

Ethnic Density Effects on Physical Morbidity, Mortality, and Health Behaviors: A Systematic Review of the Literature

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It has been suggested that people in racial/ethnic minority groups are healthier when they live in areas with a higher concentration of people from their own ethnic group, a so-called ethnic density effect. Ethnic density effects are still contested, and the pathways by which ethnic density operates are poorly understood.

The aim of this study was to systematically review the literature examining the ethnic density effect on physical health, mortality, and health behaviors. Most studies report a null association between ethnic density and health. Protective ethnic density effects are more common than adverse associations, particularly for health behaviors and among Hispanic people.

Limitations of the literature include inadequate adjustment for area deprivation and limited statistical power across ethnic density measures and study samples. (*Am J Public Health*. 2012;102:e33–e66. doi:10.2105/AJPH.2012.300832)

IT HAS BEEN SUGGESTED THAT

people in racial/ethnic minority groups are healthier when they live in areas with a higher concentration of people from their own racial/ethnic group, a so-called ethnic density effect.^{1,2} Ethnic density, defined as the proportion of ethnic minority residents in an area, is generally thought of in relation to the negative association between residential segregation and health. However, when the detrimental association between concentrated area deprivation and health is accounted for, and the focus is placed on the association between living among other ethnic minority people and health, ethnic density can also be considered in terms of social networks and supportive communities.

Theoretical discourses of the ethnic density effect propose that positive health outcomes are attributed to the protective and buffering effects that enhanced social cohesion, mutual social support, and a stronger sense of community and belongingness provide from the direct or indirect consequences of discrimination and racial harassment, as well as from the detrimental effects of low-status stigma.^{3–6}

Studies to date on ethnic density and health have yielded inconsistent results, with some studies finding a protective ethnic density effect and others reporting a detrimental or null association. The discrepancy in results may arise because of numerous study differences. Variations in national

and migration contexts have led to a wide range of racial/ethnic groups and densities being investigated, and studies have used a variety of area definitions to operationalize ethnic density, and have adjusted for different demographic and socioeconomic confounding factors. In addition to inconsistent findings, the possible mechanisms by which ethnic density affects health have not yet been fully explained, leaving the relationship between ethnic density and health poorly understood. A clear understanding of the literature on the ethnic density effect would contribute to current debates on the individual and community assets available in diverse communities. And given repeated, albeit not consistent, reports of ethnic density effects on health despite the increased levels of deprivation found in areas with high proportions of ethnic minority residents,^{3,7,8} an appreciation of the ethnic density effect and the pathways by which it operates might also help in disentangling psychosocial influences on health from the effects of material factors,⁵ making an important contribution to the field of social epidemiology.

In a parallel piece of work we have undertaken a systematic review of the ethnic density literature on mental health.⁹ Our purpose in this study was to systematically review the literature examining the ethnic density effect on physical health, mortality, and health behaviors. We employed a systematic search to

eliminate potential biases caused by study selection, and we utilized the flexibility of a narrative synthesis to accommodate the diversity of studies.

METHODS

We searched the following databases from their earliest date (given in parentheses) until January 2011: Medline (1950), Sociological Abstracts (1952), and the Science (1900) and Social Science Citation (1996) indices of the Web of Science. Following this initial electronic search, we examined the references of identified articles to minimize the risk of missing relevant papers. To optimize the trade-off between sensitivity and specificity, we used different terms for different databases. For Medline, which has a specific focus on health, we searched only for ethnic density–related phrases, such as “ethnic enclave,” “racial segregation,” and combinations of neighborhood and ethnicity terms such as “ethnic*” or “Hispanic.” For non–health-focused databases (Sociological Abstracts and the Science and Social Science Citation indices of the Web of Science) we included health terms such as “hypertension” or “cardiovascular” to improve specificity.

We included studies in the present review if (1) they were published in a journal or book; (2) the sample contained a racial/ethnic minority group; (3) they included a measure of ethnic density, measured at a geographical

scale smaller than a US state or equivalent, as an independent variable; and (4) they included physical morbidity, mortality, or health behavior as an outcome, measured via self-report or clinical assessment.

We downloaded the results of the search into Procite 5 (Thomson Scientific, Stamford, CT) and screened abstracts for inclusion criteria. Selected papers were then reviewed (R. S.) and doubts about inclusion referred for a second opinion (K. P. and L. B.). For each article meeting the inclusion criteria, 2 reviewers (R. S. and either L. B. or C. A.) extracted data on study population (age, sample size, location, recruitment method), race/ethnicity, ethnic density (geographic area size, classification of ethnicity, range), health outcome, confounding factors, statistical methods, and results.

We found 2 categories of ethnic density in the studies reviewed: *own ethnic density* and *overall ethnic minority density*. Own ethnic density examined the association between the residential concentration of 1 racial/ethnic group and the health of that particular racial/ethnic group. This consisted, for example, of studies examining the association between the proportion of Black residents in a neighborhood and the health of Black individuals. Overall ethnic minority density, on the other hand, examined the association between the proportion of all non-White racial/ethnic minority groups in an area, and the health of 1 particular racial/ethnic group. Examples of this included studies of the association between proportion of “non-White” residents, or the proportion of people belonging to “visible minorities,” and a specific racial/ethnic group’s physical health, mortality, or health behavior.

We considered results from a single data set that were presented in more than 1 published paper to be from the same study, but we treated them as separate analyses. The studies included in the review covered a wide range of racial/ethnic and demographic groups, measured ethnic density (and ethnicity) in different ways and at different area levels, used a wide variety of statistical methodology, and adapted different approaches to adjust for confounding variables, in addition to examining a variety of health outcomes. The heterogeneity of study designs and methods meant that a meta-analysis was unfeasible, so we have conducted a narrative review instead, relying on vote counting of studies based on statistical significance of results found.

Our intent, therefore, was to offer a more contextual analysis, providing a critical commentary on previous research, while suggesting ways in which future research could advance ethnic density debates.

RESULTS

We identified a total of 6624 titles through database searching, and we additionally identified 9 papers from references. We assessed 336 full-text articles for eligibility and, of these, we excluded 279 because they did not meet study inclusion criteria. The final analytic sample consisted of 57 papers (Figure 1). We only discuss ethnic density effects in fully adjusted models, and so have excluded 2 papers that, although they treated ethnic density as a covariate in their analyses, they did not report adjusted coefficients of ethnic density.^{10,11} We further excluded 2 studies that examined ethnic density not

as the percentage of racial/ethnic minorities in an area, but as a location quotient that measured whether there were more or less racial/ethnic minority residents in the area than expected, given their representation in a larger area,^{6,12} and a paper that examined the association between non-Hispanic White ethnic density and mortality mostly attributable to homicide.¹³

Studies differed greatly in the methodology used. The majority of papers reviewed (37 out of 57), used multilevel methods or robust standard errors to correct for non-independence of observations because of geographic clustering.^{3,7,8,14–47} Ten studies analyzed multilevel data but did not employ multilevel statistical methods,^{48–57} and 10 studies analyzed ecological data,^{58–67} which did not adjust for individual-level covariates. Study designs also varied among articles, as they were set out to test different aims and hypotheses. This led to a wide range of statistical controls included in the reviewed studies. We also found discrepancies in terms of the geographical level of analyses, with studies exploring the ethnic density effect at levels ranging from block group up to counties. Most studies reported the number of areas analyzed, providing an indication of study power and representativeness of results. Detailed information about methods, covariates, and geographical level of analyses can be found in Tables 1 to 4.

The majority of ethnic density studies were conducted among the African American and Black population in the United States, hereafter “US Black,” followed by studies on Hispanic people in the United States, and ethnic minorities in the United Kingdom. We present the results of the literature review divided by racial/ethnic

group, and subdivided by health outcome.

US Black Population

A mixed picture of ethnic density among US Black persons emerged from the literature, summarized in Table 1. Most studies examined childhood outcomes, including 5 studies focused on infant mortality, and 21 studies exploring other birth outcomes.

Adult mortality. From a total of 11 studies exploring the association between Black ethnic density and mortality,^{17,25,43,51,52,58–60,62–64} 6 were ecological studies conducted using 5 different data sets.^{58–60,62–64} Among the ecological studies, 3 reported a detrimental association between Black ethnic density and increased mortality from colorectal cancer,⁵⁸ premature mortality,⁵⁹ and all-cause mortality.⁶⁰ The remaining 3 ecological studies provided evidence of a protective ethnic density effect on all-cause Black mortality.^{62–64} Two of these studies reported an age effect, whereby ethnic density was only protective for people aged 65 years and older.^{62,64} The third ecological study to report a protective effect of ethnic density on mortality found an interaction between ethnic density and social capital, with a stronger ethnic density effect in neighborhoods with high social capital.⁶³

Among the 5 mortality studies that did not employ ecological methods, 1 study reported a null association,⁴³ 2 reported a protective association,^{17,25} and 2 reported a detrimental association between Black ethnic density and mortality.^{51,52} Both studies that reported protective ethnic density effects employed multilevel methods.^{17,25} One of these studies found regional effects, with protective ethnic density effects found

in nonmetropolitan South areas, a nonsignificant protective effect reported in metropolitan central cities, and a null association found in metropolitan noncentral cities.¹⁷

The 2 studies that reported an adverse association between ethnic density and all-cause mortality analyzed multilevel data, but did not employ multilevel methods.^{51,52} Age effects were also reported in a multilevel study,⁵¹ where detrimental effects of ethnic density were only found among Black men and women aged between 25 and 44 years.⁵¹ For older groups, a null association was reported between Black ethnic density and mortality.⁵¹

The different patterns of ethnic density effects observed in studies of mortality suggest differing mechanisms of ethnic density occurring across the age spectrum, with Black ethnic density possibly being more relevant for older Black persons.

