WORKING
PAPER

Evaluation of the Impact of Seattle's DWLS Impound Law

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WR-117-SEA

December 2003

PUBLIC SAFETY AND JUSTICE

Preface

In recent years, a number of jurisdictions have sought to strengthen rules and regulations for promoting safe driving. Some have authorized impounding vehicles operated by individuals driving with a suspended license. In 1998, the City of Seattle passed such an ordinance, and it was implemented on January 1, 1999. Some critics of Seattle's Impound Law contend that targeting DWLS drivers whose licenses are suspended for comparably minor offenses (called DWLS 3 drivers) is overly harsh, contending they are not significantly more dangerous than validly licensed drivers. Supporters of the law contend that more stringent actions against DWLS 3 drivers could help reduce accidents and injuries by removing more unsafe drivers from the roads.

The City of Seattle Legislative Department sponsored this evaluation to address questions about the appropriateness of targeting DWLS 3 drivers of the Impound Law, as well as the specific and general deterrence impact of the legislation. The current study utilized existing (and often limited) databases, including arrests and citations, court filing charges, impounds, accidents, and license suspensions. Seattle drivers were compared to drivers in Federal Way and Yakima.

Results of this study should be of interest to policymakers and researchers looking for ways to increase public safety through innovative penalties for driving-related offenses.

This document is reported in the RAND Working Paper publication series, intended to share the authors' latest research findings and solicit informal peer review. The earlier versions of this document have been reviewed by the client and revised according to client feedback. The final document was reviewed by RAND Public Safety and Justice.

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Acknowledgments

We would like to extend our thanks to the numerous individuals and agencies that made this research possible. Primarily, we would like to thank Peter Harris of the Seattle Legislative Department for his assistance with the study.

We would also like to thank Betty McNeely, Patti McBride, and Shirleen Skogseth for providing us with Seattle Municipal Court data. At the Administrative Office of the Courts, we appreciate the programming and data documentation assistance of Jennifer Creighton. From the Department of Licensing, we thank Vickie McDougall and Doralyn LeGarde. In the Seattle Police Department, we would like to thank Judy Demello and Lyle Turnbull. From Washington Traffic Safety Commission, we appreciate the assistance of Phil Saltzberg and Dick Nuse. Larry Blain of Puget Sound Regional Council provided information about the availability of local commuting data. Paul Sullivan at Municipal Research Services Corporation assisted us in identifying Washington cities that had adopted Impound Laws. For their assistance in understanding the nature of the available tow company data, we thank Mike Bartolotti of RoadOne/Lincoln Towing, and Sande and Linda Olson of GT Towing. From the City of Seattle, we appreciate the assistance provided by Norman Bush, Rick Wycoff, and Toby Barban in assessing the feasibility of acquiring tow company data. From Federal Way, we would like to thank the following individuals for their assistance: Derek Matheson, Assistant City Manager, Brian Wilson, Deputy Chief of Police, Cathy Schrock, Police Records Manager, and Sandra Warter, Municipal Court Administrator. We also thank Mike Vowell and Bill McGovern of the Yakima Police Department.

Glossary

Symbol	Definition
AOC	Administrative Office of the Courts
DOL	Department of Licensing
DWLS	Driving While License Suspended
DWLS 1	Driving While License Suspended in the First Degree
DWLS 2	Driving While License Suspended in the Second Degree
DWLS 3	Driving While License Suspended in the Third Degree
DWLS 1/2	Driving While License Suspended in the First or Second Degree
SMC	Seattle Municipal Court
SPD	Seattle Police Department
WSP	Washington State Patrol

Executive Summary

In recent years, a number of jurisdictions have sought to strengthen rules and regulations for promoting safe driving. Some have authorized impounding vehicles operated by individuals driving with a suspended license. In 1998 the City of Seattle passed such an ordinance and it was implemented on January 1, 1999.

Seattle's Impound Law applies to individuals who commit the offense of Driving While License Suspended (DWLS). Driver license suspensions are undertaken by the Washington Department of Licensing (DOL) for a range of violations, such as driving while intoxicated, reckless driving, and other unlawful vehicle operation (or moving violations). License suspensions are administratively assigned by DOL in three degrees, with the least serious (or third degree) suspensions resulting for relatively minor infractions, such as failure to respond to or appear in court for a traffic violation. Some critics of Seattle's Impound Law contend that targeting DWLS drivers whose licenses are suspended for such comparably minor offenses (called DWLS 3 drivers) is overly harsh, contending they are not significantly more dangerous than validly licensed drivers. Supporters of the law contend that more stringent actions against DWLS 3 drivers could help reduce accidents and injuries by removing more unsafe drivers from the roads.

The City of Seattle Legislative Department sponsored this evaluation to address questions about the appropriateness of targeting DWLS 3 drivers of the Impound Law and questions about the effectiveness of the law. Specifically, the study assessed the following three research questions:

1. Are the accident records of DWLS 3 drivers worse than the accident records of validly licensed drivers?

2. Does impounding the vehicles of persons arrested for DWLS have a general deterrence effect on the rates of motor vehicle accidents, DWLS offenses, and other driving offenses?

3. Does impounding the vehicles of persons arrested for DWLS have a specific deterrence effect, i.e., does it deter accidents, DWLS offenses, and other driving offenses by these drivers?

Are DWLS 3 Drivers More Dangerous? We examined whether DWLS 3 drivers pose a greater danger (in terms of involvement in accidents with and without injury and fatalities) than validly licensed drivers. In doing so, we tested a hypothesis that unsafe driving causes accidents. Unsafe driving also causes traffic offenses, which in turn lead to license suspensions, which in turn lead to DWLS offenses. However, not all traffic offenses lead to suspensions and DWLS offenses.

To test the hypothesis, we used driving records of all Seattle residents to assess whether traffic violations were associated with accidents, whether DWLS 3 offenses were associated with traffic violations, and whether DWLS 3 offenses were associated with accidents. We examined DOL driving records since 1995 for 1) validly licensed drivers (no suspensions or DWLS offenses on record), 2) drivers with suspensions but no DWLS violations, 3) DWLS 3 drivers, and 4) DWLS 1 and DWLS 2 drivers.

We found that DWLS 3 drivers were more likely to be involved in an accident (26%) than were validly licensed drivers (11%) and drivers with suspensions but no DWLS offenses (17%), and about as likely to have accidents as DWLS 1 and 2 drivers (28%). Similarly, DWLS 3 drivers (9%) were as likely as DWLS 1 and 2 drivers (9%) to be involved in accidents resulting in injury or fatality than were drivers with suspensions but no DWLS violations (6%) and validly licensed drivers (4%).

Using logistic regression statistical analyses, we found that DWLS offenses were more important predictors of involvement in accidents than gender or age. The odds of involvement in an accident for a DWLS 3 driver are 1.6 times greater than those of a suspended driver with no DWLS offense and 2.9 times greater than the driver with no suspensions. Among all drivers who had accidents, severity of accidents was related most strongly to driver age and gender, but the relationship between accident severity and DWLS offenses was still significant, with DWLS 3 drivers 10 percent more likely than non-DWLS drivers to have been involved in an accident resulting in injury or fatality. However, the magnitude of the difference is small.

In sum, these results suggest that DWLS 3 offenses may be indicators of unsafe driving that leads to accidents. Thus, strategies addressing the driving of DWLS 3 offenders target a group of drivers at higher risk for accidents than validly licensed drivers and may therefore help to reduce accidents overall.

Does the Impound Law Produce General Deterrence? To test general deterrence effects of the Impound Law, we compared rates of DWLS offenses,

accidents, and other traffic offenses before and after implementation of the law in Seattle to those of two comparison cities, Yakima and Federal Way. (We selected Federal Way for having a population in King County similar to that in Seattle but without, until June 2001, its own impound law; we selected Yakima for being a populous city away from cities with impound laws.) We used time series statistical analyses to compare rates of DWLS, other driving offenses, and accidents. We compared two types of rates. One type was DOL records of convictions per suspended drivers and the second type was court records of charge filings per city population.

Statistical analyses of DWLS rates using time series models indicate that there appears to be no influence of the law on DWLS court filing rates in Seattle compared to Federal Way and Yakima. The data on DWLS conviction rates among suspended drivers does suggest some deterrent effect of the Impound Law but the evidence is weak. This decline in convictions might indicate a general deterrent effect, but it could also be due to a change in prosecutor policy in Seattle following the Impound Law resulting in prosecution of fewer cases. In other words, the Impound Law had only a very weak effect (if any) on DWLS violations. Similarly, we did not find a change in rates for other driving offenses in Seattle compared to Yakima and Federal Way. In other words, we did not find the Seattle Impound Law to have contributed to a reduction in other driving offenses.

Our statistical analyses found weak evidence of a reduction in accidents in Seattle following the implementation of the Impound Law. It appears, however, that Yakima had a greater decline in accidents than Seattle during this period. Thus, we cannot conclude that any decrease in accidents in Seattle was due to the influence of the Impound Law.

The lack of a clear general deterrent effect in these results may have been due to several factors. One explanation may be that the Impound Law does not have a general deterrent effect. Another possibility is that a general deterrent effect exists but it was so weak that statistical analyses were unable to detect it. This could be due to contamination of the comparison cities by neighboring jurisdictions with impound laws around Federal Way and Washington State Patrol impounds taking place on state highway and interstates around both Federal Way and Yakima. In the presence of such contamination, the general deterrent effect of Seattle's Impound Law would need to be large in order to be detectable. Under present conditions a small or moderate general deterrent effect would not be observable.

Does the Impound Law Produce Specific Deterrence? To measure whether the Impound Law resulted in reduced offending among DWLS drivers who experienced an impound, we compared the recidivism of DWLS drivers who experienced an impound in Seattle with DWLS drivers in Federal Way who did not. We measured recidivism through repeat DWLS impounds (in Seattle) and arrest or citations (in Federal Way), court charge filings for DWLS offenses, court charge filings for other traffic offenses, and DOL records of accidents.

Both local police records and statewide court filings showed no significant difference between DWLS recidivism in Seattle and that in Federal Way. Police data on repeat DWLS arrests or citations in Federal Way and DWLS impounds in Seattle show DWLS recidivism was greater among Seattle drivers (14%) than Federal Way drivers (12%). Statistical analysis controlling for pre-existing differences between the groups, such as race, gender, and prior offenses, indicated no significant difference between Seattle and Federal Way drivers in DWLS recidivism. Similarly, analysis of statewide court records of DWLS charge filings found such filings more common for Seattle (22%) than Federal Way drivers (20%), but statistical analysis controlling for pre-existing differences found no significant difference between DWLS drivers in the two cities. The Impound Law appears to have had no overall effect on recidivism for DWLS offenses.

In a sub-group analysis comparing drivers in Seattle and Federal Way with prior records of DWLS filings (in any degree) to those without, we observed a specific deterrent effect for those with at least one prior DWLS court filing (in any degree). Of those with a prior DWLS court record, 31 percent of Seattle drivers had a repeat DWLS offense compared to 37 percent of Federal Way drivers with a prior DWLS record. Consistent with the findings of a similar California study, this suggests that repeat DWLS offenders may be more sensitive to the impound sanction than first time offenders.

Regarding other driving offenses, we found that Seattle drivers were more likely to have court filings for such offenses (23%) than Federal Way drivers (20%) during the follow-up period. Multivariate statistical analysis controlling for other key factors indicated that Seattle drivers had a significantly higher rate of other driving offenses during the follow-up period compared to Federal Way drivers. Thus, there is no evidence of an overall specific deterrent effect. In sub-group analysis, however, we found a specific deterrent effect when comparing Seattle drivers with prior court filings for other driving offenses to Federal Way drivers with a prior record.

We found Seattle DWLS drivers (8%) were more likely to be involved in subsequent traffic accidents than those in Federal Way (6%). Statistical analysis indicated this difference was attributable to other differences between the DWLS drivers in the two cities, and that the Impound Law apparently had no effect on involvement accidents.

To further explore whether specific deterrence could be observed within certain groups of Seattle drivers, we conducted additional statistical analyses examining the Seattle DWLS drivers only. We found that black and male Seattle drivers were more likely to have a repeat impound than were white and female drivers. We also found that Seattle DWLS drivers with a history of DWLS 3 and DWLS 1 and 2 court filings were significantly more likely to have a repeat impound than those with no such history.

Consistent with specific deterrence theory, we found that DWLS drivers who were the registered owners of impounded vehicles were less likely to engage in repeat offending than DWLS drivers who were not driving their own vehicles. This suggests that the Impound Law might have a greater impact if applied to DWLS offenders driving their own vehicles, rather than all DWLS offenders regardless of vehicle ownership.

We also found that participation in the Seattle Municipal Court's relicensing program designed to assist DWLS drivers regain their legal driving privileges was associated with lower rates of recidivism among Seattle drivers compared to those who did not participate. Because this study is not an evaluation of the relicensing program, we cannot draw conclusions about whether this reduced recidivism is due to the relicensing program or to the characteristics of the small number of Seattle drivers (61 or 1.2%) who participated in it.

