# Women Arrested for Domestic Violence:
# Unintended Consequences of Pro and Mandatory Arrest Policies[1]

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**Abstract**

*Domestic violence is a major social problem worldwide.   In the United States, the failure of communities and police departments to intervene resulted in a push to adopt and implement pro and mandatory arrest policies for domestic violence.   These policies have led to an unexpected increase in the number of arrests of women. Competing explanations have been offered.   This paper describes the development of a system dynamics model of women arrested for domestic violence.   Results suggest that these policies may have created or strengthened a crossover mechanism that shifts the risk of arrests in domestic violence cases from men to women.   Model analysis demonstrates how the changing role of cooperation between advocates and police can help explain the trends in women arrests.   Implications for research and policy are discussed.*

Keywords:  domestic violence, mandatory arrest, criminal justice response, women

## 1.      Introduction

Domestic violence is a major global problem with women reporting a lifetime prevalence rate of physical abuse by intimate partners between 10% and 52% (World Health Organization 2005).  In the United States, 25% of women report having been raped or physically assaulted by an intimate partner during their lifetime (Tjaden and Thoennes 1998). Battering[3] involves a constellation of tactics, including emotional abuse, isolating the victim from resources, preventing her from getting or keeping a job, coercion and threats of violence, rape, and murder. Abusers use battering tactics to keep or delay a woman from leaving an abusive relationship, with violence continuing and often escalating after she leaves.  In a Michigan study, 37.4% of the women with one or more violent partners said that the violence continued after separation and 45.6% indicated that the violence *increased* (Largo et al. 1999).

Prior to the modern battered women's movement in the United States, communities were reluctant to apply criminal law to intimate partner violence (Fagen 1996; Schechter 1982; Mullender 1996).  Most took what Pence and McDonnell (1999) describe as a *lasses-faire* approach in police and court responses.  In an effort to make effective assistance available to women in danger, advocates for battered women argued for increased involvement by the criminal justice system, which gained empirical support from Sherman and Berk's (1984) widely publicized Minneapolis Experiment of arrest policies and specific deterrence effects.

While the replication studies of arrest policies were mixed in their outcomes (for a summary, see Zorza and Woods 1994), the results from the Minneapolis Experiment study were used along with several large lawsuits and pressure from advocacy groups to pass laws requiring police departments to develop written policies on domestic violence arrests (Davis, Smith, and Nickles 1998).  Today, more than 91% of police departments have a written policy for domestic

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[3] In order to make the distinction between the single event and pattern within this paper, abuse will refer to a specific behavior while battering will refer to a pattern of abusive behaviors over time. Abusive behaviors include physical abuse, sexual abuse, emotional abuse, economic abuse, destruction of property, coercion, and threats. Battering refers to an ongoing pattern of abusive behaviors. Domestic violence includes both abuse and battering.  Men who batter will refer to men who use tactics of abuse and battering against their intimate partners (Pennsylvania Coalition Against Domestic Assault 1992, Section K. Definitions). Hence, the terms 'male batterers', 'batterers', 'abusers', and 'assailant' will be used interchangeably to refer to adult men (ages 18 and over) who batter women.

violence arrest, with 17% having a pro-arrest policy and 72% a mandatory arrest policy (Kickman and Reaves 2003). Pro-arrest policies encourage police officers to make a warrantless misdemeanor arrest when responding to calls if there is evidence of domestic violence (e.g., broken glass, over turned furniture, bruises or scrapes on a person). Mandatory arrest policies require police officers to make an arrest.

Pro and mandatory arrest policies were expected to increase the safety of battered women and accountability for male batterers (Miller 2001). While the increase in men arrested for domestic violence was expected, the disproportionately greater increase in women arrested for domestic violence was not (Hirschel and Buzawa 2002). Women now represent nearly 20% of the intimate partner related arrests (Durose et al. 2005). This has serious negative consequences for victims including disempowerment, losing custody of children, and revictimization (Das Dasgupta 2002; McMahon and Pence 2003; Mills 1998; Osthoff 2002; Hirschel and Buzawa 2002; Rajah, Frye, and Haviland 2006; Miller and Meloy 2006).

A variety of potential explanations have been offered in the literature including increases in women's use of force against intimate partners, men becoming less violent, men manipulating the criminal justice system, a more egalitarian criminal justice system, constraints on the criminal justice system to effectively respond to social problems, and "net widening" (DeLeon-Granados, Wells, and Binsbacher 2006). As applied to women arrested for domestic violence, net widening refers to the effect where more women are arrested because pro and mandatory arrest laws effectively lower the threshold for making an arrest. Considerable empirical evidence suggests that juvenile and criminal justice reforms such as diversion and treatment programs have resulted in net widening, gradually pulling in cases that would otherwise not been in the system to begin with (Blomberg 1995).

The consequences of women arrests and variety of potential explanations has placed an urgency to develop a more contextual and ecologically oriented understanding of women's use of force in domestic violence and women being arrested for domestic violence (Renzetti 1999; DeLeon-Granados, Wells, and Binsbacher 2006; Swan and Snow 2006, 2002). These accounts include attending to situational factors that help explain women's use of force and to the organizational dynamics driving the rise in women arrests.

In this paper, we describe a system dynamics model of women arrested for domestic violence. The paper is organized as follows. Section 2 summarizes the literature on women's use of force and consequences of women arrested for domestic violence. Section 3 describes the development of the model including the structure and data sources. Section 4 presents the system behavior used to test the model. Section 5 discusses the validation of the model using both numerical data and qualitative data from key informant interviews. Section 6 presents the results from behavioral analysis of the model. Section 7 concludes with a discussion of the results and their implications for policy, research, and practice.

## 2.      Background

The effects of mandatory arrest policies on battered women are mixed. These concerns range from needing to develop a better understanding of women's use of force to lack of court mandated programs for women and the impact of women being arrested on child custody and child abuse and neglect investigations. This section begins with a discussion of women's use of force and then considers some of the effects on women of being arrested for domestic violence.

2.1.    Women's Use of Force

Whereas battering is generally recognized by researchers and scholars of domestic violence as an ongoing pattern of coercion and control, the criminal justice response is largely organized around single incidents (Hirschel and Buzawa 2002). From the perspective of the police response, women are arrested because there is sufficient evidence of her use of force to warrant the arrest. This incident-based focus on meeting criteria set forth in the criminal justice codes and mandatory arrest polices prevents police from factoring in the context surrounding a person's use of force. Several researchers and scholars have drawn attention to this problem by seeking to understand women's use of force more broadly than the narrow criminal definition in domestic violence (e.g., Miller and Meloy 2006; Renzetti 1999; Osthoff 2002).

While it has often been acknowledged that women do use force in self-defense, there has been a general reluctance to understand women's agency in using force beyond an imminent threat (Renzetti 1999). Conceptually, use of force in intimate partner relationships includes everything from a single hit to an ongoing pattern of behaviors including threats, intimidation and emotional abuse. Only the last would constitute battering. Failure to recognize this distinction leads to conflating women's use of force in self-defense or in response to an ongoing pattern of battering with battering by women. This contributes to the misleading conclusion that women and men are engaged in "mutual combat" (Osthoff 2002) and that the arrest of women reflects a previously hidden population of women batterers.

Where women tend to use force defensively or to regain control, men who are arrested for domestic violence use force to establish and maintain control over their partners (Das Dasgupta 2002).  Numerous studies have found women to differ from men in their motivations for using force.  Women's motivations include self-defense, fear, defense of children, control, retaliation, showing feelings that cannot be expressed in words, and provocation or being "pushed over the edge" by her partner (Swan and Snow 2006; Stuart, Moore, Hellmuth et al. 2006).

Numerous studies also support the interpretation that women's use of force in the context of domestic violence operates defensively and in response to battering behavior.  Studies have found a high co-occurrence of domestic violence victimization with women's use of force (for a review, see Das Dasgupta, 2002).  Men who were arrested for domestic violence are more likely to have violated personal protection orders and had previous contact with police for domestic violence than women (Henning, Jones, and Holdford 2003).  Women are also much more forthcoming about their use of force in contrast to men, increasing the likelihood that they as opposed to the male abuser would be arrested by police (Larance 2006; Rajah, Frye, and Haviland 2006).  A common experience reported in the literature is that women cooperating with the police investigation and being honest about their own actions expect that police officers are going to help them, and are therefore shocked by their own arrest (Rajah, Frye, and Haviland 2006).  Thus, while small fraction of domestic violence cases involves women battering men or other women, research suggests overall that the increasing numbers of women arrested for domestic violence are largely women victims of battering.

2.2.    Mental Health

A number of studies have noted the higher co-occurrence of mental health needs related to trauma in women arrested for domestic violence, which would be consistent with ongoing patterns of victimization in a battering relationship. For example, Henning et al (2003) found that

women arrested for domestic violence have higher needs for mental health services than men arrested for domestic violence. Stuart et al (2006) found that women arrested for domestic violence experienced higher rates of mental illness, as well as high rates of sexual and psychological abuse by partners. These studies have generally not distinguished between the mental health needs arising from victimization, the arrest experience, and pre-existing mental health conditions. This has contributed to a body of research arguing for specialized batterer treatment programs for women that address these mental health needs, instead of more critically considering how these needs may have resulted from the victimization experience or been exacerbated by the arrest experience.

