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Original article

Trends in Adolescent Birth Rates in California: Examining the Influence of Community Characteristics Through Geographic and Temporal Analysis

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A B S T R A C T

Purpose: The aim of the article was to understand community-level factors associated with the decline in the adolescent birth rate (ABR) in California from 2000 to 2014.
Methods: We consolidated multiple data sources at the level of the Medical Service Study Area (MSSA), a federally recognized subcounty geographic unit (N = 497). We used ordinary least squares regression to examine predictors of change in the ABR at the MSSA level over three periods of notable change in California's ABR: 2000–2002, 2006–2008, and 2012–2014. Variables assessed include geographic density, change in sociodemographic and economic characteristics, and change in the availability of publicly funded sexual health services.
Results: The ABR declined more in urban than rural MSSAs. In the earlier period, growth in the black, Hispanic, and foreign-born populations, unemployment, and receipt of public assistance were associated with smaller declines in the ABR. Growth in the share of married households and high school completion were associated with larger declines in the ABR. In the later period, growth in public assistance receipt was associated with smaller declines in the ABR, whereas growth in high school completion and college attendance were associated with larger declines. Decline in the ABR was steeper in areas that began offering publicly funded long-acting contraception to adolescents. Rural-urban differences were no longer significant after controlling for change in the provision of long-acting contraception.
Conclusions: Identifying the independent contributions of changes in sociodemographic, economic, and service characteristics to changes in the ABR supports the development of programs and policies that are more responsive to the communities they serve.

IMPLICATIONS AND CONTRIBUTION

Using multiple data sources, this study examines trends in the ABR at the subcounty level in California from 2000 to 2014. Although the ABR declined in most Medical Service Study Areas, findings suggest that changes in communities' sociodemographic, economic, and service characteristics are associated with the level of decline.

Conflicts of interest: The authors have no conflicts of interest to disclose.
Disclaimer: The findings and conclusions in this study are those of the authors and do not necessarily represent the views of the California Department of Public Health, Office of Population Affairs, Health Resources and Services Administration, or the U.S. Department of Health and Human Services.

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The U.S. has shown significant progress in reducing rates of adolescent pregnancy and childbearing since the early 1990s. By 2017, the adolescent birth rate (ABR) dropped by 69% from 59.9 to 18.8 births per 1,000 females aged 15–19 years [1,2]. This downward trend has been observed across states, age groups, and racial and ethnic groups. Remarkably, the rate of decline has accelerated since 2007, indicating ongoing significant progress [1]. Nonetheless, disparities in adolescent childbearing persist, with certain geographic areas continuing to have elevated ABRs, including areas experiencing higher levels of poverty [3,4].

Prior research has posited several possible explanations for declining ABRs, including delayed age at sexual initiation and increased use of contraception, especially highly effective long-acting reversible contraception [5,6]. The majority of this research has focused on changes at the individual level and has not fully accounted for geographic variation in change in ABRs. Research in social determinants of health and social ecology recognizes that adolescent sexual behaviors and decision-making are influenced by myriad factors [7,8]. An adolescent's environment—including peers, family, school, community, and social policy—play critical and intersecting roles in sexual and reproductive health outcomes [9]. However, the limited research that examines external influences, such as available programs and related policies, has been conducted at the county or state level, which can mask important variations within these geographic areas [10].

Increasingly, researchers have focused on the ways in which social processes and spatial context may influence health behaviors and outcomes [11]. Neighborhood-effects research has examined community-level variation for different adolescent behaviors and sexual health outcomes [12–14]. The scale of neighborhoods or communities in the literature has varied, from county, to zip code, to census tract (CT) [15]. A systematic review of community-level studies found consistent associations between lower ABRs and higher levels of neighborhood education, employment, and income [15]. However, that same review found inconsistent results across studies examining neighborhood racial and ethnic composition and no studies that assessed access to sexual health education programs or clinical services. Relatively few studies have assessed trends in ABRs at the community level. One previous study by Gunaratne et al. analyzed change over time in ABRs and socioeconomic and demographic measures in 77 Chicago community areas; they found positive associations between increases in the percentage of residents who were poor, Hispanic, or high school dropouts and increases in the ABR [16].

