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Ecological Analysis of Teen Birth Rates: Association With Community Income and Income Inequality

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Objectives: To examine whether per capita income and income inequality are independently associated with teen birth rate in populous U.S. counties. *Methods*: This study used 1990 U.S. Census data and National Center for Health Statistics birth data. Income inequality was measured with the 90:10 ratio, a ratio of percent of cumulative income held by the richest and poorest population deciles. Linear regression and analysis of variance were used to assess associations between county-level average income, income inequality, and teen birth rates among counties with population greater than 100,000. *Results*: Among teens aged 15–17, income inequality and per capita income were independently associated with birth rate; the mean birth rate was 54 per 1,000 in counties with low income and high income inequality, and 19 per 1,000 in counties with high income and low inequality. Among older teens (aged 18–19) only per capita income was significantly associated with birth rate. *Conclusions*: Although teen childbearing is the result of individual behaviors, these findings suggest that community-level factors such as income and income inequality may contribute significantly to differences in teen birth rates.

KEY WORDS: income inequality; poverty; teen births; ecological analysis.

INTRODUCTION

In both ecological and multilevel studies, greater income inequality has been linked to higher rates of adult mortality, poor self-rated health, depressive symptoms, and unhealthy behaviors (1–16). It has been theorized that higher income inequality is associated with poorer population health because income inequality produces adverse psychosocial environments, and because more unequal societies devote fewer resources to ensure the well-being of their less well-off members.

In contrast to numerous adult studies, little research exists on the relationship between income inequality and health in children and adolescents (6, 17). Teen childbearing is an important adolescent health issue, but risk factors for teen births are usually studied in terms of individual-level characteristics (18–29). To reduce teen birth rates, it is critical to understand the full range of contributing factors. Previous research identified some community-level factors associated with teen birth rates, including poverty, racial composition, and educational attainment (30–35); however, the effect of income inequality on teen birth rate has never been explored. We hypothesized that communities with higher income inequality would also exhibit higher teen birth rates, beyond the effect of community income alone.

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METHODS

Data from the 1990 U.S. Census (File STF-3C) were used to compute the 90:10 decile share ratio, an index of income inequality. This measure is the proportion of cumulative income earned by the wealthiest 10% of people in each county divided by the income proportion earned by the poorest 10%. Larger ratios indicate greater income inequality. The 90:10 ratio is highly correlated with other inequality measures (6).

Per capita income in thousands of dollars (PCI) also came from the U.S. Census. Teen birth rates were computed using data from the National Center for Health Statistics (NCHS) public data files of 1991 births. To protect privacy, pregnancy data is restricted to counties with a 1990 population greater than 100,000; therefore, this analysis is based on data from the 414 most populous U.S. counties.

Multiple linear regression was used to test the independent associations between PCI, income inequality, and birth rates for younger (15–17) and older (18–19) teens. Birth rates were log-transformed to correct for heteroscedasticity. To adjust for the potential effect of racial composition on teen birth rate, counties were divided into tertiles based on percent of the teen population that was Black, and regressions were conducted in each tertile.

We repeated the regressions using median household income (MHI) and percent of the population below 200% of the Federal Poverty Level (FPL) as alternate measures of poverty, and the Robin Hood Index (RHI) and Gini coefficient to measure income inequality. The RHI is the percentage of aggregate income that must be redistributed to achieve equality in income distribution. The Gini coefficient is equivalent to half of the average of the absolute difference between *all* pairs of incomes in a population, normalized on average income (3).

RESULTS

For girls aged 15–17, county-level birth rates varied from 4 to 110 per 1,000; for females aged 18–19, the rates varied from 12 to 189 per 1,000 (Table I). PCI ranged from $6,630 to $28,381 and the 90:10 ratio varied from 9.25 to 82.25. Income inequality and PCI were not significantly correlated (Pearson correlation $= -0.057$, $p = 0.246$).

When counties were grouped based on tertiles of PCI and income inequality, the highest teen birth rates were in counties with high inequality and low PCI, and the lowest in counties with low inequality and high PCI [Fig. 1(a) and (b)]. For each PCI tertile, birth rate increased with increasing income inequality. Among younger teens, the difference between high and low inequality tertiles was 20 births per 1,000, a 56% difference. The ANOVA for difference between categories was significant ($F = 42.89$, $p < 0.001$). Among older teens, a similar but less pronounced pattern was found: the difference between high and low inequality tertiles was 22 per 1,000, a 26% difference; the ANOVA was also significant ($F = 18.81$, $p < 0.001$).

