Reassessing the Structural Covariates of Cross-National Infant Homicide Victimization

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Abstract:

Existing literature shows only four cross-national, longitudinal studies of infant homicide victimization. More than a decade has passed since this issue has been taken up in the literature. Consequently, our understanding of infant homicide over time at the cross-national level is limited. In this article, we build on the findings from these four studies using an expanded sample of countries, a longer time series, more valid measures, additional variables, and tests of gender differences. Our expanded analysis confirms many of the findings in the earlier studies but with a few important departures. As in earlier studies, the results confirm that female labor force participation and income inequality are significant predictors of infant homicide victimization rates. But we also found that compared with other countries, those that scored highest on culture of violence measures actually had significantly lower rates of infant homicide victimization.

Keywords: infant homicide | cross-national | gender differences | female status

Article:

Much of the literature on infant homicide is descriptive and is focused almost exclusively at the individual level (Christoffel, Anzinger, & Amari, 1983; Wilczynski, 1995).[1] There are few studies that actually explain or predict infant homicide rates at the macro level (Rodriguez & Smithey, 1999). Of the few macro-level studies that do exist, most deal with homicide victimization in the United States only (Baron, 1993; Sorenson, Peterson, & Richardson, 1997; Straus, 1987b). A review of the English-language literature shows only four studies that address cross-national infant homicide victimization (Briggs & Cutright, 1994; Fiala & LaFree, 1988; Gartner, 1990, 1991), and more than a decade has passed since the publication of the most recent of these studies.[2] Consequently, our understanding of infant homicide at the cross-national level is limited.

In this article, we build on these four earlier studies by (a) including a longer time series, (b) adding additional relevant independent variables, (c) expanding the sample of countries included, and (d) testing for gender differences.

Four Existing Studies on International Infant Homicide Victimization

Fiala and LaFree (1988) conceived of child homicide as an extreme form of child abuse. Using data from a single year, they tested four theoretical perspectives on child abuse: economic stress, social disorganization, culture of violence, and social isolation. Their models examined the homicide victimization rates of infants (aged 0 to 1) and children (aged 1 to 4). Their sample included 22 lesser developed countries and 18 developed countries. Their analysis covered a single year, 1974. Their analysis supported the economic stress hypothesis for the homicide victimization of infants, but in an interesting way. Neither the inequality nor unemployment measures were statistically significant. Instead, the connection between economic stress and infant homicide victimization rates was mediated by the status of women and through government spending on programs that reduce economic stress. The implication here is that general economic stress may have some explanatory power for the homicide victimization rates of other age groups, but for infant homicide, economic stress is bound up with economic conditions for women in particular. Indeed, female labor force participation and females in tertiary education (conceptualized as a general measure of female status) emerged as the most important explanatory variables for cross-national infant homicide victimization rates.

Gartner (1990) developed and tested a model of cross-national and temporal variation in homicide victimization rates by using age-specific victimization data from 18 industrialized nations for the years 1965 to 1980. She argued that a country's homicide victimization rates are shaped by four contexts: material, integrative, demographic, and cultural. Gartner found that some indicators are general in that they predict homicide victimization rates for all age and gender groups, whereas other variables predict homicide victimization rates for specific age or gender categories. For instance, income inequality, divorce, and weak social integration were not significant homicide risk factors for children, but they were for adults. In fact, welfare spending was the only variable that was significant for all age groups, and this effect was strongest for younger age groups. Gartner found three statistically significant predictors of infant homicide victimization rates: Infant homicides were higher when female labor force participation (included as part of the demographic context) and battle deaths (cultural context) were higher, and they were lower when welfare spending (material context) was higher.

In a related study published a year later, Gartner (1991) explored whether certain types of family structures increase infants' (aged 0 to 1) and children's (aged 1 to 4) vulnerability to homicide. Gartner found that the predictors of infant homicide victimization are different than those for other age groups. She found that percentage of teen births, battle deaths, and female labor force participation all increase infant homicide victimization, particularly in countries with lower expenditures on social welfare programs.

Briggs and Cutright (1994) explored model specification with regard to crossnational, age-specific homicide. They began with all the variables used in Gartner's (1990, 1991) and Fiala and LaFree's (1988) models and tested them in an expanded model that included several

additional measures. Briggs and Cutright found substantial agreement in significant indicators across the three age groups (0-1, 1-4, and 5-14) and were able to replicate most of the findings in Fiala and LaFree's (1988) study and some of the results in Gartner's (1990, 1991) studies. Briggs and Cutright found that divorce, female labor force participation, battle deaths, and rape rates all increased the cross-national homicide victimization of infants. Further, they found that social insurance expenditures and a higher proportion of females in higher education were associated with reduced infant homicide victimization rates.

Whereas each of these four studies examines the predictors of homicide for various age groups, in this research we are interested in isolating results for infant homicide victimization in particular. Table 1 shows a summary of the outcome of predictor variables for infant homicide victimization rates across each of the four studies (Briggs & Cutright, 1994; Fiala & LaFree, 1988; Gartner, 1990, 1991). All four studies use World Health Organization (WHO) homicide victimization data as their dependent variables. Different time frames are used in each study, and a different sample of countries is used in each but with substantial overlap across the studies.