2.3.    Disempowerment

Pro and mandatory arrest policies can function to disempower victims even if the batterer is arrested. One of the main criticisms of mandatory arrest policies for domestic violence has been the loss of decision making power women experience in the police and prosecutorial response (Rajah, Frye, and Haviland 2006). A primary concern is that with mandatory arrest, a victim's ability to choose whether an arrest is the best course of action is taken away (Danis 2003; Humphries 2002). The decision to take action against the abuse and leave an abusive partner is complex and does not necessarily result in an end to the suffering. The certainty of arrest may deter women from calling the police in a time of danger, especially if the arrest of a husband or partner will result in serious consequences to the family, such as bringing shame upon the family, loss of income, involvement with the child welfare system, being ostracized from communities, deportation of husband, or retaliation by the abusive partner (Menjivar and Salcido 2002; Shim and Hwant 2005; Mills 1999; Danis 2003; Zanipatin et al. 2005). Abusive behavior and violence continue and may even be heightened when a battered woman takes action to end an abusive relationship (Fleury, Sullivan, and Bybee 2000; Barnett 2000).

Women who are arrested are also isolated from needed supports. Women become less likely to seek assistance from police or other social services, and are therefore less likely to report continued victimization. Those who do seek assistance subsequent to arrest may find that their arrest record disqualifies them for services. Women who have been arrested are also less likely to seek assistance from police or seek assistance from social services as a consequence of the arrest decision, and therefore less likely to report continued victimization. Victims of domestic violence that have been arrested lose access to transportation, shelters and temporary housing, personal protection orders, victim assistance, and counseling and empowerment programs along with missing work, risk of deportation, increased economic hardship, and losing custody of children (Hirschel and Buzawa 2002; Humphries 2002). The result is that by increasing the state's ability to hold batterers accountable and provide for women's safety through changes in the criminal justice system, many victims of battering now have less legal protection, fewer services, and are sometimes inaccurately labeled as a suspect, defendant, or perpetrator (Miller and Meloy 2006).

In addition, low income communities, immigrants and communities of color are disproportionately affected by the unintended consequences of mandatory arrest policies (Mills 1999; Chesney-Lind 2002; Houry and Kellermann 2005). In some communities, women are more likely to use force to fight back, placing them at greater risk as being seen as an unsympathetic victim (Miller and Meloy 2006; Swan and Snow 2006, 2003). There is also the greater isolation associated with recent immigration as women are separated from extended families and support in their countries of origin (Swan and Snow 2006). These factors

underscore the need to develop accounts that understand women's use of force and domestic violence arrests contextually (Osthoff 2002; Renzetti 1999).

Understanding women's use of force and arrests contextually requires us to understand the underlying causal story. In this paper, we seek to understand how the pattern of women arrested for domestic violence develops over time in terms of specific feedback mechanisms. Our main research question is: Which mechanisms account for the dynamics of women arrested for domestic violence?

## 3.       A System Dynamics Model of Domestic Violence Arrest

The system modeled is a community implementing a mandatory domestic violence arrest policy. The simulation model and documentation are available from the first author and can be run on the personal learning edition (PLE) of Vensim (2006), available at no cost at www.vensim.com. The model itself was developed using Vensim DSS Version 5.6a.

### 3.1.    System Structure and Behavior Data

Basic model structures such as the aging chain of a domestic violence case were based on authors' understanding of the criminal justice processes related to domestic violence. Forrester points out that direct observational experiences of a system are some of the richest sources of information (Forrester 1980). The authors have more than 24 years of combined experience in the domestic violence movement researching, volunteering, serving on non-profit boards, working as staff or program director, and developing programs across five different communities in the United States. While direct experience in a system provides an invaluable source of knowledge of key structures, assumptions must be checked and hypotheses tested against other participants' perceptions of the system and as well as numerical data whenever possible.

A better understanding of system behavior and structure came through comparison of model structure and behavior against qualitative and quantitative data from an earlier study of the impact of mandatory arrest. The study followed a single case study research design (Yin 1994) of a rural Midwestern community over a four year period from 1998 through 2002. The community had a population of approximately 60,000 people that was 95% percent non-Hispanic white with median household income of approximately $37,000 and 10% of the population living below the poverty line. The initial model from the study pointed to coordination of services and the risk to clients as important structures to consider.

Key informant interviews from the study were used to confirm or disconfirm community trends and assess the initial model structure. Key informants also suggested structures that needed to be included in the model such as cooperation. For example, the initial model did not include coordination of services as a mechanism. However, key informants accounts of changes in the community identified coordination as an important mechanism that needed to be included in the model.

Informants were selected using snowball sampling, and included on the basis of their expertise with domestic violence. Snowball sampling is a method that uses data from one participant to identify additional participants. Two initial contacts were made to a domestic violence coalition coordinator and assistant prosecuting attorney. A total of seven interviews were conducted with 5 key informants. Three of the key informants had victim advocacy positions, while the other two key informants worked for the prosecutor's office. All 5 key

informants had attended a variety of domestic violence trainings, and had between 4 and 10 years of experience working with victims of domestic violence.

The numeric behavior data came from the prosecutor's office violence against women database.  In 1998, the community received funding for a domestic violence prosecution unit. This allowed the prosecutor's office to maintain a database on violence against women that included arrest warrants for domestic violence.  Each record included information on the name of the suspect, victim, victim-offender relationship and demographics along with other variables describing the circumstances of the arrest, use of force, and dates of critical events (e.g., arrest, authorization of warrant, court, disposition).  The resulting sample covered 1,455 domestic violence related arrests from January 1, 1998 through December 31, 2001 involving 2,050 individuals.  For the purpose of modeling, we selected a subset of cases that were clearly identified by their victim-offender relationship as domestic violence.  For example, cases that included victim-offender relationship of wife-ex-husband or girlfriend-boyfriend were included. Cases that involved daughter-father, sister-brother, or wife-brother-in-law were excluded. This yielded 522 incidents involving 417 individual suspects.  These data were used to generate time series of first and repeat arrests by victim-offender relationship and gender.

These time series were triangulated against other data in the community and found to be consistent in their general trends.  For example, we asked all key informants what if any trends they had observed in their community.  If they mentioned changing trends such as increasing arrest of women that had since been improving, then we inquired about when they noticed those changes.  We also compared key events against public documents and other longitudinal data such as personal protection order petitions.

## 3.2.    Units of Analysis

There are a number of ways that one might consider the units of analysis in domestic violence, from incidents and arrests to individuals, intimate partners or couples, families, and households.  In this model, the units of analysis are intimate partner relationships.  Theoretically, either or both parties could be arrested for domestic violence.  However, policies and laws that require police officers to screen for the primary aggressor eliminated the possibility of dual arrests.  So at any given time, cases of domestic violence have only men or women at risk of arrest in a heterosexual relationship, but not both.

## 3.3.    Model Structure

This section describes the resulting system dynamics model of women arrested for domestic violence. The model represents domestic violence cases moving through three risk categories of arrest in the criminal justice system.  Each risk category is represented by a stock. In Figure 1, domestic violence cases enter the system from the bottom when the abuse has escalated to the point of criminal behavior where police can make an arrest.  In the real system this flow is driven by all the factors that contribute to the onset and escalation of domestic violence by men (e.g., exposure to domestic violence as a child, substance abuse, attitudes toward women).  Cases can leave the system from *Cases exiting with men at risk and no priors, Cases exiting with men at risk and priors,* and *Cases exiting with women at risk and no priors* through cessation of domestic violence (possibly from counseling) or leaving the jurisdiction. Calibration of the model resulted in no *Cases entering with women at risk of arrest*. The

remainder of the discussion will therefore assume that cases of domestic violence only enter the system with men at risk of arrest.

