Predictors of Firearm Usage in Violent Crimes: Assessing the Importance of Individual, Situational, and Contextual Factors

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INTRODUCTION

The New Mexico Statistical Analysis Center (NM SAC) received funding from the Justice Research and Statistics Association (JRSA) to complete a study examining the degree to which person, incident, and structural characteristics predict firearm usage in violent crimes. Given the significant threat to public safety that firearm crimes pose, a better understanding of the dynamics of firearm crimes is relevant not just to researchers, but to law enforcement and to the community at large. Recognizing this, Federal, State, local and private funds have been allocated in support of a range of law enforcement initiatives aimed at reducing gun violence in communities across the country. Project Safe Neighborhoods, initiated in 2001, and its predecessor, the Strategic Approaches to Community Safety Initiative (SACSI) are notable examples of federal initiatives aimed at reducing gun violence by funding multi-agency intervention, prevention and enforcement strategies. Other interventions include the creation of gun courts and mandatory sentencing laws designed to increase penalties for firearm use and the unlawful carrying of firearms (Committee on Law and Justice, 2004). The rationale for these and other initiatives builds on the importance of reducing firearm violence in the broad interest of public safety.

A large body of research on firearms has addressed the consequences of firearm usage in crimes, and reinforces the public safety rationale that guides firearm crime reduction initiatives. These studies suggest that firearm usage increases crime-related injury severity and mortality (Brennan and Moore, 2009; Hemenway, 2004; May et al., 1995; McGonigal et al., 1993). For example, Brennan and Moore (2009: 218) note that "firearms increase the likelihood of death by 40 times" compared to incidents not involving any weapon. Conversely, knives increase the likelihood of death by 4 times, highlighting the particularly serious nature of firearm violence (Brennan and Moore, 2009). Law enforcement and the courts clearly take gun crimes seriously. Studies have shown that crime clearance rates are higher for firearm crimes compared to those for crimes that do not involve firearms (Roberts, 2008). Additionally, sentences are generally longer for crimes that involve firearms compared to those that do not (Bushway and Piehl, 2011; Lizotte and Zatz, 1986).

Though it is important to study the consequences of and systemic responses to firearm usage, we argue that it is also important to study the predictors of firearm usage in crimes. In fact, a better understanding of the characteristics that predict firearm use can help frame effective intervention. Most firearm crime reduction interventions are reactive—e.g., firearm enhancements to criminal sentences, targeted policing in areas with high rates of firearm violence, gun buy-back programs, etc. However, if we can identify some of the incident-level characteristics that increase the odds of firearm violence, criminal justice professionals might be able to craft preventative policies that aim to stop firearm violence before it happens.

In the current study, we utilize incident-level data from Albuquerque, New Mexico, to explore the person, incident, and structural predictors of firearm usage in violent crimes. In the following sections of this report we review the literature that links various characteristics with firearm usage, describe the data and methods utilized in the current study, present the results of our statistical analyses, and then conclude with a section summarizing our findings and discussing the practical and theoretical implications of the current research.

LITERATURE REVIEW

There are three distinct types of factors that may be related to firearm usage in violent crimes. First, the characteristics of the offender(s) and victim(s) involved in a violent crime may influence the likelihood that a firearm is used in a given encounter. In other words, it may be that certain types of people are more likely to be firearm offenders and firearm victims. We refer to these offender and victim characteristics as the person-level predictors of firearm usage. Second, various incident-level characteristics may influence the likelihood that a firearm is used in a given encounter. In other words, it may be the case that certain types of encounters or situations are more likely to involve firearms than others. We refer to these as these incident predictors of firearm usage. Third, the broader structural characteristics of an area may influence the likelihood that firearms are used in a given encounter. In other words, it may be the case that firearms are more likely to be used in certain neighborhoods or communities than others. We refer to these as the structural predictors of firearm usage. In the section below, we review literature on person, incident, and structural predictors of firearm usage.

Person-Level Predictors of Firearm Usage

The firearm literature clearly establishes that males are much more likely than females to engage in and be the victims of violence (Lauritsen, Heimer and Lynch 2009; Steffensmeier and Allan 1996) and that they are more likely to use firearms during the commission of a crime than females (Brennan and Moore, 2009; Felson and Pare, 2010). Indeed, most studies involving firearm-related violent offending focus on males because they are the most frequent offenders (Koons-Witt and Schram, 2006). In general, therefore, violent criminal incidents involving male offenders and victims are more likely to involve firearms. It is notable, though, that despite this general pattern, females are more likely than males to use firearms against their partners in intimate partner violence (Brennan and Moore, 2009; Wilkinson and Hamerschlag, 2005).

Prior research also suggests that race/ethnicity and age are related to firearm usage in violent crimes. Nielsen et al. (2005), reviewing the literature on firearm usage, conclude that Blacks are more likely to carry, use, and be killed by firearms than Whites; Hispanics are somewhere in between. Nielsen's research on assaults and resulting homicides occurring in Miami shows males and young adults (18 to 24) are more likely to use guns in assaults and homicides than

females or juveniles and older adults. Felson and Pare (2010), utilizing victimization data as well as official police data, also suggest that Blacks are at increased risk to use and be the victim of firearm violence.