Adult physical morbidity. The ethnic density effect on adult physical morbidity among US Blacks was explored by 11 studies using 12 different data sets.^{19–21,23,33,34,41,42,46,57,58} Five articles focused on body mass index (BMI; defined as weight in kilograms divided by the square of height in meters) and obesity,^{19,20,23,35,41} 4 on self-rated health,^{33,42,46,57} 1 on hypertension,²¹ and another on colorectal cancer.⁵⁸

Among the 5 studies that examined the association between BMI and Black ethnic density, 1 reported a null association,⁴¹ and 4 reported adverse ethnic density effects.^{19,20,23,35} One of these studies found gender effects, whereby detrimental ethnic density effects were found among women only, highlighting possible gender differences in the association with ethnic density and physical morbidity.²⁰ In this study the

authors also reported a mediating effect of physical disorder on women's BMI and obesity, so that the ethnic density coefficient attenuated and ceased to be statistically significant upon adjusting for a measure of the degeneration of the material aspects of the respondents' neighborhood.²⁰

Four papers with 5 different data sets explored the association between Black ethnic density and self-rated health. Four of these analyses reported null associations,^{33,42,46,57} and 1 found a protective Black ethnic density effect among older Black adults.⁴²

Protective ethnic density effects among older Black adults were also reported for cancer. Ecological analyses of data from the 1989 to 1991 Medicare Provider Analysis and Review (MEDPAR) file on Black adults aged 65 years and older found that cancer incidence was lower

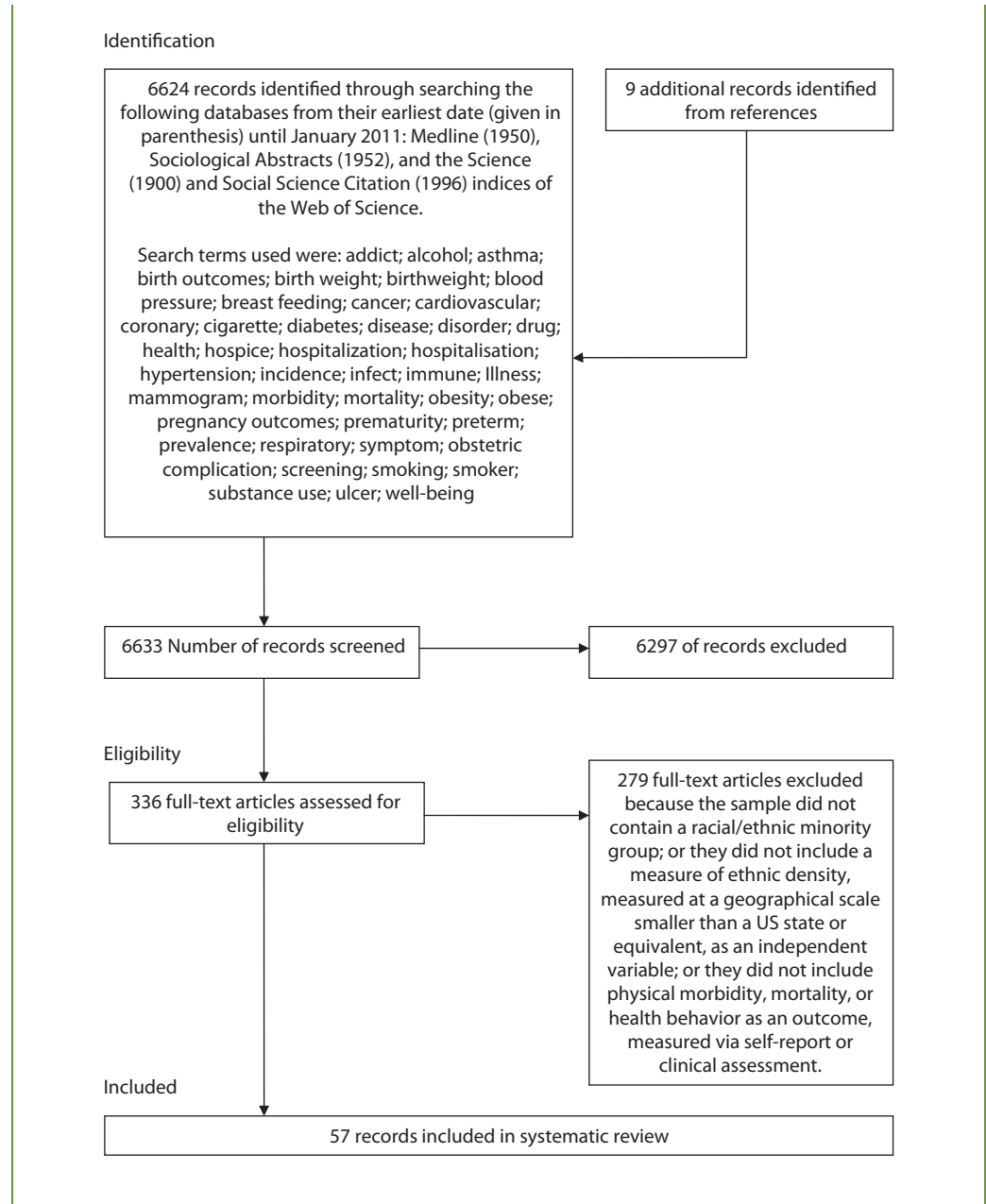


FIGURE 1—Flow diagram showing review process for literature examining the effect of ethnic density on physical health, mortality, and health behaviors.

TABLE 1—Studies Investigating Ethnic Density Among US Black Individuals

Reference	Data Set	Sample	Outcome(s)	Area Unit	Ethnic Density Measure	Covariates	Method	Results
Blanchard et al. ¹⁷ (2004)	National Health Interview Survey and the National Death Index (NDI); 1986–1994	US-born Black respondents aged ≥18 years in the nonmetropolitan South, and metropolitan areas (658 680 person years)	Mortality (nonexternal causes of death, International Classification of Diseases codes 004–780 (US Department of Health and Human Services, 1990)	County, primary sampling unit actually used so smaller counties would have been combined ^a	% Black	Gender, age, marital status, education, equivalized income, employment, health, region, metropolitan status	Multilevel data and analysis	Black ethnic density was associated with reduced risk of mortality in nonmetropolitan South. In Metropolitan non-central city areas, Black ethnic density was not significantly associated with reduced risk of mortality. In metropolitan central city areas, ethnic density had a nonsignificant protective effect.
		Black persons aged ≥ 65 years	Colorectal cancer 2-year case fatality rates	County (n = 329)	% Black aged ≥18 years categorized in quartiles as: 2%–5%, 5.1%–8.5%, 8.6%–17.4%, 17.2%–62.4%	Age, gender, census region	Ecological study	2-year case-fatality rates were lowest for Black persons in counties with lower Black ethnic density.
Cooper et al. ⁵⁸ (1997)	An inception cohort of all Medicare recipients aged ≥ 65 years with first diagnosis of colon or rectal cancer identified from Medicare Provider Analysis and Review (1990–1991)	Black persons aged ≥ 65 years	Colorectal cancer 2-year case fatality rates	County (n = 329)	% Black aged ≥18 years categorized in quartiles as: 2%–5%, 5.1%–8.5%, 8.6%–17.4%, 17.2%–62.4%	Age, gender, census region	Ecological study	2-year case-fatality rates were lowest for Black persons in counties with lower Black ethnic density.
Cooper et al. ⁵⁹ (2001)	Ecological study using data from the National Center for Health Statistics (1989–1991)	Black persons aged < 65 years	Premature mortality (death before age 65 years)	MSA (n = 267)	% Black	Segregation, median income, inequality	Ecological study	Black ethnic density was associated with increased risk of premature mortality.

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TABLE 1—Continued

Erwin et al. ⁶⁰ (2010)	Health Information Tennessee and Tennessee County Health Rankings Report (2004–2006)	Not reported	All-cause mortality	Counties (n = 95); countries that had fewer than 20 Black deaths per year (n = 59) were joined and deaths summed, becoming “units” that added up to 20 Black deaths per year	% Black	Poverty, unemployment, education, population- to-physician ratio, violent crime, single-parent households, degree of urbanization or rurality	Ecological study	Correlations for the units (but not counties) showed statistically significant positive associations between mortality rates and Black ethnic density. In the multivariate regression, Black ethnic density at the county and unit level was associated with increased mortality rates, although with very small coefficients.
Fang et al. ⁶² (1998)	New York mortality records (1988–1994)	Black men and women stratified by age 25–64 years and ≥ 65 years	All-cause mortality; coronary heart disease mortality	Zip code (n = 166)	% Black	Education, employment, % below poverty line, % born in South	Ecological study	For men and women aged ≥ 65 years, ethnic density was associated with reduced risk of all- cause mortality. For women aged 25–64 years, ethnic density was associated with reduced risk of coronary heart disease mortality but not all-cause mortality. For men aged 25–64 years, there was no association between ethnic density and mortality.
Franzini and Spears ²⁵ (2003)	Texas death certificates (1991)	Adults aged ≥ 25 years who had died from heart disease (n ≈ 50 000; % Black not reported)	Years of life lost because of heart disease	Census tract (n = 3788) and county (n = 247)	% Black	Gender, ethnicity, education; median house value, crime, % tenure	Cross-level interaction study with multilevel data and analysis	Black ethnic density measured at census- tract level but not at county level was associated with fewer years of life lost because of heart disease.

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TABLE 1—Continued

Hutchinson et al. ⁶³ (2009)	Philadelphia city vital statistics files; The Philadelphia Health Management Corporation 2004 Southeast Pennsylvania Community Health Database (1997–2000)	The entire Black population of Philadelphia	Age-adjusted Black mortality	Neighborhood (n = 68)	% Black (range: 0.21%–96.9%)	% university education, % renters, % unemployed, % male, poverty, social capital	Ecological study	There was a nonlinear relationship between Black ethnic density and age-adjusted Black mortality with reductions in mortality leveling off at densities of around 50%. Mortality was generally lower at higher densities and there was a significant interaction such that the effects of ethnic density were strongest in neighborhoods with high levels of social capital. For men and women aged ≥ 65 years, living at higher densities was associated with reduced risk of mortality. For men and women aged 25–64 years, ethnic density was not associated with mortality.
Inagami et al. ⁶⁴ (2006)	New York City mortality records (1999–2000)	Black men and women stratified by age: 25–64 years and ≥ 65 years	All-cause mortality	Zip code (n = 160)	% Black; higher density considered as areas with ≥ 70%	Education, employment, % poverty, % immigrant	Ecological study	For Black men and women aged 25–64 years, higher ethnic density was associated with reduced risk of mortality. For men and women aged 25–64 years, ethnic density was not associated with mortality.
Jackson et al. ⁵¹ (2000)	National Longitudinal Mortality Study (1978–1995), and NDI (1979–1989)	Black men and women (n ≈ 26 300) separated into age categories: 25–44 y; 45–64 y; ≥ 65 y	All-cause mortality	Census tract ^a	% Black categorized as: ≤ 0.10; 0.10–0.30; 0.30–0.70; 0.70–1.00	Age, family income	Multilevel data without multilevel analysis	For Black men and women aged 25–44 years, higher Black densities were associated with increased risk of mortality. In older age groups there was no association between ethnic density and mortality.

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TABLE 1—Continued

LeClere et al. ⁵² (1997)	National Health Interview Survey linked to the NDI (1986–1990)	N = 346 917 total sample: n = 20 843 Black men; n = 30 151 Black women	All-cause mortality	Census tract (n = 5919)	% Black categorized in empirical quartiles: 0.5%; > 0.5%–2.8%; > 2.8%–17%; > 17%	Ethnicity, age, income to needs, education, marital status, median income, education, poor households, female-headed households	Cross-level interaction study using multilevel data without multilevel analysis	High Black ethnic density was associated with increased mortality for men and women in the total sample, but there was no evidence of significant interaction terms between race and ethnic density.
Rodriguez et al. ⁴³ (2007)	Retrospective cohort study using data from the US Renal Data System (1995–2003)	Black patients with end-stage renal disease who had survived for at least 90 d (n = 153 627)	Mortality	Zip code (n = 13 622)	% Black categorized as: < 10%; 10%–24%; 25%–49%; 50%–74%; ≥ 75%	Age, gender, employment, health, census division, median income, % family in poverty, social class, tenure, % occupied, education	Multilevel data and analysis	There was no association between Black ethnic density and mortality.
Chang ¹⁹ (2006)	Behavioral Risk Factor Surveillance System (2000)	Non-Hispanic Black adults living in MSA with > 10% Black residents (n = 8800)	BMI	MSA (n = 130)	Adult physical morbidity % Black (range: 10.0%–51.3%)	Age, gender, marital status, education, household income, health care, population size, median income, % poverty, region	Multilevel data and analysis	Increasing Black ethnic density was associated with increased BMI.