This study aims to understand the community-level factors associated with the substantial decline in ABRs in California from 2000 to 2014. California's decline mirrors that of the country as a whole, decreasing more than 75% from 70.6 births per 1,000 in 1990 to 15.1 births per 1,000 in 2017 [1,2]. As the state with the largest adolescent population in the country, a racially, ethnically, and geographically diverse population and adolescent birth trends similar to those nationwide, California provides an exceptional case study. We consolidate diverse sources of data and examine predictors of the change in ABRs at the community level, including those related to sociodemographic and economic characteristics, as well as availability of sexual health services. We investigate trends at the level of the community—as defined by California's Medical Service Study Areas (MSSA)—allowing for a more nuanced analysis than is feasible at the state or county level. Spatial trends of the ABR at the MSSA level in California have not been analyzed and may aid in identifying additional strategies for supporting adolescent sexual health.

Methods

This study used data from multiple secondary sources, collected or consolidated at the level of the MSSA. MSSAs are federally recognized geographic areas developed by the California Office of Statewide Health Planning and Development to identify medically underserved areas [17]. MSSAs are created by aggregating CTs that do not cross county boundaries. CTs are designed to be relatively permanent over time, but some changes can occur between decadal censuses to reflect population growth or decline. For the MSSA to be comparable across the three periods, we used the 2010 CTs to develop a cross-walk identifying boundaries that are comparable with the 2000 CTs. Of 542 MSSAs in California in 2010, 537 were identified as comparable across the study period.

We focused on three periods for which ABR data were available at the MSSA level: 2000–2002 (Time 1), 2006–2008 (Time 2), and 2012–2014 (Time 3). We selected these periods because they coincide with marked declines in the ABR, both in California and nationally [1], along with the Great Recession from 2007 to 2009 that impacted economic opportunities for young people [18]. We analyzed trends in the ABR and each of the community-level characteristics over the three periods. We then examined change in the ABR as a function of change in community-level sociodemographic, economic, and service characteristics from Time 1 to 2 and Time 2 to 3. This study was approved by the State of California's Committee for the Protection of Human Subjects and the Committee on Human Research at the University of California, San Francisco.

Measures

Dependent variables. Our outcome of interest was the change in the *ABR* between periods (Time 1 to 2 and Time 2 to 3). ABR data were provided by the Maternal, Child and Adolescent Health Division (MCAH) of the California Department of Public Health (CDPH) [19]. The ABR was measured as the number of births per 1,000 female adolescents aged 15 to 19 years. Data were pooled over 3-year periods to estimate stable rates for MSSAs with small populations and to minimize the effect of annual fluctuations in the number of births. We calculated the change by subtracting ABRs between periods (i.e., $ABR_{T2} - ABR_{T1}$; $ABR_{T3} - ABR_{T2}$).

Independent variables. We collected variables recognized in the research literature as associated with adolescent childbearing at the community level and available at the CT level for the designated periods [15].

The California Office of Statewide Health Planning and Development designates each MSSA as urban, rural, or frontier. We combined rural and frontier MSSAs to create a dichotomous variable of population density (*urban/rural status*).

We collected sociodemographic and economic data at the CT level from the 2000 Census and 2005–2009 and 2011–2015 American Community Survey (ACS). We selected these years to align, to the extent possible, with the ABR periods. Census/ACS measures included percent of the population by *race/ethnicity*, percent of the population *foreign born,* percent of households with *incomes below the federal poverty level,* percent of households *receiving any public assistance income*, percent of the

population age 16 years and older *unemployed*, percent of the population ages 18 to 24 years who *completed high school*, percent of the population ages 18 to 24 years who were *enrolled in college or graduate school*, percent of family *households that are married*, and percent of *owner-occupied housing units*.

From the CDPH, we collected data on the location of state-funded Adolescent Sexual and Reproductive Health (ASRH) programs as a proxy for community availability of sexual and reproductive health education for adolescents. We used the primary mailing address of the funded program to measure the *number of ASRH programs* in the MSSA.

From the California Department of Health Care Services, Office of Family Planning, we collected data about California's Family Planning, Access, Care, and Treatment (Family PACT) program, which provides family planning services at no cost to low-income women and men, including adolescents without parental permission. Family PACT data were available for Time 2 and 3 but not Time 1. We collected data on the *number of adolescent Family PACT clients served* as a proxy for the availability of family planning services. We also collected data on the *presence of at least one Family PACT provider who distributed long-acting contraceptive methods to adolescent clients*, including sterilization, implant, or intrauterine contraception, as a proxy for the availability of highly effective contraception among adolescents in the community.

