DePaul University

From the Selected Works of Fernando De Maio

2018

Racial/ethnic minority segregation and low birth weight in five North American cities

Fernando De Maio

David Ansell

Raj C. Shah

Available at: <https://works.bepress.com/fdemaio/38/>

Racial/ethnic minority segregation and low birth weight in five North American cities

Fernando De Maio^a, David Ansell^b and Raj C. Shah^c

^aDepartment of Sociology and Center for Community Health Equity, DePaul University, Chicago, USA;

^bDepartment of Internal Medicine and Center for Community Health Equity, Rush University Medical Center, Chicago, USA; ^cDepartment of Family Medicine, Rush Alzheimer's Disease Center, and Center for Community Health Equity, Rush University Medical Center, Chicago, USA

ABSTRACT

Comparisons of communities *across cities* are rare in social epidemiology. Our prior work exploring racial/ethnic segregation and the prevalence of low birth weight (LBW) in communities from two large urban cities showed a strong relationship in Chicago and a very weak relationship in Toronto. This study extends that work by examining the association between racial/ethnic minority segregation and LBW in total of 307 communities in five North American cities: Baltimore, Boston, Chicago, Philadelphia, and Toronto. We used Pearson correlation coefficients and OLS regression models to examine potential variability in the association between racial/ethnic minority segregation and LBW, controlling for community-level unemployment. In a combined model with community-level data from all cities, a 10% increase in minority composition is associated with a 0.7% increase in LBW. While racial/ethnic minority segregation and unemployment are not associated with LBW in Toronto, these social determinants have strong and significant associations with LBW across communities in the four US cities in the analysis. Subsequent models revealed opposite effects for percentage non-Hispanic Black and percentage Hispanic. Across communities in the US cities in this analysis, there is considerable similarity in the strength of the effect of racial/ethnic segregation on LBW. Future work should incorporate communities from additional cities, looking to identify community assets and public policies that allow some minority communities to thrive, while other minority communities suffer from a high prevalence of LBW. More work is also needed on the generalizability of these patterns to other health outcomes.

ARTICLE HISTORY

Received 18 April 2017

Accepted 13 June 2018

KEYWORDS

Racial segregation; low birth weight; urban areas; regression; health equity; United States; Canada; cities

Introduction

Comparisons of communities *across cities* are rare in social epidemiology. Much of the work in this field either focuses on the social gradient in health in general (Marmot 2015) or takes the city itself as the unit of analysis, generating useful points of comparison but missing the within-city heterogeneity that make local data so important. For example,

CONTACT Fernando De Maio fdemaio@depaul.edu Department of Sociology and Center for Community Health Equity, DePaul University, Chicago, IL, USA

© 2018 Informa UK Limited, trading as Taylor & Francis Group

Ross et al. (2000) – in an influential study of the Wilkinson income inequality hypothesis – explored the relationship between median share of income and age-specific mortality rates across 53 Canadian and 282 US metropolitan areas, later expanding the analysis to include cities in Australia, Great Britain, and Sweden (Ross et al. 2005). More recently, researchers at the Sinai Urban Health Institute in Chicago have used rate ratios to explore Black – White health disparities in the largest 50 cities in the US, focusing on mortality from heart disease (Benamins, Hirschtick, et al. 2016), breast cancer (Hunt and Hurlbert 2016), prostate cancer (Benamins, Hunt, et al. 2016), and lung cancer (Hunt and Balachandran 2015). These studies used the city/metropolitan area as the unit of analysis to document important differences in health inequities between cities.

At a lower level of geography, De Maio et al. (2017) compared the effect of racial/ethnic segregation on low birth weight (LBW) prevalence across 77 communities in Chicago and 140 communities in Toronto. This approach – comparing cities but retaining the within-city heterogeneity among communities in those cities – reveals an important dimension of urban health inequities. In a combined regression model with data from both cities, a 10% increase in minority composition was associated with a 0.5% increase in LBW, controlling for the effects of unemployment and low educational attainment. Stratified models showed that this effect was only significant in Chicago, and subsequent models revealed opposite effects for percentage non-Hispanic Black and percentage Hispanic. In Chicago, racial/ethnic minority segregation, unemployment, and low educational attainment explained approximately 70% of the variance in LBW across communities, while these indicators were not significant predictors of LBW in Toronto. These findings illustrate some of the dynamics underlying the structural and social determinants of health, shown through variability in the strength of association between racial/ethnic minority segregation and LBW prevalence.