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TABLE 1—Continued

Chang et al. ²⁰ (2009)	Southeastern Pennsylvania Household Health Survey, Philadelphia (2002, 2004)	Adults aged ≥ 18 years (n = 6698) of whom 38.3% were Black	Census tract (n = 384)	% Black categorized as: < 20%; 20%–60%; > 60%	Age, gender, race/ethnicity, education, household income, marital status, % poverty, population size, physical disorder (vacant residential properties, vacant lots, housing code violations, fires on property, median residential sales price), social disorder/crime, park area, recreation centers, supermarkets, % commercial parcels, billboards	Cross-level interaction with multilevel data and analysis	For women, there was an association between Black ethnic density and higher BMI and obesity but this disappeared with adjustment for physical disorder. There were no associations between Black ethnic density and BMI and obesity for men.
Cooper et al. ⁵⁸ (1997)	An inception cohort of all Medicare recipients aged 65+ with first diagnosis of colon or rectal cancer identified from Medicare Provider Analysis and Review (1990–1991)	Black persons aged ≥ 65 years (n = 329)	County (n = 329)	% Black aged ≥ 18 years categorized in quartiles: 2%–5%; 5.1%–8.5%; 8.6%–17.1%; 17.2%–62.4%	Age, gender, census region	Ecological study	Lower incidence of colorectal cancer was found in high-density areas.
Cozier et al. ²¹ (2007)	Black Women's Health Study (1995–2001)	Black women aged 21–69 years at baseline (n = 36 099)	Census block group (n = 20 192)	% Black in quintiles	Age, BMI, physical activity, education, family income, number of household members, smoking, alcohol, median income	Multilevel data and analysis	No association was found between Black ethnic density and hypertension.

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TABLE 1—Continued

Do et al. ²³ (2007)	National Health and Nutrition Examination Survey III (1988–1994)	Adults aged ≥ 20 years at time of interview (n = 2188 Black women and n = 1854 Black men)	BMI	Census tract (n ≈ 160)	% Black	Ethnicity, age, employment status, education, nativity, marital status, disadvantage, education	Cross-level interaction study using multilevel data and analysis	Black ethnic density was associated with increased BMI.
Mellor and Milyo ³³ (2004)	Current Population Survey (1995, 1997, and 1999)	Black persons aged 25–74 years (n = 7120)	Self-rated health	County (n = 217)	% Black	Age, household income, ethnicity, gender, marital status, health insurance, education, mean county income, region	Multilevel data and analysis	Black ethnic density was not associated with self-rated health after adjustment for region.
Park et al. ³⁵ (2008)	Cross-sectional survey conducted by New York City government via Academic Medicine Development Company (2000–2002)	Black Caribbean residents of New York City (n = 638)	BMI	Half-mile radius around home (unique to each participant) ^a	% Black	Age, gender, education, income, nativity, % residents below poverty line	Multilevel data and analysis	There was a marginally significant ($P = .06$) positive association between Black ethnic density and BMI.
Robert and Reither ⁴¹ (2004)	Americans' Changing Lives (1986)	Adults aged ≥ 25 years (n = 3617) of whom n = 778 were Black women and n = 396 were Black men	BMI	Census tract ^a	% Black	Race, age, marital status, employment, education, income, assets, socioeconomic disadvantage, income inequality	Cross-level interaction with multilevel data and analysis	There was no association between Black ethnic density and BMI for men and women. Interaction terms were not significant.
Robert and Ruel ⁴² (2006) sample A	Americans' Changing Lives (1986)	Black adults aged ≥ 60 years (n = 382)	Self-rated health	County (n = 102)	% Black	Age, gender, education, income, assets, segregation, % poverty	Multilevel data and analysis	There was no association between Black ethnic density and self-rated health.
Robert and Ruel ⁴² (2006) sample B	National Survey of Families and Households (1987–1988)	Black adults aged ≥ 60 years (n = 290)	Self-rated health	County (n = 204)	% Black	Age, gender, education, income, assets, segregation, % poverty	Multilevel data and analysis	County-level ethnic density was associated with better self-rated health.
Usher ⁵⁷ (2007)	Cross-sectional surveys from Birmingham, Alabama (2000–2001)	Black respondents (n = 310)	Self-rated health	Census tract ^a	% ethnic minority	Gender, age, education, income, employment, marital status, residence, trust	Multilevel data without multilevel analysis	There was no association between ethnic density and self-rated health.

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TABLE 1—Continued

White and Borrell ⁴⁶ (2006)	New York Social Indicators Survey (1999–2002)	Adults (n = 2845) of whom 25.6% were Black	Self-rated health	Zip code (n = 170)	% Black categorized as: 0%–5.3%; > 5.3%–35%; >35%	Age, gender, ethnicity, education, income, health insurance, perception of neighborhood, SES	Cross-level interaction study using multilevel data and analysis	High Black ethnic densities were associated with increased risk of poor self-rated health in total sample. However, interaction term between ethnicity and ethnic density was not significant.
Health behaviors								
Baker and Hellerstedt ⁴⁸ (2006)	Birth certificates from Minnesota's 7-county metropolitan area (1990–1999)	Singleton birth of US-born Black (n = 23 649) and foreign-born Black (n = 4287) mothers	Alcohol and tobacco use during pregnancy	Census tract ^a	The proportion of Black women aged ≥ 15 y relative to the total population, categorized as: 0%–10%; 11%–20%; 21%–33%	Age, marital status, education, prenatal care	Multilevel data without multilevel analysis	Foreign-born Black mothers were more likely to use substances at higher levels of Black ethnic density.
Bell et al. ¹⁵ (2007)	National Center for Health Statistics natality detail files (2002)	Black mothers of singleton births (n = 403 842)	Maternal smoking during pregnancy	MSA (n = 216)	% Black	Age, parity, marital status, education, segregation, total population, state cigarette tax, % poverty, region	Multilevel data and analysis	Black ethnic density was associated with lower risk of smoking during pregnancy.
Datta et al. ²² (2006)	Black Women's Health Study (1995)	Black women (n = 41 726) including 1% mixed race and 1.8% Hispanic Black	Smoking prevalence (exsmokers excluded from analysis)	Census tract (n = 14 559)	% Black divided into quartiles	Education, marital status, age, social class	Multilevel data and analysis	% Black was not associated with smoking in fully adjusted models.
Shaw et al. ⁴⁴ (2010)	The 2000 US linked birth and infant death data set (2000–2001)	Singleton births of non-Hispanic Black mothers (n = 581 151)	Maternal smoking during pregnancy	County (n = 2215)	% Black, categorized as: 0%–0.99%; 1%–4.99%; 5%–14.99%; 15%–49.99%; ≥50%	Age, parity, marital status, education, nativity, median income	Multilevel data and analysis	Increasing Black ethnic density was associated with reduced risk of smoking.

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TABLE 1—Continued

Xue et al. ⁴⁷ (2007)	Longitudinal study of young people at risk for drop out in public school in Flint, Michigan (1994–1995)	Ninth graders (n = 824) who had grade point averages below 3 in eighth grade (of which n = 681 Black students)	Smoking prevalence	Census block group (n = 143)	% Black categorized as: < 10%; 10%–90%; > 90%	Gender, age, ethnicity, parent/peer substance use, social activities, neighborhood disadvantage	Cross-level interaction study using multilevel data and analysis	Higher ethnic density was associated with reduced smoking during adolescence for Black youths.
Infant mortality								
LaVeist ⁶⁵ (1992)	Vital Statistics reports (1981–1985)	Black infants	Postneonatal mortality	Central city (n = 176)	% Black	Black political power, education, segregation, single mothers, total population, birth weight	Ecological study	There was no evidence of an association between Black ethnic density and postneonatal mortality.
Shaw et al. ⁴⁴ (2010)	The 2000 US linked birth and infant death data set (2000–2001)	Non-Hispanic Black singleton births (n = 581 151)	Infant mortality, low birth weight, preterm birth, smoking during pregnancy	County (n = 2215)	% Black, categorized as: 0%–0.99%; 1%–4.99%; 5%–14.99%; 15%–49.99%; ≥ 50%	Age, parity, marital status, education, nativity, median income	Multilevel data and analysis	There was no significant association between ethnic density and infant mortality for Black mothers.
Yankauer ⁶⁷ (1950)	New York vital data of pregnancy and infant wastage (1945–1997)	Non-White births (96% Black)	Fetal mortality, neonatal mortality, postneonatal mortality, total infant mortality	Health area (n = 318)	% of non-White live births, categorized as: < 5%; 5%–9%; 10%–24%; 25%–49%; 50%–74%; ≥ 75%		Ecological study	Total infant mortality, fetal mortality, and neonatal mortality were found to increase with increasing ethnic density. No association was found with postneonatal mortality.
Yankauer and Alloway ⁶⁶ (1958)	New York vital data of pregnancy and infant wastage (1954–1955)	Non-White births (95.6% Black)	Fetal mortality, neonatal mortality, postneonatal mortality	Health area (n = 415)	% non-White live births		Ecological study	Fetal and neonatal mortality were found to increase with increasing density, but no association was found for postneonatal mortality.

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TABLE 1—Continued

		Other birth outcomes					
Baker and Hellerstedt ⁴⁸ (2006)	Birth certificates from Minnesota's 7-county metropolitan area (1990–1999)	Singleton births of US-born Black (n = 23 649) and foreign-born Black (n = 4287) mothers	Low birth weight, preterm delivery	Census tract ^a The proportion of Black women aged ≥ 15 years relative to the total population: 0%–10%; 11%–20%; 21%–33%	Age, education, marital status, prenatal care, substance use	Multilevel data without multilevel analysis	Living at high density was associated with increased risk of preterm delivery for US-born Black infants. No association was found between Black ethnic density and preterm delivery and low birth weight for foreign-born or low birth weight among US-born Black infants. There was no association between Black ethnic density and birth weight, preterm delivery, and fetal growth restriction.
Bell et al. ¹⁵ (2007)	Public-use birth files issued by the National Center for Health Statistics (2002)	US-born Black mothers of singleton births (n = 434 376)	Birth weight, preterm delivery, fetal growth restriction	MSA (n = 225) % Black residents	Age, medical complications, previous preterm birth, smoking, marital status, education, prenatal care, segregation, total population, education	Multilevel data and analysis	There was no association between Black ethnic density and birth weight, preterm delivery, and fetal growth restriction.
Buka et al. ¹⁸ (2003)	Project on Human Development in Chicago Neighborhoods (1994–1996)	Black respondents (n = 65 923)	Birth weight	Neighborhood clusters (equivalent to large census tract; N = 343) % births to Black mothers (range: 0% to > 90%)	Age, gender, marital status, education, parity, smoking, prenatal care, SES, social support	Multilevel data and analysis	There was no association between Black ethnic density and birth weight.
Eliott ⁵⁰ (2000)	National linked birth and death files (1990)	Mothers of Black (n = 563 539) and non-Black (n = 2 479 624) ethnic origin	Low birth weight	MSA (n = 252) % Black	Age, education, ethnicity, segregation, total population, median income, % Hispanic	Cross-level interaction study using multilevel data without multilevel analysis	Black ethnic density had an adverse effect on health. This detrimental effect was greater for Black persons, as indicated by interaction terms.

