Violence and Victims, Volume 29, Number 5, 2014

A Longitudinal, Multilevel Analysis of Homicide Against Children Aged 0–9 Years Using State-Level Characteristics: 1979–2007

Emily Douglas, PhD
Bridgewater State University, Massachusetts
Jennifer Vanderminden, PhD
University of North Carolina-Wilmington

Annually, over a thousand children are the victims of homicide in the United States Homicide among younger children, 0–9 years of age, is usually perpetrated by parents and caregivers. Researchers neither have tracked changes in the homicide rate among young children over time nor have they used theory to understand what factors may drive these changes. In this analysis of state-level data, we used longitudinal growth modeling and ecological theory to examine changes in homicide rate against children aged 0–9 years from 1979 to 2007. Our results indicate that states are relatively consistent, over time, in their homicide rates. Furthermore, a cultural context of criminal and risky behavior is positively associated with homicide against children. We discuss implications for future research and prevention.

Keywords: child homicide; longitudinal growth modeling; ecological theory; state-level analysis; fatal victimization

Annually, more than a thousand children are the victims of homicide in the United States (U.S. Department of Justice, 2010). Homicide among younger children, aged 0–9 years, is usually perpetrated by parents and caregivers (Finkelhor & Ormrod, 2001) and is most often the result of abuse or neglect (Kunz & Bahr, 1996; Lucas et al., 2002). Since the 1970s, researchers and practitioners have increasingly paid attention to homicide among young children by working on better identification, prevention, and passing legislation to prevent future deaths (Appell, 2002; Bunting & Reid, 2005; Dias et al., 2005; Douglas, 2009; Durfee, Gellert, & Tilton-Durfee, 1992; Herman-Giddens et al., 1999; Kaplan & Granik, 1991; Lanning & Walsh, 1996). Researchers neither have tracked changes in the homicide rate among young children over time nor have they used theory to understand what factors may drive these changes. The purpose of this state-level analysis of homicide among children aged 0–9 years is to examine if the social contexts in which children die are related to changes in the homicide rate over a near-30–year period. We ground this analysis in ecological theory, with a focus on the outer rings of the ecological model, which address the macrolevel contexts of children's lives.

http://dx.doi.org/10.1891/0886-6708.VV-D-12-00085

PREVALENCE OF HOMICIDE AGAINST CHILDREN

The U.S. Department of Justice provides annual homicide statistics, which include murder and nonnegligent manslaughter (which is the willful killing of one human being by another) in their annual homicide statistics. Estimates from 2009 indicate 627 children younger than the age of 13 years were the victims of homicide (Truman & Rand, 2010; U.S. Department of Justice, 2010). The National Center for Health Statistics reports that in 2002, 890 children died from homicide and that homicide rates among infants is highest at 7.5 per 100,000, compared with 6.1 for all children (Miniño, Anderson, Fingerhut, Boudreault, & Warner, 2006). Similar estimates are confirmed by the Centers for Disease Control and Prevention (CDC, 1997). United Nations Children's Fund (2003) reports that the number of U.S. children who die at the hands of their parents and other caregivers is three times higher than the average of other developed nations. Research shows that the homicide rate against children in the United States (U.S. Department of Health & Human Services, 2011) has been climbing during the past decade or two, even though they have been declining in some European nations (Pritchard & Sharples, 2008).

Younger victims are usually killed by someone who knows them, and most of the time, the perpetrator is a parent. Statistics from the U.S. Department of Justice show that 63% of victims who are younger than the age of 5 years are killed by a parent—33% of the time by a mother and 30% of the time by a father (Truman & Rand, 2010). Outside of parental perpetrators, the vast majority are male acquaintances (Kunz & Bahr, 1996). Perpetrators are usually in young adulthood (Herman-Giddens, Smith, Mittal, Carlson, & Butts, 2003; Kunz & Bahr, 1996), have lower levels of socioeconomic status (Birken, Parkin, To, Wilkins, & Macarthur, 2009; Overpeck, Brenner, Trumble, Trifiletti, & Berendes, 1998; Smithey, 1997), and may present with psychiatric or substance abuse concerns (Rodriguez & Smithey, 1999; Smithey, 1997). Child victims are most often killed by personal weapons (one's own body), asphyxiation, drowning (Kunz & Bahr, 1996), and household objects (Bennett et al., 2006) and are likely the result of an angry impulse (Lyman et al., 2003). Older victims are usually killed by more violent methods. Finally, perpetrators who are not as relationally close to their victims use more violent means to kill them (Smithey, 1998).

ECOLOGICAL THEORY

Ecological theory posits that to understand the influences on a child's behavior and well-being, one must consider the multilayered context in which children live (Bronfenbrenner, 2004). The theory proposes a model of four concentric circles with the child in the center. Each layer considers contextual information and the potential relationship that it has to the child. The first layer of the model, the microsystem, focuses on the interaction between the child and his or her closest relations: parents, siblings, and other close family; peers; religious setting; and neighborhood. The mesosystem is the next layer away from the child and it explores the interaction of the elements of the microsystem and their interaction with the child. The third layer out from the child is the exosystem; this layer considers the influence of the school, community, mass media, and health agencies. The final layer of the ecological model is the macrosystem, which

focuses on the larger, societal influences on a child, such as the state of the economy, culture, nationality, political system, and state laws. Research has focused on the inner layers of the model, but very little research has examined the outer layers of ecological theory to better understand homicides against children. This is the focus of the present set of analyses.