Table 1 shows that all four studies concur strongly on one conclusion: Female labor force participation has a significant effect on infant homicide victimization rates. Three of the four studies find that increases in social security expenditures are associated with lower infant homicide victimization rates, indicating that in countries where public assistance is higher, infant homicide victimization rates are lower. Culture of violence measures, operationalized as battle deaths, are positive and significant in three of the four studies.

Fiala and LaFree (1988) and Briggs and Cutright (1994) both found that countries that provide greater participation for women in higher education (as measured by women in tertiary education) enjoy lower infant homicide victimization rates. Only the Briggs and Cutright study found that higher aggregate-level divorce rates are associated with higher infant homicide victimization, and Gartner's (1991) study found that a higher percentage of teen births is a significant predictor of infant homicide.

An inspection of Table 1 shows that the strongest and most consistent findings are that countries with high levels of female labor force participation, low levels of spending on social programs, a history of high battle death rates, and low levels of women in higher education have higher rates of infant homicide victimization. These four studies reinforce the idea that variables associated with women's economic status are important in understanding infant homicide victimization. It follows that it may be useful to focus on social structural conditions that affect women when examining the causes of infant homicide victimization, particularly economic conditions connected to government support in nations characterized by an emphasis on violence.

Table 1 Outcome of Predictor Variables for Infant Homicide Victimization (aged 0 to 1), by Study

	Fiala and LaFree (1988), Infants 0 to 1	Gartner (1990), Infants 0 to 1	Gartner (1991), Infants 0 to 1	Briggs and Cutright (1994), Infants 0 to 1

Family stress				
Divorce rates	N/A	N/S	N/S	+
Female labor force	+	+	+	+
Social insurance/GDP	–	–	N/S	–
Illegitimacy ratio	N/A	N/A	N/S	N/A
Percentage of teen births	N/A	N/A	+	N/A
Fertility rate	N/A	N/A	N/S	N/A
Female status				
Female-to-male tertiary enrollment	–	N/A	N/A	–
Societal integration				
Population heterogeneity	N/A	N/S	N/A	N/S
Income inequality N/S	N/S	N/A	N/A	
Culture of violence				
1900-1980 battle deaths	N/A	+	+	+
Rape rate per 100,000	N/A	N/A	N/A	+
Death penalty	N/A	N/S	N/A	N/A
Homicide rate in 1974	N/S	N/A	N/A	N/A
Demographic context				
Population aged 15 to 29	N/A	N/S	N/A	N/A
Economic stress				
Unemployment rate	N/S	N/A	N/A	N/A
Other measures				
Urban growth	N/S	N/A	N/A	N/A
GNP per capita	+	N/A	N/A	N/A
Physicians per 1,000	N/S	N/A	N/A	N/A

Note: A plus sign represents a positive and significant relationship with infant homicide victimization rates. A minus sign represents a negative and significant relationship with infant homicide victimization rates. N/A indicates that this measure was not included in the study. N/S indicates that the measure was included in the study but was not statistically significant.

Infant homicide victimization is a unique category of homicide. We focus our study on victims aged 0 to 1 because infant homicide victimization seems to depart markedly in patterns, characteristics, and trends from the homicide victimization of other age groups (Finkelhor & Ormrod, 2001; Stanley, 1995). Infant homicide victimization warrants separate attention because prior research suggests that the patterns and trends of infant and adult homicide rates differ

(Finkelhor, 1997). Unlike the homicide victimization for other age groups, the rate for infants does not appear to be highly correlated with the overall murder rate (Straus, 1987a). In addition, a few studies have found that infant homicide rates respond to different predictors than the overall homicide rate or the homicide rates of other age groups (Gartner, 1990; Rodriguez & Smithey, 1999; Straus, 1987a). For most countries, compared with rates for other age groups, infant homicide rates (including 1- to 4-year-olds) by gender are much closer to parity. Infant boys and girls are at nearly an equal risk for fatal abuse, a lack of gender difference that has remained unexplained. It follows then that the etiology of infant homicide may be very different from the homicides of other age groups.

Data, Variables, and Analysis

In this study, we draw on the three most consistent findings from the four major published quantitative studies of cross-national variation in infant homicide: female labor force participation, economic stress through lack of government support, and culture of violence. We expand our sample of countries and argue that the same fundamental social mechanisms that are associated with infant homicide victimization are at work regardless of level of economic development.[3] This strategy allows us to address six specific issues:

1. Increases in female labor force participation were associated with significant increases in infant homicide victimization in all four studies. Does this relationship still hold with a longer time series and an expanded sample?

2. Increases in economic stress (as measured by low levels of social security spending) were associated with high rates of infant homicide victimization in three of the four target studies. Does the economic stress relationship hold with different economic stress measures (inflation, Gini index, male unemployment, and government consumption), a longer time series, and an expanded sample?

3. Higher culture of violence values (operationalized as battle deaths) were associated with increased levels of child homicide victimization in three of the four target studies. Does this relationship hold with different culture of violence measures (Amnesty International rating, military expenditures, law and order tradition, democracy rating, and ethnic tensions), a longer time series, and an expanded sample?

4. Do the above relationships hold when included in models with the addition of an institutional intervention measure (quality of bureaucracy) and an access to health care measure (physicians per 1,000 persons)?