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TABLE 1—Continued

Author (Year)	Study Location	Study Population	Exposure	Outcome	Analysis	Notes		
Masi et al. ²⁹ (2007)	The Illinois Department of Public Health Electronic Birth Certificate Database (1991)	Non-Hispanic Black singleton births (n = 25 087)	Birth weight, preterm delivery, small for gestational age	Census tract (n = 688)	Ethnic density classified as: < 10% Black and < 20% Hispanic; < 10% Black and ≥ 20% Hispanic; 10%–90% Black and ≥ 20% Hispanic; 10%–90% Black and < 20% Hispanic; > 90% Black	Gender, smoking, parity, education, maternal age, economic disadvantage, crime	Multilevel data and analysis	None of the outcomes measured were significantly associated with ethnic density.
Mason et al. ³⁰ (2009)	Birth records for Wake and Durham counties, North Carolina (1999–2001)	Non-Hispanic Black mothers (n = 9833)	Preterm delivery	Census tracts (n = 158), block groups (n = 390), blocks (n = 5838)	% Black	Age, education, parity, prenatal care, marital status, smoking, index of neighborhood deprivation	Multilevel data and analysis	A nonstatistically significant adverse ethnic density effect was found for preterm delivery at census tract, block group, and block.
Mason et al. ³¹ (2010)	New York City birth records (1995–2003)	Non-Hispanic Black singleton births (n = 249 785); Black African births; n = 21 064 Black African births; n = 86 961 Black Caribbean births; n = 141 760 Black American births	Preterm birth	Census tracts: n = 1452 tracts with Black African births; n = 1797 tracts with Black Caribbean births; n = 1885 tracts with Black American births	Proximity-weighted ethnic density—which allows the ethnic composition of the areas surrounding the mother's residence to influence her estimated exposure in proportion to their distance from her; 10th and 90th percentile of ethnic density were also calculated: African 10th percentile: 0.2%; African 90th percentile: 7.0%; Caribbean 10th percentile: 2.3%; Caribbean 90th percentile: 39.5%; US-born 10th percentile: 13%; US-born 90th percentile: 70.1%	Maternal age, education, parity, nativity, tobacco use, prepregnancy weight, health insurance payment type, residential stability, standardized index of neighborhood deprivation	Multilevel data and analysis	Increased Black African density was associated with increased risk of preterm birth for African-born mothers. Detrimental ethnic density effects were also found for US-born women, and the effect was stronger in more deprived neighborhoods. No associations with ethnic density were found for the births from Caribbean-born mothers.

Continued

TABLE 1—Continued

Mason et al. ³² (2011)	New York City birth records (1995-2003)	Singleton births (n = 887 887); n = 237 528 non-Hispanic White births; n = 256 673 non-Hispanic Black births	Preterm birth	Census tracts (n = 2202)	Proximity-weighted ethnic density—which allows the ethnic composition of the areas surrounding the mother's residence to influence her estimated exposure in proportion to their distance from her; ethnic density dichotomized at 25%; also modeled as a continuous variable with a squared term to allow for nonlinearities	Maternal age, education, nativity, parity, tobacco use, prepregnancy weight, prenatal care received in the first 120 d of gestation, health insurance payment type, residential stability, standardized index of neighborhood deprivation	Multilevel data and analysis	For Black women, living in an ethnic neighborhood (> 25% ethnic density) was associated with increased risk of preterm birth.
Messer et al. ⁵³ (2010)	Durham and Wake counties, North Carolina, birth records (1999-2001)	Black women from Durham County (n = 4275); Black women from Wake County (n = 5558)	Preterm birth	Census tract (Durham N = 53; Wake N = 105)	Percentage Black, categorized as: Durham County: 4.5%–18.8%; 19.2%–37.0%; 40.0%–65.0%; 68.6%–97.8%; Wake County: 0.7%–6.8%; 7.1%–15.2%; 15.3%–28.2%; 28.3%–92.7%	Education, marital status, maternal age, deprivation	Multilevel data and analysis	There was a nonsignificant adverse association between ethnic density and preterm birth in both Durham and Wake counties.
Mkansah-Amankra et al. ³⁴ (2010)	South Carolina Pregnancy Risk Assessment and Monitoring System (2000-2003) and the 2000 US Census	White and Black women (n = 8064) with live births (48% Black)	Low birth weight; preterm birth	Census tract ^a	% Black, categorized as: predominantly White (5%–10% African-American population); mixed majority African American population (10%–50% African-American population); predominantly African-American (< 50%–90% African-American population).	Stressful life events, marital status, maternal age, income, education, % below poverty level, household crowding, % below high-school education for adults aged 25+	Multilevel data and analysis	Black mothers living in mixed racial census tract (10%–50% census tract residents) were at > 2-fold risk of having low birth weight babies because of emotional stress. Mothers with the same stress but living in predominantly Black census tracts were at > 4-fold risk of having low birth weight.

Continued

TABLE 1—Continued

Phillips et al. ³⁷ (2009)	The Black Women's Health Study (1995–2003)	Singleton births of Black mothers aged ≥ 21 years in 1995, and < 45 years at time of birth (n = 6410)	Self-reported spontaneous and medically induced preterm births	Block group ^a	% Black residents, categorized as: < 14.4%; 14.4%–82.75%; > 82.75%	Age, education, marital status, BMI, smoking during pregnancy, relative income, income incongruity	Multilevel data and analysis	There was no association between ethnic density and preterm birth. However, there was an interaction between ethnic density and relative income. Women living at low ethnic density had lower risk of preterm birth overall if they had a high relative income. Women at high density had a higher relative risk of overall preterm birth if they had a high relative income. Black ethnic density was not significant in the final model predicting preterm delivery.
Pickett et al. ³⁸ (2002)	Case-control study using the University of California, San Francisco Perinatal Database (1980–1990)	Singleton births of Black mothers (n = 417)	Preterm delivery	Census tract ^a	% Black	Health insurance, education, % unemployed, median household income, change in % Black	Multilevel data and analysis	Black ethnic density was not significant in the final model predicting preterm delivery.
Reichman et al. ⁴⁰ (2009)	Fragile Families and Child Well-Being study (1998–2000)	Infants of unmarried Black mothers who were either aged ≥ 18 years, or considered emancipated minors (n = 1871)	Birth weight in grams, low birth weight	Census tract (n = 1181) and city (n = 20)	% Black for census tract both continuous and categorized as: < 20%; 20%–39%; 40%–59%; 60%–79%; ≥ 80%	Age, mother's age, father's age, nativity, marital, relationship status, mother's education, father's education, father's employment status, mother's health insurance, parity, proportion poor in census tract, proportion poor in city	Multilevel data and analysis	A linear measure of Black ethnic density at census tract level was negatively associated with birth weight in grams. However, this was not significant when city-level ethnic density was included. Mothers living at densities of 80% or higher Black had increased risk of preterm birth. However, densities between 40% and 79% were not significant. Black ethnic density at city level was associated with lower birth weight.

Continued

TABLE 1—Continued

Roberts ⁵⁶ (1997)	Vital records for the 6-county Illinois segment of the Chicago metropolitan area (1990)	Births of residents of the 6-county area (n = 131 457)	Low birth weight	Illinois Department of Health community areas (n = 77)	% Black	Age, marital status, education, prenatal care, parity, alcohol, smoking, SES, age structure, rental cost	Multilevel data without multilevel analysis	Increasing Black ethnic density was associated with reduced risk of low birth weight.
Shaw et al. ⁴⁴ (2010)	The 2000 US linked birth and infant death data set (2000–2001)	Singleton births of non-Hispanic Black mothers (n = 581 151)	Infant mortality, low birth weight, preterm birth, smoking during pregnancy	County (n = 2215)	% Black categorized as: 0%–0.99%; 1%–4.99%; 5%–14.99%; 15%–49.99%; ≥ 50%	Age, parity, marital status, education, nativity, median income.	Multilevel data and analysis	A nonlinear relationship between ethnic density and low birth weight and preterm birth was found, whereby relatively small increases in Black ethnic density was associated with increased risk of low birth weight and preterm birth for Black mothers.
Walton ⁴⁵ (2009)	US natality file (2000)	Singleton births to Black mothers (n = 434 326) living in MSAs with > 5000 Black residents and a total population of ≥ 100 000	Low birth weight	MSA (n = 228)	% Black	Age, parity, education, medical complications, marital status, previous preterm birth, adequacy of prenatal care, nativity, smoking during pregnancy, alcohol use during pregnancy, residential isolation, residential clustering, education, log of population size, median household income, % Black in poverty	Multilevel data and analysis	In models adjusting for residential isolation or residential clustering, Black ethnic density was associated with increased risk of low birth weight.

Note. BMI = body mass index, defined as weight in kilograms divided by the square of height in meters; MSA = metropolitan statistical area; SES = socioeconomic status.
^aN not reported.

in areas of high Black ethnic density.⁵⁸

The only study to examine the ethnic density effect on hypertension reported a null association.²¹

Health behaviors. Five studies examined the association between US Black ethnic density and health behaviors, 4 of which focused on smoking,^{15,22,44,47} and 1 on smoking and alcohol use.⁴⁸ Only 1 of these 5 studies reported a detrimental ethnic density effect,⁴⁸ whereby foreign-born Black mothers living in areas of high Black ethnic density were more likely to smoke and drink alcohol during pregnancy.⁴⁸ This association did not hold for US-born Black mothers.⁴⁸

Among the other 4 studies that examined smoking, 1 reported a null association,²² and 3 found protective ethnic density effects.^{15,44,47} One of these latter studies consisted of the only investigation of ethnic density among Black youths,⁴⁷ which analyzed data from 4 public schools in the city of Flint, Michigan, and showed that, for Black adolescents, living in a neighborhood with high levels of ethnic density was associated with reduced risk of cigarette smoking.⁴⁷

Infant mortality. Three of the 4 studies that examined the ethnic density effect on Black infant mortality were ecological⁶⁵⁻⁶⁷ and explored the association between ethnic density and post-neonatal,⁶⁵⁻⁶⁷ fetal, and neonatal mortality.^{66,67} All 3 ecological studies reported adverse ethnic density effects.⁶⁵⁻⁶⁷

The only multilevel analysis in this category reported a null association between Black ethnic density and infant mortality among singleton births of Black mothers.⁴⁴

Other birth outcomes. Sixteen studies using 14 different data

sets explored the association between ethnic density and other birth outcomes.^{15,18,29-32,34,37,38,40,44,45,48,50,53,56} Of these, 10 studies examined the ethnic density effect on birth weight,^{15,18,29,34,40,44,45,48,50,56} 5 of which found a null association with ethnic density^{15,18,29,40,48}; 4 reported a detrimental association^{34,44,45,50}; and only 1 found a protective Black ethnic density effect.⁵⁶

The association between Black ethnic density and preterm delivery was examined by 9 studies, none of which found a protective ethnic density effect.^{15,29-32,37,38,48,53}

Three studies reported a detrimental association between Black ethnic density and increased risk of preterm birth.^{31,32,48} One of these studies reported nativity effects, whereby detrimental ethnic density effects were only found for US-born Blacks.⁴⁸ Another study to report detrimental ethnic density effects found that results were only statistically significant in more deprived neighborhoods.³¹ In fact, a nonstatistically significant protective ethnic density effect was reported for women living in less-deprived neighborhoods.³¹

Two other birth outcomes were examined in association with Black ethnic density: fetal growth restriction¹⁵ and small for gestational age.²⁹ These reported a null association with ethnic density.