Finally, the number of offenders and victims involved in a particular violent incident may affect the likelihood that a firearm is used. For example, the likelihood that an adolescent carries a gun is at least partially influenced by his or her peers (Wilkinson et al., 2009). Furthermore, existing research indicates that offenses committed in groups of co-offenders tend to be more serious (McGloin and Piquero, 2009) and limited evidence suggests that, in fact, firearms are more frequently used in co-offending than solo-offending situations (Wilkinson et al., 2009). Despite the connection between the group nature of serious violent offending and firearm use, there has been little research on co-offending and the use of firearms, though Nielsen et al. (2005) found that the number of offenders and victims was not significantly related to the usage of a firearm during violent incidents in Miami, FL.

In summary, prior literature suggests that gender, age, race, and the presence of co-offenders influence the likelihood that firearms are used in a violent criminal incident.

Incident-Level Predictors of Firearm Usage

Research has demonstrated that crime incidents are more likely to occur in some types of places than others (Block and Block, 1995; Sherman, Gartin, and Buerger, 1989). Most of the literature on place and crime draws on the routine activities perspective (Cohen and Felson, 1979) and argues that certain types of places are more criminogenic because they promote the convergence in time and space of motivated offenders with suitable victims in the absence of capable guardianship. In terms of firearm crimes, it may be the case that individuals carrying firearms are more likely to frequent certain locations. In addition to the general routine activities argument, there are also theoretical reasons to believe that places themselves may influence the likelihood of gun crime incidents. For example, social psychological and psychological research suggests that the presence of an audience increases both the likelihood of responding to a provocation and the severity of the response (Felson, 1982; Kim, Smith, and Brigham, 1998), as the presence of an audience can increase feelings of anger (Miller, 2001) and create pressure to engage in a status contest (Griffiths, Yule, and Gartner, 2011). In this regard, violent altercations that occur in public places may be more likely to involve the use of firearms, as public places may be more likely to produce these sorts of audience effects. Conversely, violent incidents that happen in private places may be less likely to involve firearms. The relationship between type of place and firearm usage may not be completely straightforward. Research (Brennan and Moore, 2009; Wilkinson and Hamerschlag, 2005) suggests that women are more likely to use firearms in intimate partner situations, which are more likely to occur within private residences (Greenfield et al., 1998; Rennison and Welchans, 2000).

In addition to location, it is also possible that time of day is related to firearm usage. Crime in general varies considerably by time of day and a disproportionate amount of crime occurs during the evening. For example, Felson and Poulsen (2003) demonstrate that approximately 40% of robberies occur between the hours of 8:00 p.m. and 2:00 a.m. Similarly, Dowd, Knapp, and Fitzmaurice (1994) demonstrate that a disproportionate number of firearm injuries occur between 8:00 p.m. and 2:00 a.m., suggesting that firearm crime is more common during nighttime hours.

Structural Predictors of Firearm Usage

The extensive literature on social disorganization and crime suggests that disadvantage and residential instability likely modify the influence of demographic characteristics, co-offending and setting on firearm violence, such that in disadvantaged areas these effects are particularly strong. Indeed, research has shown that homicides, the majority of which result from gun violence, are concentrated in disadvantaged urban areas (Ousey and Augustine, 2001; Messner et al., 1999; Morenoff and Sampson, 1997). The operating theory is that disadvantaged areas are less capable of exerting informal social control (Bursik, 1988). One consequence of the limited informal social controls in these areas is the proliferation of unsupervised groups of youth (Sampson and Groves, 1989). Not only do these unsupervised groups of youth pose a general risk for increased crime (see the age-crime relationship, Farrington, 1986), their presence is also likely to increase the opportunity for co-offending, which has been shown to be positively correlated with firearm use (Wilkinson et al., 2009). Moreover, research suggests that guns and gun violence have been adopted as a cultural norm in certain types of disadvantaged neighborhoods. In these settings, firearms are viewed as "symbols of respect, power, identity, and manhood" (Fagan and Wilkinson, 1998: 105; see also Anderson, 1999: 125) and are increasingly seen as important defensive tools in disadvantaged neighborhoods (Fagan and Wilkinson, 1998; Wilkinson et al, 2009).

RESEARCH DESIGN

Hypotheses

The primary purpose of the current research is to evaluate the relationship between individual, incident, and structural factors and firearm usage in violent crimes. This study contributes to the literature on firearms in that only a few studies examine the predictors of firearm usage in criminal incidents (Felson and Pare, 2010; Nielsen et al; 2005). Moreover, we are aware of no studies that have simultaneously examined individual, incident, and structural correlates of firearm usage.

Based on the literature above, we test the following hypotheses:

Hypothesis 1: There is age variation in firearm usage in violent incidents. Incidents involving young adults (aged 18-25) are more likely to involve firearms, while those involving juveniles and older adults are less likely to involve firearms.