**Figure 1**

Stocks and Flows in a Domestic Violence Model
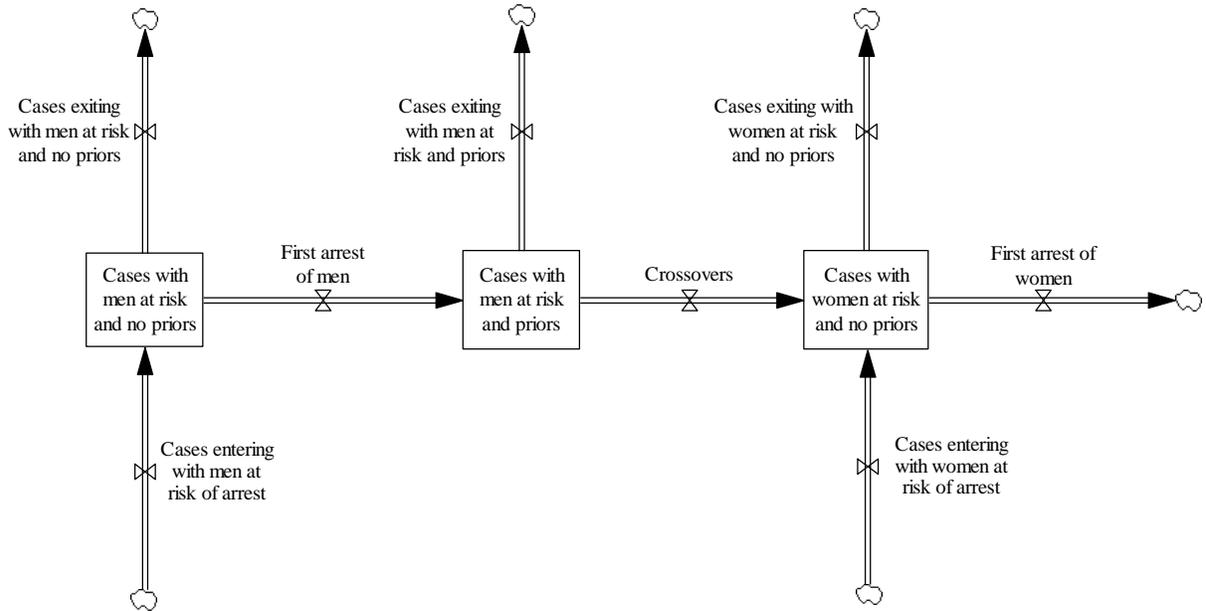


The three stocks are related through a system of feedback mechanisms represented by the causal loop diagram in Figure 2. The main reinforcing feedback mechanism is cooperation (R1 in Figure 2). The arrest of women decreases cooperation, which leads to a reduction in the amount of positive and effective communication between police and victim advocates. This increases the risk or hazard rate ratio (HRR) of crossovers represented by *HRR of cooperation on crossovers* in Figure 2, which increases the number of crossovers and leads to further increase in women arrested for domestic violence. Similarly, a decrease in women arrests will lead to improved communication and the lower risks of cases crossing over from men at risk to women at risk. This will result in fewer women being arrested and reinforce the trend toward improved cooperation and communication between victim advocates and police.

There a number of balancing feedback mechanisms shown in Figure 2. Feedback loop B1 represents general deterrence for first arrests, and B2 represents general deterrence for repeat arrests. Mandatory arrest policies are partly motivated by the expectation that these two feedback mechanisms will dominate the behavior of the system. Feedback loops B3 and B10 represents the effect of cooperation on cases of domestic violence being reported to police and leading to first and repeat arrests respectively.

**Figure 2**

Major Feedback Loops Related to Risk Categories
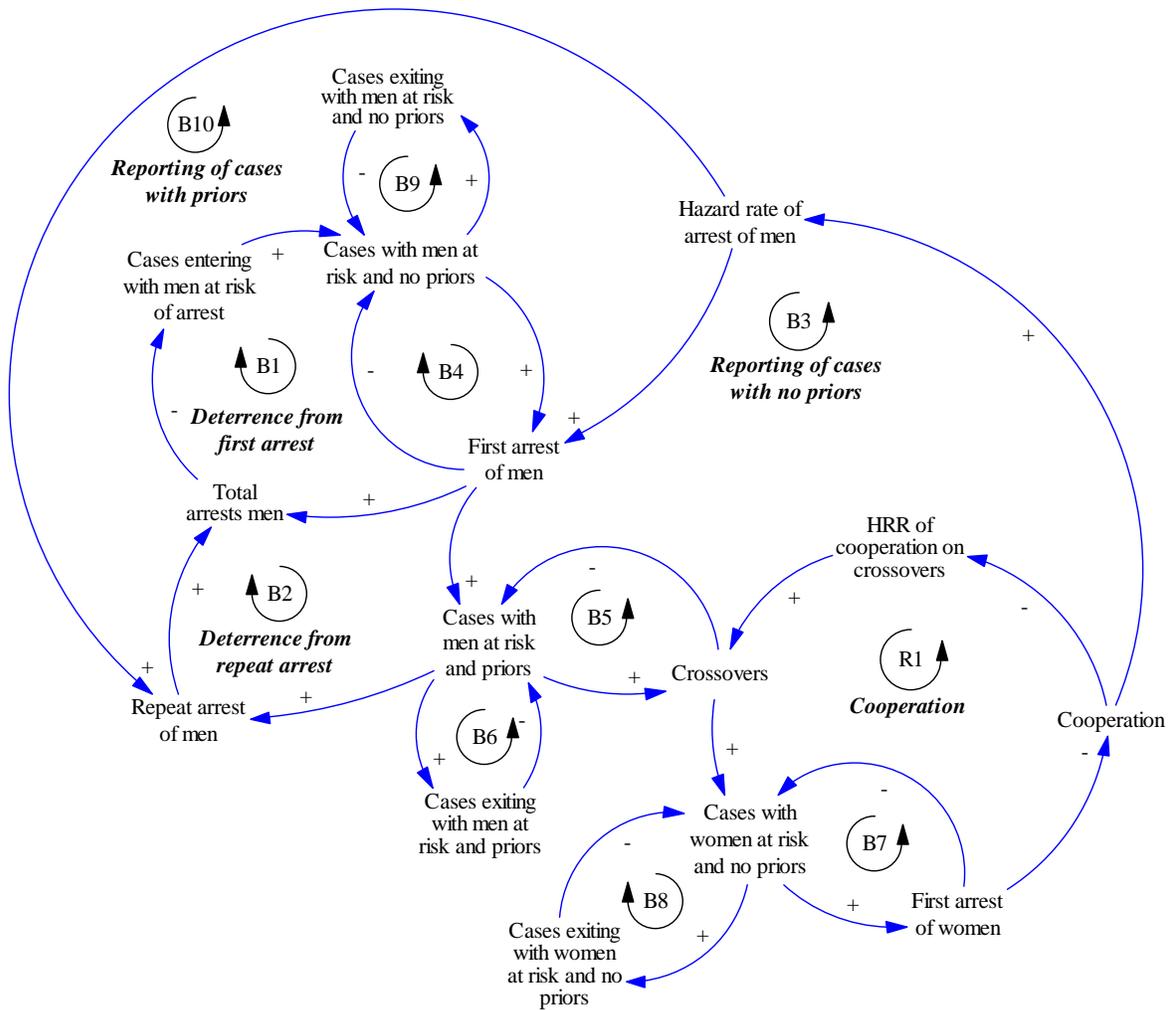


There are six balancing feedback mechanisms regulating the number of cases leaving a risk category (B4, B5, B6, B7, B8, and B9 in Figure 2). These represent the underlying logic of the system that cases cannot transition out of a risk category if there are no cases in the category to begin with. For example, in B4 the more cases there are with men at risk of arrest and no priors, the more first arrest of men there will be. With each arrest, there is one less case that is still at risk. Thus the effect of first arrest of men is to lower the number of cases with men at risk and no priors. An economically austere view of systems would try to reduce all social phenomena to this logic. While this would be wrong because behavior of social systems and services are often better explained by the perceptions and policies of decision makers, sometimes it is this logic of constraints that drives system behavior. For example, the decline of first arrest of men (see Figure 3) can be understood strictly in terms of the balancing feedback mechanism B4 as a draining process. In contrast, the first arrest of women cannot be accounted for through this simple mechanism and requires a more complicated structure.

**4.      System Behavior**

**Figure 3**

Trends of First Domestic Violence Arrests by Gender of Suspect
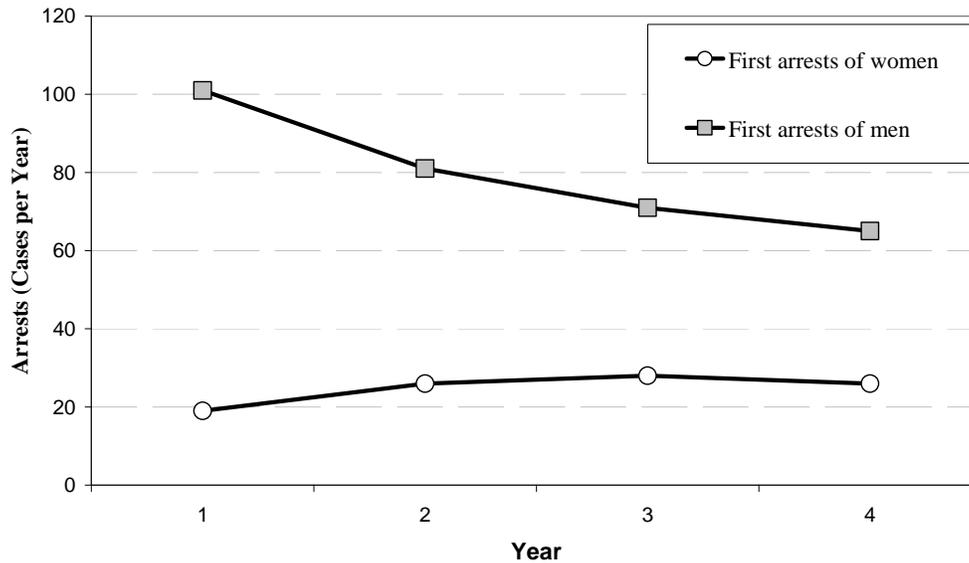