Finally, we found that for Seattle DWLS 3 drivers 30-day hold periods of impounded vehicles were associated with *higher* rates of recidivism than those with no hold periods. This finding is not consistent with specific deterrence theory, and suggests longer impound periods may not help deter repeat offending by DWLS 3 drivers. We controlled for prior DWLS record and demographic characteristics so these factors were eliminated as possible explanations. Consequently, this relationship may be attributable to other characteristics of DWLS 3 drivers not measured in our data.

In sum, these findings indicate that Seattle's Impound Law did not produce an overall specific deterrent effect on DWLS offenses, other driving offenses, or accidents of Seattle drivers compared to similar DWLS drivers in Federal Way. We did find evidence of a specific deterrent effect of impounds for drivers with a

prior record of other driving offenses and DWLS offenses in any degree. Among only Seattle drivers, we found that repeat impounds were less likely among those DWLS drivers who were registered owners of the impounded vehicle and those who participated in the relicensing program.

Overall Conclusions. The ability of the study to fully answer the three research questions was limited by the nature of the available data. For example, the lack of income data meant that we were unable to address several issues initially outlined by the Seattle Legislative Department, e.g. whether income was related to the accident involvement of DWLS 3 drivers or influenced our findings about specific deterrence. The available data also suffered from some weaknesses. For example, DOL data does not contain all accidents but only those that were reported by citizens or police officers. Individuals driving with a suspended license are probably less likely to report accidents to DOL, resulting in a bias in the data. Moreover, the presence of impound activities around the state restricted our choice of comparison cities for examining general deterrence impacts.

Due to such limitations, the results of this study must be interpreted with caution. They do, however, provide some basis for assessing the policy questions posed about the applicability and effectiveness of Seattle's Impound Law. The results suggest that, if involvement in accidents is the primary criterion, DWLS 3 drivers may be appropriate targets of the Impound Law. According to these results, however, arguments in favor of the Impound Law cannot be based on evidence of a general deterrent effect or a specific deterrent effect. The findings do suggest that if the law were more narrowly tailored to apply to only registered owners and to those with prior DWLS records, it may be more effective at reducing repeat DWLS offenses.

1. Introduction

Individuals are required to be licensed to operate a motor vehicle because of the inherent risk involved in the activity. Similarly, many rules and regulations have been developed to promote safe driving. Violation of these rules implies some degree of unsafe driving, and regulatory and legislative entities have devised measures intended to both punish the behavior and reduce the likelihood of its reoccurrence. One measure designed to modify unsafe behavior is license suspension. Suspension is thought to modify an individual's future behavior, as well as increase safety on the street while that individual is not driving. Despite this sanction, some individuals continue to drive while their license is suspended. Recently, a growing number of jurisdictions around the country have adopted legislation allowing impounds of vehicles driven by individuals driving with a suspended license. These laws are generally intended to punish individual drivers in an effort to discourage a repeat offense but also to promote safe driving.[1]

Evaluation Research Aims

The City of Seattle is among the jurisdictions that have adopted an ordinance allowing the impounding of vehicles driven by individuals with a suspended license. This study was performed under a research contract with the Seattle Legislative Department designed to evaluate the impact of Seattle's Impound Law. The goal of evaluation is to assess the impact of the Impound Law in discouraging future offenses by individual drivers who experience an impound and in discouraging others with a suspended license. In its request for research proposals, the Legislative Department provided the following context for the evaluation:

> One of the main rationales for the new law was that the potential of having a vehicle impounded would deter people from driving without a valid license, and that this in turn would reduce injuries from auto accidents. This rationale is consistent with the results of evaluations of similar vehicle impound laws in California, Ohio, and Oregon, which showed substantial specific deterrent effects. Opponents of the impound program have argued, however, that DWLS-3 [Driving While License Suspended Third

[1] Voas, R. B. & DeYoung, D. J. (2002). Vehicle action: Effective policy for controlling drunk and other high-risk drivers? *Accident Analysis and Prevention, 34*: 263-270.

> Degree] drivers are not significantly more dangerous than validly licensed drivers, and that the experience of the impound programs in other states is not applicable to Seattle because the populations of suspended drivers in those states are not comparable to those covered by the Seattle law.
>
> The theoretical connection between driving without a valid license and traffic safety is indirect. Because a driver's legal status is not part of the physical act of driving, it does not directly affect the probability of an accident, in the way that speeding or driving while intoxicated affects (that is, increases) the probability of an accident. Driving without a valid license is an indicator of unsafe driving, not a cause. People can avoid license suspension by driving safely or by paying fines and other penalties they receive for traffic offenses that consist of unsafe driving, such as speeding. Thus enforcing the DWLS [Driving While License Suspended] law may reduce accidents and injuries by reinforcing the penalties for traffic offenses that consist of unsafe driving.
>
> This assumes that the laws defining traffic offenses for which failure to pay fines can lead to license suspension are well designed and effectively enforced. If illegal driving behavior is not more dangerous than legal driving, or if law enforcement agencies or officers use criteria other than the legality of driving behavior to issue citations, the link between law enforcement and accidents and injuries will be weakened, and enforcing the DWLS law, by vehicle impounds or other means, will have less effect on accidents. (Seattle Legislative Department, February 2001: 1-2).[2]

In order to assess whether the Impound Law is having the intended impact, the Seattle Legislative Department outlined the following three research questions that the evaluation should address. These are:

1. Are the accident records of DWLS-3 drivers worse than the accident records of validly licensed drivers?[3]
    - If so, is this relationship independent of the driver's age and driving experience?
    - Is it independent of the driver's economic status, race and ethnicity?
2. Does impounding the vehicles of persons arrested for DWLS have a *general deterrence* effect?
    - If so, how strong is the effect, and what is the resulting effect on vehicle accidents and injuries?
    - Does it vary by the driving experience or age of the driver?

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[2] Seattle Legislative Department (February 2001). Evaluation of the Vehicle Impound Law in Seattle, Request for Proposals. Seattle, WA: City of Seattle.

[3] DWLS 3 is a shorthand reference to those arrested/cited for DWLS in the third degree.

- Does it vary by the race or ethnicity of the driver?

3. Does impounding the vehicles of persons arrested for DWLS have a *specific deterrent* effect?
    - If so, how strong is the effect, and what is the resulting effect on vehicle accidents and injuries?
    - Does the effect vary by whether the DWLS was in the first, second, or third degree?
    - Does the effect vary by the driving experience or age of the driver? Does it vary by the race or ethnicity of the driver?

The first research question does not ask specifically about the effectiveness of the Impound Law but about the nature of the individuals to which it applies. The last two research questions were designed to measure the impact of the Impound Law on individuals who experience impounds and on the larger population of suspended-license drivers. The latter two questions are framed in the context of deterrence theory, a criminological theory that focuses on the impact of punishment. The central component of the theory is that individuals seek to avoid punishment. It is a theory about the behavior of punished individuals (specific deterrence) and well as the behavior of groups who perceive the threat of punishment (general deterrence).[4]

Are DWLS 3 Drivers More Dangerous? This research question assesses whether DWLS 3 drivers are an appropriate target of the Impound Law. Because the underlying behavior leading to a license suspension for a DWLS 3 driver can be a relatively minor offense, one hypothesis is that these individuals drive no more dangerously than validly licensed drivers. Consequently, it may be argued that DWLS 3 drivers are an inappropriate target for the Impound Law. An alternative view is that even minor traffic offenses are an indication of unsafe driving. Therefore, those with license suspensions for minor traffic offenses are more likely to drive in an unsafe manner, increasing the risk of accidents. From this perspective, impounds for DWLS 3 are thought to reinforce license suspension and fines for minor traffic offenses. Thus, an added public safety benefit of reduced accidents would be produced through inclusion of DWLS 3 drivers under the Impound Law. In this research question, the study seeks to address these two views by comparing the accident records of DWLS 3 drivers with those of validly licensed drivers.

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[4] Cesare Beccaria (1998). On Crimes and Punishments. Excerpts, original printing 1764. In F. Williams & M. McShane (eds.). *Criminological Theory*, pp. 9-21. Cincinnati, OH: Anderson.

Does the Impound Law Produce General Deterrence? According to deterrence theory, the public is sensitive to the mere threat of punishment and people may make choices based on observation of punishment experienced by those around them. Mere passage of a new law, however, is not adequate for general deterrence to be produced. Residents must become aware of the new law and the potential consequences for violation. For purposes of the evaluation, a "general deterrent effect" would mean that rates of DWLS would drop in Seattle following the passage of the legislation because residents become aware of the threat of impound. According to the theory, the publicity around the implementation and enforcement of the Impound Law would be most responsible for creating a general deterrent effect. Since general deterrence is the group analog of specific deterrence, the greatest general deterrent impact would be expected on DWLS rates in Seattle. If a general deterrent effect were present, it may be observed to a lesser extent on accidents and driving related offenses.

The few studies that have examined the general deterrent effect of vehicle impounds and related sanctions have found mixed results. One study examined the general deterrent effect of vehicle immobilization in Oregon and Washington among drivers with a suspended and revoked license for alcohol- and/or drug-related offenses. The researchers found a general deterrent effect for Oregon but not Washington drivers. They attributed this difference to inconsistent enforcement and fewer eligible drivers in Washington.[5] A study in Manitoba, Canada found a decline in fatal and injury accidents among drivers whose licenses were suspended and revoked following the implementation of an impound law.[6] However, attributing the decline in accidents to vehicle impounds alone is highly questionable because the study included no comparison group and another law impacting the same population was passed at the same time. Finally, a study in California compared the accident records of suspended and revoked drivers to validly licensed drivers and found no general deterrent effect following the implementation of an impound law.[7]

Does the Impound Law Produce Specific Deterrence? According to deterrence theory, punished individuals who face an opportunity to engage in the behavior

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[5] Voas, R. B., Tippetts, A. S., & Lange, J. E. (1997). Evaluation of a method of reducing unlicensed driving: The Washington and Oregon license plate sticker laws. *Accident Analysis and Prevention 29 (5)*: 627-634.

[6] Beirness, D. J., Simpson, H. M., Mayhew, D. R., & Jonah, B. J. (1997). The impact of administrative license suspension and vehicle impoundment for DWI in Manitoba. As cited in Voas, R. B. & DeYoung, D. J., (2002). Vehicle Action: Effective policy for controlling drunk and other high-risk drivers? *Accident Analysis and Prevention, 34*: 263-270.

[7] DeYoung, D. J. (1998). *An Evaluation of the General Deterrent Effect of Vehicle Impoundment of Suspended and Revoked Drivers in California.* Sacramento, CA: California Department of Motor Vehicles.

again would choose to refrain because of the previous negative experience of punishment. In order to make that choice, individuals must have the opportunity to reoffend, i.e., they must not be incapacitated. For example, the specific deterrence effect of prison on future criminal behavior cannot be measured while offenders are still in prison. In the context of the evaluation research question, a "specific deterrent effect" would mean individuals who experience a vehicle impound for DWLS would not choose to drive with a suspended license in the future. According to deterrence theory, we would expect punishment to have the greatest impact on future behavior of the same type, i.e. DWLS offenses.[8] Other related behaviors, however, may also be impacted. The research question asks whether specific deterrence might also be observed in accidents and other unsafe behavior, such as driving-related criminal offenses and traffic violations. That is, drivers may seek to avoid future punishment by attempting to drive more safely, thus avoiding the commission of driving offenses and reducing the risk of accidents.

Previous studies examining vehicle impoundment and related sanctions (i.e. vehicle immobilization and forfeiture) have consistently found a specific deterrent effect among drivers subject to these sanctions. The majority of these studies focus on specific deterrence only among drivers whose licenses were suspended or revoked for offenses related to driving under the influence of drugs and/or alcohol.[9] The exception is a California study that examined the specific deterrent effect of impounding vehicles driven by those whose license was suspended or revoked for any reason. This study also found a specific deterrent effect of impounds on convictions for repeat driving with a suspended or revoked license, moving violations, and accidents.[10]

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[8] For example, see: Paternoster, R. (1987). The deterrence effect of the perceived certainty and severity of punishment: A review of the evidence and issues. *Justice Quarterly, 4*: 173-217.

[9] Rogers, A. (1994). Effect of Minnesota's license plate impoundment program on recidivism of multiple DWI violators. *Alcohol, Drugs, and Driving, 10 (2)*: 127-134. Crosby, I. B. (1995). *Portland's Asset Forfeiture Program.* Portland, OR: Reed College Public Policy Workshop. Voas, R. B., Tippetts, A. S., & Lange, J. E. (1997). Evaluation of a method of reducing unlicensed driving: The Washington and Oregon license plate sticker laws. *Accident Analysis and Prevention 29 (5)*: 627-634. Voas, R. B., Tippetts, A. S., & Taylor, E. (1997). Temporary vehicle immobilization: Evaluation of a program in Ohio. *Accident Analysis and Prevention, 29 (5)*: 635-642. Voas, R. B., Tippetts, A. S., & Taylor, E. (1998). Temporary vehicle impoundment in Ohio: A replication and confirmation. *Accident Analysis and Prevention, 30 (5)*: 651-655.