5. Do the above relationships hold when included in models with an expanded set of control variables?

6. Do the above relationships hold equally well for male and female infants?

Table 2 shows the mean homicide victimization rates for male and female infant homicide victimization rates, for each country. According to Table 2, infant homicide victimization varies

greatly across countries. Homicide victimization rates were calculated per 100,000 persons for the appropriate age and gender category. For the presentation of descriptive data only, where values were missing for 3 or fewer consecutive years, linear interpolation was used. Table 2 reveals substantial variation in homicide victimization rates across countries. For example, the murder of female children younger than 1 year of age ranges from a low of 0.61 in Spain to a high of 12.15 in Hungary. This great variation suggests the importance of studying child homicide victimization at the cross-national level. Although adult homicide rates are not reported here, there is great variability across countries in the relationship between infant homicide rates and adult homicide victimization rates. Overall, the correlation between infant homicide rates and homicide rates of adults aged 25 and over in this sample is only .026. Indeed, in many cases (e.g., Australia, Japan), infant homicide rates are substantially higher than adult rates for the same gender.

Table 2 Mean Homicide Rates for Females and Males, By Age, 1945-1998[a]

Country	Females Aged 0 to 1	Males Aged 0 to 1	Number of Years	Included in Regression Analysis?
Australia	2.55	2.74	42	yes
Austria	6.67	7.5	48	yes
Belgium	1.91	2.54	36	yes
Bulgaria	2.66	2.76	37	
Canada	2.75	3.44	48	yes
Chile	5.17	5.34	37	yes
Colombia	3.63	4.72	26	yes
Costa Rica	1.94	9.09	41	yes
Czechoslovakia	6.29	5.36	33	
Denmark	3.34	2.28	46	yes
Dominican Republic	0.83	1.01	29	
El Salvador	1.51	1.93	27	yes
Finland	10.74	11.19	48	yes
France	2.44	2.51	47	yes
Germany	5.86	5.81	30	
Greece	0.88	0.9	41	yes
Hong Kong	1.89	1.67	40	
Hungary	12.15	11.51	42	
Ireland	2.03	1.82	42	
Israel	2.17	2.59	44	yes
Italy	1.2	1.1	45	yes
Japan	7.2	7.14	49	yes
Mauritius	1.82	5.19	43	
Mexico	2.56	3.91	33	yes
Netherlands	1.67	1.66	46	yes
New Zealand	3.29	4.25	46	yes
Norway	1.91	1.44	41	yes

Panama	1.36	1.36	34	yes
Poland	3.12	3.04	38	
Portugal	2.43	2.42	44	yes
Puerto Rico	1.74	1.73	32	
Singapore	2.36	1.16	43	yes
Spain	0.61	0.74	28	yes
Sweden	2.53	2.05	40	yes
Switzerland	8.25	6.73	44	
Trinidad and Tobago	1.76	2.25	30	
United Kingdom	3.2	3.66	47	yes
United States	5.47	6	47	yes
Venezuela	2.4	2.6	41	yes

a. Rates are calculated per 100,000 persons per year in the appropriate age and gender group.

Dependent Variables

The dependent variable used in this analysis is homicide victimization rates per 100,000 residents for each country by gender for infants 1 year old or younger. Data for age and gender of victims is available from WHO as far back as 1945 for select countries in the *World Health Statistics Annual 1998*, among the cause of death reports. *Homicide victimization* is defined by WHO (1998) as homicide purposely inflicted by other persons. One of the data-oriented objectives of this study was to capture historic homicide data as far back as the records would allow. Data prior to 1979 were collected from library copies of WHO cause-of-death reports. Post-1979 WHO data were taken from the electronic files on WHO's Web site. Although we are solely focused on infant homicide victimization in this study, for comparative purposes we conducted our analysis on the following age groups: (a) 1 to 4, (b) 5 to 14, (c) 15 to 24, and (d) 25 and older (World Health Organization, 1998). These results are not reported here but are briefly discussed in the results section and are available from the authors on request. The data span the years 1945 to 1998, but as Table 2 shows, we did not have complete data on all the countries included in the sample. The most complete data were available for Japan (49 years) and Austria, Canada, and Finland (48 years). We had 40 or more years' worth of data for 25 (64.1%) of the 39 countries included in the analysis. We had the fewest years of data for Colombia (26 years), El Salvador (27 years), and Spain (28 years).

Independent Variables

Based on the arguments above and existing literature, we divided our independent variables into six categories: (a) family structure variables, (b) economic stress variables, (c) female economic status, (d) culture of violence variables, (e) institutional intervention and access to health care, and (f) control. Independent variables were measured annually and matched by the year of the dependent variable. In a few cases where data for independent variables were missing cases, we eliminated cases from the analysis. A list of the independent variables and their sources follows.

1. Family structure is measured by divorce rates per 100,000 (United Nations, 1997) and a measure of fertility (total births per woman; Organisation for Economic Cooperation and Development [OECD], 1999).

2. We include four economic stress measures. Inflation is expressed as its annual percentage increase (OECD, 1999). Male unemployment is measured as the percentage of the unemployed workforce that is male (*International Historical Statistics*, 1998).[4] Gini is a measure of economic inequality[5] (Deininger & Squire, 1999). Because government's welfare investment in families can alleviate economic stress, we include a proxy measure of social welfare, general government consumption, measured as a percentage of GDP (OECD, 1999).

3. We include three measures of female economic status. Female labor force participation is expressed as the percentage of the total labor force that is female (OECD, 1999). Percentage of women in tertiary education includes the percentage of higher education students who are female (United Nations, 1997). Female employees in agriculture[6] includes the percentage of economically active female population who work in agriculture (World Bank, 1999).

