TO PURSUE OR NOT TO Pursue?
THAT IS THE QUESTION:
MODELING POLICE VEHICULAR PURSUITS

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Police vehicular pursuit is a method of policing that epitomizes a traditional response to the need to protect society. Police pursuits are perceived by both the public and the police themselves as one of the most important ways in which police “get the bad guys”. The number of police pursuits that occur each year shows that this perception is based on the fact that these incidents are a common police use-of-force practice. While pursuits may be statistically rare in terms of the totality of all police responses per year, it is a frequent police use-of-force response. For instance, there have been estimates that between 50,000 and 500,000 police pursuits occur each year in the United States (Fennessy et al., 1970). It seems apparent that the question about whether the police should pursue suspects is moot given these rather large numbers. Moreover, there are clearly situations where police must engage in vehicular pursuits. However, the way police pursue and the outcomes of pursuits can be understood better and perhaps managed more successfully on the basis of such understanding.

Given the relative frequency of pursuits as a use-of-force technique, it is not surprising that a portion of them end unsuccessfully. It is perhaps remarkable that more pursuits do not end in accidents, given the nature of these situations and the motivations of both the police and persons being pursued. In fact, there are indications that only about one-third of all pursuits result in accidents. Research shows that of all pursuits, somewhere between 29 percent and 41 percent end in accidents (Auten, 1991; Falcone, 1994) and that one in every 58.3 (Auten, 1994) end in a fatality. Additional recent research by the International Association of Chiefs of Police (IACP) indicates that between 1982 and
1984, 2,696 pursuits resulted in injury accidents of which 506 (18.8 percent) were officer injuries (Charles et al., 1994; International Association of Chiefs of Police, 1986). In a 1988 study, the National Highway Traffic Safety Administration determined 58 law enforcement officers, or 38 percent of those police officers killed in the line of duty, died as a result of police pursuits (Grimmond, 1991). This evidence shows that police pursuits are fairly common occurrences in the course of policing with many ending unsuccessfully and resulting in injury and death.

Not only are police vehicular pursuits common uses-of-force, but there is also evidence that police pursuits result in a significant amount of civil litigation (Nugent et al., 1989). Others argue they may be a civil rights violation and an excessive use-of-force problem (Alpert and Fridell, 1992). In fact, several courts have recognized police negligence in vehicular pursuits (Zevitz, 1987). It is clear that while police vehicular pursuits are a routine use-of-force situation, they have been the subject of increasing legal scrutiny. Studies such as the current one that can help better define the pursuit outcome and contributors to such conclusions should be conducted in order to provide information that can be used to refine pursuit policies and thereby reduce the amount of civil liability.

As if the scrutiny by the courts and the frequency of pursuits were not enough to cause great concern for police administrators, the media has often sensationalized pursuits, especially those that have ended tragically. For example, a recent article from the Baltimore Sun cited “A police chase that began with a routine traffic violation in Baltimore County early yesterday ended with a woman dead and two other people critically injured in the city” (Gilbert, 1995, p. 2C), suggesting that very dangerous high-speed pursuits are occurring and that they end in accidents and death. This article went further in citing the damage to property and citizens as a “result” of police high-speed pursuits. Despite the fact that there are many pursuits that end without injury or property damage, the media is much more likely to select and publish those that end in accidents or injuries because they sell newspapers, news programs or other media products. Obviously, such publicity creates external pressure on police administrators who are compelled to respond on the basis of practical knowledge.

The purpose of this study is to identify the characteristics of police vehicular pursuits which are common in pursuit-related accidents. Hence, this study will establish baseline information on the dimensions of these incidents. This information can be used to determine what should
and should not be considered when the decision to pursue or not to pursue is undertaken and can contribute to more complete vehicular pursuit policy formulation and development.

POLICE PURSUIT LITERATURE

Much of the existing research tends to focus on descriptive aspects of police vehicular pursuits (Auten, 1991; Beckman, 1987; California Highway Patrol, 1983; Charles and Auten, 1994; Fennessey et al., 1970; O’Keefe, 1989). Although there is not a great deal of literature on police vehicular pursuits, it is focused appropriately on the initial need to define the key conceptual issues involved in such situations. The key descriptive situational variables identified in the literature are included in the present analysis.