[10] DeYoung, D. J. (1999). An evaluation of the specific deterrent effect of vehicle impoundment on suspended, revoked, and unlicensed drivers in California. *Accident Analysis and Prevention, 31*: 45-53.

Seattle DWLS Impound Legislation

In the licensing process, Washington's Department of Licensing (DOL) establishes standards to ensure that a potential driver possesses a set of minimum qualifications. Drivers who violate these standards are subject to license suspension. License suspensions are an administrative action undertaken by DOL. Suspensions can occur for a range of violations, such as driving while intoxicated and unlawful vehicle operation (major to minor moving violations). Driving with a suspended license is a criminal offense referred to as "driving while license suspended" (DWLS).

Administratively, DOL assigns a degree of suspension (first, second, or third degree). The suspension degree assigned by DOL impacts the length of the suspension. Degree of suspension is determined by the degree of the criminal offense that would be committed if an individual drives during a period of license suspension. For example, if a driver whose license was suspended for reckless driving were to continue to drive during the period of suspension, the driver would commit a second degree DWLS offense. Thus, the license is suspended in the second degree.

First-degree suspensions (and DWLS offenses) are the most serious. These result when an individual is designated a Habitual Traffic Offender. First-degree suspensions are in effect for five years. Drivers are eligible to have their license reinstated after three years if they comply with certain requirements, such as payment of all fines and fees and have no more driving related convictions in the 12 months before applying for reinstatement.[11] Second-degree suspensions arise from convictions for serious traffic offenses such as driving under the influence of intoxicants and reckless driving. The length of second-degree suspensions ranges from 30 days to one year, after which drivers become eligible to apply to have their license reinstated, provided they meet certain requirements (such as payment of all fines and fees). Third degree suspensions arise from the least serious underlying behavior. For example, they can arise from failure to respond to or appear in court for a traffic violation, failure pay fines and fees owed for a moving violation, or failure to maintain insurance. There is no required base period of suspension for third-degree suspensions. Drivers are immediately eligible to apply for reinstatement but to do so they must have complied with certain requirements, such as payment of all fines and fees and provision of evidence of insurance.

[11] For first-degree suspensions prior to January 1, 1999, licenses were suspended for seven years and drivers were eligible to apply for reinstatement after four.

There is one unique circumstance relating to suspension, however. In the case of licenses suspended in the second degree, after a time (that varies depending upon the type of underlying offense and other factors), drivers become eligible to have their license reinstated. If the license has not been reinstated during this period (due to failure to comply with all DOL requirements), driving would result in a DWLS 3 offense. In other words, for second-degree suspensions, at the point of eligibility for reinstatement, the license suspension switches to the third degree, as would any DWLS offenses committed hereafter. Thus, a driver arrested (or cited without arrest) for a DWLS 3 offense may have originally committed a more serious offense, resulting in an initial second-degree suspension.

In an attempt to reduce DWLS offenses, Washington passed legislation in 1997 that enabled law enforcement to impound vehicles driven by individuals driving with a license suspended in any degree. Individual municipalities within Washington, however, have discretion about whether to adopt this statute locally. The Washington State Patrol (WSP), the agency that provides patrol services on Washington interstates and state highways, elected to adopt the impound policy soon after passage of the state legislation. Thus, while some municipalities across the state have not adopted the impound law, impounding takes place across the state on interstates and state highways.

The City of Seattle was among the municipalities to adopt the DWLS impound law. In October of 1998, the City Council passed Ordinance 119180 (hereafter referred to as the Impound Law), allowing police to impound vehicles driven by persons with suspended licenses in any degree. Enforcement of the law began on January 1, 1999.

Following passage of the law but before its implementation, Seattle undertook a public education campaign to inform residents of the new law and consequences for its violation. For two weeks prior to implementation of Impound Law, the City notified individuals with suspended licenses for unpaid moving violations about an opportunity to speed the reinstatement of their licenses to avoid impounds of their cars. They were informed about the new Impound Law and offered an opportunity to clear up unpaid Seattle fines and fees on their court records, and to develop a time-payment plan with the Seattle Municipal Court (SMC), where needed.

Seattle Impound Procedures

The Seattle Police Department (SPD) established a set of procedures for enforcement of the Impound Law. When Seattle police identify a suspended driver, typically during a traffic stop, they may issue a citation or arrest driver for DWLS and call one of three tow companies under contract with the City to impound the vehicle. In some cases, vehicles may be released from impound lots to the registered owner without a required hold period. In other cases, vehicles are subject a mandatory hold period. Hold periods are determined by SPD based upon a driver's previous record. Initially, the Seattle ordinance specified mandatory hold periods of 15, 30, 60, or 90 days. Under some circumstances no mandatory hold period was required. Criteria for assigning hold periods were as follows:

- 0 day hold for a DWLS 3 impound with no prior DWLS 3 convictions
- 15 day hold for a DWLS 3 impound with 1 prior DWLS 3 conviction
- 30 day hold for a DWLS 3 impound with 2 or more prior DWLS convictions; or DWLS 1 or 2 with no prior DWLS 1 or 2 convictions
- 60 day hold for a DWLS 1 or DWLS 2 impound with one prior DWLS 1 or DWLS 2 conviction
- 90 day hold for a DWLS 1 or DWLS 2 impound with two or more prior DWLS 1 or DWLS 2 convictions

In July 2000, an amendment to the Impound Law led to a change in hold criteria. The change eliminated mandatory hold periods for DWLS 3 impounds, except when a DWLS 3 driver had a least one prior conviction and two or more previous impounds. For these individuals, a 30-day mandatory hold is required. Hold period criteria remain unchanged for DWLS 1 and 2 drivers.[12]

Once a vehicle is eligible for release, it can be released only to the registered owner. Vehicles are not released until all towing-related fees are paid. These include $72 impound fee and $49 administrative fee, and a daily storage fee of $12 to $24 per day, depending upon the tow company holding the vehicle. If the driver of the vehicle is also the registered owner, there are other conditions of

[12] Hold period criteria were provided by staff of SPD's Operation Impound.

release; all outstanding fines and fees owed to SMC and other Washington courts must be repaid.[13]

After the passage of the Impound Law, the City Attorney's Office implemented a new prosecution policy for DWLS 3 drivers who experienced an impound. Charges against these individuals would be dismissed resulting from the DWLS 3 offense under the following conditions:

- there was no companion criminal citation arising from the same incident
- the incident did not involve an accident
- the incident was not the direct result of a mandatory license suspension driving conviction
- charges had not previously been dismissed against the individual due to a DWLS 3 impound
- the individual was not on deferred prosecution for a driving under the influence or physical control offense.[14]

According to the City Attorney's Office DWLS 2001 Year End Report, between the beginning of Operation Impound in 1999 to 2001, close to 5,600 cases had been dismissed against DWLS 3 drivers as a result of this prosecution policy.[15]

Because the impound process and payment requirements can result in a large dollar amount due for individuals to redeem cars after impound, the Impound Law became the focus of some controversy after its implementation. In response, the Seattle City Council made some adjustments to the law and impound process. In November 2000, SMC began a pilot program intended to aid individuals in getting their license reinstated and redeeming cars from impound. SMC began holding special evening court sessions for individuals with a DWLS-related impound. Participating individuals go through an intake review process, may arrange special payment plans, and perform community service. Making arrangements with the court for satisfying these unpaid fines and fees assists individuals in having their license reinstated more rapidly by DOL. In the majority of cases, the program can address only fines and fees that originate from SMC and not those owed to other courts around the state. Thus, drivers who

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[13] For a more detailed discussion of the impound procedures, see: Bradow, A. (June 15, 2001). *DWLS Impound and Car Recovery Study*. Consultant Report. Seattle, WA: City of Seattle.

[14] See previous note.

[15] Seattle City Attorney's Office (n.d.) *DWLS Impound: 2001 Year End Report*. Seattle, WA: Author.

have outstanding payments to other courts must work directly with these other courts to satisfy debts owed. Changes to the impound procedures include free taxi rides home following a vehicle impound and waiver of the administrative towing fees if the impounded vehicle belongs to a family member or friend.

Before implementation of the Impound Law, SPD formed a special unit, called Operation Impound, to track impounded vehicle information, serve as a point of contact for citizens, and notify the three authorized tow companies about impounded vehicle eligibility for release to a registered owner.

In the next chapters, we discuss the study's methodology, results of DWLS 3 dangerousness research question, the general deterrence research question, and the specific deterrence research question. The final chapter is a summary of the study's findings and conclusions.

2. Methodology

To address each of the three research questions, three different research methodologies are required. In this chapter, we provide a description of each. First, we provide a general overview of each methodology. Second, we discuss the utility and selection of comparison groups for use in addressing the general deterrence and specific deterrence research questions. Third, we present a general description of the data sources used to address the research questions. Fourth and finally, we provide a detailed description of the research strategy for each question, including specific data used, analytic strategy, and limitations of the analyses.

Methodology Overview

In this section, we give a general overview of the research strategy used to address each research question. First, we discuss the question focusing on the dangerousness of DWLS 3 drivers. Second, we provide a methodology overview for the general deterrence research question, followed by an overview of the methodology for the specific deterrence research question.

Are DWLS 3 Drivers More Dangerous?

This question assesses whether DWLS 3 drivers have worse accident records than validly licensed drivers. The hypothesis is that DWLS 3 offenses do not directly cause accidents, but that DWLS 3 offenses are associated with a host of other driving related offenses (such as speeding and failure to stop at stop signs), which are indicators of unsafe driving. In order to test this hypothesis, we used driving records of all Seattle residents to examine 1) whether traffic violations are associated with accidents, 2) whether DWLS 3 offenses are associated with traffic violations, and 3) whether DWLS 3 offenses are associated with accidents (with and without injuries or fatalities). The assessment consisted of bivariate comparisons of observed percentages and statistical tests using logistic regression to examine the relationship of variables to involvement in accidents with and without injuries or fatalities. The results of these analyses allow us to assess whether there is an association between other traffic offenses and DWLS 3 offenses and whether drivers with DWLS 3 offenses have a higher probability of

involvement in accidents (and more severe accidents) than validly licensed drivers.

Does the Impound Law Produce General Deterrence?

In order to test whether the Impound Law has a general deterrent effect, we compared rates of DWLS offenses before and after the law's implementation in Seattle to those of a comparison city. Because the Impound Law may have other impacts, we also compared rates of accidents and other traffic offenses. To examine these three variables, we used time series analyses to compare rates constructed from the DOL driving records of all Seattle residents with a suspended license to those of suspended drivers in a comparison city. Because DOL records contain only conviction records, we also used municipal court records to examine rates of court charge filings (based on total city population) before and after the implementation of the Impound Law. If the law produced a general deterrent effect, we would expect to see a decline in DWLS, accident, and other traffic offense rates in Seattle but no similar decline in the comparison cities.

Does the Impound Law Produce Specific Deterrence?

For testing specific deterrence, we compared the recidivism of DWLS drivers who had experienced an impound in Seattle with DWLS drivers in a comparison city who did not experience an impound. Four recidivism outcome measures were compared during a one year follow-up period: 1) repeat DWLS impounds or arrest/citations, 2) court filings for DWLS offenses and 3) other traffic offenses, and 4) DOL records of accidents. We used survival analysis to assess whether time to recidivism for drivers who experienced an impound differed from those who did not on these four outcome measures. If a specific deterrent effect was produced by the experience of an impound, we would expect the results of the survival analysis to show lower rates of repeat DWLS impounds, court filings for DWLS and other traffic offenses, and accidents among those who experienced an impound in Seattle compared to those who did not.

Comparison Cities

Comparison cities are necessary for addressing both the specific deterrence and the general deterrence research questions. In this section, we discuss the relevance of comparison cities for these questions.

Specific Deterrence

In addressing the specific deterrence research question, it would be ideal to assess the impact of the new legislation by employing a random assignment design, in which DWLS drivers were assigned with "equal probability" to an impound and non-impound response by police. Random assignment designs, or true experiments, provide the strongest possible causal evidence about the impact of an intervention. With random assignment, we could be confident that observed differences between the impound and control groups are due to the impact of the new legislation, and not to differences in characteristics between the impound and comparison groups.

Because all Seattle drivers are subject to the Impound Law, it is not feasible to test the effectiveness of the law by randomly assigning Seattle DWLS drivers to an impound group and no impound control group. Consequently, it was necessary to employ a less powerful, quasi-experimental design. We compared Seattle DWLS drivers who experienced impounds to DWLS drivers in a comparable city who did not. Drawing the comparison group from a similar city will help minimize the pre-existing differences between the two groups that might cloud the interpretation of findings. For example, if we were to form a comparison group of drivers from a rural town, it would be difficult to determine the extent to which our findings are due to the considerable pre-existing differences between urban and rural environments. A comparison sample of urban residents would remove this sizeable difference between the groups, allowing a clearer view of the impact of the Impound Law.