US Hispanic Population

Investigations of ethnic density effects among Hispanic persons in the United States provide the most consistent evidence for a protective effect of ethnic density (Table 2).

Evidence of nativity effects on the association between ethnic density and health were reported by several studies. For example, protective ethnic density effects

were found to be more salient for US-born Hispanic mothers for infant mortality,²⁶ birth weight,⁵⁴ and smoking during pregnancy.⁴⁴

Hispanic ethnic density was mostly centered on the Mexican American population, so most studies are not generalizable to other Hispanic subgroups, or to the overall Hispanic population of the United States.

Adult mortality. One ecological⁶⁴ and 2 multilevel^{24,25} studies examined the ethnic density effect on Hispanic adult mortality. All 3 explorations reported protective ethnic density effects.

Gender and age effects were reported in an ecological study that found that an increase in ethnic density was associated with a decreased risk of all-cause mortality among men aged 25 to 64 years. A null association was found for Hispanic women and for Hispanic men aged 65 years and older.⁶⁴

All-cause mortality was also analyzed with data from the Hispanic Established Populations for the Epidemiologic Study of the Elderly, sampling Mexican Americans from 5 Southwestern US states. Results of multilevel analyses showed tract percentage Mexican American to be associated with reduced risk of all-cause mortality for older Hispanic adults.²⁴

The third mortality study reported a protective ethnic density effect on years of life lost because of heart disease in the state of Texas.²⁵

Adult physical morbidity. Five studies that used 4 different data sets examined the ethnic density effect on Hispanic adult physical morbidity.^{23,24,35,36,61} Two of these studies reported a null association,^{23,35} and 3 showed a protective ethnic density effect.^{24,36,61} One of these studies consisted of

an ecological analysis that found an association between high Hispanic density and lower age-adjusted incidence rate ratios of lung cancer for both men and women, breast cancer for women, and colorectal cancer for men.⁶¹

The other 2 studies to report evidence of an ethnic density effect consisted of multilevel investigations among Mexican American populations. Mexican American ethnic density was found to be associated with reduced risk of stroke, cancer, and hip fracture among older Mexican Americans.²⁴ Null associations were reported between Mexican American ethnic density and physician-diagnosed heart attack, hypertension, diabetes mellitus, or disability.²⁴ The other study reported a protective association between Mexican American ethnic density and a reduced risk of poor self-rated health.³⁶

Health behaviors. Hispanic ethnic density has been examined in association with nutrition,⁵⁵ smoking during pregnancy,⁴⁴ and adolescent substance use.²⁸ Two of these studies sampled Hispanic people of Mexican origin,^{28,55} and the third did not specify Hispanic subgroups.⁴⁴ The first study focused on consumption of 17 different food groups and serum levels of 10 nutrients, and reported an association between increased Mexican American density and increased consumption of cornbread and flour tortillas, tomatoes, beans, and hot red chili peppers, but a decrease in the consumption of fruits, carrots, and greens.⁵⁵ In the second study, an exploration of substance abuse among Mexican Hispanic adolescents in Phoenix, Arizona, Kulis et al. categorized participants depending on ethnic origin and language acculturation, yielding 3

TABLE 2—Studies Investigating Ethnic Density Among US Hispanic Individuals

Reference	Data Set	Sample	Outcome(s)	Area Unit	Ethnic Density Measure	Covariates	Method	Results
Adult mortality								
Eschbach et al. ²⁴ (2004)	Hispanic Established Populations for the Epidemiologic Study of the Elderly (1993–2001)	Mexican Americans aged 65+ in noninstitutionalized settings (n = 2669)	All-cause mortality	Census tract (n = 210)	% Mexican American	Age, gender, education, household income, nativity, language, health measures, % poor	Multilevel data and analysis	Increased ethnic density was associated with reduced risk of mortality.
Franzini and Spears ²⁵ (2003)	Texas death certificates (1991)	Adults aged ≥ 25 years (n ≈ 50 000) who had died from heart disease; % Hispanic not reported	Years of life lost because of heart disease	Census tract county (n = 247)	% Hispanic	Gender, ethnicity, education, median house value, crime, % tenure	Cross-level interaction study with multilevel data and analysis	Fewer years were lost because of heart disease mortality at higher Hispanic densities measured at census tract level, but not at county level.
Inagami et al. ⁶⁴ (2006)	New York City mortality records (1999–2000)	Men and women aged 25–64 years, and ≥ 65	All-cause mortality	Zip code (n = 160)	% Hispanic	Education, employment, % poverty, % immigrant	Ecological study	Ethnic density was associated with lower mortality for men aged 25–64 years. This effect was not found for men aged ≥ 65 years or women of any age.
Adult physical morbidity								
Do et al. ²³ (2007)	National Health and Nutrition Examination Survey III (NHANES III; 1988–1994)	Mexican American women (n = 1940) and Mexican American men (n = 2033) aged ≥ 20 years at time of interview	BMI	Census tract (n ≈ 160)	% Mexican American	Ethnicity, age, employment status, education, nativity, marital status, disadvantage, education, % Black	Cross-level interaction study with multilevel data and analysis	There was no association between ethnic density and BMI.
Eschbach et al. ²⁴ (2004)	Hispanic Established Populations for the Epidemiologic Study of the Elderly (1993–1994)	Mexican Americans aged ≥ 65 years in noninstitutionalized settings (n = 2669)	Stroke, cancer, heart attack, hip fracture, hypertension, diabetes mellitus, disability	Census tract (n = 210)	% Mexican American	Age, gender	Multilevel data without multilevel analysis	Higher ethnic density was associated with reduced risk of stroke, cancer, and hip fractures, but no association was found with heart attacks, hypertension, disability, or diabetes mellitus.

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TABLE 2—Continued

Eschbach et al. ⁶¹ Surveillance, Epidemiology and End Results (SEER) program tumor registry (1988–1992)	Incident cases living in the SEER area	Incidence rates separately for lung, colorectal, breast, prostate, cervical carcinoma	Census tract (n = 5272)	% Hispanic classified as: < 20%; 20 to < 60%; ≥ 60%	Age, gender, income	Ecological study	High ethnic densities were associated with reduced rates of lung cancer for both men and women; breast cancer for women; and colorectal cancer for men in the highest ethnic density category. There were interactions between income quartiles and ethnic density for prostate cancer and cervical cancer. There was no association between prostate cancer for men and cervical cancer for either gender.
Park et al. ³⁵ Cross-sectional survey conducted by New York City Government via Academic Medicine Development Company (2000–2002)	Hispanic residents of New York City (n = 2616)	BMI	Half-mile radius around home (unique to each participant) ^a	% Hispanic	Age, gender, education, income, nativity, % residents below poverty line	Multilevel data and analysis	No association was found between Hispanic ethnic density and BMI.
Patel et al. ³⁶ Hispanic Established Populations for the Epidemiologic Study of the Elderly (1993–1994)	Mexican Americans aged ≥ 65 years in noninstitutionalized settings (n = 2561)	Self-rated health	Census tract (n = 209)	% Mexican American	Age, gender, nativity, education, household income, acculturation, financial strain, social support, stressful life events, health behaviors, medical conditions, economic disadvantage	Multilevel data and analysis	Ethnic density was associated with reduced risk of poor self-rated health.

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TABLE 2—Continued

		Health behaviors			
		School catchment area	% Mexican American	Age, grades, school lunch program, gender, % immigrant, % poor, crime, stability, % single mothers	Multilevel data and analysis
Kulis et al. ²⁸ (2007)	School-based drug prevention trial in Phoenix Schools (1998)	Past-month use of alcohol, cigarettes, and marijuana	School (n = 35)	% Mexican American	Multilevel data and analysis
		Seventh graders (n = 3721) of whom 13% were of Mexican heritage, Spanish-language dominant; 30% were of Mexican heritage, bilingual; 37% of Mexican heritage, English-language dominant; 20% White non-Hispanic			
Reyes-Ortiz et al. ⁵⁵ (2009)	NHANES III (1988-1994)	Consumption of 17 different food groups, serum levels of 10 nutrients	Census tract ^a	% Mexican American	Multilevel data without multilevel analysis
					Ethnic density was associated with increased consumption of cornbread, flour tortillas, tomatoes, beans, and hot red chili peppers. There was no association between ethnic density and cereals, pasta, rice, citrus fruit, peach-type fruits, brussels sprouts, cauliflower, and other peppers. There was a negative association between ethnic density and melons, other fruit, carrots, greens, and broccoli. Ethnic density was negatively associated with lycopene, selenium, vitamin A, vitamin C, folate, and α -carotene. There was no association between ethnic density and vitamin E, vitamin D, vitamin B ₁₂ , and β -cryptoxanthin.

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TABLE 2—Continued

Shaw et al. ⁴⁴ (2010)	The 2000 US linked birth and infant death data set (2000–2001)	Singleton births of Hispanic White mothers (n = 763 201)	Smoking during pregnancy	County (n = 2664)	% Hispanic categorized as: 0%–0.99%; 1%–4.99%; 5%–14.99%; 15%–49.99%; ≥ 50%	Age, parity, marital status, education, nativity, median income	Multilevel data and analysis	There was an interaction between Hispanic density and maternal nativity in the prediction of smoking during pregnancy. For US-born Hispanic mothers, increasing Hispanic density was associated with reduced risk of smoking during pregnancy. For foreign-born mothers, Hispanic density was associated with low risk of smoking during pregnancy irrespective of density.
Infant mortality								
Jenny et al. ²⁶ (2001)	The US period-linked birth and infant death files for Arizona, California, New Mexico, and Texas (1995 to 1997)	Singleton birth infants of US-born Mexican-origin mothers (n = 444 758) and of Mexican-born mothers (n = 650 704)	Infant mortality	County ^a	% of births to Mexican mothers in 3 categories: low (0%–32.9%); medium (33%–65.95%); high (≥ 66%)	Parity, education, marital status, maternal age, smoking	Multilevel data and analysis	For US-born mothers, the risk of infant mortality decreased with increasing ethnic density. For Mexican-born mothers, there was a marginally significant increased risk of infant mortality at medium density.
Shaw et al. ⁴⁴ (2010)	The 2000 US linked birth and infant death data set (2000–2001)	Singleton births of Hispanic-White mothers (n = 763 201)	Infant mortality	County (n = 2664)	% Hispanic categorized as: 0%–0.99%; 1%–4.99%; 5%–14.99%; 15%–49.99%; ≥ 50%	Age, parity, marital status, education, nativity, median income	Multilevel data and analysis	Increasing Hispanic density was associated with reduced risk of infant mortality for Hispanic mothers.

