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Demographics and Homicide in Canada: A Fixed-Effects Analysis of the Role of Young Males on Changing Homicide Rates

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Abstract: *Canadian homicide rates have declined steadily since the mid-1970s, though this overall trend has been punctuated by temporal and regional fluctuations. It is almost consistently noted that young males are overrepresented in the interpersonal violence equation, and changes in this demographic can greatly affect homicide rates. Yet the ubiquity of the positive effect of age-composition has been questioned. Using fixed-effects analysis, this paper examines the relationship between young males and homicide rate changes over a thirty-year period. Results indicate that homicide rate changes in Canada are indeed a function of changing demographics; however, the relationship is complex, and socio-economic factors both mitigate and exacerbate this relationship.*

Keywords: demographics, Canada, fixed-effects, homicide

INTRODUCTION

Over the long term, western societies have experienced a decrease in levels of interpersonal violence (Elias [1939] 1978; Gurr 1981),[1] but more recent homicide patterns demonstrate geographical and temporal fluctuations (Archer and Gartner 1984; Blumstein and Rosenfeld 1998). The causes and correlates of homicide are complex and remain an important focus of debate for criminologists: some argue that sociological, economic, and cultural factors all affect homicide patterns (Phillips 2006). One of the most consistent explanations for the uneven distributions of violence over time and place is demographic variation (Andresen et al. 2003; Blumstein 2006; Cohen and Land 1987; Fox 2006; Fox and Piquero 2003; Gottfredson and Hirschi 1990). Slight changes in the population age structure over time are evident, and it has been well documented that young males are disproportionately responsible for criminal activity (Gottfredson and Hirschi 1990).

Gottfredson and Hirschi (1990) maintain that the age-crime relationship holds across time and location, and research at the individual level demonstrates a strong association between age and crime (Blumstein et al. 1986; Cohen and Land 1987; Fox and Piquero 2003; Hirschi and Gottfredson 1983). There is also support for a causal relationship between age composition and rates of interpersonal violence at the aggregate level (Fox 2006; Fox and Piquero 2003). However, there is significant disagreement regarding whether demographics actually dictate the homicide rate, or if other factors of equal, or perhaps more, weight might affect change in rates of violence (Blumstein 2006; Fox 2006; Gartner 1990; Gartner and Parker 1990). For example, research findings related to age composition overall are inconsistent, in that they sometimes indicate an interaction between demographics and changing socio-economic factors (Blumstein 2006; Pampel and Gartner 1995; Phillips 2006).

The relationship between age composition and violence is largely supported by national studies, but it has less support cross-nationally (Gartner 1990). In addition, although demographics are widely accepted as a strong predictor of interpersonal violence rates in the United States, it is also recognized that they influence Canadian rates even more (Andresen et al. 2003). Canada is a particularly fertile field within which to examine changing rates of homicide given the regional variation in

demographics, population density, heterogeneity, and economic factors. National examinations of homicide in Canada have not thus far studied the interaction between demographics and socio-economic factors. Examining how the correlates and causes of homicide function can illuminate certain aspects of interpersonal violence and social structure in Canada. In order to examine Canadian homicide rate fluctuations and the factors which influence temporal/geographical trends of violence, this analysis utilizes the varying homicide rates in seven regions from 1976 to 2005. A time series cross sectional (TSCS) dataset was constructed using information from both the Canadian Homicide Survey and Statistics Canada resources, and a fixed-effects analysis was utilized to examine the effects of structural factors on homicide rates.

Temporal and Spatial Variations in Interpersonal Violence

Although Canada displayed an overall decline in homicide rates throughout the period of interest, this downturn is not evenly dispersed over time and place (Gartner 1990; Silverman and Kennedy 1993). In the United States, Blumstein and Rosenfeld (1998) noted that sharp rate changes were related to an urban homicide epidemic starting in the late 1980s, an epidemic largely associated with the urban crack-cocaine market and the gang violence commonly associated with that activity, as well as young males' increased access to guns (Johnson, Golub and Dunlap 2006; Messner et al. 2005; Pearson-Nelson 2008). There was no similar epidemic in Canada,[2] American rates consistently exceed Canadian rates[3] at all points (Hagan 1991). In addition, homicide rates do not emerge as being driven by urban homicides in Canada. Where population density is an essential factor in most homicide research in the United States, Canada does not appear to display this same trend (Statistics Canada 2007).

Regionally, the United States homicide rates vary between states. Historically, the southern regions of the United States boasted the highest homicide rates (Redfield [1881] 2000). This trend was said to be a result of southern historical circumstances that lead to a culture of violence (Gastil 1971; Hackney 1969; Wolfgang and Ferracuti 1967). Others have argued that regional distributions in the United States were due to poverty (Loftin and Hill 1974; Williams 1984) or rates of inequality (Blau and Blau 1982). Homicide rates in Canada are also unevenly distributed, with higher levels of interpersonal violence in the western regions (Brantingham and Brantingham 1984; Kennedy et al. 1991). There is also regional diversity in demographic shifts, economic patterns, migration experiences, and overall socio-political histories. It is widely argued that such dynamics differ between eastern and western Canada (Brantingham and Brantingham 1984), and researchers tend to attribute the west's higher rates to a number of potential contributory factors generated by higher levels of social disorganization (Kennedy et al. 1991). The western provinces currently experience higher in-migration, higher divorce rates, and higher levels of income inequality than do the Maritimes, Quebec, and Ontario.