General Deterrence

For the general deterrence research question, a comparison city is also necessary. General deterrence can be tested by observing whether targeted rates (such as accident or DWLS rates) change in response to the adoption of new legislation. To observe "change," the targeted rates were measured before and after the adoption of the new legislation. Examining these rates in a comparison city before and after the legislation allows us to observe whether any change in Seattle's rates is unique or if the change is occurring in the comparison city as well. If rates in both cities move in a similar way (both up or both down), this is evidence that the rates are being "pushed" by the same force (e.g. more accidents because of bad weather in both cities, less accidents over time because people are driving safer cars) and it is not likely that the Impound Law is responsible for observable changes in Seattle. If the rates change in a dissimilar fashion, this is evidence that "something" is happening in Seattle that is not happening in the

comparison city. By comparing Seattle to a city with similar characteristics except for the legislation, we are increasing the chance that this "something" is the general deterrent impact of the Impound Law.

Below, we discuss: 1) criteria used for selecting the comparison cities; 2) the candidate cities according to these criteria; and 3) the cities that were selected among these candidates.

Criteria for Comparison Cities

There are several key criteria important for the comparison jurisdiction. These criteria are:

1. No impound law or law enforcement impound policy during study period.

Conclusions about the effectiveness of the Impound Law cannot be drawn if it is compared to a jurisdiction "contaminated" by the existence of the same type of law or law enforcement policy we are trying to examine. Public notification/advertisement of the planning, adoption, or implementation of an impound law at any point during the study period would cause "contamination" because deterrence theory predicts this would impact behavior in the comparison jurisdiction.

2. Comparable to Seattle in total population size.

Comparably sized jurisdictions are more likely to share common characteristics than differing jurisdictions, such as available public resources, infrastructure, transportation needs and patterns, and special law enforcement and judicial system concerns.

3. Comparable to Seattle in population concentration.

Related to total population size, those located within areas (e.g. counties) of similar population concentrations are likely to share characteristics than those with dissimilar concentrations (such as a large city within a urban county compared to a large city within a rural county).

4. Comparable to Seattle in population racial distribution.

Jurisdictions with comparable racial distribution are more likely to share similar social environments relative to jurisdictions with differing racial compositions.

5. Minimal commuter/regular travel between residents of comparison jurisdiction and Seattle or other jurisdiction with an impound law.[16]

The comparison sample must consist of drivers who are not subject to an impound law. In areas with no/very little "cross-traffic" between impound and no-impound jurisdictions, there would be little contamination expected. In medium to high cross-traffic areas, contamination becomes very likely because commuting residents of no-impound jurisdictions may have their vehicles impounded and have altered their behavior.

6. Local agencies possess and are willing to provide necessary data.

Because official records are the source of data for the evaluation and many of these records are maintained at the discretion of local agencies (police and court), key records must be available and agencies must allow us access to them.

7. A Washington jurisdiction.

Seattle shares similarities with Washington cities that it does not share with cities outside Washington, such as criminal and administrative law.

Candidate Comparison Cities

Table 2.1 presents Seattle and potentially eligible comparison cities with a population greater than 50,000, along with selection criteria discussed above, with two exceptions. The table does not contain the number of law enforcement agencies and courts because they are similar on this criterion (one local police department and municipal court). In addition, availability of and willingness to provide necessary data are not included (this issue is discussed below). Listing Seattle first, Table 2.1 is arranged in order of impound status and similarity of population characteristics.

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[16] We contacted Puget Sound Regional Council to assess the feasibility of obtaining data on commuter traffic between Seattle and neighboring cities. Based upon our conversations with staff, it appeared that obtaining these data would be a resource intensive effort and thus not feasible for use in our study. The US Census Bureau also maintains data on commuter traffic however working with these data is also labor intensive and thus we deemed it not feasible as an additional data source.

Table 2.1

Criteria for Selection of Comparison Cities

Cities Greater than 50,000 Population	*County*	*Impound Passed or Policy Adopted*	*City Total Population*[5]	*County Total Population*[5]	*City % White*[5]	*City % Black*[5]	*City % Asian*[5]	*City % Indian*[5]	*City % Other*[5]	*If No Impound Law, Impound Cities within 25 miles*[6]
Seattle	King	Jan-99	563,374	1,737,034	73%	9%	14%	1%	3%	Impound
Everett	Snohomish	No Impound[1]	91,488	606,024	85%	3%	7%	2%	4%	Marysville 6 mi.; Lynnwood 14 mi.; *WSP statewide
Federal Way	King	June-01[1]	83,259	1,737,034	73%	8%	13%	1%	5%	Kent 7 mi.; Tacoma 12 mi.; SeaTac 12 mi.; Burien 15 mi.; Fife 7mi.; Seattle 20 mi.; *WSP statewide
Yakima	Yakima	No Impound[1]	71,845	222,581	72%	2%	1%	2%	23%	*WSP statewide
Shoreline	King	No impound[1]	53,025	1,737,034	80%	3%	14%	1%	2%	Seattle 15 mi.; Lynnwood 6 mi.; Bellevue 16 mi.; *WSP statewide
Spokane	Spokane	June-98[1]	195,629	417,939	93%	2%	2%	2%	1%	Impound
Tacoma	Pierce	Jan-99[1]	193,556	700,820	74%	12%	8%	2%	4%	Impound
Vancouver	Clark	1998 adopted state law, enforced case by case[2]	143,560	345,238	88%	3%	5%	1%	4%	Impound
Bellevue	King	Dec-98[1]	109,569	1,737,034	77%	2%	18%	0%	3%	Impound
Kent	King	July-99[1]	79,524	1,737,034	75%	9%	10%	1%	5%	Impound
Bellingham	Whatcom	1999 adopted state law, enforced 3/01[3]	67,171	166,814	91%	1%	4%	2%	2%	Impound
Lakewood	Pierce	Sep-99[1]	58,211	700,820	70%	13%	10%	2%	6%	Impound
Kennewick	Benton	1999 adopted policy[1]	54,693	142,475	86%	1%	2%	1%	10%	Impound
Renton	King	1999 adopted state law, enforced case by case[4]	50,052	1,737,034	71%	9%	14%	1%	5%	Impound

Source: [1]Municipal Research Services, [2]Vancouver PD Law Department, [3]City Attorney's Office, [4]Renton PD Media Contact Officer, [5] U.S. Census 2000 data, [6]Municipal Research Services Corp., Washington State Patrol Field Operations; Yahoo.com driving directions distance from city center to city center

One considerable complication for locating an impound-free jurisdiction is that Washington State Patrol (WSP) adopted the authority set out in the 1998 state legislation (RCW Title 46) to impound vehicles driven by suspended drivers. This presents a problem because WSP "is primarily responsible for traffic law enforcement, collision investigation, and motorist assists on 17,524 miles of state and interstate highways."[17] Thus, all Washington interstates and state highways are impound jurisdictions and individuals driving these roads are subject to impound, regardless of the presence or absence of the ordinance in their city of residence.

Best Available Comparison City

Among the cities displayed on Table 2.1, Everett, Federal Way, Yakima, and Shoreline are potential comparison jurisdictions for Seattle because they have no impound ordinance during our period of interest. Federal Way is included as a candidate because its ordinance was adopted more recently and does not overlap with our study period (through January 2001). Among the four potential comparison cities, Everett and Federal Way are most closely matched to Seattle in terms of population size, population concentration, and racial distribution. Both jurisdictions have some proximity to impound jurisdictions (including the statewide presence of WSP on interstates and state highways), but Everett has fewer impound jurisdictions nearby than Federal Way. As a sizeable city with no impound law, Yakima can offer some insightful comparisons with Seattle, although its small number of Black residents limit analyses of racial differences.

We approached both the Everett and Federal Way Police Departments to request study participation. Everett Police Department declined to participate in the study but Federal Way Police Department was willing to provide the data needed for the evaluation. Federal Way is not an ideal candidate because its residents are at risk of impound to varying degrees during the study period depending upon their travel patterns. In the case of specific deterrence, Federal Way drivers may venture into neighboring impound territory and thus be at risk of or experience an impound. Thus, our Federal Way comparison group is potentially "contaminated" by the influence of the impound laws. If a specific deterrent effect does exist, this contamination of the comparison group would

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[17] Quotation taken from Washington State Patrol Field Operations Bureau website, accessed on 10/18/01, http://www.wa.gov/wsp/about/fobhome.htm. According to our September 27, 2001 telephone conversation with WSP Field Operations, troopers have been enforcing the impound policy statewide since 1998.

attenuate the differences between cities, make a specific deterrent effect difficult to detect.

In the case of general deterrence, contamination is also a problem. By virtue of being close to impound cities (with residents regularly traveling in these areas), Federal Way residents are at some risk of impound. In fact, all Washington residents are subject to WSP's impound authority on all interstates and state highways throughout the state. Thus, there is essentially no location in Washington that is unaffected by the threat of impound. We would expect that residents of a "no-impound" city would respond to the threat of impound nearby because collectively residents would perceive themselves to be at some risk of receiving that punishment because of regular travel into impound territory.

This is a considerable problem for measurement of general deterrence because it means that, in both Seattle and any potential comparison city, the "same force" (i.e. the threat of impound) is acting on the populations of both cities, but to different degrees. Thus, detecting a general deterrent effect would be difficult, even if one exists in Seattle. In short, the purpose of including a comparison city is somewhat defeated if residents of the comparison city are subject to the same law we are attempting to assess.

Because of the contamination of potential comparison cities for testing general deterrence, in addition to Federal Way, we included the City of Yakima. While its racial distribution is different than Seattle, Yakima is the only major Washington city with no impound law that is somewhat geographically isolated from other impound jurisdictions. It is not an impound-free area because of the impound activities of the WSP. While Yakima is different from Seattle and Federal Way in a number of ways, including climate and population density, it can provide at least serve as a benchmark useful in estimating general deterrence.

Despite the challenges presented by the essentially statewide presence of impound risk, it is still possible to detect a general deterrent effect. It is reasonable to assert that residents of Seattle perceive a greater risk of impound than residents of Federal Way and Yakima (who are at risk when traveling to other cities and on interstates and state highways). Thus, we might expect to see a difference between Seattle and these cities because of differing degrees of exposure to the Impound Law. We would only expect to observe such a difference in our data if the threat of impound has a large impact on collective behavior. A small or moderate impact is not likely to be detectable.

However, if a general deterrent effect were detected, the interpretation of this finding would not be straightforward. That is, we would be unable to attribute a deterrent effect to Seattle's law itself because it exists as part of a "package" of impound laws that include neighboring cities and the activities of WSP. In sum, because of the statewide threat of impound, this evaluation can provide only a very weak test of the general deterrence research question.

Data Sources

Data to examine all three research questions were drawn from existing official records. Thus, key to addressing the research questions was identifying and gaining access to necessary data from the local and state agencies that collect them. In this section, we discuss these data sources in general and features of the data sources relevant to analysis of the three research questions. In the following sections, we discuss specifics of how these data were used to address the individual research questions.

Seattle Police Department Data

Seattle Police Department (SPD) provided us with a copy of the database created especially for Operation Impound to track impounded vehicles. These data were used only in analyses for the specific deterrence research question. Features of these data and their use are discussed in the specific deterrence section below.

Federal Way Police Department Data

Federal Way Police Department (FWPD) provided us with data on all individuals cited or arrested for DWLS offenses from January 1, 1999 through January 31, 2001. These data were used only in analyses for the specific deterrence research question and are discussed in this section below.

Seattle Municipal Court Data

Seattle Municipal Court (SMC) provided us data on case filings, charge filings, and dispositions for DWLS, other criminal driving offenses, and traffic infractions. For the general deterrence research question, SMC provided us monthly counts of charge filings for DWLS, criminal traffic offenses, and traffic infractions between January 1996 and December 2001. These data contained no individual identifiers. For the specific deterrence research question, we provided

a list of individuals identified by FWPD and SPD as having a DWLS offense between January 1, 1999 and January 31, 2000. In return, SMC provided any available court records on these individuals, including charge filings and disposition data. The use of these records is discussed further below.

Administrative Office of the Courts Data

From Administrative Office of the Courts (AOC) we sought similar court data to that provided by SMC. AOC maintains records from courts of limited jurisdiction throughout the state, including Federal Way. For the general deterrence research question, AOC provided us a dataset of charge and case filings for the cities of Yakima and Federal Way from which we tabulated monthly counts. These data contained no individual identifiers. Records were available from Federal Way between January 1996 and March 2001.[18] Yakima records were available from January 1997 through March 2001. For the specific deterrence research question, we provided a list of individuals identified by FWPD and SPD as having a DWLS offense between January 1, 1999 and January 31, 2000. AOC conducted a search for court records in their data system and provided us with records of all individuals they were able to match. The use of these court records is discussed further below.

Department of Licensing Data

Department of Licensing (DOL) data were used for all three research questions. All of the data shared the following common features. The demographic information is limited to gender and age (as calculated using the date of birth). No race or income information is maintained in DOL records. There is no method of determining actual driving experience. The date at which an individual obtained a driver license is available but this information is not a good measure of driving experience for several reasons. First, it only refers to Washington driver licenses. Thus, a recently arrived Washington resident may have many years of driving experience in another state but DOL records would only reflect driving "experience" since the recent move to Washington. Secondly, new licenses are sometimes issued to individuals who have had their license revoked at an earlier point. DOL records reflect the most recent license issue date and not the earliest. For these reasons, it is not meaningful to use the

[18] Federal Way Municipal Court was formed in January 2000. Prior to that date, municipal level cases were filed through Federal Way Distrust Court. AOC data contain indicators for identifying municipal-level cases filed through the District Court before January 2000.

date at which a licensing was obtained to measure driving experience. Specifically, it undercounts driving experience.