Continued

TABLE 2—Continued

				Other birth outcomes				
Masi et al. ²⁹ (2007)	The Illinois Department of Public Health Electronic Birth Certificate Database (1991)	Hispanic singleton births (n = 15 929)	Birth weight, preterm delivery, small for gestational age	Census tract (n = 829)	Ethnic density classified as: < 20% Hispanic and < 10% Black; ≥ 20% Hispanic and < 10% Black; ≥ 20% Hispanic and 10%–90% Black; < 20% Hispanic and 10%–90% Black; > 90% Black	Gender, smoking, parity, education, maternal age, economic disadvantage, crime	Multilevel data and analysis	Relative to the < 10% Hispanic and < 10% Black category, living in tracts with > 20% Hispanic density was not associated with birth outcomes. Hispanic infants living at > 90% Black had lower birth weight and were at increased risk of preterm delivery and small for gestational age.
Mason et al. ³² (2011)	New York City birth records (1995–2003)	Singleton births (n = 887 887); n = 73 096 Central American and Mexican births; n = 43 324 South American Hispanic births	Preterm birth	Census tracts (n = 2202)	Proximity-weighted ethnic density—which allows the ethnic composition of the areas surrounding the mother's residence to influence her estimated exposure in proportion to their distance from her; ethnic density dichotomized at 25%; also modeled as a continuous variable with a squared term to allow for nonlinearities	Maternal age, education, nativity, parity, tobacco use, prepregnancy weight, prenatal care received in the first 120 d of gestation, health insurance payment type, residential stability, standardized index of neighborhood deprivation	Multilevel data and analysis	Analyses stratified by neighborhood deprivation showed that in poorer neighborhoods Central American mothers had a decreased risk difference of delivering a preterm baby. South American mothers experienced a nonsignificant decreased risk difference of delivering a preterm baby in poorer neighborhoods.
Peak and Weeks ⁵⁴ (2002)	San Diego County birth records (1990–1992)	US-born Mexican Americans (n = 9533), and Mexico-born immigrants (n = 34 609)	Low birth weight	Census block group ^a	% Hispanic; Spatial clustering of Hispanic ethnic density (G*); relative clustering of births of babies of Mexican descent compared with those of other ethnicities around a given birth	Nativity, maternal age, education, gestational month in which prenatal care was started, number of prenatal visits, parity	Multilevel data without multilevel analysis	A marginally significant protective association was found between Hispanic density and low birth weight (P = .06) for US-born Mexican Americans. No association was found for Mexico-born mothers.

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TABLE 2—Continued

Shaw et al. ⁴⁴ (2010)	The 2000 US linked birth and infant death data set (2000–2001)	Singleton births of Hispanic White mothers (n = 763 201)	Low birth weight, preterm birth	County (n = 2664)	% Hispanic categorized as: 0%–0.99%; 1%–4.99%; 5%–14.99%; 15%–49.99%; ≥ 50%	Age, parity, marital status, education, nativity, median income	Multilevel data and analysis	There was a nonsignificant association between Hispanic ethnic density and decreased risk of low birth weight. There was a trend of higher Hispanic densities being associated with high risk of preterm birth.
Walton ⁴⁵	(2009) US natality file (2000)	Singleton births to Latino American mothers; N = 616 750 living in MSA with > 5000 Latino residents and a total population of ≥ 100 000	Low birth weight	MSA (n = 208)	% Hispanic	Age, parity, education, medical complications, marital status, previous preterm birth, adequacy of prenatal care, nativity, smoking during pregnancy, alcohol use during pregnancy, ethnicity, residential isolation, residential clustering, education, log of population size, median household income, % Hispanic in poverty	Multilevel data and analysis	In models adjusting for residential isolation or residential clustering, Hispanic ethnic density was associated with increased risk of low birth weight.

Notes. BMI = body mass index, defined as weight in kilograms divided by the square of height in meters; MSA = metropolitan statistical area.
^aN not reported.

groups: Spanish-dominant Mexican youths, bilingual Mexican youths, and English-dominant Mexican youths. Examinations of the ethnic density effect on use of alcohol, tobacco, and marijuana in the past month found that Mexican American ethnic density had an adverse effect on alcohol use among Spanish-dominant Mexican adolescents, and marijuana use among bilingual adolescents.²⁸

The third paper exploring the ethnic density effect on Hispanic health behaviors analyzed a broad category of Hispanic births and found that, among US-born Hispanic mothers, increasing ethnic density was associated with reduced risk of smoking during pregnancy. For non-US-born Hispanic mothers, ethnic density was associated with low risk of smoking during pregnancy irrespective of ethnic density dosage.⁴⁴

Infant mortality. Two studies have examined the association between Hispanic ethnic density and infant mortality.^{26,44} Whereas both studies reported a protective effect of ethnic density on infant mortality for US-born Hispanic mothers, 1 study, which focused solely on Mexican Hispanics, found an adverse effect of infant mortality at medium levels of ethnic density among foreign-born mothers.²⁶ Nativity was not found to have an effect on mortality in the second study.⁴⁴

Other birth outcomes. Five studies explored the association between ethnic density effect and other birth outcomes among US Hispanic people, including birth weight,^{29,44,45,54} preterm delivery,^{29,32,44} and small for gestational age.²⁹

Mixed results were reported by studies of birth weight. Of the 4 studies that examined this outcome, 1 found a null association²⁹

and 1 found a detrimental ethnic density effect after accounting for residential isolation in fully adjusted models.⁴⁵ Two studies reported indications of a protective ethnic density effect. An examination of San Diego County birth records found that, among US-born Hispanic mothers, an increase in the proportion of Hispanic residents in the respondent's census block was marginally associated with a decrease in low birth weight, although this association was not found for Mexican-born mothers.⁵⁴ The second article reported that Hispanic mothers living in counties with a Hispanic population of 5% to 14.99% were less likely to deliver a low birth weight baby than those living in counties with less than 1% Hispanic residents.⁴⁴

Null associations were found between Hispanic ethnic density and preterm delivery^{29,32,44} and small for gestational age.²⁹

UK Ethnic Minority Population

Only 6 papers, analyzing 5 data sets, have explored the ethnic density effect in the United Kingdom.^{3,7,8,16,39,49} These studies focused on the 5 main racial/ethnic minority groups in the United Kingdom (Black Caribbean, Black African, Indian, Pakistani, and Bangladeshi), with 1 study examining the ethnic density effect solely among South Asian people.⁴⁹

Compared with studies examining ethnic density effects in the United States, UK-based studies have a much more limited range of ethnic density and, in general, smaller samples of racial/ethnic minority respondents, resulting in fewer statistically significant ethnic density results (Table 3)

Adult physical morbidity. Five studies using 4 different data sets examined the association between

ethnic density and different adult physical morbidity outcomes among racial/ethnic minority people in the United Kingdom.^{3,7,8,39,49} Three of these studies focused on self-rated health, all of which found a null association with ethnic density.^{3,7,39} However, an exploration of the protective properties of ethnic density against the detrimental association between racism and health reported that, although main effects of ethnic density on self-rated health were not found for any racial/ethnic minority group, a reduction in the odds of reporting poor self-rated health among Pakistani and Indian people who had experienced interpersonal racism was observed as own ethnic density increased.³ The opposite was found for Black Caribbean people.³

Two studies explored the association between own ethnic density and reports of limiting longstanding illness among Black African, Black Caribbean, Indian, Pakistani, and Bangladeshi people in the United Kingdom.^{8,39} One of these studies, which focused only on women, found protective effects for Pakistani and Bangladeshi women living at densities between 5% and 30% were found to have reduced risk of limiting longstanding illness. Pakistani women were found to be protected at all levels of own ethnic density.³⁹

The second exploration of the association between ethnic density and limiting longstanding illness in the United Kingdom included, in addition to the standard census-based measure, a perceived measure of ethnic density.⁸ Results showed that a continuous measure of own ethnic density was associated with reduced odds of reporting limiting longstanding illnesses among Black Caribbean people

after adjustment for perceived ethnic density.⁸ All racial/ethnic minority people who perceived greater own ethnic density in their area tended to report less limiting long-term illness, although results were statistically significant only for Bangladeshi people.⁸ Caribbean people were found to be more likely to report limiting longstanding illness when living in an area perceived to have high own ethnic density.⁸

The fifth UK study to examine the ethnic density effect on adult physical morbidity consisted of a study of Asian people in Glasgow exploring numerous health outcomes.⁴⁹ Systolic blood pressure, mean arterial pressure, and chronic conditions were found to be significantly higher for participants living at high Asian ethnic density. A null association was reported between Asian ethnic density and BMI, self-rated health, limiting longstanding illness, days in bed the past year, smoking, drinking, and exercise.⁴⁹

Health behaviors. Only 1 study, focusing on alcohol consumption, has examined the association between ethnic density and health behaviors in the United Kingdom.¹⁶ In a multilevel analysis examining the ethnic density effect on current alcohol consumption and sensible drinking among Black Caribbean, Black African, Indian, Pakistani, and Bangladeshi people, increased own ethnic density was associated with lower odds of reporting current drinking among all racial/ethnic minorities.¹⁶ Protective ethnic density effects were found for sensible drinking among Black African people living in areas of high own ethnic density.¹⁶

White people were found to be more likely to be current drinkers as their own density increased, and less likely to drink if they lived

in a non-White area, although this was only significant in the case of area types characterized as mixed and Black.¹⁶ This study provides some insight into the importance of social norms as one of the mechanisms by which ethnic density might be protective of health behaviors.

Other birth outcomes. The only study to explore the ethnic density effect on birth outcomes in the United Kingdom analyzed the risk of preterm birth among singleton infants of Black African, Black Caribbean, Bangladeshi, Pakistani, and Indian origin.³⁹ Results of the multilevel analysis showed a protective ethnic density effect among Pakistani infants only, for whom increased Pakistani ethnic density was associated with low risk of preterm birth.³⁹

Studies With Other Populations

Five multilevel studies have investigated the ethnic density effect with populations not included in the previous categories (Table 4). These consist of a study with Canadian visible minorities,¹⁴ and 4 studies focused on Asian American people in the United States.^{27,32,35,45}

Analyses of the Canadian National Longitudinal Survey of Children and Youth (1996–1997 to 2000–2001) examined the association between census tract visible minority density and self-rated health among adolescents. Visible minority status was defined as being non-White and included people self-identified as Black, South Asian, Chinese, Korean, Japanese, Southeast Asian, Filipino, Arab, West Asian, and Latin American. Results showed that, among visible minority adolescents, visible minority density was associated with poorer health.¹⁴ Interactions of ethnic

TABLE 3—Studies Investigating Ethnic Density Among UK Ethnic Minority Individuals

Reference	Data Set	Sample	Outcome(s)	Area Unit	Ethnic Density Measure	Covariates	Method	Results
Bécares et al. ³ (2009)	Fourth National Survey on Ethnic Minorities (1993–1994)	Respondents of Caribbean (n = 1215), Indian (n = 1278), Pakistani (n = 1190), and Bangladeshi (n = 594) ethnicity	Self-rated health	Census ward ^a	% same ethnicity (Indian, Pakistani, and Bangladeshi) density ranged from 0% to 40%; Caribbean density from 0% to 20%	Age, gender, socioeconomic position, racism, racism × ethnic density, multiple deprivation	Multilevel data and analysis	No direct effect of ethnic density on self-rated health for any ethnic minority group was found. However, effects of racism on health increased with ethnic density for Caribbean people, fell with Pakistani and Indian people, and there was no association for Bangladeshi people.
Ecob and Williams ⁴⁹ (1991)	Cross-sectional survey investigating sampling strategies for Asians in Glasgow (1987)	Asians aged 30–39 years (n = 157 for measured outcomes, 173 for self-reported outcomes)	Systolic BP, diastolic BP, mean arterial pressure, BMI, self-rated health, limiting long-standing illness, some days in bed in past year, chronic conditions	Postcode sector (n = 11)	% Asian-born categorized as: < 3%; 3% to < 6%; ≥ 6%	Age, gender, religion, household size, social class	Multilevel data without multilevel analysis	Systolic BP, mean arterial pressure, and chronic conditions were significantly higher at high ethnic density. Diastolic BP was marginally higher at high ethnic density. BMI, self-rated health, limiting long-standing illness, some days in bed in past year, smoking, drinking, and exercise were not associated with ethnic density.
Karlsen et al. ⁷ (2002)	Fourth National Survey on Ethnic Minorities (1993–1994)	Caribbean (n = 1205), Indian (n = 2000), Pakistani and Bangladeshi (n = 1776) adults	Self-rated health	Ward (n = 250)	% same ethnicity categorized as: <5%; 5%–15%; > 15%	Age, gender, occupational class, deprivation, crime, amenities, environment	Multilevel data and analysis	There was no evidence of a significant effect for any of the ethnic groups.