Figure 3 shows the system behavior of first and repeat arrests from the prosecutor's database.  Numeric values and percentages are listed in Appendix A, Table 1. Domestic violence arrests of women increased from 15% of all domestic violence arrests in year 1 to 27% in year 4. Meanwhile, the number of men arrested dropped monotonically from 85% to 73% over the same period.  Figure 3 shows the trends for the first domestic violence arrests by gender of suspect

**5.      Model Validation**

The complexity of the changes in system conditions being modeled (e.g. shifting locus of risk) and newness of the application of system dynamics to the issue of domestic violence make model validation particularly important.  Using several tests described by Sterman (2000), the model was tested for structural similarity to the system structure, consistency, reasonableness of behavior, and similarity of model behavior to system behavior.  Confidence in the similarity of the model structure to the system structure was increased by the inclusion of key mechanisms. Two of the model structures considered to be of particular importance and therefore in need of validation were cooperation mechanisms and the hypothesized crossover of cases from *men at risk* to *women at risk*.  For example, cooperation emerged as a central theme in key informant interviews:

- Three key informants explained how the relationship between the domestic violence shelter and police department deteriorated from year 1 to year 3 over the police departments handling of domestic violence cases.  One elaborated that this had to do with the fact that the police department would arrest women who the shelter knew to

be victims of domestic violence. The conflict peaked in year 3 with a standoff between the local police and shelter. The fallout forced the resignation of both the police chief and executive director of the shelter. Key informants' accounts of this conflict were corroborated with public documents.

- Several key informants shared how changes in the leadership of both the police department and domestic violence shelter in year 3 started a new sense of cooperation and access to police officers. With an increased cooperation and access, advocates started working with police officers on a case-by-case basis after a victim was arrested. These conversations focused on helping officers understand the dynamics of domestic violence and identify victims in the future.

- Key informants also explained how the prosecutor's office started in year 3 to have one assistant prosecuting attorney handle all of the domestic violence cases with the exception of sexual assaults. This improved communication and cooperation between the prosecutor's office and victim advocates in the domestic violence shelter, which made it much easier for victim advocates to respond quickly in cases where the victim had been arrested and share information with the assistant prosecuting attorney.

Similarly, we gained confidence in the crossover mechanism through the key informant interviews. For example, several key informants explained how the batterers' initial contacts led to an increased risk of victims becoming suspects in subsequent investigations:

- One informant shared how in talking with women who had been arrested, victims took matters into their own hands because nothing came from the previous arrest or the batterer provoked the victim. For example, the "Perps [perpetrators] will say, 'Hit me, this time you're going down [to jail].'" When the police arrive and ask what she did, she would say "Yeah, I pushed him" and then get arrested.

- Another informant pointed out that if we were concerned about batterers manipulation of criminal justice professionals, then we should also be concerned with they way they manipulate social workers in child protective services. For example, the batterer would initially be the one investigated for child abuse, but after the initial investigation he would brag to the victim about how he now knew how to get the children taken away from the victim.

Because we had individual level data with identifiers in the prosecutor's violence against women database, we were also able to test the existence of the crossover mechanism using statistical relationships. The stock-flow structure in the model supported by key informant accounts would entail two service pathway hypotheses that we could test: (1) women suspects were more likely than men to appear as victims in an earlier incident, and (2) this effect would be stronger in cases clearly identified as domestic violence. Chi-square tests were used to compare the expected frequencies of women's pathways through criminal justice system with men's pathways. Women suspects were more likely than men to enter the system initially as victims with nearly 37% of women suspects appearing initially as victims in an earlier incident versus 7% of men (Phi = 0.26, Chi-Square (1,1128) = 77.4, $p<0.001$).

Next, the strength of association between gender and pathway was considered for cases with clear domestic violence (victim-suspect relationship identified as current or former spouse or boyfriend/girlfriend). Within this subset of adult domestic violence cases, 32% of women appeared as victims in previous cases versus 6% of men (Phi = 0.35, Chi-Square (1,445) = 53.9, p<0.001). Phi increased from 0.26 to 0.35 indicating cases clearly identified as domestic violence had a stronger association between victim status from the first incident and gender. These results were corroborated by inspecting the tactics arresting officers reported being used and comparisons of dispositions from prosecution. This provided support for the existence of a crossover mechanism where cases with men at risk of arrest crossed over to being cases with women at risk of arrest.

**Figure 4**

Comparison of Model Simulations Against System Behavior
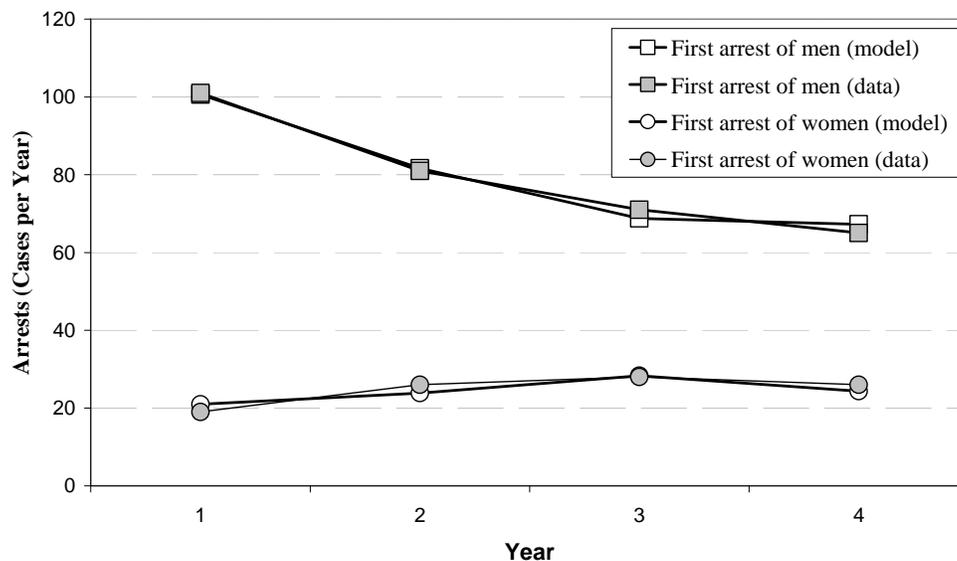


It is important to emphasize that the use of statistical tests here was to empirically test hypotheses identified through the modeling based on key informant interviews as opposed to simply testing the fit of a model against data. That is, we had an initial model that was wrong according to key informant interviews. The interviews suggested a crossover mechanism. The existence of a crossover mechanism would imply two hypotheses about pathways. We then tested these hypotheses and found independent support for the existence of a crossover mechanism in this community.

Other standard tests of the validity of system dynamics models were also used. Equations were reviewed for consistency with key informant interviews and the model uses a consistent set of units. The model also generates reasonable behavior over a wide range of exogenous parameter values. For example, the model reproduces realistic qualitative behavior patterns of arrests over a wide variation of values for *Effect size of arrest intervention, Effect size of coordination intervention, Initial cases entering with men at risk, Baseline hazard of arrest rate, Time at risk,* and *Baseline hazard rate of crossover*. The model also passed a number of extreme conditions tests, and reproduces the known behavior. Figure 4 shows the comparison of the model simulations against observed frequencies from the community for both first arrest of

men and first arrest of women.  Based on these tests the model is considered valuable for investigating the impacts of pro and mandatory arrest policies in domestic violence cases.

## 6.        Results

Having a simulation model that provides a logically consistent explanation with multiple data sources provides an important tool for understanding the relationship between the structure of feedback loops, policies, and system behavior.  Experimental manipulation is an important scientific tool for understanding the causes of behavior. Community studies, however, are complex and fraught with uncertainties, politics, and ethical concerns that often constrain the types of experiments a community might be willing and able to undertake.  Moreover, when we are able to design and conduct such studies, we generally do not have a means or the luxury to replicate the experiment precisely as we might in a lab to test our analysis and explanations. Such limitations severely constrain the ability of policy makers, advocates, and researchers to anticipate and understand the consequences of policy changes such as mandatory arrest.

However with empirically based simulation models, one is able to conduct experiments that are limited only by time and computing power. One is able to study the behavior of the system as parameters are changed; whole structures removed or added; policies and interventions modified; and all of this over a wide population of communities and over longer periods of time. This facilitates a much more rigorously tested set of hypotheses and explanations about the relationship between the structure of the system and its behavior.

The analysis reported here focuses on understanding the relationship between the model structure and first arrests of women.  The goal of this analysis is to provide an explanation of how the simulated behavior is generated in terms of the feedback mechanisms shown in Figure 2. The influence of these feedback mechanisms was identified and verified through simulation experiments.  This included a behavioral approach to identifying dominant feedback loops (Ford 1999) implemented in the S-programming language using R Version 2.3.1 (available at www.r-project.org).  The S functions are available from the first author.