4. We include five culture of violence measures in the analysis that center on characteristics of the nation state. History of battle deaths, which emerged as significant indicators in three of the four target studies, is not included here. We reasoned that battle deaths is a measure affected by a whole host of influences, such as military resources, tactics, strength and skill of opposing military forces, and so forth. Moreover, this measure used in the four target studies is a historical one, capturing battle deaths across the last century, and therefore does not necessarily capture current conditions. Although complete agreement on culture of violence measures is unlikely, our aim is to employ measures that capture the degree to which violence is a commonplace feature of the nation-state, focusing on governments' role and commitment to mediating conflict and the personal integrity and safety of citizens. The Amnesty International rating[7] is an index of personal integrity abuse or political terror scores, where lower scores indicate a respect for human rights, and higher scores are given to countries that have a record of human rights violations.[8] Law and order tradition is an index that reflects the degree to which the citizens of a country accept the existing institutions to make and implement laws and deal effectively with disputes. Higher values indicate sound political institutions and court systems. Lower values signal a tradition of relying on illegal means and physical force to settle disputes. Ethic tension is operationalized by a variable that measures the degree of tension within a country that is attributed to racial, nationality, or language divisions[9] (Knack & Keefer, 1998). The institutional democracy score measures the general openness of political institutions, or institutional democracy[10] (Gurr & Jaggers, 1998). We expect that countries with greater political stability and reduced ethnic tensions can be characterized as less violent (Lee & Bankston, 1999). Military expenditures are calculated as a percentage of central government expenditure (OECD, 1999).

5. Because access to prenatal care is thought to be particularly important in the case of infant homicide, physicians per 1,000 population is included to measure access to health care. Some case studies have found that infanticide is more likely to occur when mothers are not under the care of a physician (Christoffel & Liu, 1983; Shen & Williamson, 1997). Institutional support systems, such as community service agencies or other formal institutions that might intervene in high-risk families, may be important in preventing infant homicide victimization (Levine,

Freeman, & Compaan, 1994). Therefore, we include a measure of the quality of bureaucracy to measure the ability of government agencies to intervene and thereby reduce victimization rates.[11] Both the physicians per persons and quality of bureaucracy measures, at a minimum, capture the amount and quality of medical and social support institutional mechanisms—mechanisms that may have an effect on infant homicide victimization (Fein, 1979).

6. Finally, GDP, urban population, infant mortality, percentage of the population aged 15 to 24, and expenditure on education are included in the model as control variables. GDP controls for level of a country's economic independence (OECD, 1999). Urban population is frequently mentioned as a possible predictor of crime (OECD, 1999). Poverty has been associated with elevated infant mortality rates in some prior research (OECD, 1999; Straus, 1987a), and several cross-national studies of homicide victimization rates include a measure of population composition in their models (United Nations, 1997). Expenditure on education includes expenditure per student on tertiary education, expressed as a percentage of the GNP per capita (World Bank, 1999).

Method

We included 39 countries in the descriptive analysis. However, because of missing data, we narrowed the sample to 27 for the regression analysis. If any cells were missing values for either the dependent or independent variables, that country year was eliminated from the analysis. Countries that had a less-than-complete time series were removed from the analysis entirely. The last column of Table 2 indicates whether each country was included in the regression analysis. Our sample was selected based on availability of data and is therefore not representative of the rest of the world, and the explanations derived from this analysis extend only to these countries included. Although it would be ideal to have a representative sample of the countries of the world, the current limited availability of international data makes a globally representative sample impossible. Cross-national research should not be abandoned because of data availability; however, extra caution should be exercised in its interpretation.

It is regrettable that research on crime is too often limited to highly industrialized western nations, most notably the United States and the United Kingdom. Moreover, few studies examine homicide trends longitudinally. Without comparative and longitudinal research on crime, the generality of research findings is severely limited. Without cross-national comparative research, it can never be known whether the abundance of research on crime and victimization in the United States and other highly industrialized nations is particular to these countries or applicable to other societies. Although the need for cross-national research on crime is pressing, such research has been in short supply due to data availability and methodological difficulties (Archer & Gartner, 1984; Neapolitan, 1996). Although WHO homicide data are generally regarded as the most valid international homicide data, cross-national homicide data face a number of serious limitations. The discussion of methodological problems will be centered on infant homicide data in particular, rather than homicide victimization data in general.

One of the key methodological problems here is the issue of how accurate infant homicide statistics are. With infants, it is especially difficult to separate homicides from accidents. Many infant homicides are not counted as such because they do not meet the definition of homicide,

though they still might involve neglect or even gross negligence. Some analysts have estimated the rate of child homicide to be double the reported rate (Brown & Lynch, 1995). Other data concerns involve overreporting, misclassification, and changes in the definition of homicide over time. Misclassification is likely to happen when fatal child abuse and neglect go unrecognized (Brown & Lynch, 1995).

