Online citation: Ruddell, Rick, Dheeshana S. Jayasundara, Roni Mayzer, and Thomasine Heitkamp. 2014. "Drilling Down: An Examination of the Boom-Crime Relationship in Resource Based Boom Counties" *Western Criminology Review* 15(1):3-17 (http://wcr.sonoma.edu/v15n1/Ruddell.pdf).

Drilling Down: An Examination of the Boom-Crime Relationship in Resource-Based Boom Counties

Rick Ruddell
University of Regina

Dheeshana S. Jayasundara
University of North Dakota

Roni Mayzer
University of North Dakota

Thomasine Heitkamp
University of North Dakota

Abstract: *The expansion in natural resource development in rural communities has led to a number of social problems in these places. The media, community stakeholders, as well as law enforcement and human service personnel have reported that the rapid growth in these communities leads to increased crime and other social ills. In order to better understand the boom-crime relationship, index crimes in oil and natural gas producing counties in Montana and North Dakota were examined. Comparison of 2012 crime rates in a matched sample of counties revealed that crime rates were higher in oil-impacted counties. A pre-post analysis found that violent crime in boom counties increased 18.5% between 2006 and 2012 while decreasing 25.6% in a matched sample of counties that had no oil or gas production. Inconsistent with the media portrayal of these communities as a new "wild west" we did not find a significant association between oil or natural gas production and property or violent crime in a series of OLS regression models. Missing crime data was a significant limitation in this study and precludes us from making any broad generalizations about the boom-crime relationship. Implications for further research are described.*

Keywords: boomtowns, resource-based booms, rural crime, boomtown effects

INTRODUCTION

The rapid population and economic growth associated with resource-based exploration and extraction has contributed to a number of social ills which have been called boomtown effects (Government of New Brunswick 2012). Unlike normal population growth, resource-based booms have resulted in the influx of young male newcomers who earn large salaries and have little stake in these communities (Ruddell and Thomas 2012). In some cases these workers drive-in and drive-out (DIDO) or fly-in and fly-out (FIFO) to their worksites and live in temporary housing or man camps that may house a thousand or more workers (White 2012). As a result of these demographic changes, there has been an imbalanced population sex ratio, a disruption in normal patterns of interaction (e.g., less informal social control or density of acquaintance – see Freudenburg 1984; 1986) and damage to the social fabric that may be criminogenic in small communities (Lee and Thomas 2010).

Prior research has shown that the rapid population growth linked with resource-based booms contributes to increased levels of antisocial behavior and crime in rural

Australia (Carrington and Pereira 2011; Scott, Carrington, and McIntosh 2012), Canada (O'Connor 2011; Ruddell 2011) and the U.S. (Archbold 2013; Montana All Threat Intelligence Center & North Dakota State and Local Intelligence Center [hereafter: MND Report] 2012; Perry 2007; Ruddell and Thomas 2012).[1] In addition, there are a growing number of studies that have shown that the quality of life decreases in these places due to non-criminal acts and problems with traffic. Boomtown residents report being fearful of dangerous or drunk drivers (Ruddell, Ortiz and Thomas 2013) and scholars have found that resource development can result in traffic congestion (Archbold 2013; Petkoba-Timmer, Lockie, Rolfe, and Ivanova 2009) and a greater number of accidents (MND Report 2012).

Law enforcement agencies in resource-based boom communities often find themselves stretched thin as demand for services increase (Archbold 2013; Ruddell 2011). The authors of the MND Report (2012: 2) noted that, "Increases in calls for service, arrests, index crimes, fatal and non-fatal motor vehicle crashes, and sexual offenders, as well as significant turnover and recruitment issues have exacerbated the challenges experienced by law enforcement agencies." There is less agreement on the magnitude of these changes and a number of investigators have reported that changes in levels of crime in boom counties were modest or not significantly different than in surrounding counties (Brown 2010; Forsyth, Luthra, and Bankston 2007; Kowalski and Zajac 2012; Luthra 2006; Luthra, Bankston, Kalich, and Forsyth 2007).

Although investigators have not reached a consensus on the degree to which resource-based booms influence antisocial behavior and crime, there is more agreement that this challenge will persist as the value of commodities increases and development intensifies around the globe. Technologies that enable horizontal oil drilling and hydraulic fracturing ('fracking') are also making it profitable to extract oil and natural gas from places that might not have been considered decades ago or oilfields thought to be exhausted. As a result, there will be a corresponding growth in exploration and extraction activities and they will be carried out in out-of-the-way places that may be vulnerable to boomtown effects.

Few rural or remote communities that have resource wealth possess the infrastructure for rapid industrialization and population growth. Morrison, Wilson and Bell (2012) observed that many local governments in small towns or counties do not have the capacity or expertise to respond to rapid social changes. Consequently, a lack of knowledge about boomtown effects and an inability to anticipate these impacts could result in lost opportunities to ameliorate these conditions. The Government of New Brunswick (2012) makes a compelling argument that increasing our knowledge of boomtown effects enables community leaders to anticipate these changes and implement strategies to mitigate the negative effects of this growth.

When it comes to boomtown effects, it is sometimes difficult to separate the true picture of what is actually occurring in respect to crime from media sensationalism. Over three decades ago, Wilkinson, Thompson, Reynolds, and Ostresh (1982: 275) observed that many claims about boomtown effects were based on "undocumented assertions, questionable interpretations of evidence, and superficial analyses." Empirical work has not established a clear boom-crime relationship in jurisdictions undergoing natural resource development. In order to respond to that gap in our knowledge, the current study focuses upon changes in levels of police-reported index crimes in oil impacted counties in the Bakken region, a shale rock formation that stretches across Western North Dakota and Northeastern Montana, and straddles the Canadian border. Media accounts about the Bakken typically report high levels of antisocial behavior, disorder and serious crimes (see for instance, Associated Press 2012; Daily Mail 2013; Eligon 2013; Ellis 2011). The question that guides this research is whether these perceptions of lawlessness are accurate. In order to carry out this study we first present the results from prior research on the boom-crime relationship, describe the data and methods used in our analyses, and discuss our findings following the analyses.