Two researchers independently merged these data sources to ensure accuracy of the final dataset. We consolidated all CT data to the MSSA level and annual data to the three periods. We created variables corresponding to the change in each community-level predictor from Time 1 to 2 and from Time 2 to 3. All the change variables were continuous, except for a categorical variable we created for change in provision of long-acting contraception to adolescent Family PACT clients with four categories: never provided, started providing, stopped providing, and continued providing long-acting contraception.

Analysis

All study data were aggregated by MSSA, which served as the unit of analysis. Of the 537 comparable MSSAs across the three periods, 40 were excluded from analysis based on data suppression and reliability rules developed by CDPH to protect the confidentiality of adolescents and ensure the integrity of the data presented. Specifically, ABR data were suppressed if the denominator was less than 50, and numerator was between one and five. Among these 40 excluded MSSAs, 25 were designated as frontier, 14 as rural, and one as urban. The final study sample included 497 MSSAs.

First, we used descriptive statistics to describe the ABR and demographic, social, economic, and service characteristics in each study period: Time 1 (2000–2002), Time 2 (2006–2008), and Time 3 (2012–2014). We also examined change in ABR and community characteristics between each study period: Time 1 to 2 and Time 2 to 3. We used *t*-tests to compare the ABR and each community characteristic by period.

Second, we used ordinary least squares (OLS) regression to examine the association between change in community characteristics and change in the ABR from Time 1 to 2 and from Time 2 to 3. Regardless of the level of significance, all covariates were included in the model. Family PACT data were available for Time 2 and 3 but not Time 1, so we ran two different models of change in the ABR from Time 2 to 3, with and without the variables measuring the availability of family planning services and access to long-acting contraception. We used the variance inflation factor function in Stata to confirm that none of the covariates had particularly high collinearity (variance inflation factor < 3). We used Stata's postestimation margins command to display predicted change in the ABR by urban/rural status for each of the three models. We used Stata, version 14 (College Station, TX) for all analyses.

Results

Descriptive results

Table 1 shows the mean ABR at the MSSA level in California in each period. From Time 1 to 2, the mean ABR declined from 40.5 births to 36.9 per 1,000 ($p < .001$). Across MSSAs, change in the ABR ranged from −50.2 to 40.5 births per 1,000, and 75% of MSSAs experienced a decline in the ABR.

The downward trend in adolescent births was more substantial from Time 2 to 3; the mean ABR declined from 36.9 to 22.6 per 1,000 ($p < .001$). Change in the ABR ranged from −60.8 to 24.6 births per 1,000, although 95% of MSSAs experienced a decline in the ABR.

Table 1 also shows that, during these periods, several changes occurred in the sociodemographic and economic characteristics of California communities. The average percentage of the population that was Hispanic and Asian increased steadily over the three periods. The average percentage of households with income below poverty and receiving public assistance income declined slightly from Time 1 to 2, but then increased from Time 2 to 3. In addition, there were marked increases in educational attainment, both in high school completion and postsecondary enrollment, over time.

Consistent with a decline in state general funds, the average number of ASRH programs declined across each period. The average number of adolescents served by the Family PACT program also declined from Time 2 to 3. However, adolescents' access to long-acting contraceptive methods through Family PACT expanded over this time. Thirty-two percent of MSSAs had a Family PACT provider that offered long-acting methods to adolescent clients in Time 2, compared with 53% in Time 3. Across all MSSAs, 29% had a Family PACT provider that offered long-acting contraception to adolescent clients in Time 2 and Time 3; 24% did not offer these methods in Time 2 but did so by Time 3; 3% offered these methods in Time 2 but stopped by Time 3; and 44% offered these methods in neither Time 2 nor Time 3.

Multivariable regression results

Table 2, Model 1 presents estimates from multivariable OLS regression analyses predicting change in the ABR from Time 1 to 2. The positive coefficient for rural MSSAs indicates that the decline in the ABR was smaller in rural than urban MSSAs ($b = 2.58$; $p < .01$). Based on the multivariate model, we estimated the average change in the ABR by rural/urban status. As shown in Figure 1, the ABR declined by 2.1 per 1,000 in rural MSSAs and by 4.7 per 1,000 in urban MSSAs.