Hypothesis 2: Incidents involving males as offenders and/or victims are more likely to involve firearms.

Hypothesis 3: Incidents involving Whites as offenders and/or victims are less likely to involve firearms.

Hypothesis 4: Incidents involving multiple offenders are more likely to involve firearms than incidents involving solo offenders.

Hypothesis 5: Incidents occurring in private places are less likely to involve firearms than incidents occurring at public places.

Hypothesis 6: Incidents occurring during nighttime hours are more likely to involve firearms than incidents occurring during other hours.

Hypothesis 7: Incidents occurring in areas characterized by high levels of social disorganization (structural disadvantage and residential instability) are more likely to involve firearms.

Hypothesis 8: The effects of individual and incident-level factors are contingent on levels of social disorganization.

Data

In order to test hypotheses 1 through 8, we utilize data from two sources. Official crime data come from the Albuquerque Police Department (APD), which provided a dataset covering all Part I violent offenses (homicide, rape, robbery and aggravated assault) that occurred in the Bernalillo County area between 1996 and 2003. The data include information on the incident crime type (arrest statute), the individuals involved (arrestee, suspect, cited, victim) and demographic information for each person (sex, race, date of birth). Data also include incident characteristics including the date, crime code and statute, weapon code, type of location of the incident, address of incident, time of incident, and responding agency. All incident addresses were geocoded using ArcGIS software.

In order to link incident data to place data, we draw from the 2000 census. Specifically, we join block group-level census data for Bernalillo County with the geocoded address data from the

APD incidents using ArcGIS software. The block group-level data culled from the Summary 3 Census files include: the percentage of renter-occupied housing, the percentage of households with children headed by single females, the percentage of population that has moved in the last 5 years, the percentage of vacant housing, the percentage of people age 25 or greater with less than a high school education, the percentage of people living under the poverty line, the percentage of households receiving public assistance, and percent joblessness (unemployed individuals plus those not in the labor market).

Variables

The dependent variable in all of our analyses is a dichotomous variable measuring whether a *firearm* was ever used during the violent offense. It is coded as "0" if no firearm was used and "1" if a firearm was used.

We included a number of independent variables that reflect characteristics of the offenders, victims, incident, as well as incident location. We describe each of these variables in detail below.

Offender and victim characteristics

The data contain information about the *age*, *gender*, and *race* of both the offender and victim. We constructed dummy variables for juvenile offender and juvenile victim that are equal to 1 if any of the offenders or victims in a given incident were under the age of 18. We also constructed dummy variables for young adult offender and young adult victim that are equal to 1 if any of the offenders or victims in a given incident were ages 18 to 25.

For gender, we constructed three dummy variables indicating whether all of the offenders were men, women, or both men and women. Similarly, we constructed three dummy variables indicating whether all of the offenders were white, minorities, or both minorities and whites. Similar variables were constructed for the victims in a given incident. In the analyses below, all women and all white are the reference categories for the gender and race variables.

In addition to these demographic variables, we were interested in assessing the importance of *co-offenders* on firearm offenses. We constructed three dummy variables indicating whether the incident involved a single offender or victim, a pair of offenders or victims, or a group (3 or more) of offenders and victims. This dummy variable is necessary, as the mixed gender and mixed race variables described above can only occur in incidents involving more than one offender. Therefore, a simple dichotomous variable indicating solo or group would be collinear with the mixed race and gender offender and victim variables. Theoretically, however, this

construct offers the additional advantage of allowing us to determine if increases in group size (and not just group vs. solo) predict firearm usage.

Incident variables

Analyses also include several incident variables measuring the spatial-temporal context and type of violent offense. We constructed a variable to reflect nighttime hours. This dummy variable was coded as 1 if the incident occurred between 8 p.m. to 2 a.m. and 0 otherwise. The location of the incident was collapsed into two categories: private/residential (coded as "0") or public (coded as "1"). In some cases, the incident occurred in multiple locales. Because we expected that incidents occurring in a public place would be more likely to involve a firearm, if any public place was noted, the variable was coded as "public place."

In addition to the incident-level variables representing the location of the incident and time of day, we also constructed dummy variables to control for crime type. The data include four violent offense types: homicide, rape, robbery, and aggravated assault. It should be noted that some incidents include more than one violent offense type, so the reference category for each variable is any crime that is not a homicide, rape, robbery, or aggravated assault.

Structural variables

Prior research indicates that several of the census measures we use are collinear (Sampson, Raudenbush, and Earls, 1997). In order to address this issue, we applied principal components analysis (PCA) to our census data. This resulted in two principal components with eigenvalues greater than 1 that accounted for nearly 70% of the variance among the indicators. The results of the PCA are listed below in Table 1. This table lists the correlation between each variable on the components produced from the PCA. The following variables loaded on the first principal component: percentage of the population with less than a high school diploma, percentage of the population jobless, percentage of households living under the poverty line, and percentage of households receiving public assistance. We call this component score *structural disadvantage*. The following variables loaded on the second principal component: percentage of people that have moved in the last 5 years, percentage of housing vacant, percentage of dwellings occupied by renters, and percentage of households with children headed by single females. We labeled this component score *instability*.