CRIME AND RESOURCE-BASED BOOMS

Investigators examining crime in resource-based boom communities have observed that social disorganization may increase during the early stages of a boom in rural areas (Dooley and Ruzicka 2012; Goldenburg 2008; Hanson and Limerick 2009; Hunter, Krannich and Smith 2002; Pooley, Cohen and Pike 2004; Shandro, Veiga, Shoveller, Scoble and Koehoorn 2011). Research suggests that this is largely the result of rapid population and economic growth associated with that industrialization. Few small communities have the infrastructure or leadership capacity to accommodate waves of rapid population growth, leading to a stage of crisis where local resources are strained by a number of social ills that the Government of New Brunswick (2012:5) identified as: crime, substance abuse, health problems and the stress placed on human service organizations and public services due to increased demand for services and an insufficient capacity to meet those demands. Some scholars contest that all boomtowns go through a phase of community upheaval and especially that crime always follows a boom. A number of researchers have found an inconsistent association between crime and resource development, or only minor increases in crime (Brown 2010; Forsyth et al. 2007; Kowalski and Zajac 2012; Luthra 2006; Luthra et al. 2007). The relationships between rapid population growth and crime due to natural resource development, however, could have different effects depending on community structure and

resilience to crime, the composition of the population (e.g., transient or long-term residents), the duration of the boom, and the nature of exploration or extraction activities within counties.

In terms of the Williston Basin (in Montana and North Dakota), the MND report (2012: 6) noted that the number of Part I Violent Index Crimes in oil producing counties increased by 121% from 2005 to 2011, although a comparison group of counties showed an increase of 98%. When the total Part I offenses were considered, the number of offenses in oil producing counties increased by 32% while the comparison group grew by five percent. Crime in some boom counties may ebb and flow as development evolves and community leaders are better able to respond to problems (Archibald 2006; Carrington, McIntosh and Scott 2010; Ruddell et al. 2013). Moreover the number of required workers decrease and populations stabilize (e.g., transient or temporary workers are replaced by long-term residents). Freudenburg and Wilson (2002) also remind us that extractive industries can run in cycles of boom and bust in response to the value of commodities, which also has an impact on county populations.

One of the challenges for justice systems officials today is that crime rates in some contemporary boomtowns have not stabilized. While the boom in the Bakken started between 2006 and 2008, crime rates are still increasing and Nowatzki (2014: 1) reported that "the number of criminal defendants charged in federal court in western North Dakota jumped by 31 percent in 2013 and has nearly doubled since 2011." In Fort McMurray, a Canadian boom town, crime rates were much higher than the provincial or national averages for decades (Ruddell 2011) and, although they have decreased since 2008, the crime severity index remains almost 50% higher than the national average (Ruddell et al. 2013).

While scholars question whether crime rates are proportionate to population growth, *perceptions* of crime shape feelings of safety and the quality of life (Ruddell et al. 2013). Researchers have examined the impacts of oil booms drawing upon the perceptions of community leaders (Anderson and Theodori 2009), service workers (Bohnenkamp, Finken, McCallum, Putz, and Goreham 2011; Heitkamp and Jayasundara 2012a; 2012b; Shandro et al. 2011) and community residents (Brasier, Filteau, McLaughlin, Jacquet, Stedman, Kelsey and Goetz 2011; Ruddell et al. 2013; Wynveen 2011). All of these investigators have reported a decreased quality of life and some have identified an increased fear of crime after these booms occur.

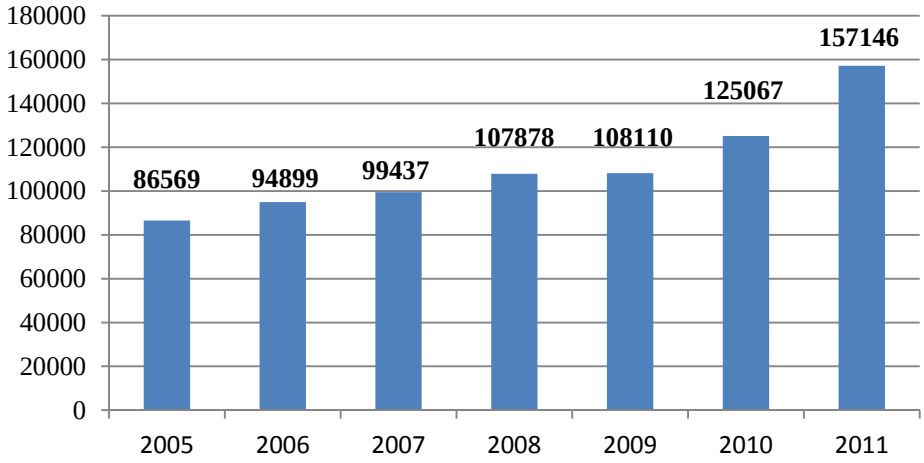
Archbold's (2013) interviews of police officers from the Bakken region mirror the perceptions of boomtown residents. One-third (33%) reported that community members were fearful of crime and those perceptions influenced their behavior (e.g., residents took more precautions to guard against crime). Over one-quarter (27%) of Archbold's respondents reported that community members expressed to them that their quality of life decreased after the boom. In terms of crime, officers overwhelmingly reported that alcohol-related offenses had increased, illicit drugs were more prevalent, property crimes and domestic violence had increased, and there were a growing number of traffic incidents, including accidents, driving under the influence (DUI), and hit and run offenses in their jurisdictions.

Given those findings, many indicators of crime, disorder or community dysfunction might not appear in the official crime statistics reported by the Federal Bureau of Investigation (FBI). The MND Report (2012: Table 25), for instance, reported that police calls for service increased by 82% between 2005 and 2011 in 22 county and police agencies in Montana and North Dakota oil producing counties (for which there were data for all seven years) and that data is presented in Figure 1. It must be acknowledged that these calls for service and arrest data are summed and mask the fact that some jurisdictions were stable while other counties experienced substantial growth. Not all studies of resource-based counties have produced similar results. Zajac and Kowalski's (2012) study of police calls for service in Pennsylvania oil producing counties showed a 33.8% increase between 2006 and 2010. While that difference might not have been statistically significant, responding to that growth in citizen demands for assistance presents meaningful challenges to law enforcement and other human service agencies.

It is plausible that boomtown offenses are dominated by offenses other than those reported in the Part I Uniform Crime Report (UCR) index crimes (homicide, aggravated assaults, rape, robbery, burglary, larceny and arson). Kowalski and Zajac (2012: 8-9) reported that the top five arrest classifications in Pennsylvania oil counties were non-aggravated assaults, DUI, disorderly conduct, all "other" offenses (except traffic) and larceny-theft. These investigators reported that the crime category with the greatest increase between 2006 and 2010 was DUI. Therefore, it is likely that increases in crimes in boom counties are driven primarily by the 21 Part II UCR offenses that are inconsistently reported to the FBI.