Other factors that were associated with smaller declines in the ABR from Time 1 to 2 included growth in the percentage of the population that was black ($b = .69$; $p < .001$), Hispanic ($b = .26$; $p < .05$), unemployed ($b = .34$; $p < .05$), foreign born ($b = .40$; $p < .05$), and the percentage of households receiving

Table 1
Change in the adolescent birth rate and sociodemographic, economic, and service characteristics of Medical Service Study Areas in California: 2000–2002 (Time 1), 2006–2008 (Time 2), and 2012–2014 (Time 3) (N = 497)

Variable	Time period			Change between time periods			
	Time 1	Time 2	Time 3	Change time 1 to 2		Change time 2 to 3	
	Mean (SD) or %	Mean (SD) or %	Mean (SD) or %	Mean (SD)	*p* value	Mean (SD)	*p* value
Adolescent birth rate	40.5 (23.8)	36.9 (22.4)	22.6 (15.3)	−3.7 (9.3)	<.001	−14.3 (10.5)	<.001
Rural (%)	37.6	n.a.	n.a.	n.a.		n.a.	
Sociodemographic and economic characteristic							
% population Black	5.6 (8.2)	5.2 (7.1)	5.1 (6.6)	−.4 (2.0)	<.001	−.1 (1.3)	n.s.
% population Asian	8.5 (10.3)	9.8 (11.4)	11.0 (12.6)	1.3 (2.3)	<.001	1.1 (2.1)	<.001
% population Hispanic	30.2 (22.0)	34.0 (22.9)	36.5 (22.9)	3.8 (4.1)	<.001	2.5 (3.1)	<.001
% population foreign born	22.2 (13.7)	23.4 (12.8)	23.6 (12.4)	1.2 (3.2)	<.001	.2 (2.6)	n.s.
% households with income below poverty	14.6 (8.2)	14.0 (7.7)	17.0 (8.5)	−.7 (3.1)	<.001	3.1 (3.5)	<.001
% households receiving any public assistance income	35.0 (9.9)	34.0 (9.3)	39.3 (9.8)	−1.0 (4.4)	<.001	5.2 (4.0)	<.001
% population aged ≥16 years unemployed	8.1 (4.4)	8.4 (3.0)	10.6 (3.6)	.3 (3.1)	<.05	2.2 (2.6)	<.001
% population aged 18–24 years completed high school	69.4 (12.2)	80.9 (9.8)	85.3 (7.7)	11.5 (7.4)	<.001	4.4 (7.4)	<.001
% population aged 18–24 years enrolled in college/graduate school	31.6 (14.0)	37.6 (14.7)	42.1 (13.7)	6.0 (6.7)	<.001	4.5 (8.7)	<.001
% family households that are married	75.2 (7.5)	73.5 (8.5)	72.0 (9.1)	−1.7 (3.5)	<.001	−1.5 (3.9)	<.001
% housing units occupied by owner	60.1 (15.6)	60.3 (15.7)	56.8 (15.1)	.3 (3.1)	<.05	−3.6 (3.8)	<.001
Service characteristics							
Number of state-funded ASRH programs	.4 (.8)	.3 (.7)	.1 (.4)	−.04 (.3)	<.05	−.2 (.6)	<.001
Number of adolescent FPACT clients served	n.a.	626.0 (991.4)	560.7 (875.6)	n.a.		−65.3 (600.7)	<.05
Long-acting contraception provided to adolescent FPACT clients (%)	n.a.	31.8	52.5	n.a.		20.7	<.001

Paired sample *t*-tests were used to compare the adolescent birth rate and community characteristics by period.
ASRH = Adolescent Sexual and Reproductive Health; FPACT = Family Planning, Access, Care, and Treatment Program; n.a. = data not available; n.s = not significant; SD = standard deviation.

public assistance income (b=.37; $p < .001$). Factors that were associated with larger declines in the ABR from Time 1 to 2 included growth in the percentage of family households that were married ($b = -.29$; $p < .05$) and the percentage of young adults who completed high school ($b = -.22$; $p < .001$). Change in the number of state-funded ASRH programs was not associated with change in the ABR between Time 1 and 2.

Model 2 presents estimates from multivariable OLS regression analyses predicting change in the ABR from Time 2 to 3. The decline in the ABR was again smaller in rural than urban MSSAs ($b = 2.24$; $p < .05$). On average, the ABR declined by 12.9 per 1,000 in rural MSSAs and by 15.1 per 1,000 in urban MSSAs.