FACTORS RELATED TO HOMICIDE AGAINST CHILDREN

Micro- and Mesosystems

The literature on homicide against children has documented several risk factors at the individual level. Age is the most consistent and reliable risk factor for homicide among children. Younger children, especially infants, are at higher risk for victimization (Anderson, Ambrosino, Valentine, & Lauderdale, 1983; Kunz & Bahr, 1996; U.S. Department of Justice, 2010), as are males (Anderson et al., 1983; Straus, 1987; U.S. Department of Justice, 2010). Some racial minorities, especially African Americans, are overrepresented among victims (Lyman et al., 2003; Straus, 1987; U.S. Department of Justice, 2010). Children of mothers who did not have prenatal care are at an increased risk for fatal victimization (Overpeck et al., 1998), as well as children whose families have experienced a major life stressor in the past 12 months (Lucas et al., 2002).

Exo- and Macrosystems

There is significantly less research documenting risk factors for children at the macrolevel. The literature that does exist indicates that children are more likely to become homicide victims in nations with higher rates of teenage births, in nations with births to unmarried women, and where there are higher rates of divorce. This is especially true in nations which have less generous spending on social problems (Gartner, 1991). In an examination of state-level characteristics, Straus (1987) determined that the risk factors for homicides against infants and toddlers were distinct from one another. In a model that considered 25 different macrolevel contextual variables, only 3 were significantly related to infanticide: higher rates of unemployment, urban settings, and the ratio of elementary school teachers to students. This model, however, only explained 15.6% of the variance in a state's rate of infanticide and was not longitudinal. Many more factors were related to the homicide of toddlers including existence of marital rape law, rate of owner-occupied housing, divorce rate, alcoholism, high school completion rate among African Americans, physical assault rate, urban location, rate of teen births, and percentage of the population living in crowded housing. This model explained 64.6% of the state-level variance in the homicide of toddlers. An examination of neighborhood factors on homicides against children found that young children who live in low-income neighborhoods are most at risk for homicide (Birken et al., 2009). We identified only one study which used a longitudinal design to examine factors related to changes in the homicide rate. Sen, Wingate, and Kirby (2012) examined the impact of abortion restriction laws on homicide against children using 19 years of data. They found higher rates of homicide against children in states with stricter abortion laws relative to states without strict abortion laws. Little other research has focused on the state-level risk factors for homicide against children. This article will address these gaps.

CURRENT ARTICLE

In this article, we assess factors related to changes in the U.S. homicide rate among child victims aged 0–9 years between 1979 and 2007. To do this, we used longitudinal growth modeling with data from all 50 states for this 29-year period. Our analyses focus on the state-level contextual factors in which children die and are framed by the "outer rings" of the ecological model. Specifically, we address the following:

1. What macrosystem factors, as measured by state-level characteristics, are related to changes in rates of homicides against children aged 0–9 years?
2. Does the model of predictive factors differ for infants versus children aged 1–9 years?

METHODS

Data

Dependent Variable. The data for this study came from existing sources of information from government agencies. Data for the state-level dependent variable, homicide against children, came from the interactive website WONDER, which is maintained by the CDC (http://wonder.cdc.gov/). The website provides data about various health indicators, including mortality rates and causes of death. At the time that we extracted data for this study, information for the years 1979–2007 was available, which provided nearly a 30-year span of time. WONDER also allows one to select indicators by various key characteristics, including age and state, which we used in our analyses.

The causes of death on the WONDER website are pregrouped into standard categories as determined by the CDC. The rate of homicide per 100,000 children, aged 0–9 years, per state was the focus of this study. Homicides beyond this age are more likely to be perpetrated by peers (Finkelhor & Ormrod, 2001; Fox, 1993); younger children, on the other hand, are almost only killed by a parent or other caregiver (Kunz & Bahr, 1996; Smithey, 1998). Thus, we selected data by age, years, and state for victims younger than 1 year, 1–4 years, 5–9 years, and a combined category of 0–9 years. This gave us a dataset with $N = 1{,}450$, which was derived by collecting data for 50 states for 29 years ($50 \times 29 = 1{,}450$). We did not include the District of Columbia because its homicide rate was a high outlier in comparison to the other states. Time is measured in years and is centered for the purposes of the analyses (1979 representing the beginning of time with a value of 0 and each subsequent year having a 1-year increase). Exploratory analyses indicated that a linear measure of time should be used rather than cubic or quadratic measures of time.