In addition to the structural disadvantage and instability measures, we also include the following control measures: the percentage of the population that is Hispanic and the percentage of the population under the age of 18.

Methods

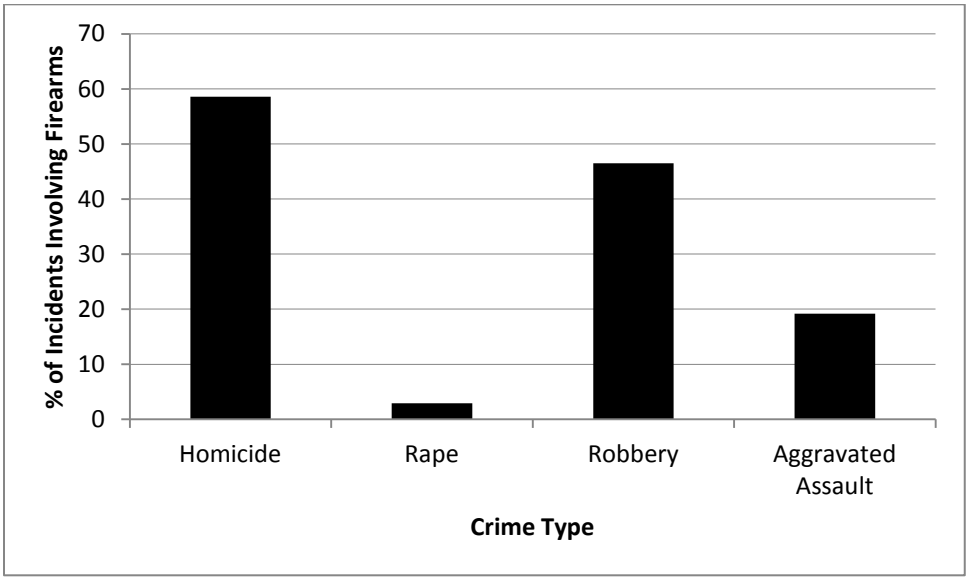
Table 2 displays descriptive statistics for all of the variables included in our models. These statistics suggest that the typical violent incident involves adult males as solo offenders and victims. Specifically, 67% of violent incidents involved all male offenders and another 20% involved male and female offenders, while 44 % of incidents involved all male victims and 13% of incidents involved both male and female victims. Only 17% of incidents involved a juvenile offender and only 23% involved a juvenile victim. And finally, only 62% of cases involved a solo offender and 75% of cases involved a single victim. Violent incidents are split evenly between private (51%) and public locations (49%) and a disproportionate amount of violent incidents occur during nighttime hours (35% of incidents occur during 25% of the day's hours).

Table 1. Principal Component Analysis of Census Data

Variable	Instability (Component 1)	Disadvantage (Component 2)
Percentage of Renter-Occupied Housing	0.898	0.226
Percentage Female-Headed Households with Children	0.631	0.213
Percentage Moved in Last 5 Years	0.863	-0.151
Percentage of Housing Vacant	0.662	0.355
Percentage with Less than a High School Education	0.056	0.897
Percentage in Poverty	0.532	0.750
Percentage of Households Receiving Public Assistance	0.262	0.703
Percentage Joblessness	0.026	0.749

Our primary goal is to evaluate factors that predict firearm usage in violent criminal incidents. Though descriptive statistics suggest that firearms are used in a minority of violent incidents (22.6%), this minority is fairly large and worthy of study. Figure 1 (below) displays the percentage of violent crime incidents involving firearms by crime type. This figure indicates that firearms were most likely to be used in homicide and robbery incidents. Firearms are fairly rare in aggravated assault incidents, though this may be reflective of the fact that assaults with firearms are more likely to result in death. And finally, firearms were rarely used in rape incidents.

Figure 1. Percentage of crimes involving firearms by crime type



Binary outcome variables require specialized regression models, like logistic or probit regression for analysis. Here, we utilize logistic regression models since they produce regression coefficients that are easier to interpret than probit regression coefficients. Specifically, the logistic regression coefficients for continuous or numeric variables can be interpreted by exponentiating each coefficient and interpreting that value as the expected change in the likelihood that a firearm was used given a 1-unit increase in the independent variable. For regression coefficients for dummy variables, the logistic regression coefficients can be interpreted as the expected difference in the likelihood that a firearm was used between the category represented by the dummy variable and the omitted reference category.

Given that our data is multi-level (incidents clustered within block groups), we utilize linear mixed logistic regression models to account for potential data dependency issues. We include a random intercept in our models to account for the fact that the raw probability that a firearm is used varies from block group to block group. This random coefficient, in effect, provides each block group with its distinct y-intercept or constant. Including this factor allows us to control for the potential bias introduced by nondependent clustering. It should be noted that the intra-class correlation coefficient (ICC), a common measure of data dependence, is quite small for these data (ICC = 0.02). This suggests that incidents within a block group are largely independent of each other. Despite this lack of dependence, we opt for the conservative approach and maintain the hierarchical structure in the analyses below. Both simple Wald's z-tests ($z = 7.68$), log-likelihood ratio tests comparing REML log-likelihood values, and AIC statistics suggest that the random intercept improves model fit.