DOL driving records also contain each individual's 1) convictions, 2) accidents, and 3) DOL departmental actions. Next, we discuss each of these data types as relevant to the present study.[19]

Referred to as violations, DOL obtains its records of convictions from courts around the state. Violations typically remain on driving records for five years. More serious offenses, such as an alcohol-related offense, remain on records for a longer period of time, which varies with the type of offense.

Accident records are obtained by DOL typically from WSP, which obtains accident reports in one of two ways: 1) through police reports of accidents or 2) driver reports of involvement in a collision. In Washington, drivers are required to report accidents that involve injuries or damage totaling more than $700. DOL records do not assign fault in accident records, merely involvement.[20] DOL records contain a notation specifying that an injury occurred in the accident but not the number of people injured, cars, or individuals involved in an accident. The total dollar amount of damage caused by an accident is not recorded. Accidents remain on driving records for five years from the date of collision in most cases.

Departmental actions include records of license suspension, revocation, and reinstatement. These are generally administrative actions taken by DOL that are recorded in its own data system. The length of suspensions varies considerably depending upon the reason for the departmental action. Once a suspension is released, record of a suspension typically remains on a driving record for more than five years.

The nature of the DOL records presents some difficulty for the evaluation for all research questions. DOL provided us the requested data in April and May of 2002. Consequently, in the case of accidents and violations, many records before 1997 were likely no longer available.[21] This presents a limitation in looking at individual records and trends before the 1999 implementation of the Impound

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[19] For more information, see the DOL's description of the Abstract of Driving Record (ADR), http://www.dol.wa.gov/ds/abstract.htm.

[20] For more information from DOL on accident reporting, see http://www.dol.wa.gov/ds/collision.htm#collision.

[21] In the data provided, there were many violations and accidents with dates prior to 1997 but we are unable to determine what share of records had already been expunged by the point in 2002 when we received the records.

Law. If the share of missing records is sizeable and/or systematic, it will make it more difficult to detect differences for each of the three research questions. Because we have no method of determining which drivers are missing records or the types of records missing, we cannot gauge the extent or estimate the potential impact of this problem.

Records of suspensions are maintained longer on driving records so it is likely the data provided in 2002 provide a more accurate picture of suspensions before 1997.

Another complication is that DOL records maintain information only about the most recent address reported. Thus, the records available for the evaluation only show where a driver reported living as of April 2002 and not the potentially multiple cities she or he may have lived while they acquired various violations, accidents, and suspensions. Moreover, we cannot determine how long an individual had resided in the state of Washington. As discussed above, problems with interpreting the "license issue date" data make this an unreliable indicator of how long an individual has been a Washington resident. Thus, a clear driving record may indicate good driving or a recent move to the state. The inability to determine earlier cities of residence presents a problem for the general deterrence and DWLS 3 dangerousness research questions. This issue is discussed further below.

Methodology for DWLS 3 Dangerousness Research Question

Are the accident records of DWLS 3 drivers *worse than the accident records* of validly licensed drivers?

Addressing this research question requires comparison of the accident records of DWLS 3 drivers and validly licensed drivers. In the next section, we describe key features of the data used to address this research question and the analytic strategy.

Number of Seattle Drivers in the Sample. We used Seattle driving records provided by DOL in April 2002. These records contained driving records of all individuals who had listed Seattle as their city of residence at that time. We examined only records of individuals who had been issued a driver license (rather than records of those who had been issued only a commercial license,

identification card, or instruction permit) and who were between the ages of 16 and 99 on October 1, 1995, the beginning of the study period.[22]

This resulted in 690,009 Seattle drivers. This number far exceeds the 563,374 total city population reported by the U.S. Census Bureau for the entire City of Seattle in the year 2000.[23] This suggests that DOL records contain a large number of individuals with listed Seattle addresses who may not in fact live within the city limits of Seattle.

Fortunately, the city of residence is less relevant to the assessing involvement in accidents of DWLS 3 drivers but it does pose some problems. For example, if drivers move from Washington without DOL's knowledge, they may have been involved in accidents in other states while their DOL record appears to be accident-free. Further, examining accident records of drivers from the same city increases the chances that individuals are driving under similar conditions which may be associated with more or fewer accidents, e.g. weather, traffic enforcement, and traffic congestion. Thus, the inability to distinguish Seattle drivers from those who live elsewhere means that our analyses contain an unknown amount of "background noise" that we are unable to remove.

If there is a systematic difference between these individuals and those who remained in Seattle for the entire study period (e.g. more DWLS 3 drivers among those living elsewhere), this may impact our results in a way we cannot predict. However, if there were little or no systematic differences between these individuals, the impact on our results would be negligible. Because we have no information about who among the 690,009 drivers lived elsewhere during the study period, we cannot estimate the likely impact of this "background noise."

Types of Records and Time Periods. DOL was able to provide us complete driving records for all individuals with a Seattle address on file in April 2002 but

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[22] We eliminated anyone younger than 16 at the beginning of the study period from study because those who turned 16 during the study period would not have the same period of exposure to acquire accidents as older drivers. Those over 100 reported as licensed drivers by DOL are not likely to drive very often.

[23] Upon our inquiry about this large number of additional Seattle drivers, DOL staff informed us that: 1) DOL records contain whatever city drivers report and there is no auditing process to assess the accuracy of this information, e.g. whether the driver reported zip code matches the reported city, 2) some records may be the result of data entry errors, 3) drivers who do not notify DOL after an out-of-state move and do not surrender their Washington license to another state in the process of acquiring a new license remain in DOL records listed by their former city, and 4) DOL's data system limits the number of entries that can be maintained for a single driver, e.g. if a single driver acquires an excessive number of departmental actions, violations, or accidents an entirely new driver record is created. In the latter case, a single driver record can contain up to 50 departmental actions, 50 violations, or 12 accidents. This latter point, however, accounts for only a very small number of drivers.

did not agree to provide us identifying information for these records. Consequently, we could not match individual DOL driving records with any other data source.

We used the DOL records to examine whether DWLS 3 drivers are at increased risk of involvement in accidents relative to validly licensed drivers. Demographic data were limited to age and gender. Since the records did not contain race, economic, or driving experience information, we were unable to look at the association between these factors and probability of accidents as requested by the Seattle Legislative Department.

Other available data were accidents with and without injuries and fatalities, traffic and driving related convictions and departmental actions, such as license suspensions.

Older information is routinely purged from driver records, so these DOL files contain only relatively recent information. Most incidents remain on record for only five years. However, because a considerable amount of data was available in the driving records back to October 1995, we included these older data in the analyses. It is unknown the extent to which data were purged from records between 1995 and 1997 (five years from the point at which we were provided the DOL records).

Definition of "Validly Licensed Driver". One important issue is defining validly licensed drivers, against whom DWLS 3 driver accident records will be compared. Validly licensed drivers would be best defined as those with no DWLS offenses and no license suspension at any point during the five-year study period. Because of limitations in the DOL data, it is does not appear that drivers who fall in this group can be clearly identified. Between October 1, 1995 and September 30, 2000, we found 45,045 drivers suspended and 13,561 drivers cited for DWLS. Importantly, those with a DWLS offense are not necessarily the same drivers as those that show a license suspension. As Appendix A indicates, the data contained a larger total number of DWLS offenses among supposedly non-suspended drivers than among drivers whose record showed a suspension during the study period. Of the 644,964 drivers whose records showed *no* suspension during the study period, 8,431 (1.3%) were cited for a DWLS offense.[24]

[24] We inquired with DOL staff about this discrepancy and were informed that only those with suspended driving privileges are eligible for DWLS offenses, not those who are simply driving without even having been issued a driver license. We provided DOL a sample of these records and they were able to determine that in a small number of these cases the DWLS offense was issued because of the suspension of driving privileges in another state. In the majority of cases, there was no

Because only suspended drivers are eligible for DWLS offenses, this suggests that, among those with no record of suspension, there may be some unknown number of suspended drivers. The potential impact of this problem would be a reduced ability to distinguish differences in dangerousness between DWLS 3 and validly licensed drivers, should a difference exist. The degree of this potential impact of the study's results is unknown because we cannot ascertain whether this problem is randomly distributed or systematic in the driver records and size of the problem (extent of the missing records).

In sum, the key comparison group for DWLS 3 drivers is the admittedly problematic category of validly licensed drivers, defined as those with no suspensions or DWLS offense on record during the five-year study period. To broaden the potential impact of the study, we included an additional category of drivers that is relevant for purposes of comparison with DWLS 3 drivers. These are individuals with a license suspension but no DWLS offense. These individuals may have stopped driving following a license suspension or continued to drive and avoided a DWLS offense by escaping detection. We also included those drivers with DWLS 1 and 2 as their most serious DWLS offense. The latter comparison allows us to examine whether the accident records of DWLS 3 drivers are more similar to validly licensed drivers or the accident records of DWLS 1 and 2 drivers. In sum, we compared the records of drivers 1) with no suspension and DWLS offense, 2) with a suspension but no DWLS offense, 3) with DWLS 3 as their most serious DWLS offense, and 4) with a DWLS 1 or 2 as their most serious DWLS offense.

Analysis Strategy. This analysis tests a hypothesis about DWLS 3 offenses as indicators of unsafe driving. The hypothesis is that unsafe driving causes accidents. Unsafe driving also causes traffic offenses, which in turn lead to license suspensions, which lead to DWLS offenses. Not all traffic offenses lead to license suspensions or DWLS offenses, however. To test this hypothesis, we examined whether:

1. traffic violations are associated with accidents
2. DWLS 3 offenses are related to traffic violations, and
3. DWLS 3 offenses are associated with accidents.

The analysis proceeded in two phases. The first tested the hypothesized relationships in simple bivariate comparisons. The second phase of the analysis was to conduct logistic regression statistical tests to examine the same

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clear indication of why a DWLS conviction was present in the absence of a license suspension on a driver record.

relationships observed in observed percentage comparisons. Then logistic regression statistical tests were used to assess the probability of involvement in an accidents and involvement in an accident with an injury or fatality, given a driver's DWLS status, gender, and age.

The results of these analyses allow us to make statements about whether DWLS 3 drivers have worse accident records than validly licensed drivers.

Methodology for General Deterrence Research Question

Does impounding the vehicles of persons arrested for DWLS have a *general deterrence* effect?

This research question asks whether rates of DWLS, accidents, and other driving offenses declined in Seattle following implementation of the Impound Law, compared to Federal Way and Yakima. These analyses relied on DOL and court data.

In general deterrence research, the denominator (the group that a rate is based on) for constructing population rates can vary. Typically, researchers construct offense rates using the number of offenses over the total population. This is how offense rates were constructed from court data; i.e. using Census population data interpolated annually and monthly for the study period. Within the present context, we have an additional option for constructing rates because of the availability of DOL data. We will discuss the usefulness of this other method and how these rates were constructed below.

Because the base rate of accidents that involved injuries was so low, the rate of accidents involving injuries was very low on a monthly basis. This problem was compounded in Yakima, the smallest of the three cities. Thus, we focused the analyses on trends in total accidents, rather than accidents involving injuries.

Court Data. Because we were unable to obtain law enforcement data on all DWLS and other driving offenses before and after the imposition of the law, records of court filings provided the next best source of data. From AOC, we obtained these records for Federal Way and Yakima and from SMC we obtained filings for Seattle. This is not an ideal source of data because filings do not occur for all offenses (thus filings undercount actual offenses) but it does provide a consistent gauge of offenses in the three cities. For DWLS and other driving offenses, we obtained data for monthly charge filings. We obtained data for

Seattle and Federal Way from January 1996 to March 2001. Yakima data were available from AOC from January 1997 through March 2001.[25]

DOL Data. DOL conviction records provide another method of observing changes in trends over time for individuals with Seattle, Yakima, and Federal Way addresses. Using DOL records, we have the capability of directly examining changes in conviction rates among the target population of the Impound Law, i.e. suspended drivers. The offenses may have occurred anywhere within the state.

For each month between January 1995 and March 2001, we identified the number of drivers with a new or existing suspension in that month and determined the degree of suspension for each driver. For each study month, we then determined how many drivers suspended in the 1st, 2nd, and 3rd degree and also had a DWLS offense during that month. We used the number of suspended drivers in a given degree as a denominator for each month, and the number of them with a DWLS offense in that month as the numerator, to generate a rate of DWLS among suspended drivers. We standardized the rates as the number of DWLS offenses per 10,000 suspended drivers.

We used the same denominator (number of suspended drivers per month) to calculate rates of accidents and other driving offenses for each month. Other driving offenses included relatively minor traffic offenses, criminal offenses requiring suspension, and criminal offenses not requiring suspension. DWLS offenses are not included in the other driving offenses category.