Continued

TABLE 3—Continued

Pickett et al. ³⁹ (2009)	Millennium Cohort Study (2001–2002)	Singleton infants and their mothers of Black African (n = 367), Black Caribbean (n = 252), Bangladeshi (n = 369), Indian (n = 462), and Pakistani (n = 868) ethnic origin	Self-rated health and limiting longstanding illness	MSO.A: Bangladeshi (n = 71); Black African (n = 80); Black Caribbean (n = 82); Indian (n = 129); Pakistani (n = 125); LSOA briefly discussed	% same ethnicity categorized as: Bangladeshi: 0%–5%; >5%–30%; >30%; Black Africans: 0%–5%; >5%–30%; >30%–50%; Black Caribbean: 0%–5%; >5%–30%; Indian and Pakistani: 0%–5%; >5%–30%; >30%–50%; >50%+	Age, parity, education, marital status, social class, benefits, Carstairs deprivation ^b	Multilevel data and analysis	There was no association between ethnic density and self-rated health for any ethnic minority group. Pakistani mothers at low densities had increased risk of limiting longstanding illness. Bangladeshi mothers at densities of >5%–30% had reduced risk of limiting longstanding illness.
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TABLE 3—Continued

Stafford et al. ⁸ (2009)	Home Office Citizenship Survey (2005)	Adults aged ≥ 16 years of Indian (n = 1299), Pakistani (n = 678), Bangladeshi, (n = 233), Black Caribbean (n = 280), and Black African (n = 690) ethnicities	Limiting longstanding illness	MSOA (n = 1416)	Ethnic density as continuous and categorized as: Indian, Pakistani, Bangladeshi: < 1%; 1%–<10%; 10% to <20%; 20% to <40%; ≥40%; Caribbean, African: < 0.5%; 0.5% to <5%; 5% to <10%; 10% to <20%; ≥20%+; perceived ethnic density: less than half of residents of one's same ethnicity, more than half of same ethnicity, all of same ethnicity	Age, gender, socioeconomic status, perceived ethnic density, multiple deprivation	Multilevel data and analysis	Greater perceived ethnic density was associated with reduced risk of limiting longstanding illness for White and Bangladeshi people. There was no association between measured ethnic density when it was a categorical variable and limiting longstanding illness for any ethnic group. Continuously measured ethnic density was associated with reduced risk of limiting longstanding illness for Black Caribbean people, both before and after adjustment for perceived ethnic density. For Bangladeshi people, continuously measured ethnic density was significantly associated with increased risk of limiting longstanding illness, after adjustment for perceived ethnic density.
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TABLE 3—Continued

		Health behaviors					
		MSOA ^a	Current alcohol consumption, exceeding sensible drinking guidelines	% ethnic minority residents in an area, separately for Whites (including White British, White Irish, and other White), Indian, Pakistani, Black Caribbean, and Black African people	Age, gender, head of household socioeconomic status, nativity, marital status, education, employment, multiple deprivation	Multilevel data and analysis	For ethnic minority respondents, increasing coethnic density was associated with lower odds of current drinking. Black African people living in areas of higher ethnic density were less likely to exceed recommended drinking guidelines
Bécares et al. ¹⁶ (2011)	Health Survey for England (1999 and 2004) and the 2001 UK Census	Adults aged ≥ 16 years (n = 30 803), who self-identified as Caribbean (n = 3459), Black African, (n = 1378), Indian (n = 3384), Pakistani (n = 3594), or White (n = 15 736)					
Other birth outcomes							
Pickett et al. ³⁹ (2009)	Millennium Cohort Study (2001–2002)	Singleton infants and their mothers of Black African (n = 367), Black Caribbean (n = 252), Bangladeshi (n = 369), Indian (n = 462), and Pakistani (n = 868) ethnicity	Preterm birth, and low birth weight	MSOA: Bangladeshi (n = 71); Black African (n = 80); Black Caribbean (n = 82); Indian (n = 129); Pakistani (n = 125); LSOA briefly discussed	Age, parity, education, marital status, social class, benefits, Carstairs deprivation ^b	Multilevel data and analysis	No association was found between ethnic density and low birth weight for any ethnic minority group. Same ethnic density was associated with a low risk of preterm birth for Pakistani mothers but not other ethnic groups.

Notes. BMI = body mass index, defined as weight in kilograms divided by the square of height in meters; BP = blood pressure; LSOA = lower super output area; MSOA = middle super output area. ^an not reported. ^bIndex of deprivation based on 4 census indicators: low social class, lack of car ownership, overcrowding, and male unemployment.

TABLE 4—Studies Investigating Ethnic Density Among Populations Not Including US Black, US Hispanic, and UK Racial/Ethnic Minorities

Reference	Data Set	Sample	Outcome(s)	Area Unit	Ethnic Density Measure	Covariates	Method	Results
Abadula et al. ¹⁴ (2007)	Cycles 2, 3, and 4 of the Canadian National Longitudinal Survey of Children & Youth (1996–1997 to 2000–2001) and the Canadian 1996 Census	Adolescents aged 12–13 years, 1996–1997	Self-rated health	Census tract (Canadian) ^a	% visible minority	Health, gender, parental income, family structure, ethnicity, length of residence, perceived neighborhood cohesion, median income, city	Cross-level interaction study using multilevel data and analysis	Ethnic density was not associated with self-rated health for White adolescents. However, for visible minority adolescents it was associated with poor self-rated health.
		(n = 1389), 8.3% visible minority						
Kandula et al. ²⁷ (2009)	California Health Interview Survey (2003)	Asian men (n = 1693) and women (n = 2174)	Current smoking (having smoked at least 100 cigarettes in one's lifetime and currently smoking every day or some days)	Census tract (n = 2039)	% Asian categorized as < 50% or ≥ 50%	Ethnicity, age, % poverty income ratio, education, employed, marital status, mental distress, language spoken at home, percentage of life lived in the United States, socioeconomic status, neighborhood social cohesion	Multilevel data and analysis	For Asian men there was no association between Asian ethnic density and smoking. For women, living in census tracts with ≥ 50% Asian was associated with reduced risk of smoking, independent of acculturation.
Mason et al. ³² (2011)	New York City birth records (1995–2003)	Singleton births (n = 887 887); n = 53 867 East Asian births; n = 41 860 South Asian births	Preterm birth	Census tracts (n = 2202)	Proximity-weighted ethnic density—which allows the ethnic composition of the areas surrounding the mother's residence to influence her estimated exposure in proportion to their distance from her; ethnic density dichotomized at 25%; also modeled as a continuous variable with a squared term to allow for nonlinearities	Maternal age, education, nativity, parity, tobacco use, prepregnancy weight, prenatal care received in the first 120 d of gestation, health insurance payment type, residential stability, standardized index of neighborhood deprivation	Multilevel data and analysis	South Asian mothers experienced a nonsignificant decreased risk difference of delivering a preterm baby in poorer neighborhoods.

Continued

TABLE 4—Continued

Park et al. ³⁵ (2008)	Asian residents of New York City (n = 1530)	BMI	Radius around home (unique to each participant) ^a	% Asian	Age, gender, education, income, nativity, % residents below poverty line	Multilevel data and analysis	No association was found between Asian ethnic density and BMI.
Cross-sectional survey conducted by New York City government via Academic Medicine Development Company (from 2000 to 2002)							
Walton ⁴⁵ (2009)	Singleton births to Asian American mothers (n = 147 082) living in MSAs with > 5000 Asian residents and a total population of ≥ 100 000	Low birth weight	MSA (n = 144)	% Asian American	Age, parity, education, medical complications, marital status, previous preterm birth, adequacy of prenatal care, nativity, smoking during pregnancy, alcohol use during pregnancy, ethnicity, residential isolation, residential clustering, education, log of population size, median household income, % Asian American affluent	Multilevel data and analysis	In models with adjustment for residential isolation or residential clustering, Asian ethnic density was associated with increased risk of low birth weight.

Notes. BMI = body mass index, defined as weight in kilograms divided by the square of height in meters; MSA = metropolitan statistical area.
^aN not reported.

density and neighborhood social cohesion showed the adverse effects of living in a visible minority neighborhood to be much reduced if adolescents perceived high levels of neighborhood cohesion.¹⁴

Each of the 4 studies examining the ethnic density effect among US Asians focused on a different health outcome. Null associations were reported between US Asian ethnic density and BMI in New York City,³⁵ and smoking among Asian men in California.²⁷ Protective US Asian ethnic density effects were found for preterm birth,³² and for smoking among Asian women.²⁷ An adverse association was reported between increased Asian ethnic density and increased risk of low birth weight.⁴⁵

DISCUSSION

This systematic review identified 57 papers exploring the association between ethnic density and physical health, mortality, and health behaviors. The majority (n = 42) of analyses focused on US Blacks,^{15,17–23,25,29–35,37,38,40–48,50–53,56–60,62–67}

followed by examinations among US Hispanics, which were analyzed by 15 studies,^{23–26,28,29,32,35,36,44,45,54,55,61,64}

UK racial/ethnic minorities (n = 6),^{3,7,8,16,39,49} and other populations (n = 5).^{14,27,32,35,45}

In general, US studies reported protective ethnic density effects of Hispanic ethnic density, particularly for health behaviors, which provides important insight into the role that acculturation, and particularly social norms, have in terms of a possible pathway by which ethnic density might be protective of health. Opposite results were found by studies of the US Black population, where Black

ethnic density was mostly found to be detrimentally associated with health, with the exception of mortality among older Black individuals. Both Black and Hispanic ethnic densities were associated with decreased reports of smoking during pregnancy. Differences in ethnic density effect findings among Hispanics and Blacks in the United States might be attributed to the differing degrees of deprivation and segregation characterizing the areas where the 2 groups live. People living in neighborhoods with high Black ethnic density have been found to be exposed to higher rates of crime and neighborhood poverty,⁶⁸ and have been shown to experience hypersegregation, or simultaneous high segregation across multiple dimensions of segregation.⁶⁹ In contrast, hypersegregation is much less common for Hispanic people.⁷⁰ Hispanic residential segregation differs from that of Black segregation not only in the range and the degree but also in the characteristics, because the African American population has experienced historical *de jure* segregation, whereas other racial/ethnic groups have experienced a more recent chain migration and *in situ* population growth.