Multiple linear regression was used to quantify the independent associations of PCI and income inequality with teen birth rate. Among younger teens, income inequality was significantly associated with birth rate, both alone and after including PCI (Table II). Similarly, PCI was significantly associated with birth rate both alone and in the full model. We found evidence of effect modification by race, i.e., the associations of both income inequality and PCI with teen birth rate were strongest within counties with the lowest proportion of Black residents. As the

Table I. Mean, Minimum, Median, and Maximum Values for Variables Used in the Analysis

	Mean[a]	Minimum	Median	Maximum
Teen birth rate				
Births per 1000 teens aged 15–17	36.28	4.35	35.94	110.28
Births per 1000 teens aged 18–19	86.54	12.34	85.01	189.32
Income inequality				
90:10 decile share ratio	24.58	9.25	22.22	82.25
Average income				
Per capita income (in dollars)	14,643	6,630	13,904	28,381
Percent Black				
Among girls aged 15–17	14.4	0.03	9.30	80.58

Note. $N = 414$ counties.
[a]Not weighted by county size.

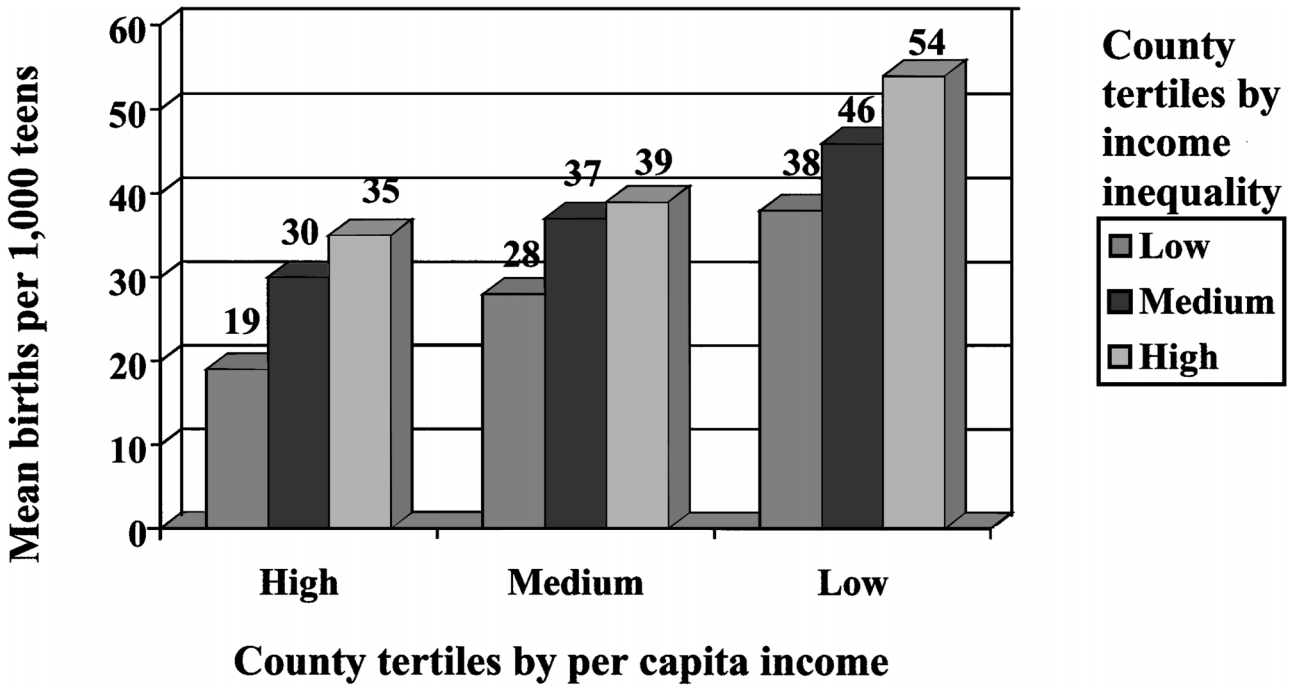

Fig. 1a. Mean births per 1000 teens aged 15–17 Counties divided into tertiles of PCI and income inequality.