The MND Report (2012) also revealed that traffic accidents increased substantially in the 33 oil producing counties they examined, and from 2006 to 2011 the number of crashes increased from 5,696 to 8,972 (57.5%). Traffic fatalities in the oil producing counties increased 81% in North Dakota and 47% in Montana between 2006 and 2011 (MND Report, 2012 Tables: 48, 49). These statistical findings about traffic collisions validate the perceptions of civic leaders (Anderson and Theodori 2009), community residents (Ruddell et al. 2013) and police officers (Archbold 2013) about the dangers of increased traffic in resource-based boom communities.

***Figure 1*. Calls for Service, 2005 to 2011**
22 Montana and North Dakota Agencies



Some populations may be at elevated risk of victimization in boom communities. For example, Hunter and colleagues (2002) found that boom migrants and women expressed greater fear of crime than long-time residents or post-boom migrants; others have found that perceptions of social problems may change over a boom-bust cycle (Shandro et al. 2011). Female respondents in O'Connor's (2011) study of young people in a Canadian boomtown also expressed a greater fear of victimization than their male counterparts. Studies that examined the perceptions of human service agents (Heitkamp and Jayasundara 2012a; 2012b) and the police (Archbold, 2013) in the Bakken region found that incidents of domestic violence were increasing.

Altogether, the extant research reveals that the police in boom communities are expected to respond to a growing number of calls for services and that crime in some jurisdictions has greatly increased. Furthermore, while the media, and to some extent, the police are reporting that there are an increased number of serious and violent offenses, many of the crimes that are occurring may be common assaults, larceny, public order and traffic offenses. In order to shed light on whether UCR Part I crimes are associated with booms, we examine offenses reported in oil producing counties in the Bakken between 2006 and 2012.

DATA AND METHODS

This study examined crime, demographic, justice-system and economic characteristics for all 109 Montana and North Dakota counties. Data to conduct the analyses were obtained from the U.S. Census Bureau (2014), Bureau of Economic Analysis (2014), Federal Bureau of Investigation (2013) and the Montana and North Dakota state governments. In terms of methods, three analytical strategies were employed. First, crime rates in 26 oil producing and a matched sample of 26 non-producing counties were compared for 2012 using t-tests. Second, pre- and post-boom crime statistics were examined for 13 oil producing and a similar sized sample of non-producing counties between 2006 and 2012. Third, ordinary least square (OLS) regression was estimated to evaluate the contribution of oilfield activity on rates of police-reported crime. Two dependent variables, property and violent crime rates for 2012, were examined in those analyses. The names of the counties included in the different analyses are reported in Appendix A.

With respect to the selection of counties for the matching sample, all counties that had at least 20,000 barrels of oil production annually were included in the development of the database and this excluded several cases with very small annual oil production. Those counties were removed from the analyses as it was hypothesized that the activities associated with a limited number of oil wells would not make a meaningful contribution to population growth, crime or disorder. Five counties that had oil production in excess of 20,000 barrels per year were also excluded as crime data were not available. In terms of the 52 oil and non-producing counties, the two comparison groups had a total population of 505,868 residents, or 27.7% of the total population of the two states. The cases were matched on state and population size for 2012 using census data. Most of the counties had small populations, with an average size of less than 10,000 residents. Further examination of the county characteristics revealed that there were no statistically significant differences in the population size but that the oil producing counties had a higher rate of growth between 2008 and 2012. Furthermore, there were no significant differences in the proportion of males in the

county population or per capita personal income when the 2012 data from these counties were compared.

Similar to the analytical strategy employed by Kowalski and Zajac (2012), the second series of analyses examined levels of police-reported crime in the pre- and post-boom eras. This task was challenged by a lack of crime data for the entire seven years of the series, and we were left with only 13 oil producing counties matched to 13 non-producing counties from the original sample (consistent with the first set of analyses these counties were matched on state and population). In the analyses county-level crime data from 2006 to 2008 were contrasted against 2010 to 2012.

Last, a series of OLS models were estimated using total UCR property and violent crime rates in 2012 as dependent variables. While census data for all 109 counties were collected, the FBI (2013) only reported crime data for 102 counties for 2012. Of the seven counties for which crime data were not reported, five had high levels of oil production (over 20,000 barrels per year). Again, this is a limitation in this research as we do not have a true picture of the extent of police-reported Part I crimes in all of the oil producing counties.

In terms of the analytical strategy, a baseline regression model was created that included six independent variables and then three indicators of oilfield activity were added in subsequent models to determine whether oilfield activities were associated with index crime. The six independent (control) variables were selected on the basis of prior theoretical work on boomtowns identifying population change and instability (see Freudenburg, 1984; 1986). Two indicators of county population heterogeneity and change were included in the models; the change in the size of the White population between 2010 and 2012 (percentage) and the county population change between 2008 and 2012. Population stability was indicated by county residents who had lived in the same residence one year prior to 2012 and the percentage of owner-occupied homes. Consistent with studies of the structural covariates of violent crime (see McCall, Land, and Parker 2010) an indicator of resource deprivation (median household income) was also included in the baseline model. Last, because levels of crime were higher in Montana, we controlled for that difference by including a dichotomous variable for state.

It was hypothesized that there would be a significant association between oilfield activity and crime after controlling for demographic and county characteristics. Three variables of interest related to oil and natural gas production were examined using data retrieved from the Montana Board of Oil and Gas Production (2014) and the North Dakota Department of Mineral Resources (2014). The first indicator was oil production in barrels while the second indicator was natural gas production for 2012. As some counties had different volumes of natural gas or oil production, principal components analyses was used to create a single variable and this explained 96.4% of the variance between the two indicators (both gas and oil had equal weights of .982 in the component matrix). These three indicators were added to the baseline model to determine whether there was a significant association between oilfield activity and crime.

RESULTS

Part I Crimes in a Matched Sample of Counties

In the first set of analyses, Part I crime rates were compared between 26 oil producing counties and a matched sample of 26 non-producing counties. An initial examination of the county-level characteristics showed that these two groups of counties were very similar. There were no statistically significant differences between the counties in respect to population, per capita personal income, or proportion of males although the change in the population (percentage) between 2008 and 2012 in the oil producing counties was higher. Consistent with expectations, the results, shown in Table 1, demonstrated that levels of UCR reported property and violent crime in 2012 were higher in the oil and gas producing counties. With respect to violent crime the oil producing counties had a mean rate of 151.7 offenses per 100,000 residents whereas the rate for the matched sample was 124.2 offenses, which was 22.1% higher. Examination of property crimes revealed that property crime rates were 24.6% higher in the oil producing counties. Despite the fact that violent and property rates were higher in the oil producing counties t-tests revealed that those differences were not statistically significant.