Other particularly disadvantageous characteristics of areas with high Black ethnic density—including the degree or nature of poverty in some areas; the particular class structures of Black communities; the age structure of such communities; employment, unemployment, and labor force participation rates; and length of residency—may have a 2-fold effect in concealing ethnic density effects: first, by overriding protective effects of ethnic density, and second, by complicating analytical attempts at disentangling harmful deprivation effects from

protective ethnic density benefits, even with the use of multilevel methods.

So, although the majority (74%) of ethnic density studies have been conducted among the US Black population, these particular characteristics of US Black ethnic density warrant against generalizing findings of ethnic density effects from this group to other populations, both within and outside the United States. Generalizations should likewise be avoided within the “US Black” group, given the documented heterogeneity in immigrant history and status.^{71,72} In fact, the few studies that have examined subgroups among broad racial/ethnic US Black categories have found differences patterned by nativity,^{31,48} age,⁵¹ and gender.²⁰ Heterogeneity should indeed be considered across all populations, including the US Hispanic group. Studies of US Hispanic populations have mostly differentiated Hispanic subgroups, with the majority of studies conducted among Mexican American people. Studies that have further differentiated across subpopulations report protective ethnic density effects of Hispanic ethnic density to be more salient for US-born Hispanics,^{26,54,44} and older Hispanic adults.²⁴

Studies that have explored ethnic density effects across subpopulations, either as interactions or via stratified analyses, report significant differences in ethnic density effects. We have highlighted these instances throughout the Results section to obtain a greater purchase on the ethnic density effect and the populations for whom ethnic density effects may be more relevant. Future studies of ethnic density should aim to precisely specify their study population, so that ethnic density effects

can be accurately attributed to well-defined populations.

Most studies of ethnic density among UK racial/ethnic minorities reported null associations between ethnic density and health, and adverse effects were seldom reported. The increased proportion of null associations reported among UK studies is likely the result of smaller samples of racial/ethnic minority groups, as well as a more limited variation in ethnic density in UK surveys, compared with those conducted in the United States. It has been suggested that, compared with studies conducted in the United Kingdom, ethnic density studies conducted in the United States have been more successful in detecting ethnic density effects because of the increased range of ethnic density of some of its populations,⁵ and results of this review provide additional support for this observation, as a greater proportion of US studies reported protective ethnic density effects, compared with studies conducted in the United Kingdom. Measures of ethnic density among US Black studies ranged from less than 5% to more than 90%, with the majority of studies reporting at least 50% ethnic density. In comparison, the highest category of ethnic density in the UK was often categorized as 30%, and only Pakistani, Indian, and Black African densities were reported to reach 50% ethnic density. It is worthy of note that the ranges used to measure ethnic density were not consistent across studies, which has implications for comparison of results, and indeed for the capacity to detect associations between ethnic density and health, given limited statistical power in samples with smaller ranges of ethnic density.

In addition to statistical power limited by narrow ranges of ethnic

density, studies conducted in the United Kingdom were also characterized by smaller samples of study populations. We have shown elsewhere that ethnic density studies with sample sizes smaller than 500 tend to report null associations, whereas the majority of studies with sample sizes greater than 4000 report protective ethnic density effects.⁹ Statistical power is thus an important element in identifying significant associations between ethnic density and health outcomes, possibly because of the subtlety of such associations, and future studies should, wherever possible, ensure that samples are large enough to detect ethnic density effects.

When one is contrasting ethnic density results across countries, additional consideration should be given to the differing degrees of residential segregation, different countries of origin of the predominant minority groups, differing reasons for migration, and differing cultural, economic, and demographic profiles of the racial/ethnic groups represented. Research on ethnic density is an emergent field that is starting to be undertaken in countries other than the United States, and, in addition to an increased work in different national settings, future studies should consider conducting cross-national comparisons of ethnic density effects to achieve a greater understanding of the importance of context in relation to ethnic density effects. Cross-national comparative analyses provide greater heterogeneity in historical and contemporary characteristics in the populations of interest, and it is when we consider this heterogeneity in the contexts of peoples' lives that we can more fully understand how social conditions and processes such as neighborhood environments, including

ethnic density, influence the health of migrant and ethnic minority populations.

Limitations

Studies differed methodologically in their analytical approach (ecological, single-level analyses of multilevel data, and multilevel analyses), and in the individual and area-level covariates they adjusted for. The majority of studies reviewed used analytical methods to account for the geographical clustering of the data, and this was particularly true for UK-based studies, where only 1 study failed to do so.⁴⁹ No stark differences in direction or strength of effect can be observed depending on the analytical approach used, however.

Levels of geography used to measure the ethnic density effect varied greatly across studies, and, although it has been argued that larger areas fail to capture local group concentration with accuracy,^{2,25} comparisons in the existent review by geographical scale do not yield a set conclusion regarding optimal levels at which to capture the ethnic density effect. The measurement of such a collective social phenomenon as ethnic density with the use of data aggregated at administrative areas is in fact one of the limitations of the existent ethnic density literature, with only 1 study using alternative perceived measures of ethnic density to understand the association between actual experienced neighborhood racial concentration and health.⁸ Future studies should aim to include, whenever possible given survey data constraints, a measure of perceived ethnic density to their explorations of the ethnic density effect.

All reviewed studies of the ethnic density effect on physical

morbidity, mortality, and health behaviors consisted of cross-sectional analyses, which is a limitation of ethnic density research. Because of the cross-sectional nature of the data, it is not possible to discern from study results whether living in a low-ethnic-density area precedes morbidity, or vice versa. Nonetheless, in a UK study of ethnic density and mental health, Halpern and Nazroo⁴ tested whether ethnic density effects found were attributable to social causation, social selection or drift, and acculturation. On the basis of their findings, they concluded that the ethnic density effects found were the result of the benefits of group density, which notably reduced the exposure to racial harassment and provided increased social support from other racial/ethnic minority people.⁴

Studies reviewed adjusted for different confounders. The majority of studies adjusted for age and at least 1 indicator of individual-level deprivation, mostly education in the case of US-based studies, and social class among UK studies. Many studies additionally adjusted for other individual-level confounders, which included other measures of individual-level socioeconomic status, and variables such as marital status, health care access and insurance, and nativity. Some studies did not adjust for area-level deprivation,^{26,48,49,51,54,55} or adjusted only for 1 area deprivation measure.^{14,21,24,44} This is a notable limitation, given both the high correlation between area deprivation and ethnic density, and the associations in different directions of area deprivation and ethnic density with health. Failure to properly adjust for area deprivation can hinder the identification of ethnic density effects, and future studies should not only

ensure that area deprivation is correctly adjusted for, but should also aim to model how the association between ethnic density and health changes upon adjustment for area deprivation, and to identify and report the independent contribution of ethnic density and area deprivation to health. It is important to note that, despite the positive correlation that exists between ethnic density and deprivation, and the established association between area deprivation and poor health, ethnic density was not consistently associated with poorer physical health among racial/ethnic minorities. This cautions against the use of ethnic density as a marker of area deprivation.

To control for confounding, studies need clarity on the hypothesized mechanisms by which ethnic density is associated with health. There is currently a need for clearly defined theoretical frameworks and empirical testing of hypothesized pathways, as only a handful of studies have focused on understanding the mechanisms by which ethnic density protects the health of racial/ethnic minorities. Two UK studies aimed to fill some gaps in the theoretical framework of ethnic density by exploring possibly underlying mechanisms behind the ethnic density effect. In their comparison between census-based measures and perceived measures of ethnic density, Stafford et al.⁸ found perceived ethnic density to be more consistently related to lower morbidity risk. The authors hypothesized that perceived ethnic density reflects individual experiences of frequency and intensity of contact with coethnics, and thus might be better at capturing residents' actual social and cultural experiences in their neighborhood.⁸

The second study contributes to the examination of the pathways behind the ethnic density effect by exploring the association between ethnic density and experienced interpersonal racism. The authors proposed that 1 of the mechanisms by which ethnic density is protective of the health of racial/ethnic minority people is through a decrease in the experiences of interpersonal racism and discrimination,³ which have been associated with poorer mental and physical health.⁷³⁻⁷⁸ As a second mechanism, they proposed that ethnic density moderates the detrimental effects of racism on the health of racial/ethnic minority people through a buffering effect.³ Findings confirmed that the experience of racism is lower in places of higher ethnic density, and indicated a tendency for a weaker association between racism and health as ethnic density increases,³ providing some support for these mechanisms.

In a systematic review of the literature of ethnic density on mental health, we have shown more consistent ethnic density effects, particularly in relation to mental illness requiring clinical treatment, as well as with less serious mental health problems.⁹ Ethnic density is thought of as a phenomenon that mitigates the detrimental impact of hazardous stressors on health through a set of hypothesized pathways, including reduced exposure to racism,³ buffering the adverse effects of racism on health,³ decreased low-status stigma,⁵ and development of positive roles,⁶ among others. Given the mainly psychosocial nature of these pathways, it is to be expected that the ethnic density effect will have a different protective association with the processes and determinants of mental health, compared with those

leading to physical ill health. For example, it is likely that whereas increased social support will buffer people in racial/ethnic minority groups against the detrimental effect of racism on psychotic symptomatology, the strength of the ethnic density effect will not be the same on the processes leading to reduced BMI. Given the hypothesized buffering properties of ethnic density on stressors such as experienced racism, it is likely that the effect of ethnic density will be stronger on psychological outcomes such as mental health and health behaviors, including smoking during pregnancy, as reported in this review, but weaker on physical health outcomes. It is also possible that ethnic density has a lagged effect on physical health outcomes, mediated by mental health, as has been suggested to be the case in the association between experienced racism and health, which has also been shown to be more strongly associated with mental health outcomes.⁷⁹

Conclusions

In conclusion, research to date on ethnic density has mainly been conducted among the US Black population, for whom ethnic density is often detrimental, with the exception of mortality among older Black persons. A large body of literature from the United States supports protective ethnic density effects among the Hispanic population, particularly for health behaviors. For other ethnic minority groups (within and outside the United States) ethnic density is seldom detrimental, although small sample sizes often result in null associations. Future research addressing the limitations that have been highlighted in this review, particularly as they relate to the inclusion of larger samples of

ethnic minority and indigenous populations in other countries, adequate adjustments for area deprivation, and clearly specified theoretical frameworks, will improve our understanding of ethnic density effects, which can make an important contribution to current debates on the individual and community assets available in diverse communities, with particular relevance to issues of prejudice, migration, and residential concentration. ■

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Contributors

K. Pickett and R. Shaw developed the protocol for the review and reviewed studies for inclusion criteria. R. Shaw, C. Albor, and L. Bécarea extracted data from the studies. L. Bécarea led the writing and all authors contributed to the final draft of the article.

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Human Participant Protection

No human participant protection was needed for this study because it was a literature review.

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