Demographic Changes and Homicide Rates

The age/crime relationship is well established at the individual level (Gottfredson and Hirschi 1990; Levitt 1999); criminal activity increases noticeably during the mid-teen years and peaks at around the age of 20, following which, this criminal propensity steadily declines (Blumstein and Wallman 2006; Gottfredson and Hirschi 1990; Fox and Piquero 2003; Phillips 2006). This fundamental criminological phenomenon is designated as the "age-crime curve" (Blumstein 1995; Gottfredson and Hirschi 1990). In addition to the age-crime relationship, it is also well documented that gender is an important factor; males are significantly more likely to be involved in criminal and violent behavior than are females. Gender is the most significant influential demographic factor; however, it is indicated as the least relevant due to its almost static proportional makeup across time (Blumstein 1995; Blumstein 2006). This may not always be accurate. For instance, when mapping the gender structure of the population in Canada, one does see a few regions in the west where this steady expected proportion is changed by a large influx of young unmarried males.

It is the combination of both age and gender which account for large differences in criminal involvement (Gottfredson and Hirschi 1990; Blumstein 1995). Gottfredson and Hirschi (1990) maintain that there is an inherent pathological characteristic within the young male demographic. This segment of the population tends to participate in high risk, and potentially violent, behaviour, because little importance is placed on the future (Wilson and Daly 1997), and they are less susceptible to mechanisms of social control (Gartner 1990).

It follows then, that the population age structure of a given area can affect rates of interpersonal violence.[4] Thus, an overall increase in this crime-prone group is likely to amplify levels of interpersonal violence; conversely an aging population should result in decreased violence rates. Steffensmeier, Streifel and Harer (1987) found that the crude homicide rate dropped in the early 1980s, when the baby boomer cohort began to move out of the high risk age group and into their twenties and thirties. In Canada, Andresen et al. (2003) insisted homicide rates be measured as a function of the young male demographic, rather than the entire population, thus stressing the importance of these demographic factors. Although the combination of gender and age demonstrably influences the homicide rate, there is some debate regarding the importance of these demographic factors. All else being equal, the population's age dictates the homicide rates (Fox 2006), but given how

rarely all else is in fact equal, many other factors can intercede to affect levels of interpersonal violence (Blumstein and Wallman 2006; Gartner 1990; Grogger 2006; Johnson et al. 2006; Phillips 2006). Gartner (1990) and Gartner and Parker's (1990) cross-national analyses suggest that fluctuations in the proportion of young males in the population do not consistently predict homicide rates, positing that other issues may be more important. Cross-national comparisons usually yield different results than intra-national analyses; however, these empirical examinations suggest that the assumed association between age structure and homicide is much more complex. Phillips' (2006) examination of multiple counties in the United States also indicates that the population/age proportion is relevant, but that social conditions can alter this association. Pampel and Gartner's (1995) analysis found that the development of national institutions could mediate the effect age structure has on homicide rates. Clearly, the interaction of gender and age with other factors is complex and requires further analysis; there is likely interplay between demographics and socio-economic influences.

Socio-Economic Factors

Socio-economic factors have long been argued to affect rates of violence. Fluctuations in employment rates and unequal distribution of resources, among other economic changes, have both emerged as significant influences upon rates of interpersonal violence. However, economic indicators such as GDP and employment rates are often found to be in direct opposition to proponents of distributive influences. Inequality factors are strongly linked to anomic factors. Kennedy, Silverman and Forde (1991) note that regional variations in Canadian homicide rates are artefacts of inequality dynamics, and of the socially structured allocation of social disorganization. Disorganized social factors, such as migration patterns, transiency, and the broken homes stemming from divorce, have all been shown to affect rates of violence.

Economic factors ground much criminological theory, and numerous studies demonstrate that disparities in the distribution of economic advantages impact homicide rates (Kubrin 2003; Weiner, Zhan and Sagi 1990; Williams and Flewelling 1988). Economic downturns or decreased employment levels in particular regions are linked to increased levels of interpersonal violence (Grogger 2006). When employment opportunities are restricted, individuals sometimes turn to crime. Conversely they may turn away from crime when legitimate employment options are available to them (Grogger 2006; Steffensmeier et al. 1987). Indeed, Blumstein and Rosenfeld (1998) point out that the decline in homicide in the 1990s in the United States is at least partially the result of a country-wide economic expansion. Grogger (2006) asserts that criminal involvement is the result of the interaction between legitimate and illegitimate opportunities. Others maintain there is no relationship between unemployment and interpersonal violence (Fox 1978, Gottfredson and Hirschi 1990). Kapuscinski, Braithwaite and Chapman (1998) indicate that although there is a large body of literature examining the relationship between criminal behavior and unemployment rates, there remains large disagreement as to its impact. Empirical evidence is inconsistent, and the relationship does not appear to hold up in longitudinal analyses (Hu, Webster and Baker 2008; Kapuscinski et al. 1998).

Homicides are concentrated in the bottom strata in all western societies; therefore, Blau and Blau (1982) and Gartner (1990) argue that rates of unemployment do not reveal actual economic deprivation, as they do not capture levels of inequality. Relative deprivation, for instance, can increase frustration and lead to higher levels of interpersonal violence (Jacobs and Richardson 2008) than basic employment levels might predict. Wilkinson's (1996) examination of inequality notes that wealthy societies often lack social cohesion when their wealth is paired with unequal resource allocation. Inequality levels escalate in the absence of social and distributive justice, as do mortality rates (Wilkinson 1996 and 2006). Divergent distribution weakens the social fabric, thereby damaging the citizenry's well-being and increasing crime rates (Wilkinson 2006). Daly et al. (2001) found that inequality was a strong predictor of homicide in Canada.