The baseline simulation in Figure 4 represents the behavior of the community under the observed conditions.  One common source of policy design failure is not anticipating the consequences of policies over longer time horizons (Sterman 2000).  So to more fully assess this relationship, the simulation of the model calibrated to the community data is run over the longer time horizon of 10 years.  While arrest data are typically reported as the number of arrests over a period of time (month or year), the dynamics driving the system are continuous over time.  To get a clearer picture of these dynamics, simulation results are plotted as they are represented in the computer simulation as opposed to how they appear in aggregated annual reports.

Figure 5 shows the time varying behavior of the variable *First arrest of women* over a 10 year time horizon.  The simulation can be understood as single system research design with three phases: baseline phase (Phase A), mandatory arrest intervention (Phase B), and mandatory arrest with the addition of a coordination intervention and advocacy intervention (Phase C). The initial baseline phase represents the model in a dynamic equilibrium.  This baseline phase provides a way to establish that the dynamics are the result of a system's response to the interventions. It is a synthetic state of a community since communities are rarely if ever in equilibrium.

Importantly, the system being in a dynamic equilibrium does not mean that there are no dynamics, but just that the changes that do occur have no net effect on the number of cases in the various stocks throughout the model.  That is, the number of cases entering each of the risk

categories in Figure 1 equals the number of cases exiting each of the risk categories. The point to be aware of is that in this initial baseline phase, these risk categories are not empty. Prior to implementation of mandatory arrest, there are cases with men who are at risk of arrest and no priors, cases with men at risk of arrest and priors, and cases with women at risk and no priors. Any policy intervention will therefore initially act on the cases in the risk categories, with subsequent effects unfolding over time as the changes move through the system.

**Figure 5**

Simulated First Arrests of Women over Ten-Year Time Horizon
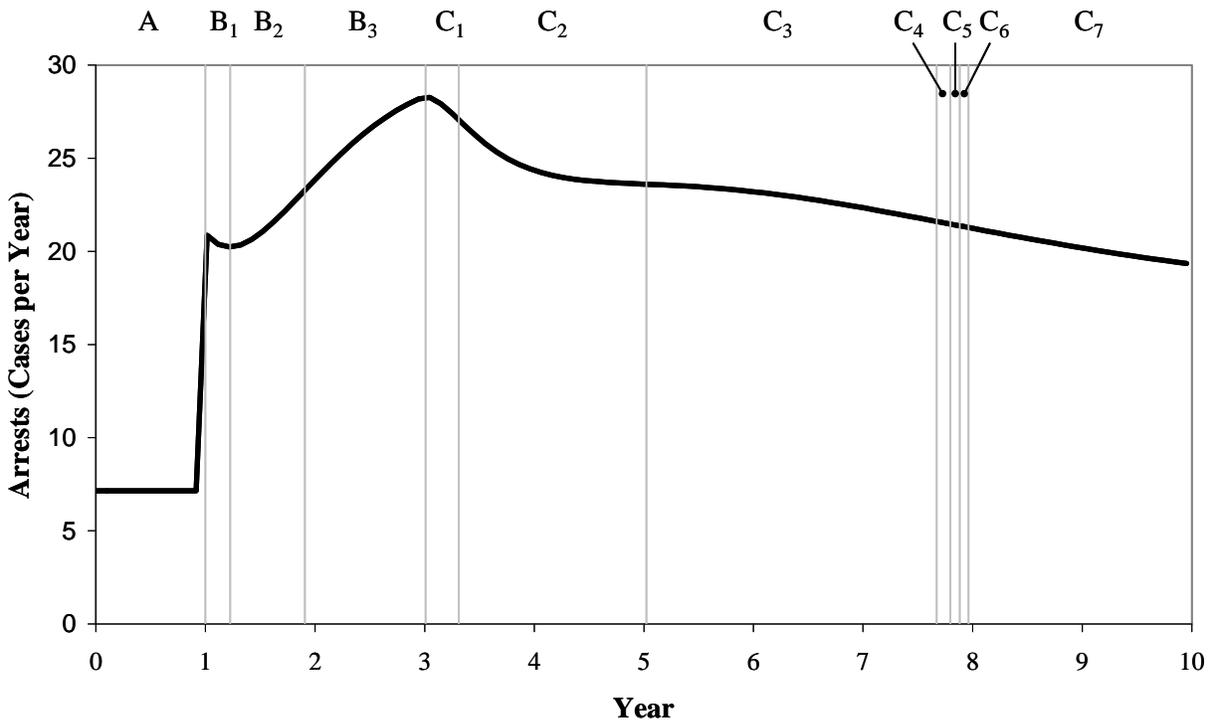


The first intervention phase starts in year 1 and represents the introduction of a mandatory arrest policy. The immediate effect is to see an increase in the first arrest of women. Over the next several months (Phase $B_1$), the number of first arrests of women actually decreases after the initial increase as the number of cases leaving *Cases with women at risk of arrest and no priors* is greater than the number of cases coming into the category from *Crossovers.* The primary loop causing this behavior is B7 in Figure 2. However, the number of arrests soon begins to increase in phase $B_2$ as an increase in arrests of men has led to more *Cases with men with at risk of arrest and priors*. This causes an increase in *Crossovers*, and hence more *Cases with women at risk of arrest and no priors*. The result is an increase in the *First arrest of women* with B7 driving the behavior again at the end of phase $B_2$.

The increase in *First arrest of women* causes a decline in *Cooperation*. This decline in cooperation between advocates and police leads to less communication and less effective advocacy on specific cases, which increases the risk of crossovers. This increases the number of women being arrested for domestic violence until the erosion of advocacy within cooperative

relationship begins to bottom out. Whatever benefit that might come from cooperation between victim advocates and police has now disappeared. This erosion of the effectiveness of direct advocacy with clients ultimately limits the rate of growth in the first arrest of women in phase $B_3$.

While direct advocacy with police has eroded, advocacy at the community level is still important. It is arguably this deterioration of the relationship between police and victim advocates that ultimately lead to major changes in the coordinating council including changes in the police chief, prosecutor handling domestic violence cases, and executive director of the domestic violence shelter. These changes reflect important feedback effects within this particular community, but it would be difficult to say whether or not such feedback effects could realistically be expected in another community. Differences in personality of the coordinating council members, local politics, and community history would all have to be considered. While these dynamics of local politics and functioning of coordinating councils are outside the boundary of this model, one might ask, what kinds of political processes would change the direction of cooperation? And, what types of interventions would result from such changes? In this model, the resulting changes are represented as exogenous variables affecting victim advocacy and cooperation.

The second intervention phase starts in year 3 with the addition of a victim advocacy intervention in the prosecutor's office and renewed effort to improve the cooperation on the coordinating council. These interventions lower the number of first arrests of women. In phase $C_1$ the drop in crossovers resulting from the improved advocacy causes a decline in the number of *Cases with women at risk and no priors*. This decline is immediately reflected in a reduction of the number of women arrested relative to the peak in year 3. The decline in the number of women arrested leads to an improvement in cooperation that increases the effectiveness of advocacy on reducing crossovers. Thus in phase $C_1$ the combination of fewer cases (B7) and improved cooperation (R1) drives the reduction in first arrest of women.

The decrease continues in phase $C_2$, but begins to slow. There are several causes for this decrease to slow down. First, there are diminishing returns from improving cooperation on the effectiveness on advocacy. Second, slowing the crossover rate of cases has the effect of increasing the number of men at risk of arrest. This increase in the number of men at risk of arrest begins to counteract the benefits of a reduced hazard rate of crossover. Simply put, while the risk is lower, the number of cases exposed to the risk increases, and crossovers start to increase again.

Beginning in phase $C_3$, the number of first arrest of women begins to decline again. This is caused by the number of cases crossing over peaking and then declining. This is the result of the effects from the initial mandatory arrest on cases with men at risk and no priors catching up to the rest of the system. Specifically, while mandatory arrest policies lead to an initial increase of men arrested for domestic violence in year 1, the men arrested for domestic violence shows a steady decline as the number of cases with men at risk of arrest and no priors was effectively drained. With fewer first arrests of men, there are more cases leaving the category of *Cases with men at risk and priors*. This causes a net outflow of cases that lowers the number of *Cases with men at risk and priors*, lowers the number of *Crossovers*, and lowers the inflow of *Cases with women at risk and priors*. The upshot of this is that the benefits of mandatory arrest are beginning to take hold throughout the system in phase $C_3$, although not without some significant unintended consequences along the way including the increased level of women being arrested for domestic violence.

By phase $C_4$, the number of *Cases with men at risk and priors* is now in a steady linear decline. This is because the number of *Cases with men at risk and no priors* is now nearly constant, and hence the number of first arrests entering the category is nearly constant. The decrease in the number of men arrested, however, has a weak but unintended consequence of reducing the effects of deterrence on new cases entering *Cases with men at risk and no priors*. This change is reflected in phases $C_5$ and $C_6$. While the rate that new cases are entering the system is increasing, it is less than the number of cases leaving the system. The net result is that that the first arrest of women continues to decline in phase $C_7$. One important implication of this is that the effects of deterrence on the system do not appear until well after the initial intervention for which the policy was designed, and when they do, it is in the weakening of deterrence resulting from fewer arrests that matters.