Part I Crimes: Pre-Post the Boom

Several investigators have used pre-post research designs to examine crime prior to resource-based booms and after they occurred (Kowalski and Zajac 2012; MND Report 2012). The comprehensiveness of our analyses for the Montana and North Dakota counties, however, was limited by missing crime data. By examining seven years of Part I offenses from 2006 to 2012, almost one-half of the oil producing counties was lost due to missing data. Table 1 shows that the crime data were disaggregated into two temporal eras: 2006 to 2008 and 2010 to 2012. The selection of those dates is somewhat arbitrary as there is no universally agreed upon date for the onset of the boom and in some counties the population growth occurred earlier than in other places. The pre-post analyses revealed that levels of UCR violent index crimes were higher in the non-producing counties in the 2006 to 2008 era, but while they decreased by 25.6% in the post-boom era (2010 to 2012), violent index crimes increased by 18.5% in the oil producing counties. With respect to property crimes, in the non-producing counties, the rate decreased by 22.1% between the two eras, while in the oil-producing counties,

Table 1. **Oil Producing and Matched Sample of Montana and North Dakota Counties, 2012**

	Oil Producing Counties (n = 26)	**Matched Sample** (n = 26)	*p* value
	Mean (s.d.)	Mean (s.d.)	
UCR Crime Rates (2012)			
• UCR Violent Crime Rate	151.7 (145.8)	124.2 (104.1)	.438
• UCR Property Crime Rate	1,333.8 (878.1)	1,070.2 (771.7)	.256
County Characteristics			
• Population (2012)	9,883 (13,026)	9,572 (13,305)	.932
• Population change (2008-2012)	1.85% (1.62)	.13% (.80)	.000
• Per capita personal income (2012)	$54,387 (21,041)	$44,784 (13,839)	.058
• Male population (2012)	51.49% (1.89)	50.95% (1.03)	.205
Pre and Post Boom Comparison UCR Crime Rates (2006-2012)	Oil Producing (n = 13)	Non-Producing (n = 13)	
• Violent Crime Rate Pre-Boom (2006-2008)	313.9	511.5	
• Violent Crime Rate Post-Boom (2010-2012)	372.0	380.4	
• Percent Change: Violent Crime	+18.5%	-25.6%	
• Property Crime Rate Pre-Boom (2006-2008)	2,122.3	2,661.5	
• Property Crime Rate Post-Boom (2010-2012)	2,369.7	2,074.0	
• Percent Change: Property Crime	+11.7%	-22.1%	

there was an 11.7% increase. In order to put the pre-post boom change statistics into perspective, the FBI crime statistics from 2006 to 2012 for non-metropolitan counties of less than 10,000 residents for the entire nation showed an 11.1% decrease in violent crime and a 6.9% drop in property offenses.

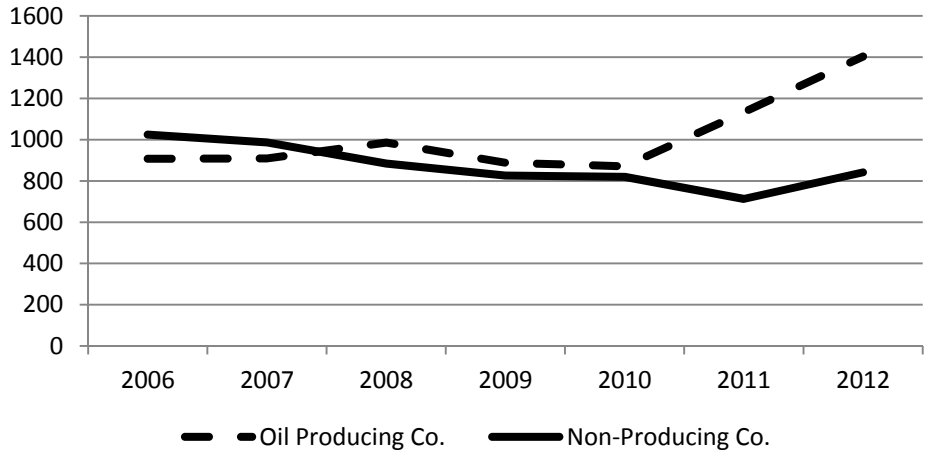
Figure 2 shows the changes in UCR Part I offenses between 2006 and 2012 in the 26 Montana and North Dakota counties. The trend shows the biggest increase occurred after 2010. Again, because of the missing cases and incomplete data, these results should be interpreted with some caution, as they are unlikely to present a true picture of the changes. These results are, however, consistent with the perceptions of law enforcement (Archbold 2013; MND Report 2012) and the human service personnel who respond to victimization (Heitkamp and Jayasundara 2012a; 2012b).

Multivariate Analyses

OLS regression was used to examine the relationships between oilfield activity and property and violent crime rates. Prior to these analyses bivariate correlations were conducted and these results are presented in Appendix B. The results revealed that the indicators significantly associated with violent crime were similar to those related to property crime and there was a strong relationship between the two dependent variables. Violent and property crime rates were significantly associated with the state variable (Montana had higher crime rates). With respect to the control variables, violent crime was negatively associated with changes in the White population. Violent and property crime were negatively related with population stability (persons who had been in the same home one year previously) and residential stability (owner occupied houses). Both dependent variables were positively associated with population change. While there was a positive relationship between median household income and property crime, that indicator had a non-significant relationship with violent crime. In terms of the indicators of oil and gas production, oil production was positively associated with violent crime, while natural gas production and the oil/gas factor had a positive relationship with both dependent variables.

Table 2 reports the results from the estimation of the OLS models. The first series of analyses reports the results from the four models examining violent crime. The baseline model was first estimated, and the three resource variables added in subsequent models. The initial model revealed a modest model fit, with an adjusted r^2 of .318 and Montana counties as well as population stability were

***Figure 2*. Total UCR Part 1 Offenses, 2006 to 2012 (n = 26 Counties)**



significantly associated with UCR violent crime. Each of the three indicators of oil and gas production was added in subsequent models, although none had a significant relationship with violent crime.