Intra-nationally, distributions of both unemployment and inequality are uneven across the country, and over the years of the present study, Canada's levels of inequality have increased overall, with the western provinces experiencing higher levels of inequality than do the eastern provinces. Alternatively, current employment rates in Canada are much higher in the western provinces, with the highest exhibited by oil rich Alberta. Absolute deprivation, a factor also demonstrated to impact rates of violence, is also unequally distributed across the country (Blau and Blau 1982); however, data are limited in Canada related to poverty distribution.

Social disorganization implies a deficiency of community cohesion resulting in an anomic situation that is strongly tied to distributive factors. Social disorganization is elevated in highly mobile areas with transient populations which lack shared norms and values (Kubrin 2003; Shaw and McKay 1942). According to Shaw and McKay (1942), two of the most important contributory features are heterogeneity and mobility. Migration influxes into particular regions are often used as proxies for both heterogeneity and regional mobility. Williams and Flewelling (1988) cite increases in rates of family dissolution as a sign of weakened inter-individual ties, a factor commonly associated with social disintegration. In Canada, various features of anomie are not evenly distributed either geographically or temporally. Divorce rates, in-migration, and heterogeneity are all

currently more common in the western provinces. Owing to its economic strength, which has produced a need for workers, Alberta has recently been the region with the leading interprovincial migratory gains in Canada (Statistics Canada 2008). However, migration patterns have changed over the time of study (Sharpe, Arsenault and Ershov 2007).

Interacting Factors: Demographics and Socio-Economic Factors

A large amount of research has been dedicated to examining the impact that changes in demographics have on changes in homicide rates. The proportion of young males affects rates of interpersonal violence, and the population's overall age structure is thought to be a key factor in determining homicide rates (Fox and Piquero 2003). However, as some have noted, the relationship between cohort size and rates of violence is more complex than that evident association implies, and it is likely mediated by socio-economic factors (Gartner 1990; Pampel and Gartner 1995; Phillips 2006). The nature of the relationship between demographics and levels of interpersonal violence is unlikely to work in isolation.

Easterlin's (1978) theory proposed that cohort size would influence age-specific rates. In particular, Easterlin (1978) indicated that very large cohorts face many barriers in opportunities in their teens and twenties. Larger cohorts would experience obstacles to employment; therefore increasing their risk of criminal behavior. For O'Brien, Stockard and Isaacson, (1999) this was not simply due to the reduction in the labour market opportunities but also a decline in the ability for mechanisms of social control to restrict behaviour. Agents of social control would be overburdened by large cohorts of youth and therefore these groups are less likely to be properly integrated into society. Pampel and Gartner (1995) indicate that in locations where perhaps there are better opportunities for young people, the effect of a large cohort may be mitigated.

The age composition in a given region at a given time likely interacts with the region's levels of unemployment, levels of inequality, and social disorganization factors, thus mediating or exacerbating rates of interpersonal violence. For example, Phillips (2006) found that young males interacted with levels of social disorganization in their affect on inter-personal violence rates. In times and locations where large cohorts face better options and less stress, the effect of the proportion of young males on homicide rates may be restrained (Pampel and Gartner 1995). These same factors in Canada could exacerbate the relationship between young males and homicide. Areas in Canada with high migration rates of young males, or high migration with a pre-existing high proportion of young males, could experience aggravated levels of social disorganization thereby increasing rates of violence.

In sum, the goal of my research is to examine the effects of the changing young male demographic on homicide rate fluctuations and the way in which demographics interact with socio-economic changes. I use the Canadian Homicide Microdata and CANSIM (2008) data to examine this by testing the following hypotheses derived from the theories and literature discussed above:

1) Increases in the proportion of young males will positively affect homicide rates

2) Changes in the proportion of young males will interact with at least one, but not both, of the economic indicators (unemployment rate and inequality) in their effect on homicide rate changes.

3) Changes in the proportion of young males will interact with at least one of the social disorganization factors (migration rate and divorce rate) in their effect on homicide rate changes.

Methodology and Data Sources

This research examines factors affecting temporal and geographical homicide rate changes in seven regions of Canada from 1976 to 2005. Six of the regions are in fact provinces: Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia. The final region utilized for this analysis is the amalgamated region of the Maritimes. The Maritimes, or the four Atlantic Provinces (New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland/ Labrador), were placed together as one geographic unit due to their relatively small geographic and population sizes. I use several data sources in order to compile a cross-sectional time-series dataset which includes repeated measures of homicide rates, demographic features and socio-economic indicators.

Although considerable contemporary criminological research is focused on smaller geographic units, such as cities and neighborhoods, the region is a useful unit of analysis for an examination of homicide trends in Canada because of the significance of provincial level characteristics, as well as better data availability at the regional level. Homicide in the United States is primarily examined at the city level as it is considered an urban phenomenon; Canadian statistics, however do not show this same pattern (Statistics Canada 2007),[5] largely due to the small number of homicides occurring each year in the nation as a whole. Data at the regional level in Canada can provide broad explanations for changes at the provincial/regional level and can capture the differences between the regions with respect to the dependent, control and test variables.