Independent Variables. Data for the independent variables also came from existing government sources. Using the work by Straus (1987) and ecological theory (Bronfenbrenner, 2004) as a guide, we selected as many state characteristics as possible, which were available with 29 years' worth of data. The political system and state laws were measured by the presence of child death review team legislation. Child death review teams are state/county-level teams that examine the deaths of children, identify gaps in systems which are intended to protect children, and make recommendations for change which may help to prevent future deaths (Douglas & Cunningham, 2008; Durfee et al., 1992). Data for this variable came from the National Center for Child Death Review. An additional variable was created to measure the impact of child death review teams over time, which reflects the number of years since legislation guiding/mandating child death review teams were in place within each state. Race was measured using data which was included in the

Statistical Abstract of the United States, published by the U.S. Census Bureau, and which reflects the proportion of the population that is African American in each state by year. Nonunique data was unavailable for 1981–1987. To include these years in the analysis, we applied the value from 1980 to 1981–1983, averaged 1980 and 1988 for 1984, and used the value for 1988 to replace 1985–1987. Economic well-being was measured by (a) the percentage of individuals in each state who meet the poverty cutoff from the Census Bureau and (b) the state-level unemployment rate from the Bureau of Labor Statistics. Family stability at the macrolevel was measured by the state-level divorce rate from the Center for Health Statistics (most states had missing data for 1996–2007). A culture of reckless behavior was measured by a combination of (a) a composite variable measuring criminal activity including rape, robbery, and assault from the Bureau of Justice Statistics (we could not include violent crime because this includes a measure of homicide, which is the dependent variable in our set of analyses) and (b) motor vehicle deaths available, which was available through the WONDER system of the CDC.[1]

Data for all of the years, except where noted, was gathered for the years 1979–2007 and all variables are time varying (have a measure for each year). All predictors (with the exception of time since child death review team variable) are time-lagged by 1 year to better address issues of time ordering. Analyses with non–time-lagged predictors were nearly identical to analysis with time-lagged predictors with only one significant difference in predictive factors for homicide against infants. With the exception of the child death review team variables (presence of and time since legislated), all predictors were centered on the grand mean for ease of interpretation.

Analysis

The analysis began with exploratory work examining changes in homicide rates over time and variation in homicide rates across states before we implemented longitudinal growth modeling (LGM). LGM allows one to examine change across time, including whether variation in an outcome/dependent variable exists across time, the form of this variation, and whether similarity exist in the rate of change across states (Singer & Willett, 2003). LGM allowed us to test the two hypotheses, determining which predictive factors are associated with homicide rates. This analysis also allowed us to examine if the variation in homicide rates is primarily within states (over time) or between states. To partition how much of the variance is between and within states, we calculated an intraclass correlation:

$$\text{Intraclass correlation (ICC)} = \frac{\text{Level 2 variance (in inital status)}}{\text{Level 2 variance (in initial status)} + \text{Level 1 variance}}$$

Exploratory work determined which predictors should be included in the longitudinal growth models predicting homicide against infants and children. Goodness-of-fit statistics (−2 log likelihood [−2LL], Akaike information criterion [AIC], and Bayesian information criterion [BIC]) were compared to determine the best fitting model. Initial exploratory work indicated that homicide against children (aged 0–9 years) was significantly associated with all predictors in the expected direction with the exception of unemployment, with which there was no significant relationship. In terms of infant homicide rates, all bivariate relationships were significant and in the expected direction with the exception of poverty. In fact, homicide was not significantly related to poverty at the bivariate level. The bivariate analysis indicates that there are some differences in predictive factors for homicide against children (aged 0–9 years) compared to infant (aged younger than 1 year). This is further described in our analyses of multivariate analysis using multilevel modeling.

To access if these relationships mattered over time and if they remained once all variables were included in the model, we used LGM in SPSS. LGM allows us to examine the change over time in homicide rates and to differentiate between differences within states over time and differences across states over time. Each longitudinal growth model analysis begins with an unconditional growth model, which tells us if there is variance in homicide to be explained and if that variance is a Level 1 (within states) or Level 2 (between states). Once we establish that there was variance and at what level the variance lay, we began to include predictors at both levels to explain changes in homicide rates. The first predictor we included in both analyses was a measure of time (year-centered). This model is called the unconditional growth model and allowed us to determine if homicide changed over time (e.g., how much of the variance in homicide can be explained by changes in time). Each analysis then proceeds by adding predictive factors and determining their impact on the level of homicide and on the rate of change over time in child homicide rates. At each step in the analysis, we examined the effect of the predictor as well as the goodness-of-fit statistics to determine which predictors significantly contributed to the model and therefore should remain in our "final" model.

RESULTS

Macrosystem Factors and Homicides Against Children

Figure 1 shows the varying homicide rate between 1979 and 2007, first for all children aged 0–9 years, and by age group as well. Results of the longitudinal growth models predicting homicide in children aged 0–9 years are presented in Table 1. The unconditional