Another source of potential bias is the extent to which infant homicides in recent years are more likely to be detected. There may be variation in the systems of infant homicide detection and forensic protocols across this sample of countries. In addition, institutional sensitivity to Sudden Infant Death Syndrome may vary across countries and time, affecting reported rates.[12] Finally, there are two coding changes that may have affected the number of deaths that WHO classified as infant homicides. WHO changed its definition of homicide during the time period under analysis. Prior to 1960, this category included "deaths by legal intervention" and "deaths due to war." After 1960, these categories were removed from the overall homicide rate. Other researchers have found the inclusion of these categories to have a negligible effect (Gartner, 1990), and though we might expect adult homicide rates to be affected by legal intervention and deaths due to war, we do not expect data on infant homicide victimization to be particularly affected by this change. Nevertheless, inaccurate reporting of infant homicides as well the kinds of issues summarized above are likely to make homicide statistics for infants less reliable than homicide statistics for other age groups.

Initially, we performed the analysis on an annual time series, but multicollinearity problems arose. The precedent in the literature is to average homicide rates over 5-year intervals to minimize extreme fluctuations. We depart from this common practice of using 5-year averages because the model that posed the fewest problems involved a systematic sampling of every 5th year. Multicollinearity was not a problem when the analysis was run using every 5th year or the next closest year within the 5-year range. The narrowing of the sample to every 5 years and the elimination of any cases for missing values resulted in a final sample of 229 country years. Given the problematic nature of infant homicide data, as well as our systematic sampling of years, caution should be exercised in interpreting the results due to the possibility of biased parameter estimates.

A least squares with dummy variables model was used to capture unobserved effects specific to each time period and country. We used a version of generalized least squares regression analysis.[13] To correct for first order autocorrelation, the Cochrane-Orcutt Estimator was used to estimate rho. Each variable was transformed by rho to eliminate serial correlation through the following equations:

Each dependent variable (DV) was transformed by DV: $Yt^* = Yt - eYt - 1$
Each independent variable (IV) was transformed by IV: $Xt^* = Xt - eXt - 1$

Where
Yt^* is the dependent variable after the rho transformation
Xt^* is the independent variable after the rho transformation
Yt is each observation of X for each time period t
Xt is each observation of X for each time period t

e represents rho

While some of the nonconstant variance was conditioned by the dummy variables, the remaining heteroskedasticity was corrected by logging several of the variables. The logging of these variables also served to correct skewness. All variables were logged except for the dependent variables, percentage of the population aged 15 to 24, Amnesty International rating, military expenditure, and physicians per 1,000 population. An examination of residual plots showed that it was not necessary to log these variables to correct for heteroskedasticity.

The relationship between homicide victimization rates and the predictors derived from the hypothesis can be expressed as

Hgnt = Bgo + Ek Bgk Xgknt + Unt (1)

Where
H equals the homicide rate for each respective age group
g equals gender (g = 1, 2)
k equals the number of explanatory variables (1__K)
n equals the number of nations (1_N)
t equals the number of time points (1__T)
Bgo is the intercept for the g-th gender
Bgk is the regression coefficient for the g-th gender of the k-th variable
Xkgnt is the value of the k-th independent variable for the g-th gender, in the n-th nation, in the t-th year
U is a stochastic term

Gender differences are now being explored in homicide studies (Smith & Brewer, 1995; Whaley & Messner, 2002), but not yet along age-graded lines. We follow Marvel and Moody (1999) in using *F* tests to observe the similarities or differences between significant coefficients and female and male infant homicide victimization rates. Because of sampling variability, we calculated these *F* tests to test whether observable differences are statistically significant across male and female populations. For these *F* tests, the null hypothesis is that coefficients are the same for both male and female populations; that is, the effect of a variable is the same for both males and females. The alternate hypothesis is that the effect is truly different for males and females. So, *F* tests, which test cross-gendered effects, can be summarized as:

*H*0: B(males) equals B(females) = same effect for males and females.
*H*1: B(males) does not equal B(females) = different effect for males and females.

Results

In the first stage of analysis, a separate regression was estimated for each of the five categories of relevant independent variables along with the control variables (see Models 1 though 5 in Table 3). In the second stage, all key independent variables were added along with the control variables (see Model 6 in Table 3). To conserve space, we focus most of our discussion on only the

statistically significant results in the final Model 6, but briefly note significant findings in Models 1 through 5. Table 3 reports the unstandardized coefficients from the regression analysis.

According to Table 3, fertility had a positive and significant effect on both male and female homicide rates in Model 1. But neither of the two family structure variables, divorce and fertility, had an impact on infant homicide rates in Model 6 when all relevant variables were added. This is not entirely surprising as in other studies, family structure variables have not been found to be significant predictors of infant homicide, with the exception of Briggs and Cutright (1994), who found divorce to be positively associated with infant homicide rates. Gartner (1990) did not find any meaningful connection between divorce and infant homicide, nor did Gartner (1991) or Fiala and LaFree (1988).

Of our three female economic status measures—female labor force participation, females in tertiary education, and female employees in agriculture—female labor force participation was positive and significant for both male and female rates in Model 2, along with females in tertiary education, which was associated with male homicide victimization rates. In the final Model 6, only female labor force participation remained significant, and only for female infant homicide rates. This result is consistent with our expectations, as all four of the target studies found this same relationship.

When economic stress measures were tested alone with control variables, only one of these measures, Gini, was positive and significant for male and female infant homicide victimization rates. This variable remained significant for female infant homicide victimization rates in Model 6. The remaining three economic stress measures—inflation, male unemployment, and government consumption—did not emerge as significant predictors of infant homicide victimization rates. The four target studies reviewed here employed fewer economic stress measures than we did in the current study. Although income inequality was not a predictor in these four target studies, it is worth noting that the relationship between income inequality and homicide rates is among the most commonly found in the literature on cross-national homicide (LaFree, 1999), so it is important to emphasize that income inequality is very likely an important indicator of homicide at all ages.