Data Sources

The Canadian Homicide Microdata (2008) are derived from the Canadian Homicide Survey. Each police department is responsible for collecting detailed information on all homicides within their jurisdiction.

These data are compiled annually by the Canadian Centre for Justice Statistics (CCJS). The crude homicide rate (CHR) was calculated for each province/region for every year of the analysis in the usual way: by taking the number of total homicides from a region, from the Homicide Microdata, dividing them by the total population of the region, taken from Statistics Canada, and then multiplying by 100,000 to create a rate. The nation was divided into seven regions without the northern territories. The northern territories were removed due to the relatively small population size and lack of information on the independent variables as indicated above. Urban areas could not be utilized as a unit of analysis due to data limitations: although homicide rates could be calculated, the remaining structural variables were unavailable in their entirety at the census metropolitan area (CMA) level.

The independent variables for the fixed-effects models were derived from CANSIM[6] (Canadian Socio-economic Information Management System): Statistics Canada's computerized socioeconomic database (2009). The CANSIM data are updated daily and contain socio-economic, demographic, health, education and justice statistics on the regions of Canada. These data are limited access, but licensed to a variety of Academic Institutions in Canada. Data for each independent variable were collected on an annual basis from 1976 to 2005 for each region or province. The main variable of interest, young male population, was measured as the proportion of young males of ages 15 to 29 in each region for each year[7].

The two economic variables were collected: unemployment rate and income inequality rate. The regional unemployment rate is calculated by Statistics Canada as the percentage unemployed of the total employable population. The inequality rate is defined as the provincial level gini coefficients. The gini coefficient is the commonly used statistic for determining level of inequality. The gini is an index which measures the level of inequality in the distribution of incomes in an area. It is calculated from the *lorenz curve* in which cumulative income is plotted against the number of arranged incomes from the poorest to the richest (Firebaugh 1999).

Two social disorganization variables were computed for this analysis: the divorce rate and the migration rate. The crude divorce rate was calculated by the number of divorces in a region divided by the population of that region multiplied by 1000. The crude migration rate was calculated using the number of migrants moving into a region divided by the total population of that area multiplied by 1000. Lastly, a population density control variable was calculated: the population of each area for each year was divided by the squared kilometres of each area.

Fixed-effects Cross-Sectional Time-Series Models of Homicide in Canada

Fixed-effects time series cross sectional (TSCS) models are employed in order to examine how changes in the independent variables over time relate to changes in the homicide rate over time within each region. The creation of 30 time points in each of 7 regions resulted in a region-year sample of 210. By using fixed-effects models, regions are effectively being compared to themselves over time by calculating the deviations of each observation from the region specific mean of all time periods for each variable (Johnston and DiNardo 1997). The fixed-effects model has the advantage of controlling for all unmeasured time-invariant variables within each region. It does this by imitating a different intercept for each region based on its time invariant effects, or stated differently, it simulates the inclusion of a dummy variable for each region in a pooled OLS regression model. Thus, the model implicitly controls for time invariant covariates (Johnston and DiNardo 1997). One of the potential limitations of the fixed-effects model is that it is difficult to make inferences beyond the data values of the independent variables in the sample; however, such problems are minimized in cross-regional studies such as this one where the sample being analyzed contains much variation across both time and region (and variation of the independent variables) for which the results are to be generalized.

In contrast to the random-effects method used often in panel analyses in sociology (Halaby 2004), the fixed-effects option holds stable any unchanging case attributes by entering separate case-specific dummy variables in models (Jacobs and Tope 2008). Such estimates are unbiased when unmeasured time-invariant provincial characteristics associated with the explanatory variables influence the dependent variable. For example, unmeasured but stable explanatory factors such as cultural features which differ between cases yet do not change cannot bias fixed-effects results. Compared to random-effects, considerably stronger claims can be made that omitted variable bias is not present in fixed-effects models (Johnston and DiNardo 1997). The fixed-effects cross sectional time series equation is expressed as:

$$Y_{it} = \alpha + \chi_{it}\beta + v_i + \varepsilon_{it}$$

Where Y_{it} is the homicide rate in region i at time t. α represents the model intercept and β represents the estimates for the parameters for χ_{it}. v_i denotes the region specific residual which varies across region but not over time. The model residual is denoted with ε_{it} and captures random variation within region over time. Overall, this estimator is sensitive to measurement error, and because fixed-effects models ignore any cross case variation, such models only capture the effects of within case changes (but these changes need not be constant from one year to the next). This implies that all time invariant effects are automatically eliminated and thus held constant in fixed-

effects models (Johnston and DiNardo 1997). Each element in an explanatory variable need only vary over time in some cross-sectional units. However, in order to determine if one should use fixed or random effects models, the Hausman test is generally utilized. The Hausman tests show whether random-effects estimates are inconsistent, thereby indicating which method should be used. In this case, the Hausman test indicated that fixed-effects were the appropriate method. This is not surprising given the small N and large T characteristics of the data (as demonstrated by Podestà 2000).