The Chicago – Toronto comparison suggests that the two cities may be opposite ends of a spectrum. Under this model, the strong association between percentage non-Hispanic Black and LBW in Chicago may reflect the health effects of a highly segregated city in a country without universal health care and a stigmatized welfare system, and the lack of association between percentage minority and LBW in Toronto reflects a city founded on multiculturalism in a country with a strong safety net. At present, we do not know if communities in other US cities follow Chicago's pattern (a strong association), Toronto's pattern (a weak or null relationship) or if communities in other cities display other patterns altogether.

The results of the Chicago – Toronto comparison also imply that racialization occurs in different ways in different places, and thus the meaning of being a minority differs from city to city and community to community. The health equity literature on racialization is rapidly growing, with plausible mechanisms linking the experience of discrimination with adverse health effects throughout the life course now well established (Bailey et al. 2017; Krieger 2000, 2016). Comparison of the strength of association between racial/ethnic minority segregation and LBW contributes to that literature, by situating the health effects of racism and discrimination in the context of specific communities and cities.

Our study examines the relationship between racial/ethnic minority segregation and across communities in five North American cities: Baltimore, Boston, Chicago, Philadelphia, and Toronto. Research has documented existing LBW inequities in all four of the US cities. In Baltimore, researchers have found that neighborhood factors influenced birth weight by shaping maternal risk factors (Schempf, Strobino, and O'Campo 2009).

Other work in Baltimore has examined the effects of self-assessed exposure to racism over the life course as a risk factor for preterm birth (Misra, Strobino, and Trabert 2010) as well as the social patterning of high-risk prenatal behaviors (Orr, James, and Reiter 2008). Baltimore-based research also indicates that exposure to psychological stressors may be ‘directly associated with the risk of low birthweight among African-American women’ (Orr et al. 1996). In Boston, studies of self-reported personal and group racism have explored varying levels of exposure to discrimination and its association with birth outcomes (Dominguez et al. 2009; Rosenberg et al. 2002). In Chicago, a large literature has now documented the associations between discrimination and birth outcomes, including low birth weight (Collins et al. 2000; David and Collins 1997). And in Philadelphia, new work is examining residential redlining as a form of institutional racism that affects birth outcomes (Mendez, Hogan, and Culhane 2014). None of these studies used a comparative community-level perspective.

We are interested in seeing if the relationship between racial/ethnic segregation and LBW in Baltimore, Boston, and Philadelphia (a) follows a similar pattern to Chicago’s (suggesting some degree of universality, at least among these US cities); or (b) shows that these cities may be ‘in-between’ Chicago and Toronto (suggesting that there is a broader spectrum of relationships that may be influenced by population dynamics and/or social policy).

Methods

Our study relies on publicly available data. In all cities, we used locally-meaningful definitions of ‘community’, rather than census tracts. The advantage of this approach is that the unit of analysis holds meaning for residents of each city. This also allows us to use data from local public health departments, who often collect and report data according to local community (or neighborhood) boundaries. In total, there are $N = 307$ communities from 5 cities in our analysis. The number of communities per city ranges from 17 in Boston (mean population of 36,329) to 140 in Toronto (mean population of 18,679).