Table 2. Descriptive Statistics

Variable	Mean	Standard	Minimum	Maximum
Dependent Variable				
Firearm Usage	0.23	0.42	0	1
Offender Variables				
All Men	0.67	0.47	0	1
All Women	0.14	0.34	0	1
Mixed Gender	0.20	0.40	0	1
All Minority	0.41	0.49	0	1
All White	0.39	0.41	0	1
Mixed Race/Ethnicity	0.21	0.49	0	1
Any Juvenile Offender	0.17	0.38	0	1
Any Young Adult Offender	0.32	0.47	0	1
Solo Offender	0.62	0.49	0	1
Pair of Offenders	0.22	0.42	0	1
Group of Offenders	0.16	0.37	0	1
Victim Variables			0	1
All Men	0.44	0.50	0	1
All Women	0.43	0.50	0	1
Mixed Gender	0.13	0.34	0	1
All Minority	0.39	0.49	0	1
All White	0.49	0.50	0	1
Mixed Race/Ethnicity	0.12	0.32	0	1
Any Juvenile Victim	0.23	0.42	0	1
Any Young Adult Victim	0.31	0.46	0	1
Solo Victim	0.75	0.43	0	1
Pair of Victim	0.18	0.38	0	1
Group of Victims	0.07	0.26	0	1
Incident Variables				
Homicide	0.01	0.11	0	1
Robbery	0.16	0.37	0	1
Rape	0.08	0.26	0	1
Aggravated Assault	0.77	0.42	0	1
Nighttime	0.36	0.48	0	1
Private	0.51	0.50	0	1
Structural Variables				
Disadvantage	0	1	-1.53	3.72
Instability	0	1	-2.23	3.09
Hispanic	51.63	23.03	0	100
% Population Under 18	25.79	9.16	0	71.99

RESULTS

In total, we estimate four nested hierarchical logistic regression models. The results of these models are presented below in Table 3. Akaike information criterion (AIC) values for each model are included in this table and allow for a comparison of nested models (where smaller values indicate better model fit). Model 1 examines the relationship between offender and victim characteristics and firearm usage. The model suggests that young adults are more likely

to be involved in firearms crime than those from other age groups. Specifically, violent incidents in which at least one of the offenders is a young adult are 22% more likely to involve a firearm than incidents in which none of the offenders are young adults. Similarly, incidents in which at least one of the victims is a young adult are 53% more likely to involve a firearm than incidents in which none of the victims are young adults. Though the presence of juvenile offenders does not significantly predict firearm usage, incidents involving juveniles as victims are 36% less likely to involve firearms than incidents not involving juvenile victims. Together, the results for young adults and juveniles provide general support for hypothesis 1 in that incidents involving young adults are more likely to involve firearms, while those involving juveniles are less likely to involve firearms.

Results also suggest that violent incidents involving males as either offenders or victims are more likely to involve firearms. Specifically, incidents involving all male offenders are 58.7% more likely to involve a firearm than incidents involving all female offenders, while incidents involving all male victims are 74% more likely to involve a firearm than incidents involving all female victims. Interestingly, there are no significant differences between incidents involving mixed gender offender and all female offender groups. Incidents involving mixed gender victim groups are, however, 42% more likely to involve firearms than incidents involving all female victim groups. These results provide general support for hypothesis 2.

Though we find support for hypotheses 1 and 2, we find only moderate support for hypothesis 3. The likelihood that a firearm was used in a violent incident is statistically no different for incidents involving all minority offenders or victims than for incidents involving all White offenders or victims. This result is contrary to hypothesis 3. Interestingly, incidents involving mixed race offenders and mixed race victims are more likely to involve firearms than incidents involving only White offenders and victims.

Finally, we find support for hypothesis 4 in model 1. Incidents involving either multiple offenders or multiple victims are more likely to involve firearms than incidents involving a solo offender or victim. Specifically, incidents involving a pair of offenders are 22% more likely to involve firearms, and incidents involving a group of offenders are 38 % more likely to involve firearms than incidents involving a single offender. Similarly, incidents involving a pair of victims are 33% more likely to involve firearms, and incidents involving a group of victims are 126% more likely to involve firearms than incidents involving a single victim.

Model 2 adds incident variables describing the type of crime and the circumstances of the crime to the variables included in model 1. The AIC for model 2 is smaller than for model 1, suggesting that these variables are important to include in models of firearm usage. The results of model 2 indicate that homicide and robbery incidents are more likely to involve firearms, whereas rape incidents are less likely to involve firearms. There is no statistically significant

difference in the likelihood of a firearm being used in violent incidents involving aggravated assault and those not involving aggravated assault.