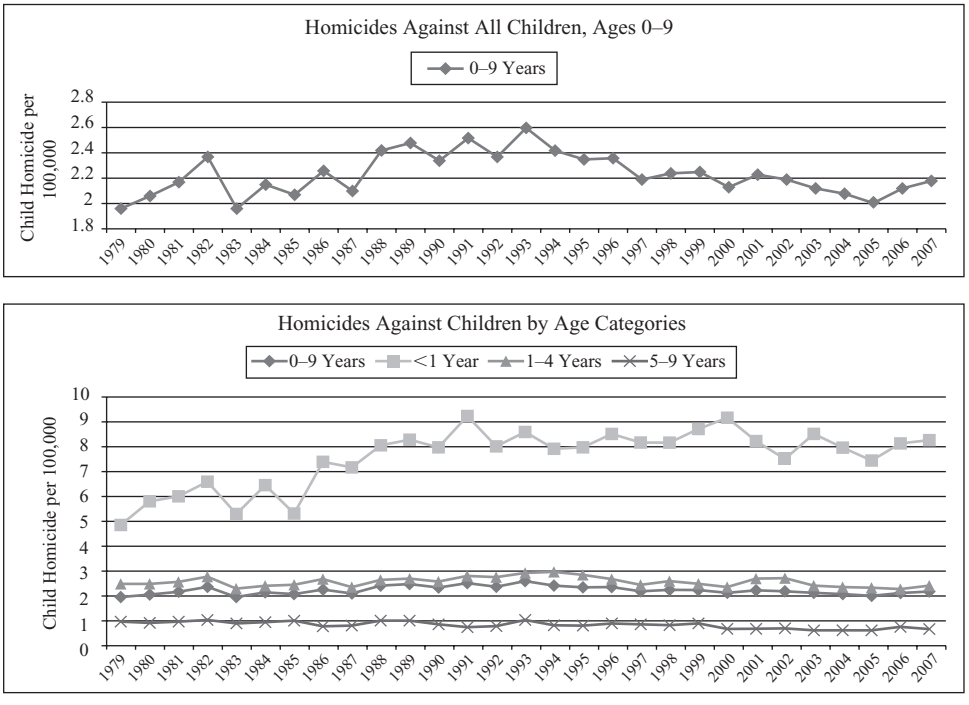

Figure 1. Homicides against children per 100,000, by age, 1979–2007.

TABLE 1. Longitudinal Growth Models Predicting Homicide Against Children Aged 0–9

	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Fixed effects									
Intercept	2.160***	2.010***	1.940***	2.040***	2.040***	2.050***	2.080***	1.990***	1.795***
Year-centered		0.011*	0.020**	0.008	0.008	0.007	0.005	0.011	0.026**
CFRT			0.088	0.101	0.100	0.100	0.083	0.099	0.105
Post-CFRT			−0.038**	−0.010	−0.010	−0.010	−0.008	−0.008	−0.220
Rape				0.015***	0.016***	0.015***	0.015***	0.013***	0.013***
Robbery				0.001	0.001	0.001	0.001	0.001	0.001*
Assault				0.001**	0.001*	0.001***	0.001**	0.001**	0.001*
Proportion African American					0.693				
Poverty						−0.007			
Unemployment							−0.032†		
Divorce								0.060†	0.018
Motor vehicle death									0.039***
Variance components									
Level 1									
W/I state	0.954***	0.895***	0.886***	0.883***	0.882***	0.881***	0.880***	0.898***	0.894***
Level 2									
In initial status	0.300***	0.401***	0.400***	0.166**	0.169**	0.170**	0.169**	0.154**	0.170**
In rate of change		0.001**	0.001**	0.001**	0.001**	0.001**	0.001**	0.001**	0.001*
Covariance		−0.009*	−0.009*	−.005	−.005	−.005	−0.004	−0.005	−0.007*
Goodness-of-fit statistics									
-2LL	4165.0	4119.9	4111.6	4063.1	4062.7	4062.7	4059.8	3946.0	3928.4
AIC	4169.0	4131.9	4127.6	4085.1	4086.1	4086.7	4083.8	3970.0	3954.4
BIC	4179.5	4163.6	4169.8	4143.2	4149.5	4150.1	4147.1	4033.0	4022.6

Note. W/I state = within state; −2LL = −2 log likelihood; AIC = Akaike information criterion; BIC = Bayesian information criterion.
*$p < .05$. **$p < .01$. ***$p < .001$. †$p < .10$.

means model (Model 0) indicates that there is significant variance in homicide rates both within states and across states to be explained. The intraclass correlation calculated from the unconditional means model indicates that 24% of the variance in child homicide can be explained by state-to-state differences. The unconditional growth model (Model 1) indicates that child homicide does change over time and that a great deal of the variance in child homicide is explained by the passage of time. The average rate of change in homicide for children aged 0–9 years is positive, meaning that the rates of homicide are on average increasing over time.

Models 3–7 show the addition of each predictive factor, building up to the final model, which we describe here. The final model shows that the political context was not related to homicides against children. Passage of child death review team laws on child homicide has no significant impact on child homicide rates at the .05 level (aged 0–9 years) once other predictors are included in the model, although it was marginally significant. For every 1-year increase in time, the child homicide rate increases by 0.026. Our contextual variables measuring first crime and then risky behavior shows that rape, robbery, assault, and motor vehicle deaths are all positively related to homicide rates over time indicating that with an increase in these rates, there is a corresponding increase in child homicide 1 year later. The variance components in Table 1 indicate that most of the variance reduction in child homicide rates is happening at the between-state level, whereas very little variance within states is explained by the inclusion of the predictors. In other words, states are fairly consistent year to year in their homicide rates against children; most of the variance occurs between states. The final model indicates that there is still variance in child homicide both within and between states left to be explained by variables which we did not include in our models.