This data source, however, does have some limitations. For DWLS and other driving offenses, DOL maintains records on convictions, not all offenses. Therefore, these data underestimate the number of actual offenses and we have no information about whether offenses are more likely to result in convictions and whether convictions are more likely for some types of individuals compared to others or in one city compared to the others. Thus, we cannot ascertain the extent of this bias or impact of the underestimate on the results of the analyses.

As discussed previously, the DOL data appear to contain too many drivers for each city's population. It may be that some of these drivers do not live within the city limits of Seattle, Federal Way, Yakima and we have no means of identifying these drivers.[26] If there are no systematic differences between those

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[25] AOC staff reported to us that earlier policy allowed individual Municipal Courts to destroy records of older cases, both locally and with AOC. Yakima had elected to destroy data for this earlier period.

[26] The addresses provided by DOL were those on record in April 2002 and an unknown number of drivers may have lived in other cities or states prior to this period. The number of licensed drivers

living elsewhere but have recorded Seattle, Federal Way, and Yakima addresses, this would have relatively little impact upon our analyses. However, a lack of data prevents us from assessing this issue so we cannot estimate the potential impact it may have upon our analyses.

In addition to the limitations inherent in the data sources, contamination of data for the comparison cities poses a considerable problem. As previously discussed, Federal Way borders a large number of impound jurisdictions and Yakima residents are subject to the impound policy of WSP. The anticipated impact of this contamination is that it would dilute the difference observed between Seattle and the comparisons cities, making a general deterrent effect more difficult to detect, should one exist. Consequently, if the results do not produce evidence of a general deterrent effect, we cannot be certain whether there is no effect or whether the presence of contamination masked its presence. The lack of an uncontaminated comparison city in Washington means this problem is unavoidable.

Analysis Strategy. There are three different questions of interest for the general deterrence question. These are whether the Impound Law appears to have had an impact on rates of 1) DWLS, 2) other driving offenses, and 3) accidents in Seattle compared to Federal Way and Yakima. Since we have a single source of data on accidents (DOL), we conducted statistical test to address the question of whether accident rates (number of accidents over the number of suspended drivers) may have been impacted by the Impound Law. For DWLS and other driving offenses, we had two different sources of meaningful information (court filings for all residents and convictions for all suspended drivers) and thus conducted a separate test for each source of data.

Like previous studies of general deterrence, the statistical technique we utilized is time series analysis.[27] This technique analyzes changes over time to construct a curve among the monthly points that represents an approximation of the underlying, actual rates, with the "noise" or random monthly fluctuation removed.

The results of the time series analyses allow us to examine whether rates of DWLS, other traffic offenses, and accidents decreased in Seattle following the

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from Seattle in the records were 690,009, in 119,230 Yakima, and 87,141 in Federal Way. These numbers are also large compared to the US Census 2000 figures for the total population for Seattle (563,374), Yakima (71,845) and Federal Way (83,259). We have no means of determining how many of these individuals actually resided within the city limits of the three cities before or on April 2002.

[27] DeYoung (1998), Voas, Tippetts, & Lange (1997), Beirness, Simpson, Mayhew, & Johan (1997).

implementation of the Impound Law relative to two comparison cities. If so, these trends would provide evidence that a general deterrent effect was produced by the introduction of Seattle's Impound Law.

We analyzed these trends using Bayesian statistics; a widely used analytical framework for public policy research with many examples in health related research and legal research.[28] While other methods, often called "classical" statistical analyses use concepts such as statistical significance to draw conclusions, Bayesian analysis relies on more direct probability statements. Because the types of tests we conducted were fairly complex, the interpretation of results is more straightforward using Bayesian analyses than classical analysis. Consequently, we do not present results in terms of statistical significance but in terms of probabilities.

In the analyses, we seek to determine if there are differences between Seattle and the comparison cities. The main test of interest is the probability that a post-law drop in DWLS rates is greater (for example) in Seattle than in the comparison cities. This kind of direct comparison is a prominent feature of Bayesian analysis. Just like with standards set out for determining statistical significance in classical analyses (such as a p-value of less than .05), statisticians have developed a set of generally accepted standards for translating Bayesian probabilities into measures of the strength of evidence.[29] We used these strength-of-evidence standards to assess the results of the general deterrence tests. These standards are presented in the general deterrence chapter along with the results.

Methodology for Specific Deterrence Research Question

Does impounding the vehicles of persons arrested for DWLS have a *specific deterrent* effect?

The specific deterrent research question asks whether those DWLS drivers who have experienced an impound are less likely to reoffend than similar drivers who did not. In this section we discuss the methodology for addressing the specific deterrence question. As discussed above, we selected a group of Federal Way

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[28] D. Berry and D. Stangl, editors (1996) *Bayesian Biostatistics*. Marcel-Dekker, New York. S. Fienberg and J.B. Kadane (1983). The presentation Of Bayesian statistical analyses in legal proceedings. *The Statistician*, 32: 88-98. E. Stasny, J. Kadane, K. Fritsch (1998). On the fairness of death penalty juries: A comparison of Bayesian models with different levels of hierarchy and various mechanisms. *Journal of the American Statistical Association, 93*: 464-477.

[29] H. Jeffreys (1961). *Theory of Probability* 2nd Ed. Oxford: Oxford Press.

DWLS drivers to serve as a comparison for impounded DWLS drivers in Seattle. The three different data sources used are discussed below.

Police Department Data. We used SPD's Operation Impound database on all DWLS impounds that had occurred since the Impound Law went into effect on January 1, 1999. These data contained descriptive information about the drivers, the registered owners of the impounded vehicles, and limited information on the outcome of the impound. SPD does not maintain records on the amount of fines and fees the DWLS drivers owe in order to redeem a vehicle or the date on which a vehicle was redeemed from impound or auctioned. According to the Operation Impound database, between January 1, 1999 and January 31, 2000, there were 5,287 drivers who had at least one DWLS impound.[30] This group constitutes our Seattle sample.

The SPD was unable to provide us other arrest and citation records (rap sheets) before or after the start of Operation Impound for use in the evaluation. Also, we were not able to obtain records for DWLS arrests or citations issued after January 1, 1999 where a SPD officer elected not to impound a vehicle. For the specific deterrence research question, this may result in some share of drivers who had a repeat DWLS offense that would go undetected in our data. Thus, we may overestimate the specific deterrent effect of the Impound Law. Without additional data, however, we cannot determine whether this was the case.

The FWPD provided us with data on all individuals cited or arrested for DWLS offenses during the study period. According to the Federal Way data, between January 1, 1999 and January 31, 2000, there were 955 drivers who had at least one DWLS citation or arrest. This group constituted the Federal Way sample. The data contained degree and date of DWLS offenses and demographic data about the driver's age, gender, and race.

Court Data. Court record provided measures of DWLS and other driving offenses before and after the first DWLS offense during the follow-up period. Using the data provided by SPD and FWPD, we provided a list of all 6,242 individuals with DWLS offenses to SMC and AOC. In turn, SMC provided records for individuals with court records in Seattle and AOC provided records from courts throughout the state, including Federal Way. The courts were able to find records for 4,925 (93%) of the Seattle drivers but only 654 (68%) of the 955 Federal Way drivers (see Table 2.2). It is not possible to distinguish between

[30] A 13-month time period was chosen for constructing the sample in order to ensure that there would be an adequate number of drivers with DWLS offenses in Seattle and in the comparison group.

drivers who legitimately had no court records and those for whom court records exist but the court database search did not produce a match. Unmatched records could result from problems in either the police or court data sources, including data entry errors, different name spellings in the two data sources, incorrect dates of birth, etc.

Table 2.2

Drivers in the Sample with Availability of Data From Administrative Office of the Courts and Seattle Municipal Court

	Federal Way	*Seattle*
Drivers within the sample	955	5287
Court Records Available	654 (68%)	4925 (93%)

It is possible for licenses to be suspended in Washington for administrative reasons that do not result for infractions or crimes for which a court case may have been filed. For example, license suspensions may occur for medical reasons, failure to maintain auto insurance, etc. In this case, if a DWLS driver committed no other offenses generating a court filing and no case was filed as a result of the DWLS offense that brought them into our study's sample, we would not expect to find them in the court records.

Because we cannot distinguish between drivers who legitimately have no court filings and those for which a record exists but the courts' attempt at matching our sample was unsuccessful, we elected to follow a more conservative route. We have included in our analyses of court data the entire sample of drivers. If we were to include only those drivers for whom the court was able to identify records, we would be essentially biasing our results towards the inclusion of only those with offending histories and potentially eliminating an unknown number of first time offenders. If the first time offenders were randomly distributed across both Federal Way and Seattle, this would not have a meaningful impact on our results. If however these first time offenders were more prevalent in the Seattle sample, for example, eliminating all those without court records would leave the Seattle sample peopled by the more serious offenders (which may obscure observation of a specific deterrent effect).

DOL Data. We used accident records from DOL in tests of the specific deterrence research question. We provided the SPD and FWPD list of the DWLS drivers to DOL to obtain individual driving records. DOL conducted a query of its statewide database and provided us records on all drivers in our sample that could be matched in the DOL database. Of the 6,242 total Seattle and Federal Way drivers in our sample, we were able to obtain DOL data for 5,966 of all drivers. For the remaining drivers, DOL was unable to match the identifying

information from the police records (full name, date of birth, and driver license number) to any individual in their database. Table 2.3 shows a breakdown by city of the drivers for whom DOL was able to provide driving records.

Table 2.3

Drivers in the Sample with Availability of Data From the Department of Licensing (DOL)

	Federal Way	*Seattle*
Drivers within the sample	955	5287
DOL Driving Records Available	867 (91%)	5099 (96%)

Unlike the court records, we can be more certain that failure to match our sample with DOL records is most likely the result of a data error, such as different name spellings or miscoding of other identifies that prevented a match. This is true because in order to be eligible for a DWLS offense in Washington, an individual must have first been issued a driver license. Drivers without a matching DOL record were eliminated from the accident analysis that relied on these records.

Additional Data Source Limitations. In study of specific deterrence, it is important that offenders have the opportunity to reoffend before we can measure the impact of a sanction on future behavior. For example, it makes little sense to measure the recidivism of those incarcerated for a crime while they are still prison. Similarly, including DWLS offenders who have no opportunity to drive in the analyses of specific deterrence will produce artificially high deterrence results. If they are not excluded from analyses and we find that impounded Seattle drivers are less likely to reoffend than the Federal Way group, we will not be able to determine whether this is due to specific deterrence (i.e. a vehicle is available yet the impound group chooses not to drive again) or to a difference between the two groups in the *availability* of a vehicle to drive.

In order to measure the period of incapacitation for impounded drivers, a large-scale, original data collection effort would be ideal.[31] One proxy measure for incapacitation we had hoped to use was the length of the impound. However, even this would not be an ideal measure because many drivers may have immediate access to another vehicle or be denied access to a vehicle redeemed from impound by a registered owner.

[31] For example, assessing availability of vehicles could involve interviewing each Seattle DWLS offender (or close relative or friend of each offender) to determine whether other vehicles might be accessible. These potentially available other vehicles might belong to family, friends, roommates, spouses, dating partners, employers, rental companies, etc.

Unfortunately, we were unable to obtain data on the length of the actual impound for use as a proxy measure of incapacitation. SPD's Operation Impound maintains records on the length of the *required* impound but do not indicate when a vehicle was actually released to the registered owner. There are also records on whether a vehicle was eventually auctioned but they do not include the date of the auction. In our conversations with Operation Impound personnel, we learned that these data would only be available directly from each of the three tow companies that perform impound services for the city. We contacted each of the three tow companies in an attempt to obtain these data. Two of the three companies maintained their records only in paper form and did not separate records of DWLS tows from those of the many other types of tows they perform.[32] Thus, it was not feasible for us to obtain these data for use in the evaluation.[33] As a result, there is no measure of incapacitation for Seattle drivers (or for comparison drivers experiencing an impound by WSP or in other impound cities).

Since incapacitation is not captured in the data, it is equivalent to the assumption that (like Federal Way drivers) most Seattle drivers are not incapacitated following a DWLS offense. If true, then the lack of an incapacitation measure would not affect our results. If the majority of Seattle drivers do experience a period of incapacitation, this may provide false evidence of a specific deterrent effect. That is, Seattle drivers may appear less likely to reoffend because they have less of an opportunity to do so than Federal Way drivers who do not experience an impound.

Another limitation is that we were unable to examine whether the effects of the Impound Law varies by income level of DWLS drivers, as the courts, police, and DOL do not maintain income information.

One question of interest is whether the specific deterrent effect is similar or different for DWLS 3 drivers compared to DWLS 1 and DWLS 2 drivers. If we conceptualize DWLS 3 drivers as those whose licenses were suspended for

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[32] We were also informed that tow companies were required to provide automated data to the City of Seattle in the past but the data system used for this purpose became non-functional. Staff of the City of Seattle Finance Department assisted us in assessing the availability of other sources of tow company data. We were unable to identify any electronic source for all three tow companies that contained actual impound release date.

