level race differences in the frequency of concurrent partnerships.

After conducting this step-wise analysis for the total sample, we will replicate it for race-ethnicity subgroups to see whether any associations between concurrency and sex ratios vary by respondents race-ethnicity. Guttentag (1983) would lead us to expect that white men have the strongest associations between sex ratios and concurrency since their structural power may

⁶ In waves 1 and 2, when the respondents are high school students, we use parents' education and income. In wave 3, when respondents are older, we use their own education and income.

make them more able to translate numerical advantage into relationship power. On the other hand, particularly strong assortative pairing along race among Black women may make Black men particularly able to take advantage of skewed ratios since Black women may not have as many partnering options outside of the Black community. Regardless of racial-ethnic differences, we expect that gender roles and expectations will moderate sex ratio-concurrency associations, most likely creating stronger associations for males than females.

To adjust for the clustering of respondents within schools/tracts, we will use multi-level regression models with random intercepts and/or coefficients. In order to account for clustering that may results from observing multiple relationships per respondent, all standard errors will be calculated with the Huber-White robust estimator. Since respondents' life circumstances may be very different in wave 3 after they have finished high school, we expect to pool waves 1 and 2 into a single set of models and analyze wave 3 separately. Comparing results from waves 1 and 2 with those from wave 3 may potentially reveal age/life-course variation in the effects of sex ratios.

	Total	White		Black		Hispanic		Other Race	
		Male	Female	Male	Female	Male	Female	Male	Female
School Sex Ratio	1.00	1.01	0.99	1.12	0.90	0.95	1.05	0.97	1.02
% with <2 partners	80.08	83.77	78.16	73.26	76.19	78.83	81.51	88.8	85.7
N	14719	3885	3943	1521	1289	1155	1157	655	574
% with Concurrent Partners (Respondents with 2+ partners)	38.4	36.4	32.6	52.4	42.3	33.6	39.6	42.8	35.4
N	3018	865	616	449	422	232	260	77	82