In terms of crime circumstances, violent incidents that occur during the nighttime hours are more likely to involve firearms than violent incidents that occur during other periods of the day. Specifically, incidents occurring during the night are 15% more likely to involve firearms than incidents occurring during the rest of the day. Incidents occurring at private residences are less likely to involve firearms than incidents occurring in public locations. Specifically, violent incidents in private residences are 40% less likely to involve firearms than incidents occurring in public places. These results provide general support for hypotheses 5 and 6 that incidents occurring in private residences are less likely to involve firearms and that incidents occurring at night are more likely to involve firearms.

Table 3. Linear Mixed Model Regression Coefficients (Standard Errors in Parentheses)

Variable	Model 1	Model 2	Model 3	Model 4
Offender Variables				
Males Only	0.462**	0.403**	0.403**	0.405**
	(0.045)	(0.047)	(0.047)	(0.047)
Mixed Gender	-0.042	0.082	0.080	0.077
	(0.061)	(0.064)	(0.064)	(0.064)
Any Juveniles	-0.017	-0.038	-0.047	-0.149**
	(0.043)	(0.045)	(0.045)	(0.050)
Any Young Adults	0.196**	0.133**	0.136**	0.134**
	(0.032)	(0.034)	(0.034)	(0.034)
Minorities Only	0.020	-0.040	-0.038	-0.040
	(0.035)	(0.036)	(0.036)	(0.036)
Mixed Race	0.190**	0.065	0.069	0.063
	(0.051)	(0.054)	(0.054)	(0.054)
Pair of Offenders	0.198**	0.161**	0.158**	0.161**
	(0.046)	(0.048)	(0.048)	(0.048)
Group of Offenders	0.324**	0.284**	0.282**	0.288**
	(0.063)	(0.066)	(0.066)	(0.066)
Victim Variables				
Males Only	0.552**	0.328**	0.327**	0.331**
	(0.032)	(0.034)	(0.034)	(0.034)
Mixed Gender	0.349**	0.287**	0.286**	0.288**
	(0.059)	(0.061)	(0.061)	(0.061)
Any Juveniles	-0.444**	-0.218**	-0.225**	-0.250**
	(0.042)	(0.044)	(0.044)	(0.046)
Any Young Adults	0.427**	0.457**	0.465**	0.463**
	(0.033)	(0.035)	(0.035)	(0.035)
Minorities Only	0.041	0.131**	0.128**	0.123**
	(0.033)	(0.035)	(0.035)	(0.035)
Mixed Race	0.134*	0.162**	0.163**	0.154**
	(0.057)	(0.060)	(0.060)	(0.060)
Pair of Victims	0.283**	0.290**	0.288**	0.291**
	(0.052)	(0.054)	(0.054)	(0.054)
Group of Victims	0.815**	0.788**	0.783**	0.784**
	90.076)	(0.079)	(0.079)	(0.079)
Crime Type				
Homicide	-	1.793**	1.800**	1.800**
		(0.168)	(0.168)	(0.168)
Robbery	-	1.308**	1.317**	1.309**
		(0.130)	(0.130)	(0.130)
Rape	-	-1.689**	-1.682**	-1.678**
		(0.179)	(0.179)	(0.179)

Aggravated Assault	-	0.069	0.071	0.067
		(0.131)	(0.131)	(0.131)
Crime Circumstances				
Nighttime	-	0.136**	0.137**	0.137**
		(0.032)	(0.032)	(0.032)
Private Residence	-	-0.515**	-0.520**	-0.582**
		(0.035)	(0.034)	(0.039)
Neighborhood Variables				
Disadvantage	-	-	0.038	-0.048
			(0.043)	(0.045)
Instability	-	-	-0.147**	-0.168**
			(0.022)	(0.024)
% Hispanic	-	-	-0.001	-0.001
			(0.002)	(0.002)
% Pop <18 years old	-	-	0.002	0.003
			(0.003)	(0.003)
Cross-Level Interactions				
Private Res. X Disadvantage	-	-	-	0.120** (0.031)
Juv. Offender X Disadvantage	-	-	-	0.200** (0.040)
Juv. Victim X Instability	-	-	-	0.102** (0.039)
Constant	-2.251**	-2.212**	-2.241**	-2.193**
	(0.056)	(0.144)	(0.180)	(0.180)
AIC	29468.36	27147.09	27102.64	27002.25

*Standard errors in parentheses. * p<0.05; **p<0.01*

The regression coefficients and significance tests in model 3 confirm this. Three of the four structural variables are not significantly related to firearm usage, controlling for individual and incident-level characteristics. Only the composite measure of residential instability is significantly related to firearm usage and this relationship is opposite of the expected direction. Violent incidents occurring in block groups with more instability are less likely to involve firearms, controlling for offender, victim, and incident characteristics. Therefore, we find no support for hypothesis 7. This result is interesting given the large body of research linking structural disadvantage and residential instability to increases in crime (Sampson and Groves, 1989; Sampson, Raudenbush, and Earls, 1997). It may be the case that neighborhood characteristics like structural disadvantage and residential instability are directly related to the extent of violent crime, but the specific nature of the crime, including whether or not it involves firearms, does not vary much by area characteristics. In other words, violent crime may not look all that different in form across neighborhoods, even though neighborhood characteristics are implicated in how much violence an area experiences.