Models Differing by Age

To address Research Question 2, testing whether the factors predicting changes in homicide rates for children aged 0–9 years differ for infants, we ran an additional LGM predicting homicide for infants (younger than 1 year old). The results, which are displayed in Table 2, for infants are similar to those of all children with a few notable differences. The intraclass correlation calculated from the unconditional means model indicates that 11% of the variance in infant homicide can be explained by state-to-state difference. The infant homicide rate of change is positive; with every 1-year increase in time, the homicide rate increases by 0.154 for infants (when controlling for all other significant predictors), which is much higher than it was for all children at 0.026.

The political context is not significant for understanding homicides against infants, either. The passage of child death review team legislation has no significant impact on infant homicide rates (aged younger than 1 year) once other predictors are included in the model. The social context of crime was only partially supported in this model. Assault rates are the only significant predictor of higher levels of homicide rates. As with the analysis predicting homicide for children aged 0–9 years, most of the variance in homicide rates is explained across states with little variance explained within states. This indicates that state-to-state differences are explained (partially) with the inclusion of the predictors but that little of the change over time is explained. The final model indicates that there is still variance in infant homicide rates at both the within- and between-state levels, which we were not able to explain with the current models.

TABLE 2. Longitudinal Growth Models Predicting Homicide Against Children Aged Younger Than 1 Year

	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Fixed effects								
Intercept	7.500***	5.610***	5.380***	5.690***	5.690***	5.870***	5.650***	5.300***
Year-centered		0.135***	0.161***	0.127***	0.127***	0.113**	0.126***	0.154***
CFRT			0.956†	0.876†	0.874	0.811	0.987†	1.006†
Post-CFRT			−0.188**	−0.107	−0.108	−0.099	−0.109	−0.139†
Rape				0.009	0.010	0.010	0.007	0.009
Robbery				−0.000	−0.000	0.000	−0.000	0.001
Assault				0.007***	0.007***	0.007***	0.007***	0.006**
Proportion African American					0.474			
Unemployment						−0.123		
Divorce							0.055	−0.034
Motor vehicle death								0.069
Variance components								
Level 1								
W/I state	27.70***	25.37***	25.14***	25.22***	25.22***	25.16***	25.54***	25.48***
Level 2								
In initial status	3.50***	2.00†	2.18*	0.715	0.725	0.726	0.784	1.09
In rate of change		0.014**	0.016**	0.012*	0.013*	0.012*	0.013*	0.013*
Goodness-of-fit statistics								
-2LL	9007.6	8910.4	8902.2	8878.4	8878.4	8876.3	8606.2	8603.7
AIC	9011.6	8922.4	8918.2	8900.4	8902.4	8900.3	8630.2	8629.7
BIC	9022.2	8954.1	8960.4	8958.5	8965.7	8963.7	8693.1	8697.9

Note. W/I state = within state; −2LL = −2 log likelihood; AIC = Akaike information criterion; BIC = Bayesian information criterion.
**$p < .05$. **$p < .01$. ***$p < .001$. †$p < .10$.

DISCUSSION

The purpose of this study was to explore the changing homicide rate against children within the context that children live. Most previous research has examined homicide against children at the individual level. This article is among a small number of papers which considers the social context in which children die and the only to examine the social context using a longitudinal design with time-varying predictors. Our results show that many factors which are related to homicide against children at the individual level do not predict homicide at the macrolevel. The primary social contextual characteristic that appears to matter most is risky behavior, which is positively related to homicides against infants and children aged 0–9 years. Other important outcomes include that states are relatively consistent in their rates of homicide against children and that our models predicted a small amount of variance in the change of homicides against children from 1979 to 2007.

The Social Context in Which Children Die

Political Context. The results indicate that legislation mandating or guiding child death review teams are not related to changes in the homicide rate against children, even though the primary mission of review teams is to lower the death rate among children (Webster, Schnitzer, Jenny, Ewigman, & Alario, 2003). Most legislation concerning child death review is oriented toward prevention versus investigation, by a factor of about three-to-one (Douglas & McCarthy, 2011a). That said, despite the resources that are dedicated to child death review (Durfee, Parra, & Alexander, 2009; Webster et al., 2003), there have been very few attempts to evaluate the effectiveness of child death review teams (Douglas, 2005); what few attempts have been made have had mixed outcomes (Kellermann et al., 1999; Palusci, Yager, & Covington, 2010). One potential reason why there may have been no statistically significant relationship between child death review teams and homicides against children in our analyses is that we examined when legislation mandating or guiding child death review was implemented. Many states initiated their own review teams before legislation was formally enacted (Durfee & Durfee, 1995; Durfee et al., 1992; Webster et al., 2003). For teams that were well-established, the passage of legislation may have had little-to-no impact on their current operations. Finally, we note that child death review team legislation was marginally significant at the .10 level and could be considered in future research on child homicide rates and patterns.