Two points are worth emphasizing in the results from the behavioral analysis. First, the dynamic behavior shown in Figure 5 arises from the feedback mechanisms. That is, the results were generated by the feedback loops and stocks interacting over time in response to the interventions in year 1 and year 3. Second, the additional feedback mechanism of cooperation can explain the pattern of women arrested for domestic violence in a way that is both logically and empirically consistent with data from this particular community. It is obviously not the only possible explanation or model of the phenomenon of women arrested for domestic violence in this community. Nor is the model one that can be immediately generalized to other communities without modification and additional data. It is, however, one that is explicitly formulated, transparent, replicable, and therefore refutable.

## 7.        Discussion

These results also illustrate some of the inherent complexities in the relationship between mandatory arrest policies and women arrested for domestic violence. The promised benefits of the initial intervention do not appear to affect the system until much later. The appreciable declines in the number of men arrested have more to do with increasing the number of people moving into a system than an effective deterrence policy. The causes of the unintended consequences on women shift over time with the dynamics of the system from an initial increase in the arrest rate, to a declining stock of cases at risk, and erosion of cooperative relationship that leads to a second intervention. In some phases it is the number of cases within a particular category that is driving a change. In other phases it is one or more feedback loops.

These results emerge not from programming in the values, but from deductions based on the underlying logic of how cases move through service systems, principles of system dynamics, some numeric data, and key informant interviews. The model is a simplification of reality that practitioners, administrators, and policy makers must contend with in trying to make decisions about mandatory arrest and other domestic violence policies. Yet even at this stage of development, the model provides important conceptual insights into the arrest of women for domestic violence.

First, there is empirical support for the existence of a crossover mechanism for domestic violence cases. This mechanism represents a shift in the risks from the batterer to the victim through efforts to learn and game the system response. Key informants pointed to examples of where this happened with the police response, but also pointed to a similar effect in child protective service investigations. These reports were supported through subsequent statistical analyses using the violence against women data set. Simulation analyses of these effects showed

how this crossover mechanism could play a central role to the arrest of women, and be counter-acted through interventions to improve victim advocacy in the prosecutor's office and cooperation between service providers.

Such a mechanism would have important implications for both child welfare and domestic violence policies.  Part of the response to dual arrests has been the development of protocols and primary aggressor screenings.  For example, some have argued for more protocols and statues encouraging the identification of primary aggressors to address rigid criminal justice procedure and better training of police officers (Miller and Meloy 2006).  Such approaches presume that providing standardized instruments to police and other professionals intervening in domestic violence will increase the likelihood that the primary aggressor can be identified.  However, the existence of a crossover mechanism would imply that batterers how to manipulate the system learn through their initial contact.  To the extent that such protocols are accompanied by increased training that reduces the variation in responder's behavior, the opportunity to learn and manipulate the system would increase, exacerbating the risk of cases crossing over rather then mitigating them.  What is forgotten in these protocols is that people can and often do have previous contacts with service systems and learn from the experience.  Similar efforts to screen for domestic violence cases in child welfare, family courts, and mediation are underway.  If the possibility of crossover mechanisms is ignored or not monitored, these effects will not only be ineffective, but put women and other victims at even greater risk.

However, crossover mechanisms are readily researchable.  They appear as cases involving multiple parties tracked over time where the suspects appear initially as victims.  Many administrative databases from child welfare and courts keep track of both victim and suspect identifiers.  Conducting secondary analyses of administrative data along with qualitative analysis with victims, advocates, and batterers to investigate crossover mechanisms in cases of domestic violence should be a top priority among domestic violence, child welfare, and criminal justice researchers.  The aim should be to develop strategies for improving victim safety.

Second, the model shows how both feedback mechanisms and the stock-flow distinction play substantively important roles over the course of service system response to a change in policy.  For example, the number of cases crossing over and impacting the number of women arrested for domestic violence is sometimes driven by the number of cases at risk and at other times by one or more feedback mechanisms.  Both are required to understand how the dynamics evolve in this system.

In this model, some risk categories or stocks *increased* with successful interventions on crossovers, which in turn had an unintended consequence later on of undermining the initial benefits.  For policies to be more effective and sustainable, it is important to find ways to both reduce the risk of adverse events like crossovers, but also find ways of draining the problematic stocks.  Efforts to do more aggressive outreach with women who have already come in contact with the criminal justice system (e.g., risk assessment for high-risk cases or domestic assault response teams for cases of re-victimization) would help drain the stock of cases when women are at risk and have no priors.  Likewise, efforts to increase monitoring or develop more effective batterer intervention programs would help drain the stock of cases with men at risk of arrest and priors.

The benefits of such interventions will depend on the specifics of the community along with the specific sequence of interventions.  Additional empirical and simulation work is required to fully evaluate these policy options.  In particular, both quantitative analyses using administrative data with identifiers and qualitative analysis with community stakeholders

working in the area of domestic violence across multiple communities are needed in order to better understand the structure of such systems. The primary goal here should be to test the model across the widest variation of communities.

This seems imminently feasible using system dynamics and drawing on existing or ongoing studies of domestic violence. In particular, system dynamics provides a way to model the underlying structure of systems in terms of feedback loops that researchers can use as a basis for comparative analyses. Data can come from a wide selection of sources, including numeric data from administrative databases and qualitative data from focus groups and key informant interviews. More to the point, system dynamics provides a tool to rigorously synthesize the results from diverse community studies. Such studies would not only develop and illustrate how one could conduct more flexible evaluations of complex social problems, as Goodman and Epstein (2005) have argued for, but also deepen our understanding of the community ecology of domestic violence and criminal justice response.

Lastly, the paper highlights the importance of cooperation in community responses to domestic violence. Cooperation provided the central reinforcing mechanism driving some of the benefits, but also some of the unintended and negative consequences of mandatory arrest policies. Allen (2005) has studied cooperation within the context of coordinated community responses (CCR), and pointed out that these types of interventions might not always be beneficial. For example, CCR efforts often increase expectations that agencies will share information about victims and offenders. This information sharing is not always symmetrical, nor beneficial in terms of improving victim safety or increasing assailant accountability, and can lead to conflicts that undermine the effectiveness of coordinated community response efforts. The model illustrates how the benefits and dangers of CCR efforts might shift over time in response to various policy interventions. Moreover, the short and long-term benefits of efforts to improve cooperation between stakeholders may be dependent on the state of the service system. In particular, the model shows how the same structure can produce both types of effects. Further empirical and simulation work should be undertaken to understand these effects in hopes of developing more robust strategies for successfully implementing interventions.

With the success of the battered women's movement in raising awareness of domestic violence, more communities have implemented mandatory arrest policies than ever before and are motivated to address issues of victim safety and batterer accountability. In the next period of the policy reforms, the issues facing coordination efforts will require more sophisticated approaches for involving multiple stakeholders, addressing political issues, and informing the debates through sound empirical analysis. Moreover, domestic violence issues are, like many other social issues, increasingly being understood through the lens of public health and related to other issues such as health and mental health, immigration, child welfare, poverty, schooling, and economic development. Decision makers recognize that that many of the most challenging problems we face as a society, both in the more developed countries and developing countries, are related. System dynamics and group model building can play a vital role in helping stakeholders understand and solve dynamically complex problems. The readiness of stakeholders to apply system dynamics toward social problems is in no small part a measure of the success of system dynamics over the last 50 years. While this bodes well for the future prospects of system dynamics, the important point is that with policies that are better and more sustainable, people's lives will improve.

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**Appendix A: Data**

**Table 1**

Distribution of Arrests by Gender, First/Repeat Arrest and Year

| | Year | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| **First arrests of women** | | | | |
| Number | 19 | 26 | 28 | 26 |
| Percent of first arrests | 16% | 24% | 28% | 29% |
| **Repeat arrests of women** | | | | |
| Number | 2 | 3 | 4 | 8 |
| Percent of total repeat arrests | 13% | 13% | 13% | 23% |
| **Total arrests of women** | | | | |
| Number | 21 | 29 | 32 | 34 |
| Percent of total arrests | 15% | 22% | 25% | 27% |
| | | | | |
| **First arrests of men** | | | | |
| Number | 101 | 81 | 71 | 65 |
| Percent of first arrests | 84% | 76% | 72% | 71% |
| **Repeat arrests of men** | | | | |
| Number | 14 | 20 | 27 | 27 |
| Percent of repeat arrests | 88% | 87% | 87% | 77% |
| **Total arrests of men** | | | | |
| Number | 115 | 101 | 98 | 92 |
| Percent of total arrests | 85% | 78% | 75% | 73% |
| | | | | |
| **Total first arrests** | 120 | 107 | 99 | 91 |
| **Total repeat arrests** | 16 | 23 | 31 | 35 |
| **Total arrests** | 136 | 130 | 130 | 126 |

**Appendix B: Model Equations**

Listing of equations for model
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*
  .Control
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

(01)    FINAL TIME  = 10
        Units: Year
        The final time for the simulation.

(02)    INITIAL TIME  = 0
        Units: Year
        The initial time for the simulation.