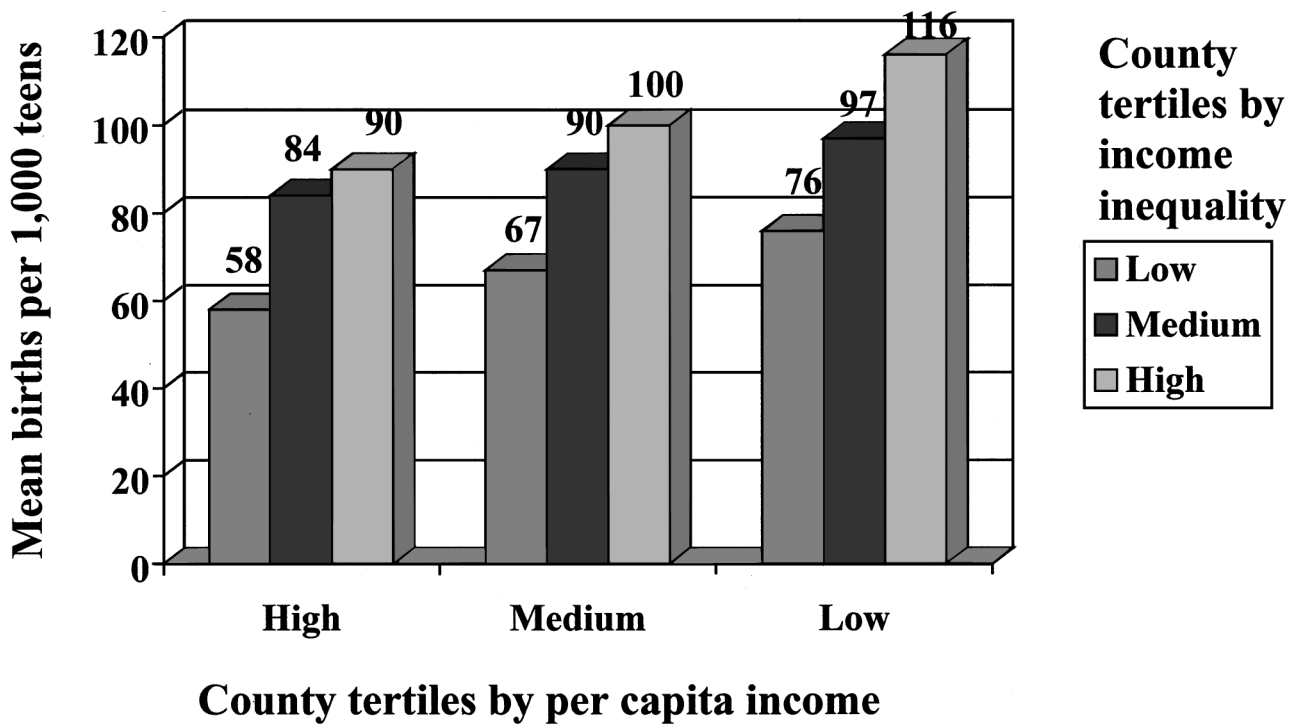

Fig. 1b. Mean births per 1000 teens aged 18–19 Counties divided into tertiles of PCI and income inequality.

Table II. Results of Linear Regression Assessing the Association Between Per Capita Income, Income Inequality, and Log (Rate of Births Per 1,000 15–17-Year-Old Females)

	Independent variables	Adjusted R^2	F	β
All counties	Income inequality alone	0.240	131.5***	0.032***
	Per capita income alone	0.258	144.5***	−0.084***
	Income inequality	0.472	185.5***	0.030***
	Per capita income			−0.079***
Counties with lowest % Black (<4.4% Black)	Income inequality alone	0.176	30.3***	0.049***
	Per capita income alone	0.368	87.3***	−0.104***
	Income inequality	0.496	68.3***	0.039***
	Per capita income			−0.095***
Counties with medium % Black (4.4–15.3% Black)	Income inequality alone	0.058	9.4***	0.025**
	Per capita income alone	0.479	127.0***	−0.097***
	Income inequality	0.506	71.2***	0.017**
	Per capita income			−0.093***
Counties with high % Black (>15.3% Black)	Income inequality alone	0.113	18.5***	0.011***
	Per capita income alone	0.152	25.5***	−0.042***
	Income inequality	0.298	30.0***	0.012***
	Per capita income			−0.046***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

proportion of Black residents increased, the effects of both income inequality and PCI became weaker.

Among older teens (18–19 years) the results were somewhat different (Table III). The associations of both income inequality and PCI were much weaker than in the analyses of births to younger teens. In stratified analyses, the effect of income inequality was statistically significant only for the counties with the lowest proportion of Black residents; PCI was significantly associated with older teen birth rates across all counties.

Similar results were obtained from regressions using alternate measures of poverty and income inequality. In unstratified models, using the Gini coefficient or the Robin Hood Index, income inequality was still significantly associated with birth rate (younger teens) both alone and controlling for PCI. Likewise, alternate measures of county-level income—mean household income and percent of the population below 200% of the FPL—were also significantly associated with teen birth rates alone and after controlling for income inequality.