As in the earlier period, growth in the percentage of households receiving any public assistance was associated with smaller declines in the ABR from Time 2 to 3 ($b = .24$; $p < .05$). Growth in the percentage of young adults who completed high school ($b = -.17$; $p < .05$) and enrolled in college (b=−.21; $p < .001$) were associated with larger declines in the ABR from Time 2 to 3. Changes in other sociodemographic or economic characteristics or the number of state-funded ASRH programs were not significantly associated with change in the ABR from Time 2 to 3.

Model 3 adds covariates for change in the availability of publicly funded family planning services and long-acting contraception for adolescents. Change in the number of adolescents who received Family PACT services was not significantly associated with change in the ABR. However, compared with the MSSAs that never provided long-acting contraception to adolescent Family PACT clients, there were significantly larger decreases in the ABR in MSSAs that started offering these methods to adolescents ($b = -4.65$; $p < .001$) or continued to do so ($b = -7.48$; $p < .001$). Controlling for the availability of long-acting contraception for adolescents, there were no longer statistically significant rural/urban differences in change in the ABR. This is likely due to the relationship between rural/urban status and change in contraceptive provision: 12% of rural MSSAs offered long-acting contraception to adolescent Family PACT clients in Time 2, compared with 44% of urban MSSAs. Between Time 2 and 3, 21% of rural MSSAs started providing long-acting contraception to adolescent Family PACT clients, compared with one fourth (26%) of urban MSSAs, further increasing the gap in available services between urban and rural communities.

Discussion

This study documents the relationship between changes in community characteristics and the declining ABR in California. Our findings make a notable contribution to the literature by examining geographic and temporal variation in adolescent childbearing at the subcounty level and by analyzing a wide range of sociodemographic, economic, and service characteristics.

We found that from 2000 to 2014, urban MSSAs experienced a greater decrease in the ABR compared with rural areas, which is consistent with previous research at the county level [20]. Rural–urban differences in ABR trends were independent of fluctuations in sociodemographic and economic characteristics but were not independent of the availability of long-acting contraception. It is important to note that, in addition to long-acting contraception, rural adolescents may have less access to all sexual and reproductive health services, including abortion, than urban adolescents. [21–23].

We also found a striking association between change in neighborhood-level educational attainment and adolescent childbearing over both periods. The percentage of young adults attending college or graduate school increased dramatically from 2000 to 2014. Over both periods, an increase in the percentage of young adults who graduated high school was associated with significantly larger declines in adolescent childbearing. Similarly,

Table 2
Ordinary least squares regression models predicting change in the adolescent birth rate with change in community-level characteristics among Medical Service Study Areas in California, 2000–2002 (Time 1) to 2006–2008 (Time 2) and 2006–2008 to 2012–2014 (Time 3) (N = 497)

	Change Time 1 to 2		Change Time 2 to 3			
	1		2		3	
	b	SE	b	SE	b	SE
Rural	2.58**	.89	2.24*	1.01	−.21	1.05
Sociodemographic and economic characteristics						
Change in % population Black	.69***	.20	.62	.34	.69*	.33
Change in % population Asian	−.21	.22	.35	.27	.15	.26
Change in % population Hispanic	.26*	.13	−.19	.19	−.22	.18
Change in % population foreign born	.40*	.17	.43	.22	.40	.22
Change in % households with income below poverty	−.12	.14	−.02	.14	.06	.13
Change in % households receiving any public assistance income	.37***	.10	.24*	.12	.19	.11
Change in % population aged ≥16 years unemployed	.34*	.14	−.30	.19	−.29	.18
Change in % family households that are married	−.29*	.12	.21	.12	.19	.12
Change in % population aged 18–24 years completed high school	−.22***	.06	−.17*	.07	−.13*	.07
Change in % population aged 18–24 years enrolled in college/graduate school	.06	.06	−.21***	.06	−.21***	.06
Change in % housing units occupied by owner	−.06	.14	.11	.14	.09	.13
Service characteristics						
Change in number of state-funded ASRH programs	−.01	1.10	.83	.73	−.24	.73
Change in number of adolescent FPACT clients served					<−.001	<.001
Change in provision of long-acting contraception to adolescent FPACT clients						
Never provided					(Ref)	
Started providing					−4.65***	1.14
Stopped providing					−2.94	2.50
Continued providing					−7.48***	1.17
Intercept	−3.68***	.99	−13.02***	1.27	−8.98***	1.40