Economic Well-Being. We did not find that the economic well-being of a state was related to changes in the rates of homicide against children, despite the fact that previous research has found that socioeconomic status at the individual level is related to homicides against children (Birken et al., 2009; Overpeck et al., 1998; Smithey, 1997) and that states' unemployment (Straus, 1987) and poverty rates (Douglas & McCarthy, 2011b) at the macrolevel is related to homicides against young children or maltreatment-related deaths. The same is true for research that has examined the relationship between state-level income and the overall homicide and crime rates (Miller, Hemenway, & Azrael, 2007; Wilkinson, Kawachi, & Kennedy, 1998). None of this research, however, used multilevel modeling. We can only speculate that it is the methodology of our article which leads our finding regarding the insignificant relationship between income and the child homicide rate to be inconsistent with the literature. It is possible that our use of more advanced statistical techniques to explore the data has yielded new results, which are not in keeping with the existing literature. Additional research is needed to address this discrepancy.

Family Stability. We did not find that family stability, as measured by the state-level divorce rate, was related to the homicide of children. This is in contrast with previous research which has found that the divorce rate was positively related to homicides against children (Gartner, 1991; Straus, 1987). That said, this previous research was conducted during the 1960s–1980s, a period when divorce was on the rise and the research did not involve a longitudinal design—instead, homicide rates were averaged over several years or decades. Our research used a dataset which started in 1979, which was just about the time when the divorce rate peaked and then started to slowly decline (Stevenson & Wolfers, 2007). Thus, the potential reasons for the differences in our findings are related to both the period during which our research was conducted and our research design.

Culture of Risky Behavior. We found a positive relationship between the crime rate, as measured by rape, robbery, and assault, and homicides against children aged 0–9 years. Only the assault rate was positively related to homicides against infants. This research is consistent with previous macrolevel work, which found a positive relationship between aggravated assault and homicides against toddlers but is inconsistent with this same research which found no relationship between aggravated assault and homicides against infants (Straus, 1987).

We found that the rate of motor vehicle deaths was related to homicide against children. Previous research also found a positive relationship between motor vehicle deaths and homicide against children (Straus, 1987). We framed this particular characteristic as one that taps into a culture of reckless behavior, which would again be a measure included in the macrolayer of the ecological model. This finding is somewhat consistent with previous research which found a macrolevel, positive relationship between nations with high rates of deadly wars and homicide against children (Gartner, 1991). Future research on homicides against children might also investigate the potential relationship with other risky behavior such as drug or alcohol use, cigarette sales, and so forth.

LIMITATIONS

The primary limitation of this set of analyses is the relatively small number of variables which were available to represent the outer ring of the ecological model, which likely explains the small percentage of variance explained in the dependent model, especially among infants. Despite this limitation, we were able to develop a model which included factors from previous research at both the micro- (Birken et al., 2009; Overpeck et al., 1998; Smithey, 1997) and macrolevels (Straus, 1987) and which represented several different elements of the ecological framework (Bronfenbrenner, 2004). We had to estimate several years' worth of data for the variable measuring the proportion of African Americans in state population. This variable was not statistically significant in our final models. It is possible that the missing data had an impact on that finding. Nevertheless, our results are overall consistent with previous research which has found a smaller number of predictors explain homicides against infants, as compared with older children (Straus, 1987).

CONCLUSIONS

The findings of this study add new knowledge about the macrolevel risk factors for children to become homicide victims. It also confirms what many social scientists already

know—we have inadequate measures to examine the social context of human behavior over time. This is an area which needs focused attention. In other developed nations, government provides funding for longitudinal, prospective research which is conducted over decades (Economic Social Research Council, n.d.). Second, our analyses spread some light on the potential reasons for why children become homicide victims, including criminal and reckless behavior. That said, we only explained a small amount of variance in the homicide rate against children aged 0–9 years and an even smaller amount of the variance among infants. Despite the attention paid to children who die at the hands of their caregivers, we continue to know very little about the actual prevalence of homicides against young children (Herman-Giddens et al., 1999; Tursz, Crost, Gerbouin-Rérolle, & Cook, 2010), risk factors which are associated with fatality (Lucas et al., 2002; Straus, 1987), and the effectiveness of prevention efforts (Douglas & Cunningham, 2008; Kellermann et al., 1999). These are areas for future research as well as research which examine the potential interaction between the micro-, meso-, and macrolevels of the ecological framework.

In closing, the findings of this research point to the larger and broader implications of the importance of lowering the crime rate to ensure that children are less likely to be the victim of homicide. We also found that a cultural context which includes risky behaviors fosters an environment where children are more at risk for homicide. Public education could address some of the concerns regarding the wide-reaching and potentially last impacts of risky behavior.

NOTE

1. Descriptive information on all of the time-varying, state-level predictors is available upon request from the first author (ED).

REFERENCES

Anderson, R., Ambrosino, R., Valentine, D., & Lauderdale, M. (1983). Child deaths attributed to abuse and neglect: An empirical study. *Children and Youth Services Review*, *5*(1), 75–89.

Appell, A. R. (2002). Safe havens to abandon babies, part I: The Law. *Adoption Quarterly*, *5*(4), 59–68.