Results

As previously indicated, the homicide rates in Canada vary across time and region, and western Canada exhibits higher rates than does eastern Canada. Overall, the homicide rate has declined since the mid-1970s. However, rates in the Prairie Provinces (Manitoba, Saskatchewan, and Alberta) are currently the highest in the country. The Maritimes, or Atlantic Canada, which include Nova Scotia, New Brunswick, Prince Edward Island, Newfoundland and Labrador, almost consistently demonstrate the lowest homicide rates in the country; they are, however, followed closely by the most populous province Ontario (ON). Quebec's (QC) homicide rate has seen a relatively consistent decline over the time of study and the rate is currently similar to that of Ontario's rate.

All independent factors also vary over time and space. Table 1 outlines the descriptive statistics for each covariate in Canada and also describes the overall standard deviations, the spatial standard deviations and the temporal standard deviations. The mean homicide rate for Canada is 2.56 per 100,000 with a regional standard deviation of .70 and a .60 standard deviation over time. Unemployment (mean of 8.63) and inequality measured with the gini coefficient (mean of .40) are the measures of economic strength and resource allocation respectively. Social disorganization is measured in two ways: first, by crude divorce rate, and second by crude migration rate with means of 25.12 per 1,000 and 15.43 per 1,000 respectively. The central focus of the independent variables is the percentage of young males, which is a mean of 12.3%; although the temporal standard deviation is 1.7%, the spatial standard deviation is only 0.5% indicating limited variation in proportion of young males over the various regions.

Table 1:
Descriptive Statistics for Dependent and Independent Variables (1976-2005)

Variable	Mean	Total Standard Deviation	Spatial Standard Deviation (n=7)	Temporal Standard Deviation (n=30)
Homicide Rate per 100,000	2.555	0.861	0.696	0.569
Unemployment rate working pop.	8.633	2.93	2.478	1.816
Inequality gini	0.398	0.018	0.007	0.017
Crude divorce rate per 1,000	25.12	5.311	4.196	3.611
Crude migration rate per 1,000	15.429	8.612	7.68	4.834
Population density per sq km	4.166	2.54	2.669	0.562
Population age structure prop male 15 to 29	0.123	0.018	0.005	0.017

In order to determine the effects of structural changes on homicide rates, this fixed-effects analysis begins by estimating a general model of regional Canadian homicide rates outlined in Table 2. First, the socio-economic factors are run in Model 1 without the demographic variable. All factors are significant with the exception of the density control variable, a factor which as indicated above does not appear to have the same effect in Canada as in the United States[8]. Increases in unemployment rates result in increases in homicide rates, whereas increases in inequality rates result in decreases in homicide rates. This result supports the argument that an expanding economy will decrease homicide rates, but does not support the theory that poor resource allocation increases homicide rates. The social disorganization features show contradictory results in this model. Divorce rate, which is

often demonstrated as having a positive impact on rates of violence, actually indicates the opposite. More specifically, when the divorce rate increases, the violence rate decreases. However, migration rate does show positive significant results: increases in migration rates give rise to increases in homicide rates.

Model 2 displays the effects of the addition of the proportion of young males. Goodness of fit criteria indicate that the model including young males is a better fit than excluding them (chi-square = 14.37). There are now only two significant findings: first, increases in migration rates continue to be associated with increases in homicide rates; however, no other socio-economic factors remain significant. Second, increases in the proportion of young males have a significant positive impact on changes in homicide rates. The estimate suggests that a one percent rise in the young male population size results in a 0.147 increase in the homicide rate. These results lend support to the demography-violence arguments, as increases in the young male segment results in increases in Canadian regional homicide rates.

Because a goal of this research is to explore the interaction between demography and socio-economic factors, the fact that many socio-economic variables are not significant with the addition of the demographic factor is thought to be a function of this interaction. Model 3 displays the effects of the interaction between young males and deprivation factors: it outlines the young male-inequality interactions. Goodness of fit criteria indicate that this model is a better fit than the full model (chi-square = 6.33). Although not shown here, the interaction between young males and unemployment was tested and is not significant. Contrary to results in Model 1, and as indicated by Blau and Blau (1982) and Gartner (1990), unemployment is not an important predictor for homicide as it does not capture deprivation. The inequality-demography interaction is significant, showing that the combination of both unequal resource access changes and changes in proportion of young males in a region strongly influence homicide rate variations. The effects of demographics on homicide differ depending upon the levels of inequality, indicating that the effect of the young male segment on homicide is mediated by rates of inequality.

Model 4 displays the interaction between demographics and one of the social disorganization factors. Goodness of fit criteria indicate that this model is a better fit than the full model (chi-square = 6.33). Not displayed here is the divorce rate-demography interaction as it was not significant. Divorce rates do not appear to interact with demographics, a finding contrary to research conducted by Phillips (2006) who did find a significant interaction in her examination of United States counties. The interaction between young males and migration indicates a significant negative interaction. The effects of young males on homicide are altered by changes in migration rates. Migrating young males or a pre-existing segment of young males coupled with changing levels of migration interact in their effect on homicide rates.

Although not displayed here, a model was run with both interaction effects. The inclusion of both demography-migration and demography-inequality interactions demonstrate that the interaction of percentage male and migration rate is significant and the interaction of percentage male and inequality is not. This illustrates that the demography-migration factor is robust with the inclusion of the demography-inequality factor.

In order to better understand the interaction effects of young males and inequality as well as young males and migration rates, predicted homicide rate values were calculated and are presented in Table 3 and Table 4. Table 3 shows the predicted homicide rates for the interaction values of young males and inequality and can be interpreted as any one cell being the predicted homicide rates given the row-column values for the gini coefficient and proportion of young males. The values for both factors display the approximate range experienced in Canada over the period of study.