Table 3 Regression Results for Homicide Victimization, Females and Males, Aged 0 to 1 (standard errors in parentheses)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Variable	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Divorce	–0.233 (0.558)	0.248 (0.558)	__	__	__	__	__	__	__	__	–0.460 (0.564)	0.245 (0.569)
Fertility	–3.323 (1.559)**	–3.078 (1.559)**	__	__	__	__	__	__	__	__	–1.299 (1.677)	–0.401(1.677)
Femal	__	__	8.349	6.959	__	__	__	__	__	__	6.132	3.270

e labor force			(2.225)****	(2.225)****							(2.433)***	(2.440)
Females in tertiary education	—	—	0.142 (1.405)	3.154 (1.405)**	—	—	—	—	—	—	–2.010 (1.546)	2.316 (1.534)
Female employees in agriculture	—	—	–0.254 (0.407)	0.162 (0.407)	—	—	—	—	—	—	–0.283(0.403)	0.209(0.401)
Inflation	—	—	—	—	0.295(0.298)	0.304(0.298)	—	—	—	—	0.006 (0.297)	–0.005(0.298)
Gini	—	—	—	—	2.652(1.355)**	2.311(1.355)*	—	—	—	—	2.838(1.409)**	2.139(1.408)
Male unemployment	—	—	—	—	–0.272(0.518)	–0.304(0.518)	—	—	—	—	0.374(0.525)	0.009(0.525)
General government consumption	—	—	—	—	–1.019(1.283)	–1.407 (1.265)	—	—	—	—	–1.087(1.369)	–0.797(1.359)
Amnesty International rating	—	—	—	—	—	—	–1.201 (0.398)***	–1.384 (0.398)***	—	—	–0.839(0.445)*	–0.884(0.451)
Military expenditures (% of GNP)	—	—	—	—	—	—	0.006 (0.123)	–0.005 (0.123)	—	—	0.101(0.131)	–0.131(0.130)
Law and order tradition	—	—	—	—	—	—	3.705(1.092)***	4.370 (1.092)***	—	—	4.267 (1.216)****	2.374(1.306)*
Institutional demo	—	—	—	—	—	—	0.156 (0.162)	0.008 (0.162)	—	—	0.109 (0.173)	–0.002(0.173)

cracy rating												
Ethnic tensions	—	—	—	—	—	—	–0.003(0.364)	0.200(0.364)	—	—	–0.142(0.353)	0.175(0.353)
Physicians per 1,000	—	—	—	—	—	—	—	—	0.146(0.468)	0.254(0.468)	0.339(0.486)	0.311(0.488)
Quality of bureaucracy	—	—	—	—	—	—	—	—	0.873(0.365)***	1.830(0.416)****	0.217(0.411)	1.842(0.529)***
GDP	–0.691(1.218)	–0.644(1.218)	–0.734(1.175)	–0.855(1.175)	–0.794(1.191)	–0.834(1.191)	–0.452(1.152)	–0.504(1.152)	–0.483(1.173)	–0.522(1.173)	excluded	excluded
Urban population	1.415(1.541)	1.463(1.541)	0.538(1.607)	1.024(1.607)	1.286(1.557)	1.158(1.557)	1.336(1.466)	1.505(1.466)	1.973(1.532)	2.149(1.532)	–0.495(1.438)	–0.276(1.500)
Infant mortality	0.249(0.759)	0.799(0.759)	0.007(0.747)	0.282(0.747)	0.193(0.696)	0.456(0.696)	0.004(0.659)	0.459(0.659)	0.288(0.743)	0.561(0.684)	–0.001(0.757)	0.521(0.765)
Percentage of the population aged 15 to 24	4.118(10.897)	3.782(10.897)	6.589(10.679)	2.078(10.679)	6.215(10.911)	17.526(10.778)	20.813(10.778)**	2.364(2.152)	7.890(10.872)	7.330(10.872)	17.482(10.975)	12.621(11.055)
Government spending on tertiary education	–0.404(0.642)	0.435(0.642)	–0.490(0.633)	0.671(0.633)	–0.188(0.655)	–0.544(0.617)	0.293(0.617)	0.478(0.694)	–0.443(0.644)	0.467	–0.848(0.700)	0.877(0.683)
Constant	–3.364		–17.809		–7.709		–12.099		–14.122		–20.906	
R^2	0.231		0.258		0.232		0.29		0.219		0.349	

*p < .10. **p < .05. ***p < .01. ****p < .000.

As we saw above, three of the four target studies found that a history of high battle deaths was associated with increased infant homicide victimization rates, and one of the four target studies found that increases in rape rates were associated with higher infant homicide victimization rates.

When we operationalized culture of violence differently, we found that countries characterized by higher Amnesty International ratings (i.e., more violations) actually had significantly lower rates of child homicide. In addition, countries characterized by high values on the law and order traditions (i.e., sound political and court systems) had significantly higher levels of child homicide. In our analysis of other age groups (available on request), these same two culture of violence measures had the opposite effect on adult homicide victimization rates. We consider the implications of these findings in the next section.