We used the standard definition of LBW – a birth weight of less than 2,500 grams; we examined the percentage of total live births in a community that were recorded as LBW. Toronto LBW data are from 2011 and were obtained from the Toronto Community Health Profiles Partnership, who compiled data from the Ontario Ministry of Health and Long-Term Care. Chicago data are from 2009 and were obtained from the Chicago Department of Public Health, who calculated the percent of total births by community area using geocoded annual birth certificate datasets supplied by the Illinois Department of Public Health. Baltimore LBW data were obtained from the Baltimore City Health Department’s Neighborhood Health Profile Reports. Boston LBW data are from 2009 to 10, as published in the Boston Public Health Commission’s *Health of Boston: A Neighborhood Focus* report. Philadelphia LBW data are from 2010, as reported in the Philadelphia’s Department of Public Health *Community Health Assessment*.

Our main independent variable is racial/ethnic segregation, which we operationalized in two steps. First, we examined the percentage of community residents that are ‘minority’ (i.e. non-white). This definition is based on the practice in Canada of measuring ‘visible minority’ status. Second, we disaggregated percentage minority by the two largest categories in the US cities – percentage non-Hispanic Black and percentage Hispanic. To

explore the robustness of the racial/ethnic segregation – LBW relationship, we also incorporated percentage unemployed into our models.

Data analysis

Our analytic strategy involves first examining descriptive statistics, followed by correlations (Pearson coefficients). Our final step involved the development of OLS regression models (Aneshensel 2013; Tarling 2009). We first examined a pooled model, with all five cities included. Subsequent models stratified the data by city. The stratified model enabled an exploration of the differential effects of racial/ethnic minority segregation within each city. To test the robustness of the relationship between racial/ethnic segregation and LBW deliveries, we included one additional measure of community-level socioeconomic status to our models: percentage unemployed, with all continuous variables scaled to reflect a 10% increase. All analyses were conducted using Stata.

Results

Birth outcomes are worse in all four US cities than in Toronto, with a higher overall prevalence of LBW deliveries. The mean community proportion of LBW deliveries in Toronto is 7.3%, while in the US cities it ranges from 9.1% in Boston to 11.8% in Baltimore (see Table 1). There is greater dispersion in the US data, with larger standard deviations and higher maximum values – with at least one community in Chicago and another in Baltimore having a LBW prevalence of almost 20%.

Table 1. Description of the data.

	Toronto	Chicago	Boston	Philadelphia	Baltimore
LBW					
Mean	7.3	10.1	9.1	10.1	11.8
Standard deviation	1.4	3.9	2.3	2.2	3.9
Minimum	3.4	3.5	5.2	6.8	3.7
Maximum	11.0	19.7	12.9	13.1	18.9
% Minority					
Mean	42.2	70.3	49.6	58.1	71.0
Standard deviation	22.1	28.4	26.2	30.1	28.3
Minimum	8.5	6.4	8.2	17.8	9.7
Maximum	94.0	99.8	96.2	97.9	99.3
% non-Hispanic Black					
Mean	8.0	39.7	20.0	39.2	61.8
Standard deviation	6.9	40.5	22.7	30.0	33.3
Minimum	0.1	0	0.7	5.6	2.7
Maximum	30.7	98.5	80.4	91.8	96.7
% Hispanic					
Mean	2.7	24.3	16.1	9.8	4.6
Standard deviation	2.8	27.1	12.2	11.3	6.0
Minimum	0	0	3.6	1.2	0.7
Maximum	16.2	85.7	52.9	46.7	30.3
% Unemployed					
Mean	7.5	15.4	10.3	14.6	14.9
Standard deviation	2.0	7.5	4.3	5.3	6.9
Minimum	4.0	4.7	4.4	5.7	3.5
Maximum	15.5	35.9	18.2	24.0	29.0
N Communities	140	77	17	18	55
Mean (sd) community population	18,679	35,008	36,329	84,778	11,215

Table 2. Associations between community-level LBW, racial/ethnic concentration, and socio-economic indicators (*r* values).