A majority of the recent police vehicular pursuit literature focuses on the policy implications of pursuit incidents (Alpert and Fridell, 1992; Blankenship and Moneymaker, 1991; Charles et al., 1994; Crew, 1992; Falcone, 1994; Homant et al., 1993; Homant and Kennedy, 1994; Nugent et al., 1989). In sum, this literature tends to show that the more restrictive the police policy permitting pursuits the fewer the number of pursuits as well as the smaller the proportion that end in accidents. However, the literature also shows that it is possible that there are differential effects given different offenders and police officers. The focus of the present study is not directly on policy implications but on establishing information for policy making and, as such, this literature will be revisited in the discussion to follow. That is not to say that policy implications are not important, but examining them before understanding the probable indicators associated with pursuits ending in accidents seems like placing the cart before the horse. It is our view that effective pursuit policies can, and should, be based on a realistic and complete understanding of pursuits ending in accidents rather than on opinions about what the policies should contain or whether the policies “work” or are “appropriate.” Thus, we focus on explaining the accidental outcome of pursuits based on several situational variables rather than attempt to test whether the pursuit policy is effective or ineffective. Although these outcomes certainly may be related to policy, our focus is on the direct situational variables rather than the indirect policy influences on these variables or the accidental conclusion of police pursuits.
There are studies of police pursuits that explore the officers’ motivations. For example, in a recent study researchers explored the association between sensation seeking and police officers’ tendencies to engage in high-speed vehicular pursuit (Homant et al., 1993). Self-reported scores on a “sensation seeking scale” showed that scores were correlated with measures of pursuit tendency (Homant et al., 1993). In essence, the officers who sought sensations, as per the measured scale scores, were more likely to engage in pursuits. It is possible under this theory that some pursuits may be more likely to end in accidents because the pursuit is not disengaged due to the stimulation it provides to the officer. While this theory is plausible, motivation of the officer is only one part of the pursuit situation and one that may likely remain unchanged regardless of policy directives especially if the policy recommendations are not internalized by the officers. On the other hand, policy may have a great deal to do with officer pursuit behaviors. While the study of officer and suspect motivations and attitudes is certainly important, given the nature of the concepts it is also more appropriate for qualitative study.

**Pursuit Accidents**

There are a few studies that focus specifically on pursuit-related accidents. Although most of these are descriptive in nature and are generally consistent, they do differ in the proportions of accidents that occur. This section provides a review of this literature as well as its conceptual linkages to the present study.

In a study of police pursuits in Kentucky, Oechsli (1992) found that pursuit-related fatalities typically involved fleeing drivers, passengers or uninvolved bystanders. Research shows that traffic violations were more likely to be the triggering event for pursuits (Fennessy et al., 1970; Oechsli, 1992; Police Training Institute, 1990) than were criminal actions. There is other research that shows that pursuits tend to be alcohol or drug related (Fennessy et al., 1970; Oechsli, 1992). Generally the current research shows that there is not only agreement about the proportion of pursuits that end in accidents, but there is also a limited understanding of the correlates of pursuits ending in accidents.

While Oechsli (1992) found that only 24 percent of pursuits resulted in accidents, the Police Training Institute (1990) study reported
that 48 percent ended in an accident. In an early study on police pursuits (See Fennessy et al., 1970) it was found that only one in nine pursuits resulted in an accident, whereas in 1994, Auten found that one in every 2.6 end in an accident, one in 9.2 end in personal injuries and one in 58.3 end in a fatality (Auten, 1994). However, pursuits are productive in Kentucky, resulting in an apprehension rate of 76.9 percent of those pursued (Oechsli, 1992). These findings are important precursors to understanding pursuits that end in accidents. We know, for instance, that there are clear differences in the proportions and types of pursuit-related accidents across different jurisdictions. However, none of these studies attempted simultaneously to describe the proportion that ended in accidents as well as explain the accidents based on situational and operational variables. Such research is the key to creating policy-based information about why accidents occur and is crucial to changing policies and procedures.

In a study that describes police pursuits in general, Auten (1991) found that pursuits usually involved a single police unit traveling between 41 and 60 miles per hours, and that one in every 2.6 pursuits involved a traffic accident of some type, with a total economic loss estimated at $22,118 per traffic accident (Auten, 1994). It is important in the present study, therefore, to include not only the number of police vehicles involved but other situational factors such as whether the pursuit crossed jurisdictional lines. It is also necessary to include measures of the conditions under which the pursuit occurs to define more fully the pursuit-related accident and to provide key policy relevant information.

Research by Dunham and Alpert (1991) shows that female officers appear to be more cautious in pursuits (controlling top speeds, not running red lights, etc.), while older males attempt to avoid negative outcomes while taking more risks. This suggests that officer gender, the speed of the pursuit, whether the running lights are used, and the age of the officer may be associated with accident outcomes and should be incorporated into the present study.