Models 1 and 2 do not include change in the number of adolescent FPACT clients or change in the provision of long-acting contraception to adolescent FPACT clients.
ASRH = Adolescent Sexual and Reproductive Health; FPACT = Family Planning, Access, Care, and Treatment Program.
*$p < .05$; **$p < .01$; ***$p < .001$.

a prior study in Chicago found that population changes in high school dropouts were significantly associated with change in the ABR from 1999 to 2009 [16]. In the latter period, a rise in the percentage of young adults pursuing postsecondary degrees was also associated with larger declines in adolescent childbearing. Living in a community in which more young people attend college may result in declining ABRs, independent of one's own educational pathway. One qualitative study in California found that adolescents living in communities with declining birth rates were more likely to view college as a realistic option for themselves and their peers and to have a more positive sense of their future education and career opportunities than adolescents living in communities with relatively high ABRs that were stagnant or increasing [24].

The association between changes in other community-level characteristics and the ABR varied across periods. For instance, we observed growth in the Hispanic population between the two periods. Net of other factors, growth in the Hispanic population was associated with an increase in the ABR from 2000–2002 to 2006–2008 but not from 2006–2008 to 2012–2014. Since the Hispanic population had the highest ABR in both periods, the association between increasing Hispanic population and smaller declines in the ABR in the earlier period is expected. The nonsignificant association in the second period is consistent with national data where the largest decline in the ABR from 2007 to 2011 was reported for the Hispanic population [25]. In comparison, growth in the black population was associated with smaller declines in the ABR across both periods. Across California, ABRs have reached historical lows for all racial and ethnic groups. However, disparities in ABRs by race and ethnicity persist. The patterns observed here suggest that existing policies and programs have helped some youth of color prevent unintended births. However, a broad range of structural, cultural, familial, and individual factors contribute to the patterns in both intended and unintended childbearing by race/ethnicity [26,27]. Further research considering a broader range of factors will help to understand what underlies the difference between the two periods and where additional progress in reducing disparities in reproductive autonomy can be made.

A strength of this study is the inclusion of community-level data on service characteristics, in addition to the sociodemographic and economic characteristics available through census data. Change in state-funded ASRH programs was not significantly associated with change in the ABR, but communities in which Family PACT providers began offering long-acting contraceptive methods experienced a significantly larger decline in the ABR than those that did not offer these methods. Other studies have shown that adolescent pregnancy, birth, and abortion rates have decreased primarily because of more effective contraceptive use, not because of fewer adolescents having sexual intercourse [6]. California has a long history of supporting access to comprehensive and confidential publicly funded family planning services for low-income adolescents and adults through the Family PACT program. Our results provide support for expanding access to the full range of contraceptive methods at low or no cost in all communities to further reduce ABRs and disparities in ABRs.

Another strength of this study is our ability to examine the relationship between neighborhood characteristics and adolescent childbearing at such a small geographic scale. MSSAs are advantageous because they allow for capturing meaningful differences in neighborhoods that may be lost