It is possible, however, that structural factors condition the relationship between incident characteristics and the likelihood that a firearm is used in a violent crime. In model 4, we evaluate this possibility by examining interactions between structural factors and offender, victim, and incident variables. Though we examined every possible interaction, model 4 presents only the interactions that are statistically significant predictors of firearm usage.

Specifically, disadvantage conditions the effect of private residence and juvenile offenders, while instability conditions the effect of juvenile victim on firearm crime.

The interaction between private residence and disadvantage is positive, suggesting that firearms are more likely to be used in incidents occurring within private residences in highly disadvantaged areas and are less likely to be used in incidents occurring within private residences located in less disadvantaged areas. Overall, however, firearms are still less likely to be used in private residences than in public locations. Specifically, the relationship between private residences and firearm usage can be written as follows: -0.582 (Private Residence) + 0.120 (Private Residence X Disadvantage). This means that in an area with an average level of disadvantage (that is, disadvantage = 0), violent incidents occurring in private residences are 44.1% ($e^{-0.582}$) less likely to involve firearms than incidents occurring in public locations. Conversely, incidents occurring in private residences located within highly disadvantaged areas (for example, if disadvantage = 2) are 29% ($e^{-0.582+0.120(2)}$) less likely to involve firearms than incidents occurring in public locations. This suggests that the difference between public and private locations is at least partially a function of neighborhood disadvantage.

The interaction between juvenile offender and disadvantage suggests that incidents involving juvenile offenders are more likely to involve firearms in disadvantaged areas. While the main effect of the juvenile offender variables is negative, the overall effect is contingent on level of disadvantage. This contingency effect suggests that juvenile offenders in disadvantaged areas are at increased risk of involvement in gun violence but that is not the case in less disorganized areas. Specifically, in areas with high levels of disadvantage (again, disadvantage = 2), incidents involving juvenile offenders are 29% ($e^{-0.149+0.200(2)}$) more likely to involve firearms than incidents not involving any juvenile offenders. Conversely, incidents involving juveniles in areas with average levels of disadvantage (disadvantage = 0) are 14% ($e^{-0.149}$) less likely to involve firearms than incidents not involving any juvenile offenders.

Finally, the interaction between juvenile victims and residential instability is positive, suggesting that incidents with juvenile victims are more likely to involve firearms in areas with high levels of instability. Again, while incidents involving juvenile victims occurring in areas with average levels of instability (instability = 0) are 22% ($e^{-0.250}$) less likely to involve firearms than incidents in which none of the victims were juveniles, incidents involving juvenile victims occurring in highly instable (instability = 2) areas are only 5% ($e^{-0.250+0.102*(2)}$) less likely to involve firearms than incidents not involving any juvenile victims.

CONCLUSIONS

Our results suggest that there are certain offender, victim and incident characteristics that firearm crimes tend to share, suggesting that there may be ways to craft policies that would reduce the

likelihood of such incidents. Specifically, the use of firearms is more likely in incidents involving males, young adults, and groups. They are also more commonly used in violent incidents that occur between the hours of 8 p.m. and 2 a.m. Conversely, firearms are less common in incidents involving juveniles, and incidents that occur at private residences are less likely to involve firearms than those occurring in public settings. Our findings also highlight the way in which structural disadvantage can interfere with the protective effect some characteristics offer in other contexts (e.g., juvenile status and private residences).

In terms of age, our results support Nielsen et al.'s (2005) finding that young adults are more likely to utilize firearms than individuals in other age groups. Like Nielsen et al. (2005), we also find that juveniles are less likely to utilize firearms than other groups. This is an interesting result, given the broad interest in juvenile gun violence (Sheppard et al., 2000). Prior research suggests that much of the concern related to juveniles and assault weapons is unfounded in data and socially constructed (Ruddell and Decker, 2005). Though we do not wish to minimize the importance of studying and preventing juvenile gun violence, we suggest that the bigger gun problem lies with young adults. Of course, it is likely that the young adult offenders and victims involved in firearms incidents have some history of juvenile offending or victimization (Loeber et al., 2005 Smith et al., 2005). As such, efforts to intervene with violent juvenile offenders and victims could reduce the odds that they transition into more serious firearm violence in young adulthood. In addition, the significant cross-level interaction between structural disadvantage and juvenile offenders/victims in firearm crimes suggests that efforts to address juvenile gun violence should target these areas in particular and that broader community mobilization and development programs that address neighborhood disadvantage might also reduce juvenile gun violence in these areas.