The relationship between young males and rates of inequality is complex. At all levels of inequality the proportion of young males has an increasing affect on predicted homicide rates. However, at low levels of young males in a population, we see a decreasing effect of inequality on homicide rates. Yet once the young male population reaches 12% the increasing gini coefficients begin to have a positive effect on homicide rates. Therefore, the values of proportion of young males must be over a certain point for inequality to impact homicide rates in the expected way: the positive affect of poor resource allocation requires a minimum proportion of young males in a region.

Table 4 displays the predicted values for homicide rates for different values of young males and migration rates. Again, the approximate range of existing values for both migration and young males are used. At all levels of migration, the increasing proportion of young males in an area has an increasing effect on expected homicide rates. The highest predicted homicide rates though are when migration rates are low and the proportion of young males is high (top right quadrant). This runs contrary to ideas of social disorganization as migration influxes are a primary proxy for high levels of transiency and heterogeneity, yet here it appears that the young male segment is driving the interpersonal violence rates and that migration rates may actually temper this influence.

Table 2:
Fixed Effects Models for Homicide Rates in Canada 1976 to 2005 (N= 210)

	Model 1		Model 2		Model 3		Model 4	
	B	SE	B	SE	B	SE	B	SE
constant	5.932***	1.416	0.440	2.011	16.577*	8.549	-1.843	2.193
MAIN EFFECTS								
Economic Indicators								
Unemployment Rate	0.055**	0.024	0.032	0.024	0.020	0.024	0.031	0.023
Inequality (Gini)	-8.505**	3.521	1.090	4.270	-40.080*	21.627	3.049	4.292
Social Disorganization								
Divorce Rate	-0.028**	0.012	-0.016	0.012	-0.020	0.012	-0.011	0.012
Migration Rate	0.039***	0.009	0.019*	0.010	0.017	0.010	0.103***	0.036
Demographic Control								
Population Density	-0.086	0.097	-0.069	0.094	-0.021	0.097	-0.036	0.094
Population Age Structure								
Proportion Male 15 to 29			14.651***	3.922	-118.121*	68.504	22.729***	5.087
INTERACTION EFFECTS								
Proportion Male 15 to 29* Inequality Rate					340.807*	175.555		
Proportion Male 15 to 29* Migration Rate							-0.527**	0.215
R-square within		0.258		0.307		0.320		0.328
rho		0.689		0.649		0.668		0.672
BIC		327.750		318.727		320.074		317.743
AIC		307.667		295.297		293.297		290.966
- 2 log likelihood		-147.834		-140.648		-138.649		-137.483

**p<0.10; **p<0.05; ***p<0.01*

Table 3
Predicted Homicide Rates by Inequality Levels and Proportion of Young Males With All Variables at Their Mean.

Gini Coefficient	Proportion of Young Males								
	0.09	**0.10**	**0.11**	**0.12**	**0.13**	**0.14**	**0.15**	**0.16**	**0.17**
0.360	1.891	1.937	1.982	2.028	2.074	2.119	2.165	2.211	2.256
0.370	1.797	1.877	1.956	2.036	2.116	2.196	2.275	2.355	2.435
0.380	1.703	1.817	1.930	2.044	2.158	2.272	2.386	2.500	2.614
0.390	1.609	1.757	1.905	2.052	2.200	2.348	2.496	2.644	2.792
0.400	1.515	1.697	1.879	2.061	2.243	2.425	2.607	2.789	2.971
0.410	1.420	1.637	1.853	2.069	2.285	2.501	2.717	2.933	3.149
0.420	1.326	1.577	1.827	2.077	2.327	2.577	2.827	3.078	3.328
0.430	1.232	1.517	1.801	2.085	2.369	2.654	2.938	3.222	3.506
0.440	1.138	1.457	1.775	2.093	2.412	2.730	3.048	3.367	3.685

Table 4

Predicted Homicide Rate by Migration Levels and Proportion of Young Males With All Variables at Their Mean.

Migration Rate (per 1,000)	Proportion of Young Male								
	0.09	**0.10**	**0.11**	**0.12**	**0.13**	**0.14**	**0.15**	**0.16**	**0.17**
5	2.627	2.860	3.094	3.327	3.561	3.794	4.027	4.261	4.494
10	2.539	2.752	2.965	3.177	3.390	3.602	3.815	4.027	4.240
15	2.452	2.643	2.835	3.027	3.219	3.410	3.602	3.794	3.985
20	2.364	2.535	2.706	2.877	3.048	3.218	3.389	3.560	3.731
25	2.277	2.426	2.576	2.726	2.876	3.026	3.176	3.326	3.476
30	2.189	2.318	2.447	2.576	2.705	2.835	2.964	3.093	3.222
35	2.101	2.209	2.318	2.426	2.534	2.643	2.751	2.859	2.968
40	2.014	2.101	2.188	2.276	2.363	2.451	2.538	2.626	2.713
45	1.926	1.992	2.059	2.126	2.192	2.259	2.325	2.392	2.459

Discussion

The fluctuating homicide rates in the seven regions of Canada are strongly impacted by changing demographics. As much previous research demonstrates, demographics are a key influencing factor on rates of interpersonal violence (Andresen et al. 2003; Cohen and Land 1987; Fox 2006; Fox and Piquero 2003). Although socio-economic factors have a significant influence in the absence of demographic factors, the addition of young males obscures all but one of these influences. Migration is the only factor that continues to influence homicide rates: migration patterns in Canada affect interpersonal violence rates. Social disorganization levels, which are higher in the western regions of Canada, initially appear to have a direct impact on rates of violence. This may provide a partial explanation for specific homicide trends: geographic fluctuations in migration rates are also higher in the western provinces.