In another pursuit study, Alpert and Dunham (1990) found that approximately one-third of the pursuits resulted in an accident, 83 percent of the chases resulted in no personal injury, and 62 percent resulted in no property damage. While Alpert and Dunham’s findings may or may not be generalizable beyond Dade County, they do suggest that pursuit related problems can be minimized if the policy is strong, officers are trained effectively, there is supervision during the pursuit and there is officer accountability (Alpert and Dunham, 1990)².
In a review study, the ACLU of Rhode Island determined that the most dangerous police chases are often initiated – and proceed for lengthy periods – for traffic violations or other minor offenses, rather than felonies (American Civil Liberties Union of Rhode Island, 1989). The Rhode Island ACLU recommended that a statewide policy for high-speed pursuits be implemented, patrol officers be required to undergo periodic practical retraining, there be formal investigations of all cases resulting in serious property damage, injury or death and, perhaps most important, the State should work toward changing police officials’ implicit encouragement of high-speed chases in general (American Civil Liberties Union of Rhode Island, 1989). This suggests that the inclusion of the key independent variables of reason for initiation of the pursuit, the distance traveled and the speed of the pursuit in the present study are conceptually cogent.

Alpert and Dunham (1989) conducted one of the few studies identifying the salient factors that influence the outcome of pursuit driving. They found that 55 percent of the pursuits did not result in serious injury, property damage or traffic accidents. They also determined that while pursuit driving was 65 times more likely to result in an accident than other police driving, the differences in serious injuries were much smaller, and that three-quarters of pursuits resulted in an arrest. The researchers also reported age effects in that younger officers were much more likely to both produce negative outcomes and not apprehend suspects. Alpert and Dunham suggest that future research should shift attention from an exclusive focus on the pursuing officer’s attributes to the mechanisms that explain the interaction among the officer, the suspect and the bystander. Although this recommendation is clearly appropriate, such data may be difficult to obtain. In addition, accidents have not been explained sufficiently on the basis of key situational and officer characteristics at this point to rule out these predictors and to recommend a more indirect approach considering the suspect and bystanders.

There is also some question about whether pursuits initiated as a result of a traffic violation are not serious. Just because the pursuit results in an arrest for a charge not included in the precipitating traffic violation does not mean that the police ought to pursue in the belief that offenders run because of a more serious criminal violation. Officers must have objective knowledge that a serious offense has been committed or they should not pursue. Most research reveals that officers believe that offenders run because they have committed a more serious offense. For example, Alpert (1987) determined that 61 percent of pursuits were
initiated for traffic infractions, but that many of those apprehended were often charged with serious felony offenses unrelated to the pursuit. That is, the suspect may be fleeing because they know they have outstanding felony warrants. In addition, Alpert reports that accidents occurred in slightly more than 50 percent of pursuits in which an arrest was made, (although 58 percent of these were minor and resulted in no personal injuries), and accidents occurred in 43 percent of the traffic-initiated pursuits indicated for reckless driving, felony, driving-while-intoxicated and “be on the look-out for” stops. A study published one year earlier reported that in 77 percent of the pursuits suspects were apprehended, 70 percent ended without an accident and 68 percent lasted less than five miles (Alpert and Anderson, 1986). The work by Alpert and others in this area is important and helpful for policy makers; however, this research has not examined the accident outcome in reference to several important situational and officer characteristic variables simultaneously and interactively as does the present study.

In sum, the literature on pursuit accidents shows that they occur, in general, when the chase is initiated for traffic violations as well as for criminal matters, that they are common in police pursuits, that they are potentially costly, and that they may be influenced or explained by situational variables as well as officer and offender characteristics.

**METHODS**

This study relies on incident-level pursuit data collected directly by a large metropolitan police department over the past ten years. The Department was selected because it requires a pursuit incident report to be filed for every pursuit that occurs regardless of whether they end accidents. In addition, the department is large and is located in a major metropolitan area. The jurisdiction is also a nationally accredited agency with over 1,500 sworn personnel and a fleet of approximately 600 vehicles. Hence, this department has the critical mass and potential variety of vehicular pursuits to enable accurate probabilistic modeling of outcomes including both accidents and non-accidents.