Interestingly, our results suggest that there is no direct relationship between structural disadvantage and firearm usage, and that counter to our hypotheses, instability decreases the likelihood of firearm usage in violent incidents. Despite the significant influence of instability, overall model fit statistics suggest that including structural variables in the model adds little to model fit. This suggests that offender, victim, and incident-level variables are the primary factors responsible for explaining variation in firearm usage. Though structural conditions may influence where and how much crime occurs, it may be that structural conditions are less important in directly determining the content of a given violent incident.

As indicated above, structural factors do have a contingent effect on firearm usage. There are statistically significant interactions between disadvantage and juvenile offenders, juvenile victims, and private residences. While juveniles and private residences seem to decrease the likelihood that a firearm is used in general, the protective features of incidents involving juveniles and incidents occurring in private places is diminished in disadvantaged areas. Similarly, while incidents involving juvenile victims are less likely to involve firearms, the

protective effect of juvenile victims decreases in disadvantaged areas. As noted above, the fact that juvenile risk for involvement in firearm violence increases in disadvantaged areas highlights the particular importance of violence intervention for youth living in these areas. The increased risk these juveniles experience may set the stage for their long-term involvement in crime given the well-established link between early involvement in serious crime and long-term offending trajectories (Piquero and Buka, 2002; Patterson et al., 1998).

These results highlight the importance of examining cross-level interactions in linear mixed models. The direct effect models indicate a weak relationship between structural factors and firearm usage. Indeed, a comparison of model fit statistics might lead researchers to conclude that structural factors do not play an important role in determining whether or not a firearm is likely to be used in a given incident. These cross-level interactions, however, highlight ways in which structural factors do actually influence firearm utilization. Moreover, the model (4) including these cross-level interactions shows considerably more improvement in model fit than model 3, which does not include these interactions. This further highlights the importance of these interactions for explaining firearm utilization.

Theoretically, our research provides support for perspectives highlighting the role of place and co-offenders in determining the content of criminal events. While prior research highlights the role of place in generating crime (Sherman, Gartin, and Buerger, 1989; Block and Block, 1995), our results suggest that place can shape the content of criminal incidents. Admittedly, our measure of place in the current research is limited in that places are categorized as either private or public. Future research might consider a more detailed disaggregation of public places in order to determine if certain types of public places (like bars) are especially likely to generate firearm crime. Still, the general private-public distinction is important and is theoretically founded. Some violence theorists suggest that serious violence is more likely to occur in public places due to the status costs associated with deference in public settings (Gould, 2003; Griffiths, Yule, and Gartner, 2011; Luckenbill, 1977). Others suggest that the presence of audiences can heighten the seriousness of a given incident (Kim, Smith, and Brigham, 1998; Felson, 1982). Our results are broadly supportive of this claim in that violent incidents that occur in public places are more likely to involve firearms. It is also possible that firearms are more likely to be used in public places because people who carry firearms in public spaces intend to use them (or, in the very least, anticipate a potential need for firearms).

Our results also reinforce the literature on peer effects, since firearm violence is more likely in incidents with multiple offenders. Unfortunately, our data do not allow us to specify the exact process by which the presence of co-offenders increases the likelihood of violence. This result suggests that firearm usage is likely driven by factors like learning, modeling and imitation, status seeking, and peer reinforcement. It may be the case that for certain individuals in certain social groups, there are positive social rewards associated with carrying and utilizing firearms and these rewards are most directly realized in the presence of members of those social groups.

Theoretically, this result is interesting in that peer groups not only influence individual propensities to engage in crime and violence, but the presence of peer groups shapes actual criminal events. Substantively, this result highlights the violent potential associated with interpersonal conflicts involving larger groups of people.

In general, the current research can help inform both criminal justice and non-criminal justice responses to firearm-related crimes in a number of ways. The results regarding offender, victim, and incident characteristics have implications for how criminal justice professionals approach groups of suspected offenders and how private security personnel should address and monitor the behavior of groups of people. Incidents that involve males, multiple parties, and incidents occurring in public places are more likely to involve firearms than other incidents, so police and private security forces should approach such incidents with particular care for their own safety and that of bystanders. Social control agents, for example, should be especially wary of interpersonal conflicts that develop at night between groups of young adult males. Security guards and ushers should be trained to spot these potential conflicts early and to intervene before such situations escalate. Private security might also be trained to better enforce firearm prohibitions to reduce the likelihood that individuals carry firearms in public places. Metal detectors and physical searches in places where large groups of young males gather are, for example, likely to be useful at reducing firearm incidents in public places. Moreover, given that firearms are more commonly used in crimes occurring at night and in public venues, increased patrols in areas where young adults congregate at night would be sensible.

In addition to these direct social control efforts, our results suggest that primary prevention efforts should focus on males more broadly and on youth living in disadvantaged areas. The epidemiology and public health literatures may be useful in the development of such programs. Webster and Wilson (1994), for example, highlight the role that pediatricians might play in primary prevention of gun violence through parental counseling. Similarly, Kellerman et al. (1991) advocate for the increased use of programs that promote nonviolent resolution of arguments, increased training and background checks for individuals who purchase firearms, and the use of trigger locks.

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