[33] While we were able to obtain automated records of impounds from Lincoln/Road One Tow Company, these data would not be informative alone for only a subset of the Seattle sample. Given that the tow companies serve particular areas, the impounds would not be representative of the entire city but only of the impounds of vehicles of individuals who are the most likely to drive in the area served by Lincoln/Road One.

relatively minor underlying offenses, identifying these drivers is complicated because of discrepancies between the police and DOL data (explained below).

In the case of licenses suspended in the second degree, after a time (that varies depending upon the type of underlying offense and other factors), drivers become eligible to have their license reinstated. At that time, the degree of license suspension switches from the second degree to the third degree. After this point, if an individual were found to be driving, their offense would be DWLS 3, rather than a DWLS 2 offense. Thus, the license of a driver arrest or cited for a DWLS 3 offense may have been originally suspended for a relatively serious underlying offense. In order to identify these drivers, we compared DOL records of suspensions to SPD and FWPD DWLS data.[34] Unfortunately, we were unable to confidently determine which DWLS 3 drivers might have been previously suspended in the second degree because of the considerable disagreement between DOL and police data across all degrees of suspension and DWLS. For example, DOL records may show a third-degree suspension but police records indicate a DWLS 1 arrest. The complete results of this data source comparison are shown in Appendix B.

Contamination of the group of DWLS 3 drivers with those originally suspended in the second degree reduces the ability to distinguish DWLS group differences in the impact of specific deterrence. The magnitude of this problem is unknown because we cannot determine how many drivers fall into this group or assess their characteristics.

Analysis Strategy. In order to assess whether a specific deterrent effect exists, we compared Seattle and Federal Way DWLS drivers using several types of recidivism measures. For DWLS offenses, we used two measures:

1. repeat DWLS offenses in police data (i.e. repeat arrests and citations in Federal Way and repeat DWLS impounds in Seattle)
2. DWLS charge filings from AOC and SMC records

DWLS conviction records are not used because a change in policy by the Seattle City Attorney's Office after the implementation of the Impound Law. The new policy increased the use of diversion from prosecution for DWLS 3 drivers. This increased use of diversion alone would reduce the number of convictions in Seattle thus making convictions a problematic measure of recidivism. For other

[34] Comparing only DOL data is not particularly informative, because DOL DWLS records represent convictions. Thus, suspension and DWLS degree may not match because of plea agreements or court findings.

driving offenses, we used charge filings from AOC and SMC records and DOL data to examine accidents.

For the specific deterrence test, we had data from all sources at least through January 31, 2001. We conducted two types of analyses. The first is a comparison of observed percentages of Seattle and Federal Way drivers with repeat DWLS offenses, other driving offenses, and accidents during the study's one year follow-up period. The second is a more sophisticated statistical analysis that examines recidivism over time and adjusts for any pre-existing group differences.

Drawing substantive conclusions about the specific deterrent effect of the Impound Law based on only observed percentages relies on the assumption that the drivers in the two cities are identical in the characteristics that might be associated with recidivism. Thus, we must use statistical techniques to control for identifiable pre-existing differences between the samples. This removes systematic differences in the background characteristics of the groups, allowing us to isolate the effect of the Impound Law by comparing similar individuals.

Comparisons of percentages would be misleading if individuals had follow-up periods of differing lengths. Thus, we standardized the follow-up period at one year for each individual. For example, for an individual with a DWLS offense on January 2, 1999, we "follow" this person in the data until January 1, 2000. In more complex analyses, however, we used a method called survival analysis that is designed to accommodate differing follow-up period lengths. Thus, survival analysis allows us to make use of data for all individuals available through January 31, 2001. A driver with a DWLS offense on the first day of the study period (January 1, 1999) would have the longest period of observation: 761 days. There is one exception to the January 31, 2001 follow-up period length. DOL was only able to provide accident data until September 30, 2000. Thus, the maximum follow-up period for the accident outcome (for a driver with an offense on January 1, 1999) would be 638 days.

The type of survival analysis we used to control for these pre-existing group differences was Cox proportional hazards survival model.[35] This statistical method is a common technique employed by researchers examining specific deterrence of vehicle impounds.[36] The recidivism rate is quantified via the

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[35] Hosmer, D.W. & Lemeshow, S. (1999). *Applied Survival Analysis: Regression Modeling of Time to Event Data*. New York: John Wiley and Sons.

[36] In DeYoung's (1998) California study, the primary method of analysis was factorial analysis of variance but consistency of results was tested and confirmed using survival analysis. Also see:

"hazard function," which is a function of days since the initial DWLS offense in the study period. For an individual of given background characteristics, the hazard function for a particular day is the probability that the individual recidivates at or immediately after that day, given that he or she has not yet recidivated by that particular date.

The control variables used in the models were the following:

- whether the driver was in the Seattle or Federal Way sample
- black, white, or other race[37]
- age
- gender
- degree of first DWLS offense during the study period
- accident history
- DWLS court charge filing history
- DWLS conviction history
- other traffic offense court charge filing history
- other traffic offense conviction history

The results of the survival analysis models allow us to examine whether impounds appear to have produced a specific deterrent effect among Seattle drivers.

Limitations for All Research Questions Due to the Use of Official Records

As discussed above, data for all three research questions, including outcome measures, are drawn from official records. These records are not perfect measures of driver behavior. For example, DOL records only show an accident if the involved parties or police agencies report it to DOL. Citizens might not always comply with this requirement and suspended drivers might be even less

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Rogers, A. (1994). Effect of Minnesota's license plate impoundment program on recidivism of multiple DWI violators. *Alcohol, Drugs, and Driving, 10 (2)*: 127-134. Crosby, I. B. (1995). *Portland's Asset Forfeiture Program.* Portland, OR: Reed College Public Policy Workshop. Voas, R. B., Tippetts, A. S., & Taylor, E. (1997). Temporary vehicle immobilization: Evaluation of a program in Ohio. *Accident Analysis and Prevention, 29 (5)*: 635-642. Voas, R. B., Tippetts, A. S., & Taylor, E. (1998). Temporary vehicle impoundment in Ohio: A replication and confirmation. *Accident Analysis and Prevention, 30 (5)*: 651-655.

[37] Other races were not broken out separately because the very small representation of these individuals in the samples prevents their classification as separate variables.

likely to do so. Thus, these data will probably undercount accidents. Further, police do not always catch drivers who speed, drive with a suspended license, etc. Moreover, when offenses are detected police often exercise discretion in making arrest and citation decisions, even under conditions of mandatory laws intended to remove or restrict police discretion.[38] Thus, police data are not a perfect reflection of actual recidivism. Moreover, charges might not always be filed against individuals who commit offenses and therefore court records undercount involvement in offending behavior.

These problems are regularly confronted in research involving official records. The potential bias introduced by missing information from official records is reduced if we can assume that the records are all equally likely to be missing information. That is, no one group is more likely to report an accident than another group; Seattle police and Federal Way police are similar in enforcement of traffic laws; the illegal behavior of one group does not come to the attention to police more frequently than another group; and police and prosecutors are not more likely to arrest/cite/impound or file charges against one group more than others. Available resources prohibited us from assessing these potential sources of bias in official records and thus caution must be exercised in interpreting our results.

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[38] For example, see Sherman, L.W. (1992). *Policing Domestic Violence: Experiments and Dilemmas*. New York: The Free Press. Brooks, L.W. (1997). Police discretionary behavior: A study of style. In R. G. Dunham & G. P. Alpert (eds). *Thinking About Police: Contemporary Readings* (pg. 149-166). Prospect Heights, IL: Waveland Press.

3. Are the Accident Records of DWLS 3 Drivers Worse than the Accident Records of Validly Licensed Drivers?

This research question assesses whether DWLS 3 drivers are an appropriate target for the Impound Law. If the accident records of DWLS 3 drivers are no worse than validly licensed drivers, this would provide support for the argument that DWLS 3 drivers should not be subject to the same sanction (vehicle impound) as DWLS 1 and 2 drivers. If however the accident records of DWLS 3 drivers were worse than those of validly licensed drivers, this would lend support for the inclusion of DWLS 3 drivers under the Impound Law.

As discussed in previous chapters, the hypothesis is that DWLS 3 offenses do not cause accidents directly but are associated with accidents because they both result from unsafe driving. Unsafe driving causes accidents. Unsafe driving also causes traffic offenses, which in turn lead to license suspension, which in turn lead to DWLS offenses. Not all traffic offenses lead to suspensions or DWLS, however.

Traffic offenses are likely to be indicators that an individual was driving in an unsafe manner (e.g. speeding, failure to stop at stop signs, etc.). Consequently, traffic offenses are likely to be related to accidents. Because traffic offenses are related to DWLS 3 offenses (driving offenses result in license suspensions which leads to DWLS offenses for those who continue to drive), DWLS offenses should also related to accidents. In this chapter, we test these hypothesized relationships between driving offenses, DWLS 3 offenses, and accidents. If these hypothesized relationships are observable, this will provide support for the argument that DWLS 3 offenses are an indication of unsafe driving (mediated by traffic offenses) and therefore appropriate targets of the Impound Law.

In the analyses, we compared the records of drivers 1) validly licensed drivers (no suspension and no DWLS offense), 2) with a suspension but no DWLS offense, 3) with DWLS 3 as their most serious DWLS offense, and 4) with a DWLS 1 or 2 as their most serious DWLS offense. All categories of drivers may have traffic offenses and accidents on their records.

Accident records were compared in terms of: 1) no accident on record, 2) involvement in any accident, 3) involvement in an accident with an injury or

fatality. We would expect to see a greater share of DWLS 3 drivers involved in accidents with and without injury or fatalities than validly licensed drivers. We are not testing a hypothesis about the accident records of DWLS 1 and 2 drivers but include them for purposes of simple comparison.

In the next sections, we present a description of the driving records that were used to examine this research question. We then present several tables showing the relationship between these variables from driving records and discuss how the findings relate to the research question. Finally, we present the statistical examination of the driving records and conclusions about the dangerousness of DWLS 3 drivers.

Characteristics of the Study Population

In this section, we describe the characteristics of the driving records that are used to examine this research question.

Demographic Characteristics

Table 3.1 shows the available demographic characteristics of the drivers. The drivers are slightly more likely to be males (54%) than females (46%). Drivers aged 25 to 44 represent the largest age cohort.

Table 3.1

Demographic Characteristics of All Seattle Drivers, 1995 - 2000

	No. Drivers	*Percent*
Gender		
Male	369,618	53.6%
Female	320,391	46.4%
Age		
16-24	159,863	23.2%
25-44	321,693	46.6%
45-64	139,127	20.2%
65+	69,326	10.0%

NOTE: Age is computed as of October 1, 1995, based on date of birth.

Traffic Violations

Approximately one-fourth of all Seattle drivers had one or more traffic violations during the five-year study period. Table 3.2 shows the number of drivers convicted of different kinds of violations. Most of the violations were for minor traffic offenses.

Table 3.2

Severity of Traffic Violations for All Seattle Drivers, 1995 - 2000

Type of violation	*No. Drivers*	*Percent*
No violation on record	509,099	75.8%
Criminal violation not requiring suspension	8,901	1.3%
Criminal violation requiring suspension*	9,136	1.3%
Other traffic violations	174,413	25.3%

* This category does not include DWLS offenses. Violation categories are not mutually exclusive.

Traffic Accidents

A majority (89%) of the drivers had no traffic accidents and fewer than two percent had more than one accident between October 1, 1995, and September 30, 2000. As Table 3.3 indicates, most accidents involved no injury and very few resulted in fatalities.

Table 3.3

Severity of Traffic Accidents, 1995 - 2000

Accident severity	*No. Drivers*	*Percent*
No accident	610,504	88.5%
Accident, no injury	52,030	7.5%
Injury, no fatality	27,239	4.0%
Fatality	236	<0.0%

Suspension of License and DWLS Offenses

Fewer than seven percent of drivers had a suspended license during the five-year study period. Of all drivers, two percent were convicted for DWLS, with most in the third degree. This indicates that a very small share (2%) of all Seattle drivers would actually be subject to the Impound Law. Table 3.4 shows license suspension and most serious DWLS offense for drivers within the study period.

Table 3.4

License Suspension and DWLS Offenses, 1995 – 2000

	Drivers n = 690,009	*Percent*
License Suspension		
No suspension	644,964	93.5%
Any suspension	45,045	6.5%
DWLS Offenses		
No DWLS	676,448	98%
DWLS 1st degree	694	0.1%
DWLS 2nd degree	1,175	0.2%
DWLS 3rd degree	12,612	1.8%

Percentages do not add to 100 due to rounding.

Accidents and DWLS Offenses

Using the variables shown in the previous section, we now turn to the relationships relevant to the research question. The hypothesis we are testing asserts that unsafe driving leads to accidents and that traffic violations are indicators of unsafe driving. DWLS 3 offenses are associated with traffic violations and therefore, DWLS 3 drivers are likely to be involved in accidents. In testing this hypothesis, we would expect to see that:

- traffic violations are associated with accidents
- DWLS 3 offenses are related to traffic violations, and
- DWLS 3 offenses are associated with accidents.

In the next sections, we assess the evidence relevant to each of these statements.