The second series of analyses, displayed in panel two of Table 2, shows the results using property crime as a dependent variable. Again, the baseline model reveals a modest model fit, with an adjusted r^2 of .310. Similar to the analyses reported above, population stability was negatively associated with property crime. These results also revealed a statistically significant association between median household income and property crime. Inconsistent with expectations, adding the resource related variables did not produce a statistically significantly association in the three subsequent models that were estimated.

Altogether, the results using three different methodological strategies reported above provided modest support for the proposition that crime is higher in oil producing counties and that crime increased after the boom. Inconsistent with expectations, there was not a significant association between oil and natural gas production and police reported property and violent crimes. There are a number of possible explanations for those findings, and they are highlighted below.

***Table 2.* OLS Regression of UCR Index Crime Rates in Montana and North Dakota Counties, 2012 (n = 103)**

	Violent crime					Property crime			
	Model 1	Model 2	Model 3	Model 4		Model 1	Model 2	Model 3	Model 4
	Baseline	Oil	Gas	Oil/Gas Factor		Baseline	Oil	Gas	Oil/Gas Factor
State	-.412***	-.417***	-.419***	-.419***		-.142	-.145	-.149	-.147
White population change	-.160	-.125	-.107	-.111		-.097	-.083	-.048	-.062
Same house 1 yr. ago	-.221*	-.227*	-.232*	-.230*		-.370***	-.372***	-.380***	-.377***
Population change	.103	.040	.005	.013		-.023	-.049	-.116	-.089
Owner occupied home	-.087	-.102	-.108	-.108		-.172	-.179	-.193	-.188
Md. Household Income	.153	.144	.145	.143		.264*	.260*	.256*	.257*
Oil Production		.102	-----	-----			.043	-----	-----
Gas Production			.153	-----				.144	-----
Oil/Gas factor				.139					.102
Constant	761.3	801.2	819.3	820.1		8093.2	8223.3	8520.2	8430.3
Adjusted r^2	.318	.314	.319	.317		.310	.303	.310	.306

* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

DISCUSSION

Prior research has demonstrated that calls for service, arrests, and traffic accidents increased substantially between 2005 and 2011 in oil producing counties in the Bakken region (MND Report 2012). Interviews with police officers and sheriff's deputies in these counties revealed that they are overworked and stretched thin (Archbold 2013) which is similar to the findings reported in Canadian boomtown research (Ruddell 2011). Those perceptions about crime and disorder are shared by the staff members of human service agencies who are often tasked with responding to those who were victimized (Heitkamp and Jayasundara 2012a; 2012b) and the media has echoed these perceptions (Associated Press 2012; Eligon 2013). The analyses conducted in this study revealed that UCR index crimes increased between 2006 and 2012 in oil impacted Montana and North Dakota counties, while in the matching sample of counties the number of crimes decreased during the same era.

Although the findings reported in this study support the perceptions of law enforcement, community residents and the media about the Bakken region as being impacted by crime, it falls short of the sensationalist label of a new "wild west." Almost every scholarly article ends with a call for further research, and since our knowledge about boomtown effects is under-developed we present a number of recommendations for future investigators. Perhaps the biggest obstacle to boomtown research is that tests of the boom-crime hypothesis are limited by a lack of longitudinal crime statistics. In this study, for example, five oil producing counties did not report any UCR statistics for 2012 and when a pre-post design was used to examine UCR data from 2006 to 2012 almost one-half of the oil producing counties were lost due to missing data. As a result, we made interpretations about the longitudinal boom-crime relationship based on only 13 of 35 (37%) oil producing counties in these two states.

The lack of information about crime and justice systems is not surprising given that many of the counties where natural resource development is occurring may have only a few thousand residents and gathering and disseminating crime statistics is not a priority for local government officials. This lack of complete information is exacerbated in tribal lands affected by booms as statistics from these agencies are inconsistently reported to the FBI (Indian Law & Order Commission 2013). The challenge is that if investigators find a clear and consistent boom-crime relationship it is likely that it will be established using calls for service, arrests, and Part II UCR arrest data for offenses such as "other" (simple) assaults, DUI, disorderly conduct, and drug possession. It is unlikely that these data will be readily available for these smaller counties due to a lack of infrastructure in these organizations to collect and disseminate this information. While this lack of data about crime is frustrating to academic researchers, the inability for smaller law enforcement agencies to accurately report their activities also makes it difficult for them to justify additional funding that would help respond to these offenses. Yet, given a choice, few sheriffs would hire a data analyst when the same funds could be used for another deputy or to replace aging equipment.

Crime statistics are also influenced by the practices of justice system personnel and organizational factors. It is possible that some offenses are handled informally whereas prior to the boom officers responded more formally. An officer in Archbold's (2013: 11) study stated that "Right now, we have to pick and choose arrestees. Years ago, we would arrest people in two seconds for things that we would not arrest for today. There is simply not enough room for everyone in the jail." As a result, the threshold for formal sanctions may have increased in some counties and such changes are not easily captured in quantitative methodologies.

A challenge – albeit a positive one for county residents – in the study of structural covariates of serious crime in rural communities is that these offenses rarely occur. In the 109 Montana and North Dakota counties, UCR violent crime data were missing for seven cases and 21 counties reported no violent crimes in 2012. A second obstacle of this research is that the factors that are correlated with serious crimes in urban areas, which is the focus of most criminological research, may be different than what occurs in the countryside (see Deller and Deller 2011; 2012; Donnermeyer and DeKeseredy 2014; Wells and Weisheit 2004). As a result, investigators might consider using variables other than census data in their analyses. Other indicators that might prove fruitful in future studies include indicators of disorder, such as admissions to domestic violence centers, traffic accidents, reports of truancy, referrals for child protective services, juvenile delinquency referrals and emergency room visits due to overdoses or assaults.

In addition to understanding the extent of crime in boom communities, our knowledge of who is actually committing these acts is also underdeveloped. While much of the crime increase has been attributed to newcomers we also have to acknowledge that some offenses are committed by local residents (Archbold 2013; Heitkamp and Jayasundara 2012a; 2012b). In addition, organized crime offenders and gang members are also drawn to boom communities to supply residents with illicit drugs, and the presence of human trafficking in Montana boom counties led to the enactment of new legislation in 2013 (Johnson 2013). Moreover, we have very little knowledge of the extent of juvenile crime in boom counties and how juveniles are adapting to booms since Freudenburg's (1984) seminal work (although see O'Connor 2011).