Table III. Results of Linear Regression Assessing the Association Between Per Capita Income, Income Inequality, and Log (Rate of Births Per 1,000 18–19-Year-Old Females)

	Independent variables	Adjusted R^2	F	β
All counties	Income inequality alone	0.071	32.5***	0.015***
	Per capita income alone	0.237	129.3***	−0.068***
	Income inequality	0.295	87.2***	0.013***
	Per capita income			−0.066***
Counties with lowest % Black (<4.7% Black)	Income inequality alone	0.058	9.0**	0.027**
	Per capita income alone	0.259	46.5***	−0.075***
	Income inequality	0.288	27.3***	0.020*
	Per capita income			−0.0710***
Counties with medium % Black (4.7–15.7% Black)	Income inequality alone	0.000	0.9	0.007
	Per capita income alone	0.303	63.6***	−0.080***
	Income inequality	0.300	31.8***	0.004
	Per capita income			−0.080***
Counties with high % Black (>15.7% Black)	Income inequality alone	0.002	1.2	0.003
	Per capita income alone	0.236	43.3***	−0.050***
	Income inequality	0.240	22.6***	0.003
	Per capita income			−0.050***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

DISCUSSION

This study is an ecological analysis assessing associations between teen birth rate, average income, and income inequality. Ecological analysis was appropriate because PCI, income inequality, and teen birth rate are each aggregate-level variables, and it was the relationship of these community-level variables that we sought to measure. County was the unit of analysis because it is the smallest unit for which single year birth data are available nationally.

As hypothesized, counties with higher income inequality had significantly higher teen birth rates, especially among younger teens, even when controlling for PCI. We found evidence for effect modification by racial demography, i.e., the associations of both income inequality and PCI with younger teen birth rates became weaker as the proportion of Black residents increased. Among younger teens, the proportion of variance (R^2) explained by income inequality and PCI was substantially lower in counties with the highest proportion Black, implying that in these areas other factors may be more important in explaining birth rate. Among older teens, only PCI remained significantly associated with birth rate in counties with higher proportions of Black residents, implying that absolute income—compared to relative income—may be more important in this age group.

The income inequality literature suggests possible causal explanations for the relationship between poverty, income inequality, and teen birth rate (1, 4–6, 10–16). Greater poverty and income inequality are thought to lead to poor health behaviors and outcomes through higher stress levels, greater vulnerability to stress, and less access to health resources. Higher social stress and associated negative psychological effects could in turn promote a weaker sense of self-worth or purpose among teens, affecting sexual health behaviors and reproductive choices (10, 12–13, 36). In addition, income inequality may affect health because a smaller relative proportion of community resources is allocated to maintain the health of the poor, which could translate into limited access to contraceptives or abortion facilities.

These results may be generalizable only to populous counties, though it is likely that the associations found here occur in less populous counties as well. Because of this limitation it is not possible to generalize these findings to the entire U.S. population. We used teen birth rate rather than pregnancy rate because we were concerned about the impact of teenage childbearing on both teens and their infants. Furthermore, county-level abortion data, and therefore teen pregnancy data, are highly erratic (38–39).

Ecological analysis, as used in this study, is useful for assessing the impact of community-level factors on community-level outcomes; however, limitations are associated with even the appropriate use of this methodology. Selecting the appropriate geographic unit of analysis is problematic; some community-level factors have differing levels of impact depending on level of aggregation (41). We used counties because they were the smallest unit for which our data were available.

Another potential methodological problem is multicollinearity, i.e., when group-level variables are highly correlated, making it difficult to assess the impact of each. Although PCI and income inequality were not correlated, racial composition (percent Black among teens) was significantly correlated with income inequality among younger and older teens ($r = 0.65$ and $r = 0.62$, respectively), and significantly correlated with PCI (42). Therefore it is not surprising that adjusting for percent Black substantially reduced income inequality's effect. Nevertheless, in younger teens there was a persistent association between income inequality and birth rate, even after stratifying by percent Black. There appeared to be effect modification by percent Black such that income inequality was most strongly associated with younger teens' birth rates in counties with the lowest proportion Black. Among older teens, stratifying by proportion Black virtually removed the effect of income inequality. Combined with the finding that the variance in older teens' birth rates explained by income inequality was lower than in younger teens, these results suggest that factors other than income inequality may be more important predictors of birth rates in the older group.

CONCLUSION

Our results suggest that adolescent health may be affected not just by individual characteristics but by the macroeconomic structure of communities. The negative impact of greater income inequality, previously associated with mortality and morbidity among adults, affects teen birth rate as well—especially among younger teens. Interventions aimed at reducing teen births may need to focus not just on individual behaviors, but also on community characteristics associated with higher teen birth rates.

Understanding the causal mechanisms through which adolescent sexual health is affected by income

inequality may be a critical part of learning how adolescents relate to their communities and how that relationship impacts their health behaviors and choices. This study provides a starting place for understanding these causal mechanisms. Additional research on community-level factors controlling for individual-level race and income would help to develop a better understanding of the complex risk factors associated with teen births. While more research is needed to determine this interplay between individual- and community-level factors, public health policy planners interested in reducing teen births should begin to consider the importance of contextual economic factors.

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