	LBW	% minority	% non-Hispanic Black	% Hispanic	% unemployed
LBW	1.00				
% minority	0.64***	1.00			
% non-Hispanic Black	0.81***	0.77***	1.00		
% Hispanic	-0.13*	0.20***	-0.18*	1.00	0.12
% unemployed	0.72***	0.79***	0.82***	0.11	1.00

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

There is a greater level of racial/ethnic segregation in the US cities than there is in Toronto. On average, communities in Toronto include 42.2% minority residents, while in Baltimore this is 71.0% and Chicago it is 70%. Reflecting heightened patterns of racial/ethnic segregation in the US, there are communities with 0% or near 0% non-Hispanic Black and Hispanic residents and also some communities that comprise almost entirely of non-Hispanic Black or Hispanic residents in Baltimore, Boston, Chicago, and Philadelphia. Toronto communities, in contrast, never reach the same level of segregation by sub-group (see [Table 1](#)).

Correlations between LBW and all independent variables are presented in [Table 2](#). Across all $N=307$ communities in these five cities, there is a strong and positive association between percentage minority and LBW ($r=0.64$, $p < 0.001$), but this is confounded by divergent correlations between percentage non-Hispanic Black and LBW ($r=0.81$, $p < 0.001$) and percentage Hispanic and LBW ($r=-0.13$, $p < 0.05$).

Our regression results are presented in [Table 3](#). First, we estimated a combined model, pooling data from all five cities. Here, a 10% increase in minority composition is associated with a 0.7% increase in LBW, with an initial r -squared value of 0.41. Disaggregating percentage minority into percentage non-Hispanic Black and Hispanic echoes the bivariate correlation findings, with the percentage Black model producing a positive coefficient and an r -squared value of 0.66 (0.67 when we also include percent unemployment) while the percentage Hispanic model has a negative coefficient and very little explanatory power, with an r -squared value of 0.02.

[Table 3](#) also includes results of city-specific regression models (see also [Figure 1](#) for scatterplots). The Toronto models have very little explanatory power (r -squared values less than 0.1) while the Chicago model has the highest explanatory power (r -squared of 0.71 for model 3, including percentage non-Hispanic Black and percentage unemployed as predictors of LBW). The coefficient for percentage minority is fairly stable across the US cities, with a 10% increase in percentage minority being associated with a 0.6% to 1.0% increase in LBW. The coefficient for percentage non-Hispanic Black is also consistent, with a 10% increase in non-Hispanic Black composition associated with an increase in LBW of 0.4% to 0.8%, controlling for the effect of unemployment (see model 3 for US cities in [Table 3](#)).

Discussion

There are three major findings in this paper. First, birth outcomes are worse in the four American cities than in Toronto. While the mean community proportion of LBW deliveries in Toronto is 7.3%, in the US cities, this ranges from 9.1% in Boston to 11.8% in

Table 3. OLS regression, predicting LBW in 5 North American cities.

	Intercept	coefficients % Minority	% non-Hispanic Black	% Hispanic	% Unemployed	R-squared
<i>All Cities</i>						
Model 1	5.00**	0.73**				0.41
Model 2	6.85**		0.80**			0.66
Model 3	6.30**		0.68**		0.77*	0.67
Model 4	9.34**			−0.25*		0.02
Model 5	5.12**			−0.41**	3.85**	0.56
<i>Toronto</i>						
Model 1	6.93**	0.1				0.02
Model 2	6.88**		0.58**			0.08
Model 3	7.17**		0.66*		−0.47	0.08
Model 4	7.26**			0.31		0.00
Model 5	6.71**			0.24	0.76	0.01
<i>Chicago</i>						
Model 1	3.80**	0.90**				0.42
Model 2	6.91**		0.80**			0.69
Model 3	5.79**		0.63**		1.19*	0.71
Model 4	11.85**			−0.72**		0.25
Model 5	5.92**			−0.48**	3.47**	0.67
<i>Boston</i>						
Model 1	6.34**	0.56*				0.42
Model 2	7.92**		0.61*			0.37
Model 3	7.00**		0.41		1.28	0.49
Model 4	9.50**			−0.22		0.01
Model 5	6.68**			−0.73*	3.74**	0.60
<i>Philadelphia</i>						
Model 1	6.93**	0.55**				0.56
Model 2	8.04**		0.54**			0.52
Model 3	6.91**		0.44*		1.03	0.57
Model 4	9.78**			0.37		0.04
Model 5	6.03**			−0.60	3.21*	0.37
<i>Baltimore</i>						
Model 1	4.70**	1.00**				0.51
Model 2	6.58**		0.84**			0.50
Model 3	6.33**		0.76**		0.49	0.51
Model 4	12.6**			−1.87*		0.08
Model 5	7.55**			−0.94	3.13**	0.36

* $p < 0.05$.** $p < 0.001$.