Last, there is a need to better understand the characteristics of communities that have mitigated boomtown effects. That endeavor might involve

developing indices of community functioning, social capital/reciprocity, or collective efficacy. Lee and Thomas (2010) argue that crime occurs more frequently in places with a weaker social fabric, and their work has a theoretical association with both social capital and social disorganization (see Deller and Deller 2012). Brown, Forsyth and Berthelot's (in press) study of the offshore oil industry suggests that community integration between newcomers and long-term residents can mediate the negative impacts of rapid population growth. In addition, the organizational responses of local governments may play a significant role in reducing boom-related harms. As such, identifying the community-level and government-related factors that contribute to lower dysfunction and crime rates should be a key goal of future studies.

CONCLUSIONS

Our analyses did not reveal a consistent statistically significant boom-crime relationship using UCR Part I data, although we noted several data-related challenges that contributed to that finding, and especially a lack of comprehensive county-level data and the inability to track Part II offenses in boom communities. The bane of a researcher's existence is a lack of valid data that enables one to properly investigate crime and the justice system responses to those offenses. As a result, we are often forced to work with the data that we have. This challenge is exacerbated in rural counties and tribal lands where data about crime and the responses to those acts is often missing or incomplete. As a result, investigators may have to use alternative methods of examining boomtown crime, including surveys, focus groups, and interviews of community members, service providers (including the police and other justice system officials) and representatives of the firms profiting from resource development. While these undertakings require a more significant investment in time and resources than analyses of secondary data, these mixed methods will provide the rich contextual information that enables academic researchers to better identify the boom-crime relationship and how it manifests itself in different communities. This research is an important first step in developing responses to mitigate boomtown effects.

Note

[1] Antisocial behavior refers to non-criminal but objectionable conduct, such as drunkenness and rude behavior that may be threatening or disturbing to others.

References

Anderson, Brooklyn J. and Gene L. Theodori. 2009. "Local Leaders' Perceptions of Energy Development in the Barnett shale." *Southern Rural Sociology* 24:113-129.

Archbold, Carol A. 2013. *"Policing the Patch": An Examination of the Impact of the Oil Boom on Small Town Policing and Crime in Western North Dakota*. North Dakota State University: Fargo, ND: North Dakota State University.

Archibald, Gerald. 2006. *Fort McMurray Quality of Life and Social Indicator Review*. Retrieved August 12, 2013 http://www.woodbuffalo.ab.ca

Associated Press. (2012). "Crime Booms in Montana, Dakota Oil Fields." Retrieved June 23, 2013 (http://missoulian.com/news/state-and-regional/crime-booms-in-montana-dakota-oil-fields/article_e15bd0d2-8d40-11e1-915d-0019bb2963f4.html)

Bohnenkamp, Shelby, Alex Finken, Emily McCallum, Audrey Putz and Gary A. Goreham. 2011. *Concerns of the North Dakota Bakken Oil Counties: Extension Service and Other Organizations' Program Responses to These Concerns*. Retrieved August 15, 2013 (http://www.ag.ndsu.edu/ccv/documents/bakken-oil-concerns)

Brasier, Kathryn J. Matthew R. Filteau, Diane McLaughlin, Jeffrey Jacquet, Richard C. Stedman, Timothy W. Kelsey and Stephan J. Goetz. 2011. "Residents' Perceptions of Community and Environmental Impacts from Development of Natural Gas in the Marcellus Shale: A Comparison of Pennsylvania and New York Cases." *Journal of Rural Social Sciences* 26:32-61.

Brown, Ralph B., Shawn F. Dorius and Richard S. Krannich. 2005. "The Boom-Bust-Recovery Cycle: Dynamics of Change in Community Satisfaction and Social Integration in Delta, Utah." *Rural Sociology* 70:28-49.

Brown, Timothy C. 2010. *Social Change, Social Capital and Civic Community: A Qualitative Study of the Long Term Effects of Industrial Restricting on a Coastal Community*. Unpublished Dissertation. Baton Rouge, LA: Louisiana State University.

Brown, Timothy C., Craig J. Forsyth, and Emily R. Berthelot. (in press). "The Mediating Effect of Civic Community on Social Growth: The Importance of Reciprocity." *The Social Science Journal*.

Bureau of Economic Analysis. 2014. *Interactive Data*. Retrieved Jan. 5, 2014 (http://www.bea.gov/itable/index.cfm)

Carrington, Kerry, Alison McIntosh and John Scott. 2010. "Globalization, Frontier Masculinities and Violence: Booze, Blokes and Brawls." *British Journal of Criminology* 50:393-413.

Carrington, Kerry and Margaret Pereira. 2011. "Assessing the Social Impacts of the Resources Boom on Rural Communities." *Rural Society* 21:2-20.

Daily Mail. 2013. "Welcome to the New Wild West: Inside the Once Sleepy North Dakota Backwater that has Become a New Boomtown – and a Den of Inequity – With Explosion of Oil Drilling." Retrieved August 17, 2013 (http://www.dailymail.co.uk/)

Deller, Stephen C. and Melissa W. Deller. 2011. "Structural Shifts in Select Determinants of Crime with a Focus on Rural and Urban Differences." *Western Criminology Review* 12:120-138.

------. 2012. "Spatial Heterogeneity, Social Capital, and Rural Larceny and Burglary." *Rural Sociology* 77:225-253.

Donnermeyer, Joseph F., and Walter S. DeKeseredy. 2014. *Rural Criminology*. New York: Routledge.

Dooley, Lisa and Rebecca Ruzicka. 2012. *Law Enforcement Survey on Domestic Violence and Sexual Assault*. Retrieved August 14, 2013 (http://www.minotstateu.edu/rcjc/pdf/LawEnforcementSurveyBrief.pdf)

Eligon, John. 2013. "An Oil Town Where Men are Many, and Women are Hounded." *New York Times*, Retrieved May 23, 2013 (http://www.nytimes.com/2013/01/16/us/16women.html?_r=0)

Ellis, Blake. 2011. "Crime Turns Oil Boomtown into Wild West." *CNN*. Retrieved August 17, 2013 (http://money.cnn.com/2011/10/26/pf/America_boomtown_crime/index.htm)

Federal Bureau of Investigation. 2013. *Crime in the United States, 2012*. Washington, DC: U.S. Government, Department of Justice.

Forsyth, Craig J., Asha D. Luthra and William B. Bankston. 2007. "Framing Perceptions of Oil Development and Social Disruption." *The Social Science Journal* 44:287-299.

Freudenburg, William. R. 1984. "Boomtown's Youth: The Differential Impacts of Rapid Community Growth on Adolescents and Adults." *American Sociological Review* 49:697-705.