Overall, this analysis shows support for the age-crime relationship at the aggregate level. Larger cohorts of young males will positively influence homicide rates in Canada. The young male subgroup of the population is more likely to engage in higher risk behavior (Gottfredson and Hirschi 1990), and as Gartner (1990) indicates, the younger the population, the more dispersed its activities and the less effective social control is. This result can at least partially explain the overall decrease in the homicide rate: first, the proportion of this segment has also decreased over the period of interest. Second, there have been slight increases in the young male population in the west, where homicide rates are higher.

However, there are likely multiple feedback loops in this equation which may explain some of the complexity in the empirical results. Wilson and Daly (1997) indicate that if a high proportion of people in a given area fall into the high risk category, the time of onset of risky and violent behaviors will be decreased; yet, this relationship is potentially aggravated by contributing factors such as economic fluctuations. Demographics affect homicide rates through socio-economic features: the young male factor, although having a strong influence on homicide rates in this Canadian analysis, is affected by both migration rate changes and changes in inequality. As Phillips (2006) found of counties in the United States, the young male segment of the population interacts with other structural factors. However, counter to Grogger (2006) and Phillips (2006), there was no effect found for the interaction of unemployment and young males on homicide rate changes in this empirical examination.

Resource allocation on the other hand does affect rates of interpersonal violence. On its own, distributive justice does not impact homicide rates in Canada: the distribution of wealth interacts with regional demographic features. Expected rates of homicide begin increasing with increasing inequality only after a point is met for the proportion of young males in a specific region. In fact, if this proportion is not reached, inequality has a decreasing effect on homicide. The positive association of inequality and homicide exists after the young male population reaches 12%. This suggests a cohort effect: as the size of the proportion of young males surpasses a specific proportion of the population, unequal resource distribution begins to play a role. The critical suggestion is that the effect of demographics (which cannot themselves be controlled) on homicide can be tempered by decreasing levels of inequality and perhaps, as Pampel and Gartner

(1995) suggested, the implementation of social institutions which can bring about more equitable access to resources.

As indicated, social disorganization does appear to affect homicide rates on its own, as illustrated by the positive effects of migration rates, or by interacting with the young male segment. Social disorganization implies that the informal structures that are meant to direct behavior exercise less power over individuals resulting in social breakdown (Silverman and Kennedy 1993). Theory would indicate that disorganizing factors, such as migration, would interact with the young male demographic to intensify its effect on homicide rates. An influx of young males to an area should create a high level of chaos thereby decreasing the capacity for social control.

The interaction between migration and demographics is quite interesting as the relationship appears to be dictated primarily by the proportion of young males. Migration rates are not directing the increases when the proportion of young males is taken into consideration; in fact, it is when the proportion of young males is large and the migration rate is low which produces the highest homicide rates. Initially these results and the expected influence of disorganized social conditions seem at odds; however, since social disorganization is based on the idea of lack of shared values and norms due to breakdown, there could be another explanation. If more youth migrate to areas with many employment opportunities there may be more informal controls (through commitments to work) and therefore less frustration, resulting in lower levels of interpersonal violence. It is possible this would not be captured by unemployment rates per se, but rather by proportion of jobs created in a particular region or age specific employment rates. This complex issue requires further attention. Job market increases and employment rate increases for young males could possibly temper the positive effects of social disorganization factors on rates of violence.

There are, of course, limitations to the current study. First, the use of regions as the units of analysis can lead to inappropriate generalizations. Canada is an extremely heterogeneous country and there are many distinctions not only between regions/provinces but within as well. For example, the largest and most populated province, Ontario, likely has huge intra-provincial discrepancies in all measure of both independent and dependent factors. The province contains multiple diverse cities as well a vast rural area. These areas would be substantially different with regards to demographics and socio-economic features. In addition, it is not only Ontario which contains such diversity, but most of the provinces in the country. Future research should attempt to include examinations of these complex relationships with finer units of analysis, perhaps CMA as the focus, if data on all structural features are made available.

Second, a drawback to TSCS data is that they need to be perfectly balanced prior to completing any analysis and certain aggregate level data are not often updated in Canada, for example during the data collection period, divorces had not been updated since 2005 which limited the analysis to that year. Third, TSCS fixed effects cannot deal with spatial autocorrelation in the error term, which could be a problem for this examination. That is, some factors in adjoining regions will be impacted by one another.[9] Geographical proximity to violence has been demonstrated as affecting an area's own violence levels at the community level (Griffiths and Chavez 2004), a factor which cannot be controlled for in this analysis.

Finally, fixed-effects analysis cannot control unobserved time varying heterogeneity, and given that this analysis uses a 30 year time period this is likely an issue. Nevertheless it is important to note that, although not illustrated here, when decade dummy variables were created there were no significant coefficients and when shorter series (10 years) were created there were no significant differences from the overall results[10]. Although fixed-effects can control for time invariant covariates, the omission of relevant time varying factors remains problematic for this type of analysis. Therefore, future research should perhaps attempt to include other relevant factors such as a measure of poverty which could uncover another layer of complexity to the relationship between deprivation and demographics. However, access to information, even at the aggregate level, is restricted in Canada which can make these types of analyses extremely difficult.