Note: All continuous variables scaled to reflect a 10% increase.

Baltimore. There is also greater variability in LBW prevalence across communities in US cities than in Toronto. Two communities, one in Chicago and one in Baltimore have LBW prevalence of 20% while the worst performing community in Toronto has a LBW prevalence of 10%; in other words, the worst-off community in Toronto has a LBW prevalence on par with the *average* rate in the US cities. The second finding is that across the five cities there is a strong correlation between the percentage minority and LBW. However, when we disaggregate racial/ethnic community composition by percentage non-Hispanic Black and percentage Hispanic, there are diverging correlations, with percentage non-Hispanic Black positively correlated with LBW prevalence and percentage Hispanic negatively correlated with LBW prevalence. The third observation is that while racial/minority segregation and unemployment have strong and significant associations with LBW prevalence across the four US cities, these factors are not associated with LBW prevalence in Toronto.

Figure 1. Association between percentage minority composition and low birth weight in five North American cities.

There are a number of potential explanations for both the wider variability in LBW prevalence in the four US cities and the correlation with racial/ethnic segregation and unemployment in these communities. First, Canada with its single payer healthcare system provides a lifetime of access to health services well in advance of the perinatal period allowing for risk factor modification and the prevention of LBW-associated risks. Combined with more favorable profiles across a range of other structural and social determinants of health, Canadian cities enjoy vastly smaller inequities in LBW. For example, LBW ratios comparing lowest income category / highest income category are 1.50 in Winnipeg, 1.37 in Halifax, 1.29 in Edmonton, 1.24 in Toronto, 1.19 in Montréal, and only 1.02 in Vancouver (suggesting parity in LBW prevalence between the poorest and richest income groups in that city) (Direction de Santé Publique 2011).

Second, there are specific social service interventions in Toronto, such as housing services available to vulnerable pregnant women (Murphy et al. 2013; Ordean et al. 2013). Third, the legacy of structural racism in the United States has created more profound residential segregation in the four US cities than in Toronto (for discussion of residential segregation in Toronto, see Hou 2006). Lastly, we know from previous work that nativity, not just race/ethnicity, matters as a predictor of LBW (2007; De Maio 2012; Urquia et al. 2010; Ray et al. 2007). Future research should seek to incorporate place of birth, length of time in the US/Canada and immigrant status in models of LBW inequities.

There are a number of limitations in this study. First, there are some variables associated with LBW such as maternal smoking rates that were not available for analysis. In so far that smoking rates might vary in communities in Toronto compared to communities in the four United States cities, this might explain the findings. Secondly, minorities in Toronto are likely very different than minorities in the United States; black residents of Toronto are more likely to be immigrants than black residents of the four American cities. A 'healthy migrant' effect thus might explain the variation in minority LBW between Toronto and US cities. Finally, the study would have been strengthened by using a larger sample of Canadian and US cities.

Future work should incorporate communities from additional cities, looking to identify community assets and public policies that make allow some minority communities to thrive, while other minority communities suffer from a high prevalence of LBW. Future work should also incorporate more nuanced measures of community-level socio-economic marginalization such as the index of concentration at the extremes (Krieger et al. 2016). This would enable a much-needed ongoing surveillance of the structural drivers of community health inequities.

Disclosure statement

No potential conflict of interest was reported by the authors.