The measure of access to health care, physicians per 1,000, was not statistically significant. The one target study that included this measure (Fiala & LaFree, 1988) arrived at the same result. Our measure of the strength of government agency intervention, quality of bureaucracy, was statistically significant for both male and female infant homicide victimization rates in Model 5 but remained significant only for male infant homicide victimization rates in Model 6. Higher values of quality of bureaucracy indicate better ratings, so this positive association between quality of bureaucracy and male homicide victimization rates may mean that efficient organizations are better at detecting infant homicide victimization that would have otherwise gone unrecognized.

None of the five control variables emerged as significant indicators of infant homicide victimization. Overall, *R*-square values account for a low proportion of the variation in infant homicide victimization ($R2 = .35$) in the model with all relevant variables included.

F tests indicated very little gender difference. For the infant homicide victimization, all significant regressors had the same effect for male and females, except quality of bureaucracy ($F = 6.02$, $p < .05$). The remaining significant indicators likely have the same effect for males and females.

Discussion and Conclusion

Despite the fact that the homicide victimization rates of different age groups differ substantially, criminologists do not completely know how certain economic, social, and institutional variables affect the homicide rates of different age groups. What little is known in this area tends to be limited to the United States, with only a handful of studies addressing this issue across nations. Since the publications of Fiala and LaFree (1988), Gartner (1990, 1991), and Briggs and Cutright (1994), some age-specific determinants of infant homicide victimization at the cross-national level have been identified. Most other empirical studies on age-specific homicide victimization are micro-level studies aimed at description rather than explanation (S. J. Crittenden, 1995; Fein, 1979; Sorenson, Peterson, & Richardson, 1997; Wilczynski, 1995). The purpose of this article was to revisit the literature on longitudinal, international infant homicide victimization (a literature that has not produced a major published study in more than a decade) and to expand and deepen our understanding of the variables that predict infant homicide cross-nationally. Although the objective of this study was to expand and replicate the four existing studies in this area, the results of this research may contribute to the development of age-sensitive theories of victimization.

The main focus of this article was to replicate the key findings from the four major existing quantitative studies on cross-national infant homicide victimization using an expanded sample of countries, a longer time series, more refined measures, additional variables, and an analytic framework that allowed us to test for gender differences. We organized our analysis around six questions presented at the front end of this article. This discussion centers on the first three of these questions, which constitute the three key findings from our analysis.

The first question in our study asked whether increases in female labor force participation were associated with significant increases in infant homicide victimization when tested with a longer time series and an expanded sample. Our findings in this analysis confirm the connection between female labor force participation and female infant homicide victimization rates. The implications of this consistent finding are far reaching. It is possible that the connection between female labor force and infanticide is a matter of resources, economic stress, the status of women in society, or guardianship. Surveillance and guardianship of infants may be an important indicator of infanticide but only to the extent that women, who are the usual capable guardians, are occupied by greater labor force participation.

The fact that women's economic status is such a universal finding warrants further study. It would be interesting to explore in more detail the extent to which infant homicide is bound up with women's social status. The practice of infanticide has often been interpreted as a signal of the desperation of women and is often regarded as being bound up with women's oppression throughout history (Laster, 1988). A recent study considered the association between availability of abortion and the homicide victimization of infants and toddlers. Sorenson, Wiebe, and Berk (2002) found that the legalization of abortion was associated with decreases in the homicide of toddlers but not of infants. Although modeling availability of abortion was not possible in this study, it is suggested that future research on infant homicide victimization consider the availability of abortion as an indicator of female social and economic status and explore the possible links between abortion and infant homicide.

Our second major question was whether increases in economic stress (as measured by low levels of social security spending) were associated with high rates of infant homicide victimization when we included different economic stress measures (inflation, Gini index, male unemployment, and government consumption), a longer time series, and an expanded sample. Our analysis found a positive relationship between income inequality and female infant homicide victimization. Whereas this is a consistent finding in the cross-national homicide literature, there are clear implications for infants in particular. Societies with extreme poverty may use infant homicide as a means to conserve resources, reduce economic strain, or improve the quality of life for the family (Lowenstein, 1997). This may be particularly true for infants who are deformed, infants who are illegitimate or motherless, female infants, or infants who are the result of multiple births (P. M. Crittenden & Craig, 1990). And as Fiala and LaFree (1988) found, the economic stress connected to infant homicide victimization may be particular to social structural conditions that affect the economic position of women. Economic stress may indeed influence infant homicide victimization rates, but it may be that only certain types of economic stress are relevant. It could be that alleviating economic stress through government social programs may be more important than addressing other types of economic stress, such as income disparity or unemployment. Increases in government support, such as family services, day care relief, and

other types of parental support, may mitigate some of the negative effect of the economic impact of women in the labor force. These findings are important because researchers are typically concerned with how economic stress might explain homicide victimization rates. It is likely that economic stress affects different demographic groups in different ways, playing out through a variety of complex institutional mechanisms.

Our third key question was whether culture of violence values are associated with increased levels of child homicide victimization across several culture of violence measures (Amnesty International rating, military expenditures, law and order tradition, democracy rating, and ethnic tensions), a longer time series, and an expanded sample. Our findings show that two culture of violence measures were significantly associated with infant homicide victimization but all in a direction opposite of expectations from prior research. Our results show that infant homicide victimization actually decreases in countries characterized by a culture of violence. The results from our analysis of adult homicide victimization rates (not reported here), show the opposite relationship. It appears that a culture of violence may indeed be a general precursor to homicide in spite of age, but the way in which this plays out may be very different depending on the age group. To the extent that a culture oriented toward violence fosters those conditions that increase homicide, infant homicide victimization actually declines in the presence of such cultural forces. Gartner (1991) discovered this relationship when looking at crime rates in industrialized countries from 1965 to 1980. She found violent crime increased rapidly, whereas infant homicide victimization actually declined by an average of 50% during the same time period.