Conclusion

The preceding analysis and discussion outlines the complicated relationships between demographic features and social-structural factors on interpersonal violence and adds significantly to our understanding of homicide rate changes in Canada. Despite the limitations, this analysis improves our understanding of some important relationships in criminology. In examining the broad strokes at the regional/provincial level, demographics remain a key indicator for homicide changes: as the size of the young male population between 15 and 29 increases, regions are more at risk of increasing violence. Although not tested in this examination, young males are more likely than other sectors of society to experience the brunt of socio-economic features, an important factor to consider in future research. The young male factor's influence on homicide rates is thought to be essential in Canada (Andreson et al. 2003). This relationship, though, is not straight forward as it appears to be both tempered and aggravated by socio-demographic factors.

While the strength of the association between demography and violence remains, the ubiquity of the demographic-violence relationship comes into question through this analysis. As Gartner (1990) also found, this feature interacts with other structural influences. Although,

previous research indicates these interactions exist, it was either derived from the United States (see Phillips 2006) or the relationships were examined cross-nationally on multiple developed nations (see Gartner 1990; Pampel and Gartner 1995). This examination of Canadian regions supports the complexity of the interaction between young males and socio-economic factors and their combined effect on homicide rate changes. Although the relationship between age and crime is well established at the individual level, the current interactions demonstrate a complex relationship at the aggregate level in Canada.

The relationship demonstrated here between socio-economic factors in combination with demographics on homicide would benefit from other types of analyses into the Canadian case. Wilkinson (2006) indicates that unequal access to resources breaks down community relations; however, exactly how these factors come together to effect wellbeing and interact with demographics cannot be explicated completely. In addition, migration and divorce as proxies for social disorganization would benefit from the addition of measures of heterogeneity or transiency. Finally, there may be other cofactors which could influence the young male segment and homicide rate changes, such as poverty, age-specific employment rates or shifting economic conditions, all of which should be considered in future research into changing homicide trends in Canada.

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Endnotes

[1] This long-term trend is cited as decreasing by a factor of no less than ten to one since the 13th century (Gurr 1981).

[2] Differences in homicide rates in Canada and the United States have been examined by a number of researchers (see Hagan 1991; Ouimet 1999; Zimring and Hawkins 1997).

[3] This statement holds with the exception of the northern territories where the homicide rate has been known to exceed that of the United States at times. Nunavut, Yukon, and the Northwest Territories have both high and volatile homicide rates. This is largely a result of the extremely sparse population, a factor that inflates homicide rates during certain periods. The territories are not included in this analysis, but this geographical area does require further attention given the volatility of both structural factors and homicide rates.

[4] There are also issues of race, which can be an important demographic aspect for homicide rates. In the United States, young black males are disproportionately represented overall as both homicide victims and offenders (Blumstein 2006). In Canada, it is native Canadians who are overrepresented in these groups (Silverman and Kennedy 1993); however, there is some difficulty with the issue of race owing to a lack of transparency in Canadian reporting methods (see Wortley 2003). Racial statistics are not collected in homicide reports with the exception of being identified as native, and even these data are incomplete. It is almost impossible to statistically examine the role young black males play in Canadian homicide rates, with the exception of one rare study. Ouimet (1999) studied the results when police in Montreal coded the race of all victims of homicide in 1993; the homicide rate for blacks was 24 per 100,000, while the rate for non-blacks was under 3 per 100,000. Regardless of this important finding, it is not possible to include race as a variable in the present analysis owing to limitations in the data.

[5] Furthermore, Canadian Centre for Justice Statistics (CCJS) did not collect city level identifiers prior to 1991and many of the macro-level socio-economic variables are not available at the city level.

[6] Data derived from CANSIM were accessed through McGill Library the reproduction is a copy of an official work that is published by the Government of Canada and the reproduction has not been produced in affiliation with, or with the endorsement of the Government of Canada.

[7] Cohort size is measured differently by various researchers, the entire range for the young population covers from age 15 to age 34. This research follows Gartner's (1990) choice of 15 to 29 years of age. One should be cautious when comparing studies that use different cohort definitions (see Leenaars and Lester 1996 for further discussion of cohort sizes).

[8] It is important to note that city level data could potentially show otherwise.

[9] See Worrall and Pratt (2004) and Phillips (2006) regarding spatial autocorrelation in TSCS fixed-effects models.

[10] See Appendix A for the inclusion of time period dummy variables.

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Appendix A:
Period Effects on Homicide Rates in Canada 1976 to 2005 (N= 210)

	Model 1	
	B	SE
constant	-0.012	2.098
MAIN EFFECTS		
Economic Indicators		
Unemployment Rate	0.040	0.029
Inequality (Gini)	1.599	4.576
Social Disorganization		
Divorce Rate	-0.026	0.016
Migration Rate	0.021*	0.011
Demographic Control		
Population Density	-0.097	0.100
Population Age Structure		
Proportion Male 15 to 29	19.485***	6.641
DECADE (1996-2005 ref)		
1976-1985	-0.205	0.269
1985-1995	-0.017	0.143
R-square within		0.310
rho		0.658
**p<0.10; **p<0.05; ***p<0.01*		

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