References

- Aneshensel, C. S. 2013. *Theory-Based Data Analysis for the Social Sciences*. Thousand Oaks, CA: Sage.
- Bailey, Z. D., N. Krieger, M. Agenor, J. Graves, N. Linos, and M. T. Bassett. 2017. "Structural Racism and Health Inequities in the USA: Evidence and Interventions." *The Lancet* 389 (10077): 1453–1463. doi:10.1016/S0140-6736(17)30569-X.
- Benjamins, M. R., J. L. Hirschtick, B. R. Hunt, M. M. Hughes, and B. Hunter. 2016. "Racial Disparities in Heart Disease Mortality in the 50 Largest U.S. Cities." *Journal of Racial and Ethnic Health Disparities*. doi:10.1007/s40615-016-0300-6.
- Benjamins, M. R., B. R. Hunt, S. M. Raleigh, J. L. Hirschtick, and M. M. Hughes. 2016. "Racial Disparities in Prostate Cancer Mortality in the 50 Largest US Cities." *Cancer Epidemiology* 44: 125–131. doi:10.1016/j.canep.2016.07.019.
- Collins, J. W., Jr., R. J. David, R. Symons, A. Handler, S. N. Wall, and L. Dwyer. 2000. "Low-income African-American Mothers' Perception of Exposure to Racial Discrimination and Infant Birth Weight." *Epidemiology* 11 (3): 337–339.
- David, R. J., and J. W. Collins, Jr. 1997. "Differing Birth Weight among Infants of U.S.-Born Blacks, African-Born Blacks, and U.S.-Born Whites." *New England Journal of Medicine* 337 (17): 1209–1214. doi:10.1056/NEJM199710233371706.