(03)    SAVEPER  =
        TIME STEP
        Units: Year
        The frequency with which output is stored.

(04)    TIME STEP  = 0.0078125
        Units: Year
        The time step for the simulation.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*
  .Cooperation
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

(05)    AT decrease in cooperation=
           0.5
        Units: Year
        Adjustment time to decrease cooperation.

(06)    AT to increase cooperation=
           Baseline AT to increase cooperation \*
           (1+STEP(Effect size of coordination intervention, Time of coordination efforts))
        Units: Year
        Adjustment time to increase cooperation between police and victim advocates.
        Coordination interventions facilitate the development of relationships, and thereby
        shorten the time that it takes to increase cooperation.

(07)    Baseline AT to increase cooperation=
           1
        Units: Year
        Adjustment time to increase cooperation in the baseline phase.

(08)     Cooperation= INTEG (
                    (Max cooperation - Cooperation)/AT to increase cooperation -
                    Cooperation/AT decrease in cooperation *
                    Effect of women arrests on cooperation (First arrest of women/Initial arrest rate of
                    women),
                    Initial cooperation)
         Units: Cooperation
         Cooperation refers to the strength of positive professional relationships between different
         sectors, for example, between domestic violence advocates and police departments.
         Cooperation is treated as an abstract value between 0 and 100, with 0 representing no
         cooperation and 100 representing the highest level of possible cooperation. Cooperation
         increases naturally through social interaction between agencies and relationship building.
         Cooperation also decreases naturally through staff turnover in agencies. Cooperation also
         decreases faster if First arrest of women increases relative to the initial rate of first
         arrests.

(09)     Effect of women arrests on cooperation(
                    [(-0.02,0)-
                    (2,2)],(0,0.4),(0.270336,0.464912),(0.501529,0.561404),(0.770703,0.72807),(1,1)
                    ,(1.23401,1.25439),(1.46177,1.41228),(1.66024,1.54386),(1.8085,1.61404),
                    (1.99388,1.66667))
         Units: Dmnl
         Effect that arrest of women has on cooperation between victim advocates and police
         departments. Increasing number of arrests above the initial value leads to an increase in
         the rate that cooperation decreases.
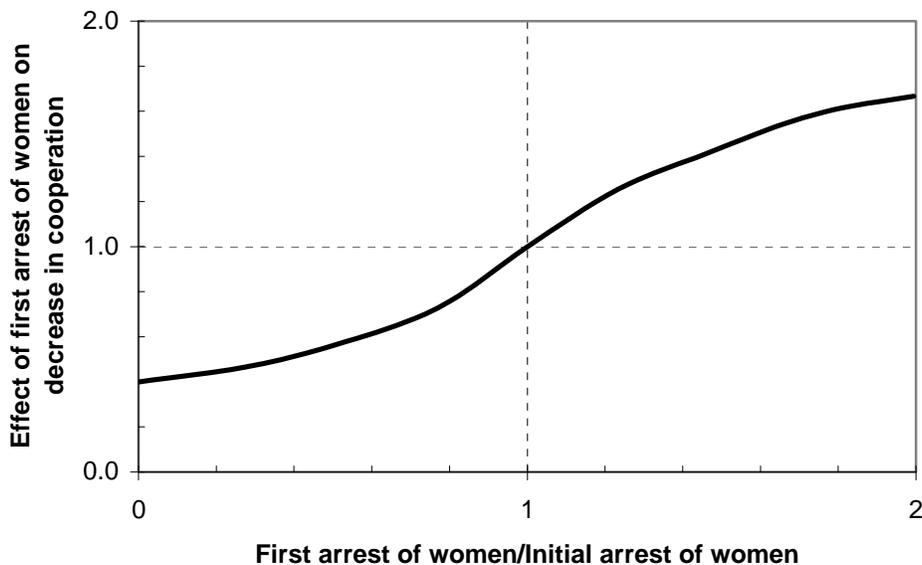


(10)     Initial cooperation= INITIAL(

Max cooperation * AT decrease in cooperation/
(AT decrease in cooperation + Baseline AT to increase cooperation))
Units: Cooperation
Initial value of cooperation assuming that the system is in equilibrium.

(11)     Max cooperation=
               100
         Units: Cooperation
         Maximum value of cooperation.


\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*
  .Crossovers.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

(12)     Baseline hazard rate of crossover=
               0.705
         Units: Dmnl/Year
         Initial risk of cases crossing over from men being at risk of arrest to women being at risk
         of arrest.

(13)     Crossovers=
               HRR of cooperation on crossovers *
               Hazard rate of crossover *
               Cases with men at risk and priors
         Units: Cases/Year
         Cases of DV where the risk of arrest crosses over from men being at risk of arrest to
         women being at risk of arrest.

(14)     Effect of cooperation on crossovers(
               [(0,0)-(2,2)],(0,1.5),(1,1),(2,0.25))
         Units: Dmnl
         Effect of cooperation on crossovers. The greater the level of cooperation the more
         effective the communication and reduction on crossovers.
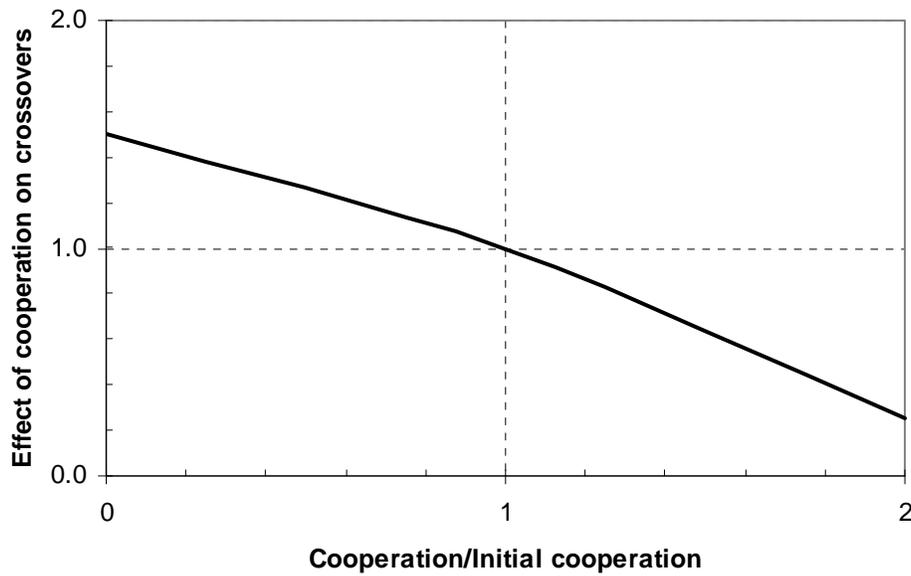
(15)    Hazard rate of crossover=
            Baseline hazard rate of crossover *
            (1 + STEP(Effect size of advocacy intervention, Time of victim advocacy
            intervention))
        Units: Dmnl/Year
        Risk of cases crossing over from men being at risk of arrest to women being at risk of
        arrest.

(16)    HRR of cooperation on crossovers=
            Effect of cooperation on crossovers(Cooperation/Initial cooperation)
        Units: Dmnl
        The Hazard Rate Ratio (HRR) of cooperation on crossovers refers the effect that
        cooperation has on crossovers resulting from the ability of advocates, police, prosecutors,
        and other professional to effectively communicate and educate each other to lower the
        risk of crossovers. This includes communicating between sectors about previous cases as
        a means to educate other professionals as well as advocate on behalf of a specific client.

(17)    Time at risk=
            10
        Units: Year
        Average time of cases at risk.

```
*******************************
  .Interventions
*******************************
```

(18)    Effect size of advocacy intervention = -0.094
        Units: Dmnl
        The effect of advocacy intervention on reducing crossovers. Negative values lower the
        risk of cases crossing over, while positive values increase the risk of cases crossing over.

(19)    Effect size of arrest intervention = 1.932
        Units: Dmnl
        The fraction amount of increasing arrests relative to the baseline. Positive values increase
        the rate of arrests, while negative values decrease the risk of arrest.

(20)    Effect size of coordination intervention = -0.59375
        Units: Dmnl
        Fractional amount of increasing adjustment time. Positive values increase the adjustment
        time, while negative values decrease the adjustment time.

(21)    Time of arrest intervention = 1
        Units: Year
        Time of mandatory arrest intervention.

(22)    Time of coordination efforts = 3
        Units: Year
        Time of the coordination intervention.

(23)    Time of victim advocacy intervention = 3
        Units: Year
        Time of the victim advocacy intervention.

```
*******************************
  .Risk categories
*******************************
```

(24)    Baseline hazard rate of arrest = 0.097
        Units: Dmnl/Year
        The initial risk of arrest at the start of the simulation in equilibrium.

(25)    Cases entering with men at risk of arrest =
                Initial cases entering with men at risk*
                Effect of arrests on new cases(Total arrests men/Initial arrests of men)
        Units: Cases/Year
        New cases of DV where men at risk of domestic violence arrest with no priori contact
        with the prosecutor's office

(26)     Cases exiting with men at risk and no priors =
              Cases with men at risk and no priors/Time at risk
         Units: Cases/Year
         Cases of DV leaving the risk category of men at risk of arrest before an arrest, i.e., prior
         to an arrest. This represents cases that are leave the risk category of arrest because one or
         more individuals leave the jurisdiction, violence has shifted to non-criminal behaviors, or
         ceased.