Bennett, M. D., Jr., Hall, J., Frazier, L., Jr., Patel, N., Barker, L., & Shaw, K. (2006). Homicide of children aged 0-4 years, 2003-04: Results from the National Violent Death Reporting System. *Injury Prevention: Journal of the International Society for Child and Adolescent Injury Prevention*, *12*(Suppl. 2), ii39–ii43.

Birken, C. S., Parkin, P. C., To, T., Wilkins, R., & Macarthur, C. (2009). Neighborhood socioeconomic status and homicides among children in urban Canada. *Pediatrics*, *123*(5), 815–819. http://dx.doi.org/10.1542/peds.2008-0132

Bronfenbrenner, U. (2004). Ecological systems theory. In U. Bronfenbrenner (Ed.), *Making human beings human: Bioecological perspectives on human development*. Thousand Oaks, CA: Sage.

Bunting, L., & Reid, C. (2005). Reviewing child deaths—Learning from the American experience. *Child Abuse Review*, *14*(2), 82–96.

Centers for Disease Control and Prevention. (1997). Rates of homicide, suicide, and firearm-related death among children: 26 industrialized countries. *Morbidity and Mortality Weekly Report*, *46*, 101–105.

Dias, M. S., Smith, K., DeGuehery, K., Mazur, P., Li, V., & Shaffer, M. L. (2005). Preventing abusive head trauma among infants and young children: A hospital-based, parent education program. *Pediatrics*, *115*(4), e470–e477.

Douglas, E. M. (2005). Child maltreatment fatalities: What do we know, what have we done, and where do we go from here? In K. Kendall-Tackett & S. Gaicomoni (Eds.), *Child victimization* (pp. 4.1–4.18). Kingston, NJ: Civic Research Institute.

Douglas, E. M. (2009). Media coverage of child maltreatment fatalities: Does it result in state legislative change intended to prevent future fatalities? *Journal of Policy Practice*, *8*(3), 224–239.

Douglas, E. M., & Cunningham, J. M. (2008). Recommendations from child fatality review teams: Results of a US nationwide exploratory study concerning maltreatment fatalities and social service delivery. *Child Abuse Review*, *17*(5), 331–351. http://dx.doi.org/10.1002/car.10.44

Douglas, E. M., & McCarthy, S. C. (2011a). Child fatality review teams: A content analysis of social policy. *Child Welfare*, *90*(3), 91–110.

Douglas, E. M., & McCarthy, S. C. (2011b). Child maltreatment fatalities: Predicting rates and the efficacy of child welfare policy. *Journal of Policy Practice*, *10*(2), 128–143.

Durfee, M. J., & Durfee, D. T. (1995). Multi-agency child death review teams: Experience in the United States. *Child Abuse Review*, *4*, 377–381.

Durfee, M. J., Gellert, G. A., & Tilton-Durfee, D. (1992). Origins and clinical relevance of child death review teams. *Journal of the American Medical Association*, *267*(23), 3172–3175.

Durfee, M., Parra, J. M., & Alexander, R. (2009). Child fatality review teams. *Pediatric Clinics of North America*, *56*(2), 379–387.

Economic Social Research Council. (n.d.). *Center for longitudinal studies*. Retrieved from http://www.esrc.ac.uk/funding-and-guidance/tools-and-resources/research-resources/surveys/cls.aspx

Finkelhor, D., & Ormrod, R. (2001, October). *Homicides of children and youth*. Retrieved from http://www.ncjrs.gov/pdffiles1/ojjdp/187239.pdf

Fox, J. A. (1993). *Children are slain by their parents and teenagers by their peers*. Boston, MA: National Crime Analysis Program, Northeastern University.

Gartner, R. (1991). Family structure, welfare spending, and child homicide in developed democracies. *Journal of Marriage & Family*, *53*(1), 231–240.

Herman-Giddens, M. E., Brown, G., Verbiest, S., Carlson, P. J., Hooten, E. G., Howell, E., & Butts, J. D. (1999). Underascertainment of child abuse mortality in the United States. *Journal of the American Medical Association*, *282*(5), 463–467.

Herman-Giddens, M. E., Smith, J. B., Mittal, M., Carlson, M., & Butts, J. D. (2003). Newborns killed or left to die by a parent: A population-based study. *Journal of the American Medical Association*, *289*(11), 1425–1429.

Kaplan, S. R., & Granik, L. A. (Eds.). (1991). *Child fatality investigative procedures manual*. Chicago, IL: American Bar Association.

Kellermann, A. L., Thomas, W., Henry, G., Wald, M., Fajman, N. N., & Carter, J. (1999). *The best intentions: An evaluation of the child fatality review process in Georgia*. Retrieved from http://www.sph.emory.edu/CIC/gafatality.html

Kunz, J., & Bahr, S. J. (1996). A profile of parental homicide against children. *Journal of Family Violence*, *11*(4), 347–362.

Lanning, K. V., & Walsh, B. (1996). Criminal investigation of suspected child abuse. In J. Briere, L. Berliner, J. A. Bulkey, C. Jenny, & T. Reid (Eds.), *The APSAC handbook on child maltreatment* (pp. 246–270). Thousand Oaks, Sage.