The department’s enforcement activities are accomplished through routine patrol, foot patrol, traffic and criminal investigation. In addition, citizen demands for police services in the study jurisdiction have also increased substantially over the study period. That is, since 1980 calls for service have increased by 41 percent. In addition, the total
number of reported criminal incidents have increased over the last ten years from a low of about 67,400 in 1983 to 83,600 in 1992. This department, while certainly not representative of most police departments, because of its large size, experienced a sufficient number and variable nature of police vehicular pursuits so that one can assume this data to be useful for determining the salient variables that are related to vehicular pursuit accidents.7

In order to allow readers to assess more completely the nature of the department from which we collected the study data, and to remain true to our promise of not revealing the jurisdiction’s name, the following characteristics about the area are offered. The jurisdiction being studied surrounds a very large city, and encompasses over 600 square miles. It is located along a major interstate corridor in the Northeastern United States, and is bordered by tidal waters on one side and the foot hills of the Appalachian Mountains on the other. The study jurisdiction also has over 2,400 miles of roadways and more than 31 smaller communities and 10,000 businesses located within its boundaries. The following sections describe how the data were collected, the nature of the sample, and the analytic procedures to be used.

Data Collection and Sample

This research utilizes existing data collected on the characteristics of police pursuits. The use of agency-level data allows us to address questions the department may not have considered or anticipated (Senese, 1996) and will eventually allow us to examine pursuits over time and the potential changes in practice.8

In 1985, the study department began collecting data on vehicular pursuits in order to develop a comprehensive pursuit policy and to better manage pursuits. Consequently, this study includes all vehicular pursuits from September 1985 through January 1992 that occurred in the study jurisdiction and for which a report was filed. Hence, the sample consists of over six years of all vehicular pursuit incidents that occurred, with a resulting sample size of 1,064 cases.

Since the departmental data set is designed to be continuous (so that trends could be identified and the pursuit policy could be adjusted accordingly) it is presumed to be consistent over the study period.9 Officers engaging in pursuits are required to record information on every such occurrence, and there is no evidence that they have not done so given supervisory oversight and comments.10 The form used to capture
the data was a hybrid product of items selected from earlier police vehicular pursuit studies. The form includes variables measuring a complete range of the environmental conditions surrounding the pursuit, the reason why a pursuit was initiated and terminated, the strategy employed during the pursuit, apprehension and accident data, the status and characteristics of the pursuing officer and data relative to the organizational structure of the department. Once the pursuit form is completed by the officer involved in the pursuit, it is reviewed by the officer’s immediate supervisor and forwarded to the Departmental Research Office. The resulting data were obtained from this office.

Procedures

The independent variables that should help explain whether accidents occur will be the characteristics identified in the literature as having an influence on pursuits and those which are associated with accident outcomes. These characteristics are: the speed of the chase, the location of pursuit, the reason for the pursuit, weather conditions, road types, road conditions, the number of units involved and officer characteristics (see Table 1). In addition, several new variables (i.e. the time elapsed in a pursuit, the distance traveled, traffic density, the number of units from another jurisdiction, and whether or not the pursuit event entered another jurisdiction) have been included because they not only fit the implied conceptual models offered by others but because they appear to have the potential for having an influence on pursuit accidents.

The data analyses will be completed in three stages and will rely on multi-nominal log linear models. The logistic regression equation, which relies on a dichotomous dependent variable, will be employed as the primary technique. This technique is superior to other multi-nominal techniques when one has a dichotomous dependent variable and when several of the independent predictor variables are of mixed levels of measurement. A main effects model examines the simultaneous and probabilistic explanations of each of the identified 26 independent variables. It is important to examine the main effects prior to the development of a complex, and perhaps more realistic, interactive model given the sample size as well as its potential to contribute more clearly to policy purposes.

Once the simple main effects model is identified it is also important to determine if a more complex interactive model might describe more accurately the accident pursuit outcome. Although the
main effects model allows one to determine the simple explainors of accidents, it can sometimes miss higher-order interactive effects. For instance, suppose one wanted to model the decision to arrest citizens (i.e. arrest/do not arrest) for drunk driving. One may look at the main effects of the citizens’ age, their income, and whether they were belligerent toward the police officers. Each of these variables could be used to model the decision to arrest or not arrest a citizen when examined singularly. However, by looking at these variables as only main effects (i.e. looking at each by themselves) one cannot determine the interactive effects of all three variables simultaneously. That is, one may miss the three-way interaction of citizens that are old, have high income and are very belligerent toward the arresting officers (e.g. a self-important businessman) as opposed to those that are very respectful, old and have low incomes (e.g. a little old lady) in the arrest decision. Police officers, like the rest of us, are more likely to consider multiple characteristics simultaneously when they arrest, and such a situation is modeled in the interactive analyses.