(27)     Cases exiting with men at risk and priors =
              Cases with men at risk and priors *
              HRR of time at risk for cases with priors/Time at risk
         Units: Cases/Year
         Cases of DV leaving the risk category of men at risk of arrest with prior arrests. This
         represents cases that are leave the risk category of arrest because one or more individuals
         leave the jurisdiction, violence has shifted to non-criminal behaviors, or ceased.

(28)     Cases exiting with women at risk and no priors =
              Cases with women at risk and no priors *
              HRR of women on time at risk/Time at risk
         Units: Cases/Year
         Cases of DV leaving the risk category of women at risk of arrest with women not having
         any priors. This represents cases that leave the risk category of arrest because one or
         more individuals leave the jurisdiction, violence has shifted to non-criminal behaviors or
         ceased.

(29)     Cases with men at risk and no priors= INTEG (
              Cases entering with men at risk of arrest -
              Cases exiting with men at risk and no priors -
              First arrest of men,
                   (Initial cases entering with men at risk * Time at risk)/
                   (1 + Baseline hazard rate of arrest * Time at risk))
         Units: Cases
         Cases of DV with men at risk of arrest for criminal domestic violence.

(30)     Cases with men at risk and priors= INTEG (
              First arrest of men -
              Cases exiting with men at risk and priors - Crossovers,
                   (First arrest of men * Time at risk) /
                   (HRR of time at risk for cases with priors +
                   Baseline hazard rate of crossover * Time at risk))
         Units: Cases
         Cases of DV with men at risk of arrest and having prior domestic violence arrests.

(31)     Cases with women at risk and no priors= INTEG (

Crossovers + New cases of women -
Cases exiting with women at risk and no priors - First arrest of women,
        -((Crossovers +New cases of women ) * Time at risk)/
         (HRR of women on time at risk + Baseline hazard rate of arrest *
        HRR of women for arrest * Time at risk))
Units: Cases
Cases of DV where women are at risk of arrest and do not have any priors. These can
include cases that involve men with priors as might happen when cases crossover, or if
cases enter the stock with no priors.

(32)     Effect of arrests on new cases(
            [(0,0.8)-(2,2)],(0,1.2),(1,1),(2,0.8))
         Units: Dmnl
         Represents the effect that total arrests of men has on new cases of DV entering the
         category of being at risk of arrest. The more total arrests of men there are, the more men
         are deterred from escalating to criminal domestic violence.
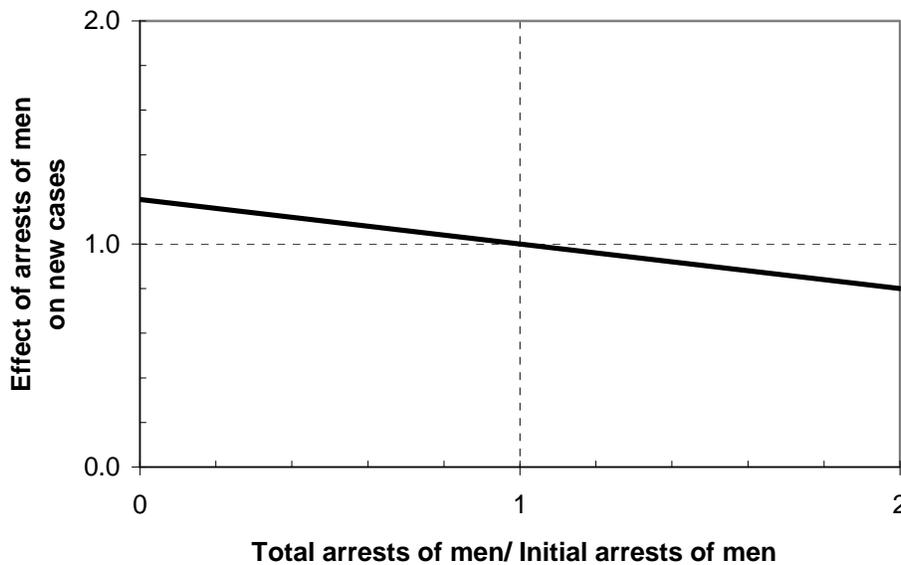


(33)     Effect of cooperation on arrests(
            [(0,0.8)-(2,2)],(0,1),(1,1),(1.18654,1.10526),(1.43731,1.24561),(1.65138,
            1.32456),(1.8104,1.36842),(1.99388,1.38596))
         Units: Dmnl
         The effect of cooperation on arrests represents the impact that cooperation has on
         reporting of domestic violence by victims to police. Better cooperation leads to more
         reporting of domestic violence cases. The model assumes, however, that the initial level
         of reporting in the community is independent of cooperation.
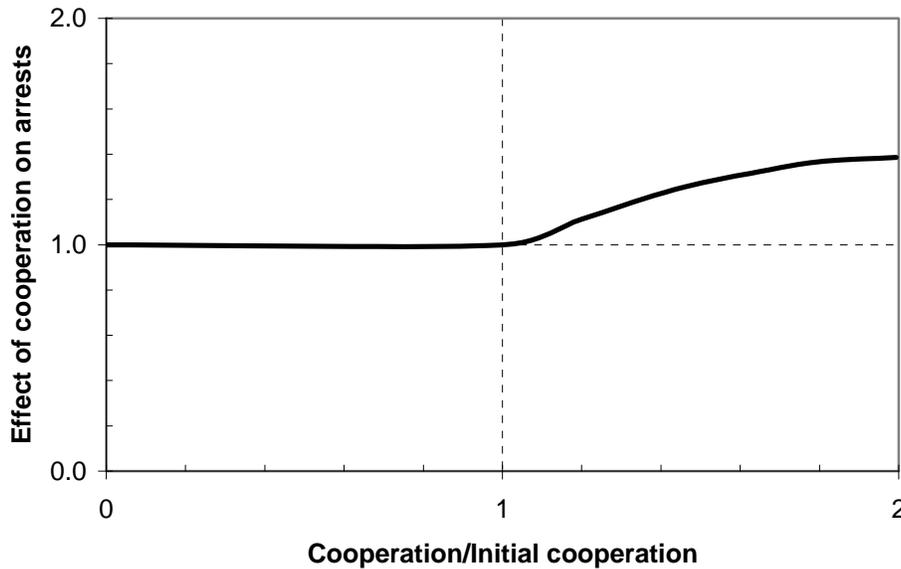
(34)    First arrest of men =
           Hazard rate of arrest of men * Cases with men at risk and no priors
        Units: Cases/Year
        First arrest of men

(35)    First arrest of women =
           HRR of women for arrest *
           Hazard rate of arrest *
           Cases with women at risk and no priors
        Units: Cases/Year
        The first arrest women in cases of DV

(36)    Hazard rate of arrest  =
           Baseline hazard rate of arrest*
           (1+STEP(Effect size of arrest intervention, Time of arrest intervention))
        Units: Dmnl/Year
        This represents the overall hazard rate of arrest for both women and men. The
        introduction of a mandatory arrest policy is represented as a step function, where the
        effect size of the arrest intervention is the fraction above the baseline hazard rate.

(37)    Hazard rate of arrest of men =
           Hazard rate of arrest *
           Effect of cooperation on arrests(Cooperation/Initial cooperation)
        Units: Dmnl/Year
        Refers to risk of men being arrested for domestic violence, which is a function of the
        overall hazard rate of arrest multiplied by the impact of cooperation on the hazard rate.
        Cooperation affects the hazard rate of arrest by increasing the likelihood of victims
        making reports.

(38)    HRR of time at risk for cases with priors = 1.259
        Units: Dmnl
        The ratio of the hazard rate of cases exiting if there is a prior.

(39)    HRR of women for arrest = 1.816
        Units: Dmnl
        The ratio of the hazard of arrest of women to the general hazard of arrest.

(40)    HRR of women on time at risk = 5.41
        Units: Dmnl
        The ratio of the hazard rate of cases exiting if women are at risk to the general rate of
        leaving.

(41)    Initial arrest rate of women = INITIAL(First arrest of women)
        Units: Cases/Year
        The initial rate of women being arrested at the start of the simulation.

(42)    Initial arrests of men =  INITIAL(Total arrests men)
        Units: Cases/Year
        Initial arrests of men at the start of the simulation.

(43)    Initial cases entering with men at risk = 69.7
        Units: Cases/Year
        The initial rate that DV cases enter the men at risk category.

(44)    New cases of women = 0
        Units: Cases/Year
        New cases of women at risk of domestic violence arrest with no priori contact with the
        prosecutor's office

(45)    Repeat arrest of men=
                Hazard rate of arrest of men * Cases with men at risk and priors
        Units: Cases/Year
        Repeat arrests of men

(46)    Total arrests men=
                First arrest of men + Repeat arrest of men
        Units: Cases/Year
        Total number of arrests of men