Lucas, D. R., Wezner, K. C., Milner, J. S., McCanne, T. R., Harris, I. N., Monroe-Posey, C., & Nelson, J. P. (2002). Victim, perpetrator, family, and incident characteristics of infant and child homicide in the United States Air Force. *Child Abuse & Neglect*, *26*, 167–186.

Lyman, J. M., McGwin G., Jr., Malone, D. E., Taylor, A. J., Brissie, R. M., Davis, G., & Rue, L. W., III. (2003). Epidemiology of child homicide in Jefferson County, Alabama. *Child Abuse & Neglect*, *27*(9), 1063–1073.

Miller, M., Hemenway, D., & Azrael, D. (2007). State-level homicide victimization rates in the US in relation to survey measures of household firearm ownership, 2001-2003. *Social Science & Medicine*, *64*(3), 656–664. http://dx.doi.org/10.1016/j.socscimed.2006.09.024

Miniño, A. M., Anderson, R. N., Fingerhut, L. A., Boudreault, M. A., & Warner, M. (2006). *National Vital Statistics Report—deaths: Injuries, 2002* (DHHS Publication No. [PHS] 2006-1120). Hyattsville, MD: Department of Health & Human Services. Retrieved from http://www.cdc.gov/nchs/data/nvsr/nvsr54/nvsr54_10.pdf

Overpeck, M. D., Brenner, R. A., Trumble, A. C., Trifiletti, L. B., & Berendes, H. W. (1998). Risk factors for infant homicide in the United States. *The New England Journal of Medicine*, *339*(17), 1211–1216.

Palusci, V. J., Yager, S., & Covington, T. M. (2010). Effects of a citizens review panel in preventing child maltreatment fatalities. *Child Abuse & Neglect*, *34*(5), 324–331.

Pritchard, C., & Sharples, A. (2008). Violent deaths of children in England and Wales and the major developed countries 1974-2002: Possible evidence of improving child protection? *Child Abuse Review*, *17*(5), 297–312.

Rodriguez, S. F., & Smithey, M. (1999). Infant and adult homicide: Incompatibility of predictive models. *Homicide Studies*, *3*(2), 170–184.

Sen, B., Wingate, M. S., & Kirby, R. (2012). The relationship between state abortion-restrictions and homicide deaths among children under 5 years of age: A longitudinal study. *Social Science & Medicine*, *75*(1), 156–164.

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. Oxford, NY: Oxford University Press.

Smithey, M. (1997). Infant homicide at the hands of mothers: Toward a sociological perspective. *Deviant Behavior*, *18*(3), 255–272.

Smithey, M. (1998). Infant homicide: Victim/offender relationship and causes of death. *Journal of Family Violence*, *13*(3), 285–297.

Stevenson, B., & Wolfers, J. (2007). Marriage and divorce: Changes and their driving forces. *Journal of Economic Perspectives*, *21*(2), 27–52.

Straus, M. A. (1987). State and regional differences in U.S. infant homicide rates in relation to sociocultural characteristics of the states. *Behavioral Sciences & the Law*, *5*(1), 61–75.

Truman, J. L., & Rand, M. R. (2010). *Criminal victimization, 2009* (NCJ 231327). Washington, DC: U.S. Department of Justice. Retrieved from http://bjs.ojp.usdoj.gov/content/pub/pdf/cv09.pdf

Tursz, A., Crost, M., Gerbouin-Rérolle, P., & Cook, J. M. (2010). Underascertainment of child abuse fatalities in France: Retrospective analysis of judicial data to assess underreporting of infant homicides in mortality statistics. *Child Abuse & Neglect*, *34*(7), 534–544.

United Nations Children's Fund. (2003). *A league table of child maltreatment deaths in rich countries*. Retrieved from http://www.unicef-icdc.org/publications/

U.S. Department of Health & Human Services. (2011). *Child maltreatment 2010: Reports from the States to the National Child Abuse and Neglect Data Systems—National Statistics on Child Abuse and Neglect*. Washington, DC: Author.

U.S. Department of Justice. (2010). *Crime in the United States: Expanded homicide data*. Washington, DC: Author. Retrieved from http://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2010/crime-in-the-u.s.-2010/tables/10shrtbl02.xls

Webster, R. A., Schnitzer, P. G., Jenny, C., Ewigman, B. G., & Alario, A. J. (2003). Child death review: The state of the nation. *American Journal of Prevention Medicine*, *25*(5), 58–64.

Wilkinson, R. G., Kawachi, I., & Kennedy, B. P. (1998). Mortality, the social environment, crime and violence. *Sociology of Health & Illness*, *20*(5), 578–597.

Acknowledgments. This study was in part supported by the Presidential Fellows Program at Bridgewater State University. The authors thank Sean C. McCarthy and Patricia Serino for their assistance in data collection.

Correspondence regarding this article should be directed to Emily M. Douglas, PhD, Bridgewater State University, School of Social Work, Bridgewater, MA 02325. E-mail: emily.douglas@bridgew.edu