The conceptual basis here is that each of the independent variables contributes to the explanation of accidents. The officer variables (i.e. officer’s age and years of service) should be negatively associated with accidents, as one would expect older officers with more experience to be more adept at vehicular pursuits than younger less experienced officers. It also makes intuitive sense to assert that the more units involved in the pursuit the more chances there are for accidents to occur. There are two equally viable possibilities with respect to the length (distance and time) of a pursuit. First, longer pursuits might be more likely to end in an accident because the officers might become impatient and intensify the pursuit to end the incident there are also more opportunities for accidents. On the other hand, longer pursuits could be more likely not to end in accidents because the officer involved has more time to consider his/her actions and to thereby avoid dangerous situations where an accident may result. When there is a high speed chase there may be more accidents given the reduction in control over vehicles at higher speeds. In addition, when the roadway is congested or where the driving conditions are poor there may be more potential for accidents. Where weather conditions are not clear and where lighting restricts visibility one might also expect to see more accidents. Most of the literature which has examined pursuits has determined a great deal of pursuits are triggered by traffic violations. If there are, in fact, more pursuits as the result of traffic violations then it may follow that there are more chances for accidents to
occur in these more common forms of chases. Last, one might presume there would be more chances for accidents where the pursuit proceeds into another jurisdiction because the officer or officers would be less familiar with that other jurisdiction.

FINDINGS

In terms of the general characteristics of the pursuits in the data set in this study, 36.7 percent resulted in an accident. In addition, half of the accidents occurred in another jurisdiction and when there was more than one police vehicle involved in the chase. Interestingly, 86 percent of the officers involved in pursuits had more than three years experience (the median experience), and less experienced officers had nearly the same proportion of pursuits ending in accidents as the more experienced officers. Seventy-five per cent of the pursuits occurred when the weather was clear, 86 percent when the road was dry, 86 percent on a two-way road and 66 percent at night when street lights were illuminated. The average distance traveled was 1.7 miles and the median time elapsed was three minutes, with a median speed of 60 miles per hour. These basic descriptive results are compatible with the research that exists with some proportional differences. However, these findings also imply that pursuits ending in accidents may involve a complex interaction of factors that may not be readily apparent from simple description. That is, it is difficult to understand which of the conditions surrounding the pursuit is most important (relative to others) in determining the likelihood of accidental outcomes by viewing the simple proportions. Hence, the following analyses attempt to make more sense of these interesting descriptive findings.

Table 1 shows the percentage of cases for each of the key characteristics used in the modeling of police pursuits. The largest differences between pursuits that end in accidents and those which do not are in whether the weather was clear, the pursuit involved more than one police unit, the pursuit was triggered by a traffic offense, it was nighttime, the street lights were illuminated, the roadway was dry, and the roadway was a highway or expressway. On the other characteristics, the pursuits that ended in accidents were fairly similar to those that did not. One would expect that the characteristics in which there were the most differences would be most instructive in the modeling of pursuit outcomes, but that is not the case (see below).
Table 2 shows the results for a simple main effects model of the accident outcome. This model is very enlightening not only for the effects that are significant but for the ones that are not. For instance, the officer characteristics (i.e. years of service and age) apparently have little to do with whether the pursuit ends in an accident in the study jurisdiction. This may or may not be the case when other variables are included (as suggested by Alpert and Dunham, 1989) but this model does demonstrate that officer experience makes little difference in the accident outcome in this data set.

The duration of the pursuit (i.e. distance, time and speed) also had little apparent power to explain whether an accident occurred. This suggests that accidents are unrelated to the duration and perhaps the intensity of the pursuit. This may also point to the need for more detailed data about why the suspect was pursued and the nature of the officer’s training and arrest history, given the intuitive “sense” these variables make in explaining the pursuit outcome yet their unimportance to the
current model. As is true of most research, these “non-significant” factors, open many more questions about pursuits than they answer.

The main effects model (see Table 2) shows that pursuits that move from the study jurisdiction into another jurisdiction (OJPUR) are 1.5 times more likely to end in an accident. In addition, pursuits that end in accidents are less likely to involve one police vehicle (UNITSC), are less likely to occur in clear weather conditions (WETHC), are less likely to be triggered by traffic offenses (REASONC), and are less likely to occur on an expressway (XWAY). Conversely, pursuits that stay in the study jurisdiction are much less likely to end in accidents. However, pursuits that involve several police vehicles, non-clear weather conditions, a criminal offense as the initiating event and do not occur on an expressway are more likely to end in an accident.