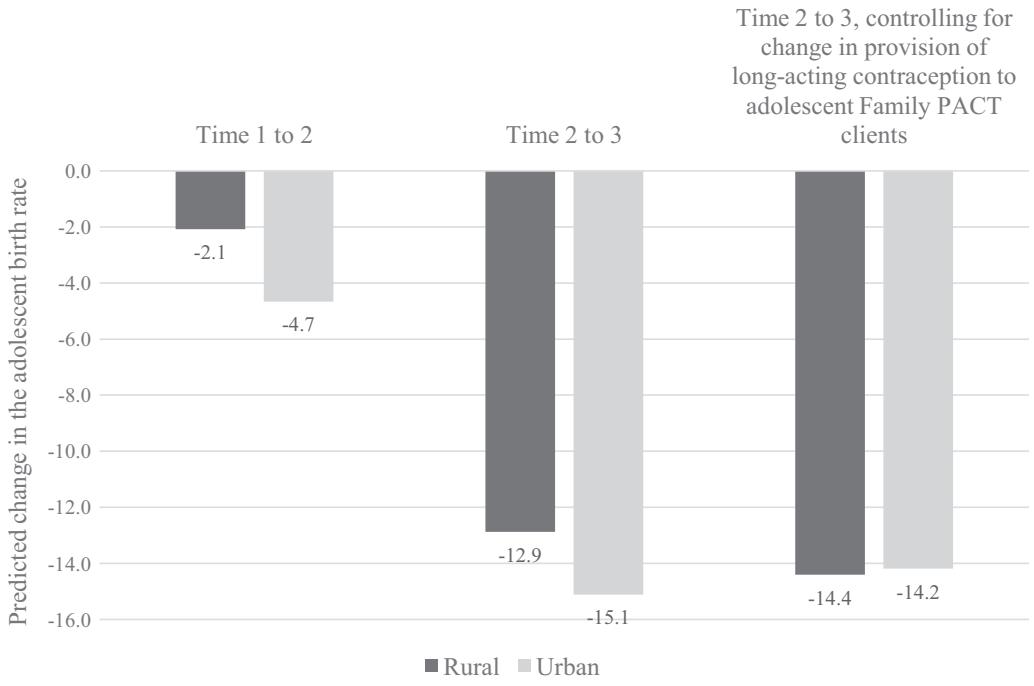

Figure 1. Predicted change in the adolescent birth rate among California Medical Service Study Areas, by rural and urban status, between 2000–2002 (Time 1), 2006–2008 (Time 2), and 2012–2014 (Time 3), based on multivariable ordinary least squares regression models (N = 497).

when examining larger geographic units, such as counties. More research is needed at this smaller geographic scale to identify community-level predictors on adolescent sexual and reproductive health outcomes, such as the provision of sexual health education in schools and barriers to adolescents accessing contraceptive services.

This study also has a number of limitations. First, ABR data were unavailable for MSSAs with smaller population sizes because of concerns about confidentiality and data stability. Recognizing this challenge, we aggregated ABR data across multiyear time spans and conducted sensitivity analyses to compare results when including versus excluding unstable data. Nonetheless, missing data for select MSSAs may affect our results, particularly in sparsely populated areas. Second, our measures of service delivery availability are approximate. Although Family PACT serves a large number of adolescents in need of sexual health services, other sources of contraception are not accounted for in our analysis. Similarly, the state's ASRH programs do not represent all sexual health education available to California adolescents in their schools and communities. Our use of the ASRH grantees' main address is a proxy for the state investment in these programs but does not account for the many sites of service delivery that these reached. Third, our data sources do not align perfectly with our three time periods. For example, Time 2 uses 2005–2009 ACS data to predict 2006–2008 birth rates. Finally, our study does not account for all community-level influences on birth rates. Policy-level factors, an important component of the socioecological model, were not measured. However, many policies that may influence ABRs are implemented statewide and thus would not account for variation in birth rates at the MSSA level. Other social processes such as collective efficacy and safety were not measured due to lack of data [28].

These results add to the growing recognition of the role community-level factors may play on adolescent opportunities and decision-making. It also helps to highlight the complexity of these factors and their potential interrelationship. Identifying the independent contributions of sociodemographic, economic, and service characteristics to changes in ABRs can help programs and policymakers better refine and target their efforts and make them more responsive to the communities they serve.

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References

[1] Ventura SJ, Hamilton BE, Mathews TJ. National and state patterns of teen births in the United States, 1940-2013. Natl Vital Stat Rep 2014;63:1–34.

[2] Martin JA, Hamilton BE, Osterman MJK. Births in the United States, 2017. NCHS Data Brief 2018:1–8.

[3] Takahashi ER, Florez CJ, Biggs MA, et al. Teen births in California: A resource for planning and policy. Sacramento, CA: California Department of Public Health, Maternal, Child and Adolescent Health Division and Office of Family Planning, and the University of California, San Francisco; 2008.

[4] Chabot MJ, Campa M, Barr L, Damesyn M. Adolescent birth rates, percentage of repeat births and births in high poverty areas by medical service study area: California, aggregated 2010–2012. Sacramento, CA: California Department of Public Health, Maternal, Child and Adolescent Health Division; 2015.

[5] Finer LB, Philbin JM. Sexual initiation, contraceptive use, and pregnancy among young adolescents. Pediatrics 2013;131:886–91.