------. 1986. "The Density of Acquaintanceship: An Overlooked Variable in Community Research?" *American Journal of Sociology* 92:27-63.

Freudenburg, William R. and Lisa J. Wilson. 2002. "Mining the Data: Analyzing the Economic Implications of Mining for Nonmetropolitan Regions." *Sociological Inquiry* 72:549-575.

Goldenburg, Shira. 2008. "Youth Sexual Behavior in a Boomtown: Implications for the Control of Sexually Transmitted Infections." *Sexually Transmitted Infections* 84:220-223.

Government of New Brunswick. 2012. *Chief Medical Officer of Health's Recommendations Concerning Shale Gas Development in New Brunswick*. Fredericton, NB, Canada: Government of New Brunswick.

Hanson, Jason L. and Patricia N. Limerick. 2009. *What Every Westerner Should Know About Oil Shale: A Guide to Shale Country*. Center of the American West, University of Colorado.

Heitkamp, Thomasine and Dheeshana Jayasundara. 2012a. *Social Work in a Time of Economic Change*, University of North Dakota Social Work Homecoming Event, Grand Forks, North Dakota.

------. 2012b. *Oil Boom in North Dakota*, Osher Lifelong Learning Institute (OLLI), University of North Dakota.

Hunter, Lori M., Richard S. Krannich, and Michael D. Smith. 2002. "Rural Migration, Rapid Growth, and Fear of Crime." *Rural Sociology* 67:71-89.

Indian Law & Order Commission. 2013. *A Roadmap for Making Native America Safer*. Los Angeles: Indian Law & Order Commission.

Johnson, C. (2013). "Montana attorney general spotlights human trafficking." *Missoulian*. Retrieved January 15, 2014 (http://missoulian.com/news/state-and-regional/montanaattorney-general-spotlights-human-trafficking/article_7049186e-378f-11e3-99b4-0019bb2963f4.html)

Kowalski, Lindsay and Gary Zajac. 2012. *A Preliminary Examination of Marcellus Shale Drilling Activity and Crime Trends in Pennsylvania*. University Park, PA: Justice Center for Research.

Lee, Matthew R. and Shaun A.Thomas. 2010. "Civic Community, Population Change, and Violent Crime in Rural Communities." *Journal of Research in Crime and Delinquency* 47:118-147.

Luthra, Asha D. 2006. *The Relationship of Crime and Oil Development in the Coastal Regions of Louisiana*. Unpublished dissertation. Retrieved Jan. 2, 2014 (http://etd.lsu.edu/docs/available/etd-06122006-133233/unrestricted/Luthra_dis.pdf)

Luthra, Asha D., William B. Bankston, DeAnn M. Kalich, and Craig J. Forsyth. 2007. "Economic Fluctuation and Crime: A Time Series Analysis of the Effects of Oil Development in the Coastal Regions of Louisiana." *Deviant Behavior* 28:113-130.

McCall, Patricia L., Kenneth C. Land, and Karen F. Parker. 2010. "An Empirical Assessment of What We Know about Structural Covariates of Homicide Rates: A Return to a Classic 20 Years Later." *Homicide Studies* 14:219-243.

Montana All Threat Intelligence Center and North Dakota State & Local Intelligence Center. [MND Report] 2012. *Impact of Population Growth on Law Enforcement in the Williston Basin Region.* Helena, MT: Author.

Montana Board of Oil and Gas Conservation. 2014. *Annual Production by County*. Retrieved January 10, 2014(http://www.bogc.dnrc.mt.gov/WebApps/DataMiner/Production/ProdAnnualCounty.asp)

Morrison, Tiffany H., Ceit Wilson, and Martin Bell. 2012. "The Role of Private Corporations in Regional Planning and Development: Opportunities and Challenges for the Governance of Housing and Land Use." *Journal of Rural Studies* 28:478-489.

North Dakota Department of Mineral Resources. 2014. *North Dakota Drilling and Production Statistics*. Retrieved January 10, 2014 (https://www.dmr.nd.gov/oilgas/stats/statisticsvw.asp)

Nowatzki, Mike. 2014. "Criminal Defendants in Fed Court Up 31 Percent in Western N.D. in 2013. *WDAY News*. Retrieved January 14, 2014 (http://www.wday.com/event/article/id/92257/)

O'Connor, Christopher. 2011. *Young People's Perceptions of Crime and Disorder in a 'Boomtown.*' Paper presented at the Annual Meeting of the American Society of Criminology Annual Meeting, November, San Francisco, CA.

Perry, John R. 2007. "The Effect of Energy Development on the Courts." *Wyoming Law Review* 7:321-332.

Petkova-Timmer, Vanessa, Stewart Lockie, John Rolfe and Galina Ivanova. 2009. "Mining Developments and Social Impacts on Communities: Bowen Basin Case Studies." *Rural Society* 19:211-228.

Pooley, Julie A., Lynne Cohen and Lisbeth T. Pike. 2004. "Can Sense of Community Inform Social Capital?" *The Social Science Journal* 42:71-79.

Ruddell, Rick. 2011. "Boomtown Policing: Responding to the Dark Side of Resource Development." *Policing* 5:328-342.

Ruddell, Rick, Natalie R. Ortiz, and Matthew O. Thomas. 2013. *Boomtown Blues: Economic Development, Crime and Decreased Quality of Life.* Paper presented at the Annual Meeting of the American Society of Criminology, November, Atlanta, GA.

Ruddell, Rick and Matthew O. Thomas. 2012. *Boomtown Policing: Fighting Crime and Disorder During a Resource Boom*. Paper presented at the Annual Meeting of the American Society of Criminology, November, Chicago, IL.

Scott, John, Kerry Carrington and Alison McIntosh. 2012. "Established-Outsider Relations and Fear of Crime in Mining Towns." *Sociologia Ruralis* 52:147-169.

Shandro, Janis A., Marcello M. Veiga, Jean Shoveller, Malcolm Scoble and Mieke Koehoorn. 2011. "Perspectives on Community Health Issues and the Mining Boom–Bust Cycle." *Resources Policy* 36:178-186.

U.S. Census Bureau. 2014. *American Fact Finder*. Retrieved August 15, 2013 (http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t)

Wells, L. Edward and Ralph A. Weisheit. 2004. "Patterns of Rural and Urban Crime: A County-Level Comparison." *Criminal Justice Review* 29:1-22.