This model correctly classifies (or explains) 69 percent of the pursuit cases in the sample\textsuperscript{14}. In addition, the data clearly fits the logistic model (see Table 2 for “model” and “improvement Chi square” values) and there are no significant residuals. Based on this model it is not very likely that accidents will occur when there is one police vehicle, the weather is clear, the trigger event is a traffic incident and the pursuit takes place on an expressway. Conversely, when the pursuit moves into another jurisdiction the probability of accident is 0.9290, indicating that accident is highly probable\textsuperscript{15}.

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>SE</th>
<th>Wald</th>
<th>$p$</th>
<th>$r$</th>
<th>Odds</th>
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<td>OJPUR</td>
<td>0.3974</td>
<td>0.1420</td>
<td>7.8266</td>
<td>0.0051</td>
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<td>UNITSC</td>
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<td>0.1333</td>
<td>5.7742</td>
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<td>0.0029</td>
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<td>-0.2772</td>
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<tr>
<td>XWAY</td>
<td>-0.4659</td>
<td>0.2311</td>
<td>4.0646</td>
<td>0.0438</td>
<td>-0.0386</td>
<td>0.6276</td>
</tr>
</tbody>
</table>

Constant = 2.1744
Model $\chi^2 = 34.857; p = 0.00001$; Improvement $\chi^2 = 4.246; p = 0.0393$
Overall classification percent correctly classified = 63.01%
Residual $\chi^2 = 16.530; p = 0.6217$
In Table 3, the results for the hierarchical log linear tests of the saturated model up to a five-way interaction, are presented. These results show (referring to the Chi square values and their associated probabilities) that only two-way interaction effects are significant with the five main effects variables identified in the first model (see Table 2). The hierarchical tests (not shown) also test each individual interaction and main effect term. These reveal that all five main effect terms are significant (i.e. important to the model) but also that only four out of the ten possible two-way interaction terms are significant. Hence, the interactive model (below) was built using the five main effects and the four significant interaction terms.

Table 4 shows the final interactive effects model for the data. The data correctly classified 68 percent of the cases but adds additional clarification to the explanation of pursuits ending in an accident. The only main effect that remained significant is OJPUR (the pursuit continued into another jurisdiction). The interpretation is the same as the main effects model in that accidents are 1.5 times more likely to occur when the pursuit continues into another jurisdiction. The probability of an accident when the pursuit continues in this interactive model is 0.7685, indicating that it is still highly probable but not as definite as indicated in the main effects model (see Table 2). However, none of the simple main effects for the remaining terms were significant in the final interactive model. Hence, the main effects model may misspecify the nature of the explanation because it ignores these important interactive and higher-

**Table 3**

**Hierarchical Log Linear: Tests that K-Way and Higher Effects are Zero**

<table>
<thead>
<tr>
<th>Number of terms</th>
<th>df</th>
<th>$\chi^2$ likelihood</th>
<th>$p$</th>
<th>$\chi^2$ Pearson</th>
<th>$p$</th>
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*Significant PARTIAL associations: OJPUR*REASONC, UNITS*REASONC, WETH*REASONC, and UNITSC*XWAY
order effects. The first interactive term (REASON by WETHC) shows that when there is an accident the reason for the pursuit is less likely to be a traffic incident and the weather is less likely to be clear. That is, both the non-traffic reason and non-clear weather conditions must be present for an accident to be very likely.

The improvement in the model can be demonstrated through observation of the main effects model. In Table 2 (the main effects model), the $\beta$ coefficients for $\text{REASON} = -0.3204$ and for $\text{WETHC} = -0.4457$. The combined effects of these terms is greater than these individual effects as the interactive term’s $\beta$ coefficient is $-0.2351$ (the probability of accidents for this term is 0.6413). That is, the interactive term specifies more clearly the influence of the interaction between reason and weather conditions than do the individual simple main effects models for each of these variables. The second interaction term (UNITSC by XWAY) also demonstrates that accidents are less likely to occur when there is only one police vehicle and the pursuit occurs on an expressway. Once again, the combined $\beta$ coefficient shows that the interactive term is superior to the two individual terms (the probability of accidents for this term is 0.6533). The probability of accidents when the pursuit does not continue into another jurisdiction and where the second interaction term is present is 0.5984. Hence, accidents are slightly more probable when the pursuit takes place in another jurisdiction yet less likely when the incident is traffic-based and the weather is clear, as well as where there is only one police unit and the pursuit takes place on an expressway.
DISCUSSION

The findings in this study demonstrate that about one-third of all pursuits end in an accident outcome, which is fairly close to what has currently been reported in the literature (see Alpert, 1987; Alpert and Dunham, 1990; Oechsli, 1992). However, this proportion is a bit lower than the earlier Alpert and Dunham studies that show an accident proportion of nearly 45 percent (1989) or the recent proportion of 38 percent reported by Auten (1994).