This anomalous finding suggests that complex structural conditions are tied to infant homicide victimization. For example, it is possible that whereas adult homicide victimization is rooted in violent cultural norms, perhaps infant homicide stems from nonviolent social norms, particularly in the case of benevolent infanticide (mercy killing), where the goal may be to alleviate suffering, not to cause it.

One of the clues to understanding the negative relationship between a culture of violence and infant homicide may lie in the descriptive data for different countries. This negative relationship may be better explained by a case study approach. This approach might involve first separating out those countries that have high general homicide victimization rates but low infant homicide victimization rates against those countries that have high infant homicide victimization rates yet low general homicide victimization rates. Then an evaluation of cultural forces, as well as intersecting institutions and conditions, might shed some light on the relationship. As shown in Table 2, for example, many of the countries that have high infant homicide victimization rates can be characterized as generally nonviolent (e.g., Japan), yet some exhibit high rates of infant homicide victimization. On the other hand, in Latin American countries, infant homicide victimization rates are low in spite of a high overall homicide rate. The relatively low bivariate correlation between infant and adult homicide rates noted above (r = .026) underscores this point.

Finally, our culture of violence measures are very different from the ones used in the other four studies reviewed here. Our predecessors used war as a barometer for a culture of violence, operationalized at the number of battle deaths over time. Whereas we are in uncharted territory in developing new culture of violence measures, we intended for our measures of a culture of

violence to capture a range of tension, abuse, and corruption among nation-states. More exploration of appropriate culture of violence measures is clearly needed before we can be sure if our unique culture of violence finding is a "true" relationship or an artifact of the data. A question for further research is to investigate why these cultural forces are countervailing for various groups; that is why, how, and under what circumstances does a stronger culture of violence increase homicide rates in one demographic group while suppressing rates in another? Perhaps the source of infant homicide and the source of adult homicide are carried by two different currents. It is possible that a culture of violence actually serves as a protective factor for infants.

Notes

1. There are more than 50 descriptive articles on child homicide victimization, produced mostly by the medical sciences. These articles tend to highlight patterns in child homicide victimization and raise questions and concerns, but they typically do not employ explanatory tests. For a recent example, see Pritchard and Buler (2003).

2. There is one current cross-national study of infant homicide victimization that is tangentially related to this study: Fuse and Crenshaw (2006). This study is cross-sectional and uses male-to female infant mortality ratio as a proxy for female infant homicide victimization. We thank one of the anonymous reviewers for bringing our attention to this study.

3. Although we are arguing that the same underlying processes of homicide victimization are at play regardless of economic development, it is possible that the level of economic development in a given country may affect the quality of homicide data through reporting and classification mechanisms.

4. Because male and female unemployment are so highly correlated, we were unable to use both measures. Males are still expected to be the breadwinner, so this measure is likely a better indicator of economic stress on the family.

5. Values close to 0 indicate greater equality, with 0 representing perfect equality and the value of 1 indicating perfect inequality.

6. Previous research has indicated that the measure of female labor force participation alone is not a satisfactory measure; the *type* of work women are engaged in may predict different outcomes (Hunnicutt & Broidy, 2004). Therefore, we include females employed in agriculture to capture a particular type of work. High percentages of females employed in agriculture likely reflect restricted opportunities for education as well as opportunities to work in industrial- or technical-oriented jobs.

7. For all of the ordinal variables, higher values indicate better ratings, except for the Amnesty International rating, where lower values indicate better ratings. We chose not to recode this variable to avoid any confusion in its interpretation, because it is a widely used indicator. So we expect a positive relationship between Amnesty International rating and the dependent variables,

whereas we expect a negative association between the remaining ordinal variables and the dependent variables.

8. Lower values indicate better ratings. “This is an index of personal integrity abuse or political terror that ranges from 1 to 5. These values were generated by the use of particular standards developed by Gastil (1980), frequently known as political terror scales. The ratings were derived from country profiles included in the Amnesty International Reports” (Poe & Tate, 1994, p. 15).

9. “Higher values indicate better ratings. Values range from 0 to 6. Lower ratings are given to countries where racial and nationality tensions are high because opposing groups are intolerant and unwilling to compromise. Higher ratings are given to countries where tensions are minimal, even though such differences may still exist” (Knack & Keefer, 1998, p. 2).

10. Higher values indicate better ratings. This measure ranges from 0 to 10, where higher ratings indicate greater openness of institutions and more democratic operations.

11. “Higher values indicate better ratings. Values range from 0 to 6. High scores indicate an established mechanism for recruitment and training, autonomy from political pressure, and strength and expertise to govern without drastic changes in policy or interruptions in government services when governments change” (Knack & Keefer, 1998, p. 3).

12. We thank our anonymous reviewers for bringing these last two points to our attention.

13. We used generalized least squares because problems of autoregression and heteroskedasticity were evident in the diagnostic phase, as ordinary least squares would not be appropriate in light of the violation of the regression assumptions.

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