White, Nancy E. 2012. "A Tale of Two Shale Plays." *The Review of Regional Studies* 42:107-119.

Wilkinson, Kenneth P., Robert R. Reynolds, James G. Thompson and Lawrence M. Ostresh.1982. "Local Social Disruption and Western Energy Development: A Critical Review (and Response)." *Pacific Sociological Review* 25:275-296.

Wynveen, Brooklyn J. 2011. "A Thematic Analysis of Local Respondents' Perceptions of Barnett Shale Energy Development." *Journal of Rural Social Sciences* 26:8-31.

Appendix A: Counties and Agencies Included in the Analyses

The 22 counties included in the analyses presented in Figure 1 were: Tioga Police Department (PD), McKenzie County (CO), Ward CO, Williston PD, Stark CO, Killdeer PD, Minot PD, Stanley PD, Dickinson PD, Grant CO, Burlington PD, Divide CO, Morton CO, Morton CO, Billings CO, Fallon CO, Prairie CO, Richland CO, Dawson CO, Glendive PD, Glasgow PD, Wolf Point PD, Baker PD.

Of the 52 counties included in the matching sample analyses, the 26 oil producing counties were: Billings (ND), Bottineau (ND), Burke (ND), Golden Valley (ND), McHenry (ND), McLean (ND), Mountrail (ND), Slope (ND), Stark (ND), Ward (ND),Williams (ND), Carbon (MT), Carter (MT), Dawson (MT), Fallon (MT), Glacier (MT), Musselshell (MT), Pondera (MT), Richland (MT), Roosevelt (MT), Rosebud (MT), Sheridan (MT), Teton (MT), Toole (MT), Valley (MT), and Wibaux (MT). The matched sample of 26 non-producing counties were: Adams (ND), Benson (ND), Dickey (ND), Grand Forks (ND), LaMoure (ND), Logan (ND), Morton (ND), Oliver (ND), Sheridan (ND), Stutsman (ND), Traill (ND), Beaverhead (MT), Blaine (MT), Broadwater (MT), Custer (MT), Deer Lodge (MT), Granite (MT), Jefferson (MT), Judith Basin (MT), Madison (MT), Mineral (MT), Phillips (MT), Prairie (MT), Sanders (MT), Stillwater (MT), and Sweet Grass (MT).

The 26 counties in the longitudinal analyses (matched sample) presented in Figure 2 were: Oil producing counties (n = 13) were: Bottineau (ND), McHenry (ND), McLean (ND), Ward (ND), Williams (ND), Dawson (MT), Glacier (MT), Roosevelt (MT), Rosebud (MT), Sheridan (MT), Stillwater (MT),Teton (MT) and Toole (MT). The 13 non-producing counties were: Dickey (ND), Stutsman (ND), Traill (ND), Blaine (MT), Broadwater (MT), Deer Lodge (MT), Jefferson (MT), Madison, (MT), Mineral (MT), Phillips (MT), Sanders (MT), and Sweet Grass (MT).

Appendix B: Correlations, Means, and Standard Deviations, Montana and North Dakota Counties, 2012 (n = 102).

	Variable	1	2	3	4	5	6	7	8	9	10	11
1	Violent Crime	-----										
2	Property Crime	.602*	-----									
3	State MT=1, ND=2	-.403*	-.152*	-----								
4	White Pop. Change	-.227*	-.157	.041	-----							
5	Same House last yr.	-.400*	-.524*	.164*	.009	-----						
6	Pop. Chng (2010-2)	.258*	.260*	.107	-.269*	-.273*	-----					
7	Owner Occ. Homes	-.314*	-.362*	.218*	.240*	.473*	-.215*	-----				
8	Median HH Income	.085	.238*	.395*	-.045	-.173*	.480*	.197*	-----			
9	Oil Production	.188*	.159	.207*	-.464*	-.051	.711*	.004	.463*	-----		
10	Gas Production	.212*	.190*	.183*	-.476*	-.043	.714	-.020	.427*	.930*	-----	
11	Oil/Gas Factor	.203*	.178*	.198*	-.479*	-.048	.725*	-.008	.453*	.982*	.982*	-----
	Mean	142.5	1242.5	1.49	-.109	87.7	.739	73.3	45,658	2,474.5	2,788.3	.000
	Standard Deviation	121.4	948.2	.50	.727	4.8	1.58	7.48	7,978	9,993.6	11,162.9	1.00

* $p \leq .05$

Data Sources: Crime data for 2012 were obtained from the Federal Bureau of Investigation (2013); county demographic data were obtained from the U.S. Census Bureau for 2012 and the Bureau of Economic Analysis. Oil and gas production data for 2012 were obtained from the states of Montana and North Dakota. Columns 9 and 10 are rounded and expressed in 1000's.

About the Authors:

Rick Ruddell is Professor and Law Foundation of Saskatchewan Chair in Police Studies at the University of Regina. He has authored, co-authored or edited nine books and 75 peer-reviewed articles, technical reports, book chapters, and articles in professional journals.

Dheeshana Jayasundara is an Assistant Professor in the Department of Social Work at the University of North Dakota. She received her Ph.D. in social work from the University Texas at Arlington. Her research interests include human development with a focus on reproductive health and crime and victimization of women.

Roni Mayzer is an Associate Professor in the Department of Criminal Justice at the University of North Dakota. She received her Ph.D. in criminal justice and developmental psychology from Michigan State University. Her research interests include developmental criminology, juvenile competency, corrections, and women in the criminal justice system.

Thomasine Heitkamp is an Associate Provost and Professor in the Department of Social Work at the University of North Dakota, where she has taught since 1983. Professor Heitkamp's expertise is in rural issues and education, with a background in child welfare and violence against women.

Contact information: Rick Ruddell, Department of Justice Studies, University of Regina, 3737 Wascana Parkway. Regina, Saskatchewan, Canada, S4S 0A2; Phone: (306) 337 854; Email: rick.ruddell@uregina.ca

Dheeshana S. Jayasundara, Department of Social Work, University of North Dakota, Grand Forks, ND 58202; Phone: (701) 777 4869; Email: dheeshana.jayasundara@email.und.edu

Roni Mayzer, Department of Criminal Justice, University of North Dakota, Grand Forks, ND 58202; Phone: (701) 777 2078; Email: roni.mayzer@email.und.edu

Thomasine Heitkamp, Department of Social Work, University of North Dakota, Grand Forks, ND 58202; Phone: (701) 777 4950; Email: Thomasine.heitkamp@email.und.edu