The current research on police vehicular pursuits suggests that certain policy approaches can change pursuit practices (Falcone, 1994), whereas others report that pursuit policies are too complex or nonexistent to be followed (Charles et al., 1994). Still others have suggested that vehicular pursuits are contrary to the trend toward community policing (Blankenship and Moneymaker, 1991) and thereby imply that pursuits are unnecessary. The present study does not investigate the specific policy that was used nor does it concern the esoteric consideration of whether the police shall engage in pursuits. This study has shown, however, that there are a limited number of factors that are associated with the most unfavorable of pursuit outcomes: accidents. Regardless of whether pursuits are necessary or not, it behooves police administrators to consider the specific factors that are associated with the accident outcome and work to reduce these factors. The most significant result of the study is that the pursuit policy should include an ongoing evaluation of the pursuit, and perhaps the cessation, if it continues into another jurisdiction. Coordination and communications between neighboring jurisdictions in picking up the pursuit at the borders could result in fewer accidental outcomes, thereby increasing police pursuit effectiveness as well as reducing civil liability.

The current findings also suggest that pursuit policy should emphasize supervision and control as a main element for insuring positive outcomes (Alpert and Dunham, 1990). The findings herein do not suggest that Alpert and Dunham’s other recommendations (i.e. a strong pursuit policy, effective pursuit training and officer accountability) should be abandoned but only that pursuits that are permitted to continue into other jurisdictions are more likely to end in an accident. While it is clear that a strong pursuit policy, training and accountability are certainly logical measures to prevent accidents, they are relatively less important once a pursuit is engaged in unless a supervisor is involved to insure policy is followed, to reiterate training and to record the pursuit for
culpability purposes. The findings also allude to the fact that training may be the most important preventative measure that can be undertaken as it directly addresses the liability issue (Carlin, 1986). Moreover, training should include supervisor-based training in the monitoring and oversight of active pursuits in addition to the traditional officer pursuit training. However, if it is more probable for accidents to occur when the pursuit moves out of the jurisdiction or the weather is bad, then supervision could intervene to break-off the pursuit before it ends in an accident. It also makes sense, based on the findings, to install a review process (Nugent, et al., 1989) to help further and continually define the factors that are associated with unfavorable pursuit outcomes. The quality, quantity and process of pursuits should be monitored continually in order to manage most appropriately unfavorable outcomes and civil liability.

The current research also contradicts some of the early pursuit literature. For instance, Auten (1991) found that accidents were more common when only one police vehicle was involved. In the current study, we found that accidents are more probable when there is more than one police unit and when the pursuit occurs on a non-expressway roadway. Intuitively, it makes much more sense to suggest that accidents are more likely when there are more vehicles involved. In addition, our study clarifies the variable of the number of police units involved by showing that even when there are more police involved accidents are more likely on roads that may not accommodate high speed pursuits. This suggests, once again, that supervisors may be able to reduce accidents by insuring that fewer vehicles are directly involved in the pursuit especially in consideration of the context (i.e. roadway, weather conditions, etc.) of the chase.

Another point that is important to note is that the issue of the speed of the pursuit had little to do with the accident outcome in the current data. A review of litigation (Zevitz, 1987) indicated that the speed of pursuits may be indicative of police negligence which suggests that it is a key issue in the accidental outcome. However, past research supports the current findings that no particular speed is dangerous (Beckman, 1987) or more likely to end in accidents. Although this study clearly shows that speed alone is not a probable indicator of whether a pursuit will end in an accident, it is likely that this variable will continue to be used in negligence suits against police because it makes intuitive sense and because attorneys tend to put less faith in objective research than they do in their perceptions or what they believe they can spoon-feed to the typical juror18.

Certain recommendations for future research can be proposed at this point. First, although much of the current literature is based on quantitative
data, there is much to be understood at the individual level, and much of this information can only be obtained through qualitative data collection methods. Studies should include complete data from officers, suspects and supervisors as regards specific pursuit incidents and the influences on initiating the pursuit, its continuation, and its conclusion. These data should include officer, suspect and supervisor perceptions or opinions as well as specific quantitative indicators. Such in-depth data could lead to a more complete understanding of the reasons, process and conclusion of pursuits than can be obtained through quantitative reports alone.