[6] Lindberg LD, Santelli JS, Desai S. Changing patterns of contraceptive use and the decline in rates of pregnancy and birth among U.S. adolescents, 2007-2014. J Adolesc Health 2018;63:253–6.

[7] Bronfenbrenner U. The ecology of human development: Experiments by nature and design. Cambridge, MA: Harvard University Press; 1979.

[8] Viner RM, Ozer EM, Denny S, et al. Adolescence and the social determinants of health. Lancet 2012;379:1641–52.

[9] Salazar LF, Bradley ELP, Younge SN, et al. Applying ecological perspectives to adolescent sexual health in the United States: Rhetoric or reality? Health Educ Res 2010;25:552–62.

[10] Chabot MJ, Navarro S, Swann D, et al. Association of access to publicly funded family planning services with adolescent birthrates in California counties. Am J Public Health 2014;104(Suppl 1):e1–6.

[11] Diez Roux AV, Mair C. Neighborhoods and health. Ann N Y Acad Sci 2010;1186:125–45.

[12] Oman RF, Vesely SK, Aspy CB, et al. A longitudinal study of youth assets, neighborhood conditions, and youth sexual behaviors. J Adolesc Health 2013;52:779–85.

[13] Warner TD, Settersten RA Jr. Why neighborhoods (and how we study them) matter for adolescent development. Adv Child Dev Behav 2017;52:105–52.

[14] Cubbin C, Brindis CD, Jain S, et al. Neighborhood poverty, aspirations and expectations, and initiation of sex. J Adolesc Health 2010;47:399–406.

[15] Decker MJ, Isquick S, Tilley L, et al. Neighborhoods matter. A systematic review of neighborhood characteristics and adolescent reproductive health outcomes. Health Place 2018;54:178–90.

[16] Gunaratne S, Masinter L, Kolak M, Feinglass J. Change in population characteristics and teen birth rates in 77 community areas: Chicago, Illinois, 1999-2009. Public Health Rep 2015;130:372–9.

[17] Office of Statewide Health Planning and Development (OSHPD). Medical service study areas (MSSA). 2013. Available at: http://www.oshpd.ca.gov/hwdd/MSSA/index.html. Accessed March 6, 2018.

[18] Grusky DB, Western B, Wimer C. The great recession. New York: Russell Sage Foundation; 2011.

[19] California Department of Public Health, Center for Health Statistics and Informatics geocoded Birth Statistical Master Files, 2000-2002, 2006-2008, 2012-2014 for the number of births (numerator); U.S. Census Bureau, Censuses 2000 and 2010 and California Department of Finance, Race/Hispanics Population with Age and Gender Detail and State and county population projections 2010-2060 [P-3: State and County Projections Dataset].

[20] Ng AS, Kaye K. Sex in the (non) city: Teen childbearing in rural America. Washington, D. C.: The National Campaign to Prevent Teen and Unplanned Pregnancy; 2015.

[21] Jones RK, Kooistra K. Abortion incidence and access to services in the United States, 2008. Perspect Sex Reprod Health 2011;43:41–50.

[22] Yarger J, Decker MJ, Campa MI, Brindis CD. Rural–urban differences in awareness and use of family planning services among adolescent women in California. J Adolesc Health 2017;60:395–401.

[23] Rayburn WF, Klagholz JC, Murray-Krezan C, et al. Distribution of American Congress of Obstetricians and Gynecologists fellows and junior fellows in practice in the United States. Obstet Gynecol 2012;119:1017–22.

[24] Decker MJ, Gutmann-Gonzalez A, Lara D, Brindis CD. Exploring the influence of neighborhood-level factors on adolescent birth rates in California: A social-ecological approach. Youth Soc 2019;51:49–72.

[25] Hamilton BE, Mathews TJ, Ventura SJ. Declines in state teen birth rates by race and Hispanic origin. NCHS Data Brief 2013:1–8.

[26] Driscoll AK, Biggs MA, Brindis CD, Yankah E. Adolescent Latino reproductive health: A review of the literature. Hisp J Behav Sci 2001;23:255–326.

[27] Frost JJ, Driscoll AK. Sexual and reproductive health of U.S. Latinas: A literature review. New York: Guttmacher Institute; 2006.

[28] Sampson RJ, Morenoff JD, Gannon-Rowley T. Assessing "neighborhood effects": Social processes and new directions in research. Annu Rev Sociol 2002;28:443–78.