- De Maio, F. G. 2012. "Understanding the Health Transitions of Immigrants to Canada: Research Priorities." *Journal of Health Care for the Poor and Underserved* 23 (3): 958–962. doi:10.1353/hpu.2012.0105.
- De Maio, F., R. C. Shah, K. Schipper, R. Gurdziel, and D. Ansell. 2017. "Racial/Ethnic Minority Segregation and Low Birth Weight: A Comparative Study of Chicago and Toronto Community-Level Indicators." *Critical Public Health* 27: 541–553. doi:10.1080/09581596.2016.1273510.
- Direction de Santé Publique. 2011. *Social Inequalities in Health in Montréal*. Montréal, QC: Agence de la Santé et des Services Sociaux de Montréal.
- Dominguez, T. P., E. F. Strong, N. Krieger, M. W. Gillman, and J. W. Rich-Edwards. 2009. "Differences in the Self-Reported Racism Experiences of US-Born and Foreign-Born Black Pregnant Women." *Social Science & Medicine* 69 (2): 258–265. doi:10.1016/j.socscimed.2009.03.022.
- Hou, F. 2006. "Spatial Assimilation of Racial Minorities in Canada's Immigrant Gateway Cities." *Urban Studies* 43 (7): 1191–1213. doi:10.1080/00420980600711993.
- Hunt, B., and B. Balachandran. 2015. "Black: White Disparities in Lung Cancer Mortality in the 50 Largest Cities in the United States." *Cancer Epidemiology* 39 (6): 908–916. doi:10.1016/j.canep.2015.10.003.
- Hunt, B., and M. S. Hurlbert. 2016. "Black: White Disparities in Breast Cancer Mortality in the 50 Largest Cities in the United States, 2005–2014." *Cancer Epidemiology* 45: 169–173. doi:10.1016/j.canep.2016.07.018.
- Krieger, N. 2000. "Epidemiology, Racism, and Health: The Case of Low Birth Weight." *Epidemiology* 11 (3): 237–239.
- Krieger, N. 2016. "Living and Dying at the Crossroads: Racism, Embodiment, and Why Theory Is Essential for a Public Health of Consequence." *American Journal of Public Health* 106 (5): 832–833. doi:10.2105/AJPH.2016.303100.
- Krieger, N., P. D. Waterman, J. Spasojevic, W. Li, G. Maduro, and G. Van Wye. 2016. "Public Health Monitoring of Privilege and Deprivation with the Index of Concentration at the Extremes." *American Journal of Public Health* 106 (2): 256–263. doi:10.2105/AJPH.2015.302955.
- Marmot, M. 2015. *The Health Gap: The Challenge of an Unequal World*. London: Bloomsbury.
- Mendez, D. D., V. K. Hogan, and J. F. Culhane. 2014. "Institutional Racism, Neighborhood Factors, Stress, and Preterm Birth." *Ethnicity & Health* 19 (5): 479–499. doi:10.1080/13557858.2013.846300.
- Misra, D., D. Strobino, and B. Trabert. 2010. "Effects of Social and Psychosocial Factors on Risk of Preterm Birth in Black Women." *Paediatric and Perinatal Epidemiology* 24 (6): 546–554. doi:10.1111/j.1365-3016.2010.01148.x.
- Murphy, C. C., C. Mill, J. Fordham, and A. Gorman. 2013. "Homeless and Pregnant: A Public Health Unit's Innovative Response." *Canadian Journal of Public Health* 104 (3): 271.
- Ordean, A., M. Kahan, L. Graves, R. Abrahams, and T. Boyajian. 2013. "Integrated Care for Pregnant Women on Methadone Maintenance Treatment: Canadian Primary Care Cohort Study." *Can Family Physician* 59 (10): e462–e469.
- Orr, S. T., S. A. James, C. A. Miller, B. Barakat, N. Daikoku, M. Pupkin, K. Engstrom, and G. Huggins. 1996. "Psychosocial Stressors and Low Birthweight in an Urban Population." *American Journal of Preventive Medicine* 12 (6): 459–466.
- Orr, S. T., S. A. James, and J. P. Reiter. 2008. "Unintended Pregnancy and Prenatal Behaviors Among Urban, Black Women in Baltimore, Maryland: The Baltimore Preterm Birth Study." *Annals of Epidemiology* 18 (7): 545–551. doi:10.1016/j.annepidem.2008.03.005.
- Ray, J. G., M. J. Vermeulen, M. J. Schull, G. Singh, R. Shah, and D. A. Redelmeier. 2007. "Results of the Recent Immigrant Pregnancy and Perinatal Long-Term Evaluation Study (RIPPLES)." *Canadian Medical Association Journal* 176 (10): 1419–1426.
- Rosenberg, L., J. R. Palmer, L. A. Wise, N. J. Horton, and M. J. Corwin. 2002. "Perceptions of Racial Discrimination and the Risk of Preterm Birth." *Epidemiology* 13 (6): 646–652. doi:10.1097/01.EDE.0000030929.51122.20.

- Ross, N. A., D. Dorling, J. R. Dunn, G. Henriksson, J. Glover, J. Lynch, and G. R. Weitoft. 2005. "Metropolitan Income Inequality and Working-age Mortality: a Cross-Sectional Analysis Using Comparable Data From Five Countries." *Journal of Urban Health: Bulletin of the New York Academy of Medicine* 82 (1): 101–110. doi:10.1093/jurban/jti012.
- Ross, N. A., M. C. Wolfson, J. R. Dunn, J. M. Berthelot, G. A. Kaplan, and J. W. Lynch. 2000. "Relation between Income Inequality and Mortality in Canada and in the United States: Cross Sectional Assessment Using Census Data and Vital Statistics." *BMJ* 320 (7239): 898–902.
- Schempf, A., D. Strobino, and P. O'Campo. 2009. "Neighborhood Effects on Birthweight: An Exploration of Psychosocial and Behavioral Pathways in Baltimore, 1995–1996." *Social Science & Medicine* 68 (1): 100–110. doi:10.1016/j.socscimed.2008.10.006.
- Tarling, R. 2009. *Statistical Modelling for Social Researchers*. London: Routledge.
- Urquia, M. L., J. W. Frank, R. Moineddin, and R. H. Glazier. 2010. "Immigrants' Duration of Residence and Adverse Birth Outcomes: a Population-Based Study." *BJOG: An International Journal of Obstetrics & Gynaecology* 117 (5): 591–601.