Another useful line of research would be to focus on the evaluation of specific pursuit policies across several types of police agencies. While Charles et al. (1994) conducted such a study in Illinois, other samples from other states would also contribute greatly to policy development. At this point, the pursuit literature dealing with policies, is dominated by a few samples of police pursuits (primarily from the Eastern and Midwestern United States and Southern Florida). While these investigations are beyond reproach, the research community should remain cautious until similar findings are reported from other jurisdictions. Future research should also examine agencies with restrictive, moderate and unrestricted pursuit policies (especially with regard for when to initiate and when to terminate pursuits). In addition, such future research should examine the qualitative issues of strong policy, effectively trained officers, supervision and officer accountability.

Last, it is also important that further research take into account the potential idiosyncrasies of specific police agencies or policies through time. Police practice, policies and leadership change through time and thus it is likely that the way pursuits are engaged in and reviewed will change. One potentially productive line of analysis would be to look at the survival time of pursuits that end in accidents in comparison to those that do not for different police administrations. Through such analyses we may be able to determine the critical considerations in the course of a pursuit where it should be ended.

NOTES

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also like to thank the anonymous reviewers as well as Dr Geoffrey Alpert for their helpful comments and sage advice. Last but certainly not least we would like to acknowledge the assistance and cooperation of the study police department without which this research would not have been possible.

1. It is likely that more pursuits occurred in 1995 due to the fact that there were more police officers and therefore more potential for such incidents.

2. Including the constant of officer responsibility is likely to add little to the modeling of pursuit accidents because accountability is a matter of policy and legal ramifications.

3. Limited variables about the suspect are contained in this data set but were not included in the modeling of accidents because of the number of missing values and the apparent inability to help explain accidents.

4. This comprehensive model is clearly appropriate but it is also arguable that pursuing officers have little knowledge of the suspect and no knowledge of the bystanders during the course of a pursuit. It is unclear, therefore, how these indirect variables would influence pursuit outcomes at this point.

5. The department is not identified because the researchers agreed to this condition in exchange for copies of all pursuit incident reports that have been generated since 1982. While some who review and read this article may be troubled by this fact, we view our ethical and legal obligations to the department as more important than revealing the source of our data.

6. Fully 80 percent of the staff are so engaged.

7. Since here is no reason to believe the sample of pursuits is inaccurate or unrepresentative this presumption is maintained. One would, however, be remiss to not question any sample that relies on official data or which is limited to a single jurisdiction. In addition, this data may not apply to less urban or smaller police agencies.

8. This will be the focus of future studies of this data.
9. There have been very few changes in the pursuit reports since 1985.

10. In conversations with supervisors, they believed that no pursuits occurred where a report was not filed because it is a departmental policy to fill in the report. There may be, however, pursuits that are broken off early that are not defined as pursuits and for which a report is not included in the data set. Since the focus herein is on accidents, we presume that few pursuits where accidents occurred will not be recorded on the departmental report form.

11. Primarily from an early study done by Beckman (1987) and from the study by the California Highway Patrol (1983).

12. This technique is appropriate herein because much of the data are nominal and because we are interested specifically in the relative value of several independent variables on a dependent variable.

13. Although a sample size of 1,064 is certainly large enough to drive a more complex model, it is probably not large enough to drive a model with multiple-level interactions. Main effects models are often translated more easily into policy because they can allow the researcher to determine which simple variables effect the outcome relative to each other. Hence, the most important predictors of accidents can simply be identified.

14. This measure was corrected to represent only the correctly predicted values along the diagonal instead of the row totals as is computed by SPSS. The value of the correctly classified cases SPSS computed was 63.01 percent.

15. The closer the probability value is to the value 1, the more likely that accidents will occur.

16. Five-way interactions were the highest tested order because there were five main effects variables.

17. The four significant two-way interaction terms are: other jurisdiction by reason for pursuit, number of police units by reason for pursuit, weather conditions by reason for pursuit and number of police units by express way.
18. The National Traffic Highway Safety Administration (1990) has not proven that higher speed limits result in more fatalities for citizens in general let alone police trained in the vehicular pursuit.

19. This has been suggested Alpert and Dunham (1989).

REFERENCES


American Civil Liberties Union of Rhode Island (1989), *Life and Death in the Fast Lane: the Dangerous Nature of Police High-speed Chases in Rhode Island*, American Civil Liberties Union of Rhode Island, Providence, RI.