Association Between Other Traffic Violations and Accidents

In testing the hypothesis about the relationship of unsafe driving to accidents, the first step is to assess whether there is a relationship between other (non-DWLS) traffic offenses and accidents. The hypothesis is supported if those with no violations would be less likely to be in accidents and accidents with injury and fatalities than individuals with traffic violations on their records. As Table 3.5 shows, the data support this relationship. The largest percentage of drivers with no accidents is found among those with no violations on record (94%). In contrast, the largest percentage of those involved in accidents producing an injury or fatality was found among those with criminal violation convictions (13%). These relationships can be taken as evidence that traffic violations are indicators of unsafe driving in that they are associated with accidents.

Table 3.5

Most Serious Accident by Most Serious Non-DWLS Traffic Violation, 1995 – 2000

Violation type	*No accident*	*No injury*	*Injury/fatality*	*N*
No violations	93.8%	4.3%	1.9%	510,672
Non-criminal violation only	73.6%	16.9%	9.5%	162,372
Criminal violation not requiring suspension	74.0%	17.6%	8.5%	7,829
Criminal violation requiring suspension	67.2%	20.2%	12.7%	9,136

Association Between Other Traffic Violations and DWLS Offenses

The next step in testing the hypothesis is to assess whether there is a relationship between DWLS offenses and other traffic violations. As Table 3.6 shows, there appears to be such a relationship. DWLS 3 drivers make up less than one percent of those with no traffic violations during the study period but 24 percent of those with criminal violations not requiring suspension and almost 19 percent of those (non-DWLS) violations requiring suspension. This is evidence to support the assertion that DWLS 3 offenses are more common among those with traffic offenses than among those without.

Table 3.6

DWLS Offenses by Most Serious Non-DWLS Violation, 1995 – 2000

Violation type	*No DWLS*	*DWLS 3*	*DWLS 1/2*	*N = 690,009*
No violations	99.7%	0.3%	<0.0%	510,672
Non-criminal violation only	95.4%	4.3%	0.3%	162,372
Criminal violation not requiring suspension	74.0%	24.2%	1.8%	7,829
Criminal violation requiring suspension	72.0%	18.5%	9.6%	9,136

DWLS offenses are not included in the violation categories in the left-hand column.

Association Between DWLS Offenses and Accidents

From the last hypothesized statement, we would expect greater involvement in accidents and accidents with injury and fatalities among DWLS 3 drivers than 1) validly licensed drivers and 2) suspended drivers with no DWLS offenses. The relationships shown in Table 3.7 support the hypothesis. Validly licensed drivers are least likely to be involved in accidents with (3.6%) and without (7.2%) injuries and fatalities compared to drivers with suspension only (5.8% and 11.4%, respectively) and DWLS 3 drivers (9.4% and 16.7%, respectively).

DWLS 3 offenders were more likely to be involved in an accident (26.3%) than validly licensed drivers (10.8%) and those with a suspension but no DWLS

offense (17.3%). DWLS 3 drivers are more comparable in accident involvement to DWLS 1 and 2 drivers (27.7%) than they are to validly licensed drivers. This provides support for the argument that DWLS 3 drivers are unsafe drivers compared to validly licensed drivers.

Table 3.7

Most Serious Accident by Most Serious DWLS Offense, 1995 – 2000

DWLS status	*Any accident*	*Accident, No injury*	*Accident, Injury/fatality*	*N =690,009*
No suspension or DWLS	10.8%	7.2%	3.6%	636,533
Suspension, no DWLS	17.3%	11.4%	5.8%	39,915
DWLS 3	26.3%	16.7%	9.4%	11,902
DWLS 1/2	27.7%	18.3%	9.2%	1,659

While the results in Table 3.7 indicate that DWLS drivers have higher rates of injury and fatality accidents, this appears to be due to their greater involvement in accidents, not an increase the severity of accidents. DWLS drivers involved in accidents were as likely to have injury/fatality accidents as validly licensed drivers involved in accidents. Table 3.8 below shows the involvement in injury/fatality accidents for drivers in each category with accidents in their records. Nevertheless, DWLS drivers of any degree are substantially more likely to be involved of accidents than non-DWLS drivers.

Table 3.8

Injury and Fatality Accidents by Most Serious DWLS Offense For Drivers with Accidents, 1995 – 2000

DWLS status	*No injury*	*Injury/fatality*
No suspension or DWLS	66.7%	33.3%
Suspension, no DWLS	66.3%	33.7%
DWLS 3	64.0%	36.0%
DWLS 1/2	66.5%	33.5%

It may be that DWLS 3 offenses are associated with accidents due to the demographics of those likely to have such offenses. To explore this, we examined the relationship between accidents and groups defined by age, gender, and DWLS offenses. As Table 3.9 shows, this comparison indicates that across age and gender categories, DWLS 3 drivers show a greater involvement in accidents with and without injuries and fatalities than validly licensed drivers and suspended drivers with no DWLS offenses.

Table 3.9

Most Severe Accident by Age, Gender, and DWLS, 1995 – 2000

Age	*Gender*	*DWLS status*	*No accident*	*No injury*	*Injury or fatality*	*N*
16-24	Male	No suspension or DWLS	88.3%	7.8%	3.9%	73,163
		Suspension, no DWLS	81.7%	12.4%	5.9%	8,444
		DWLS 3	70.5%	19.0%	10.4%	3,396
		DWLS 1/2	73.5%	18.0%	8.2%	501
	Female	No suspension or DWLS	89.7%	6.5%	3.8%	69,289
		Suspension, no DWLS	77.4%	14.3%	8.3%	3,984
		DWLS 3	69.6%	19.5%	10.8%	1,031
		DWLS 1/2	72.7%	10.9%	16.4%	55
25-34	Male	No suspension or DWLS	89.0%	7.3%	3.6%	91,798
		Suspension, no DWLS	84.1%	10.7%	5.2%	9,841
		DWLS 3	75.9%	15.5%	8.5%	3,291
		DWLS 1/2	74.8%	18.1%	7.2%	531
	Female	No suspension or DWLS	89.8%	6.5%	3.7%	72,744
		Suspension, no DWLS	81.9%	11.8%	6.3%	3,902
		DWLS 3	74.5%	14.9%	10.5%	965
		DWLS 1/2	60.0%	25.0%	15.0%	60
35-45	Male	No suspension or DWLS	87.8%	8.2%	4.0%	75,310
		Suspension, no DWLS	83.6%	10.7%	5.6%	5,864
		DWLS 3	75.7%	16.2%	8.0%	1,973
		DWLS 1/2	70.6%	17.7%	11.7%	350
	Female	No suspension or DWLS	88.7%	7.3%	4.0%	64,248
		Suspension, no DWLS	83.5%	10.1%	6.2%	2,434
		DWLS 3	78.5%	12.9%	8.2%	573
		DWLS 1/2	73.3%	20.0%	6.7%	45
46+	Male	No suspension or DWLS	87.8%	8.4%	3.7%	90,818
		Suspension, no DWLS	83.8%	11.1%	5.1%	3,665
		DWLS 3	74.4%	14.2%	11.0%	563
		DWLS 1/2	69.1%	20.0%	10.9%	110
	Female	No suspension or DWLS	91.6%	5.6%	2.8%	99,163
		Suspension, no DWLS	87.9%	7.9%	4.1%	1,781
		DWLS 3	76.4%	16.4%	7.3%	110
		DWLS 1/2	42.9%	57.1%	0.0%	7

Note: Age categories were constructed based on quartiles in the data

Statistical Analyses of DWLS Offenses and Accidents

We also employed statistical tests (using logistic regression) to examine the relationships between age, gender, DWLS offenses, and accidents. First we examined how predictive these variables were in determining whether a driver had been involved in an accident. Table 3.10 shows the results of this analysis. According to quartiles in the data, we broke age into four categories, 16-25, 25-35, 35-46, and over 46. Male is a binary indicator of whether the driver is male. DWLS is a variable with four categories: 1) no suspension and no DWLS offense,

2) suspended but no DWLS, 3) DWLS 3, or 4) DWLS 1 or 2.[39] As shown in Table 3.10, all three variables are important predictors of involvement in accidents as were the interactions among the variables, DWLS offenses alone had the greatest influence on involvement in accidents.

Table 3.10

Logistic Regression Results Estimating Probability of Involvement in an Accident by Age, Gender, and DWLS

	df	*F value*	*p-value*
Age	3	122.95	< 0.0001
Male	1	640.19	< 0.0001
DWLS	3	913.33	< 0.0001
Age x Male	3	89.63	< 0.0001
Age x DWLS	9	10.73	< 0.0001
Male x DWLS	3	18.14	< 0.0001
Age x Male x DWLS	9	2.37	0.011
Residual	279,469		

Model was fit using all drivers with accidents and random sample of 200,000 drivers without accidents. All relationships are statistically significant.

We employed a second statistical test examining only the records of those involved in accidents. In this test, we explored whether DWLS offenses were related to the probability of involvement in an accident with and injury or fatality. Table 3.11 shows the results of this analysis. Results indicate that age, gender, and DWLS offenses are important for predicting accidents that involve injuries and fatalities. In this test, however, DWLS offenses had the least influence on the odds of such accidents.

In sum, the results of these tests provide support for the hypothesis that DWLS offenses are important predictors of accidents.

[39] For each variable in Table 3.10 the *df* column indicates the "degrees of freedom" or the number of comparisons made in order to determine the predictiveness of each variable. For age, with three degrees of freedom, the model estimates differences in accident rates between the 16-25 group and each of the 25-35, 35-46, and over 46 groups. The magnitude of differences translates in the F value shown in the third column. The p-value column indicates the probability of observing an F value larger than the observed F value if the variable was not predictive of the accident rate. The p-values indicate that all of these variables and their interaction effects are predictive of accident rates.

Table 3.11

Logistic Regression Results Estimating Probability of an Injury/Fatality Accident for Drivers Involved in an Accident by Age, Gender, and DWLS

	df	*F value*	*p-value*
Age	**3**	**17.8017**	**< 0.0001**
Male	**1**	**65.6850**	**< 0.0001**
DWLS	**3**	**2.5622**	**0.05**
Age x Male	3	0.3812	0.77
Age x DWLS	9	1.5417	0.13
Male x DWLS	3	0.0724	0.97
Age x Male x DWLS	9	1.4671	0.15
Residual	79,469		

Model was fit to all drivers with accidents. Bold indicates a statistically significant relationship with accident probability.

Probability of Accidents for DWLS 3 Drivers. The analyses presented above showed that there was a relationship between accidents and DWLS offenses. In this section, we show how much a DWLS 3 offense contributes to the probability of having an accident.

The odds of involvement in an accident for a DWLS 3 driver is 1.6 times greater than accident odds for a suspended driver with no DWLS offense and 2.9 times greater than a validly licensed driver. The odds that a DWLS 1 or 2 driver had an accident is 3.2 times greater than the odds of involvement in a accident by a validly licensed driver. There was no significant difference in the odds of involvement in an accident of DWLS 3 and DWLS 1 or 2 drivers. These results indicate that DWLS 3 drivers have a greater probability of involvement in accidents than validly licensed drivers. DWLS 3 drivers are more similar to DWLS 1 and 2 drivers in their involvement in accidents than validly licensed or those suspended drivers with no DWLS offenses.

Table 3.12 shows the results of the logistic regression model from which these odds were calculated.[40] Since we had only a single categorical variable (DWLS) in this table, we list all of the parameter estimates for this model rather than the

[40] The odds were calculated using the following formula:

$$\frac{1}{1+\exp(-(\beta_0+\beta_1 x_1+\beta_2 x_2+\beta_3 x_3))}$$

where x_1 is an indicator of suspended/no DWLS, x_2 is an indicator of DWLS 3, x_3 is an indicator of DWLS 1 or 2. The intercept term of –2.11 concerns the accident rate for drivers with no suspensions or DWLS offense and translates to an 11 percent accident rate (1/(1+exp(-(-2.11)))). About 17 percent (1/(1+exp(-(-2.11+0.54)))) of suspended drivers with no DWLS have an accident in their record. The rate for DWLS drivers is more than twice the rate of drivers with out suspensions, 26 percent (1/(1+exp(-(-2.11+1.07))))for DWLS 3 and 27 percent (1/(1+exp(-(-2.11+1.05)))) for DWLS 1 or 2 drivers.

more compact displays in Tables 3.10 and 3.11. The intercept term of –2.11 concerns the accident rate for validly licensed drivers and translates to an 11 percent accident rate. The rate for suspended drivers with no DWLS offense is 17 percent. The rate for DWLS drivers is more than twice the rate of validly licensed drivers at 26 percent for DWLS 3 and 27 percent for DWLS 1 and 2 drivers.

Table 3.12

Logistic Regression Estimating the Probability of Involvement in an Accident by DWLS

	Estimate	*S.E.*	*p-value*
(Intercept)	-2.11	0.004	< 0.0001
Suspension, no DWLS	0.54	0.014	< 0.0001
DWLS 3	1.07	0.021	< 0.0001
DWLS 1 or 2	1.15	0.055	< 0.0001

The model was fit to all 690,000 drivers. All relationships are statistically significant. Drivers with no suspension and no DWLS offenses compose the reference category corresponding to the intercept term in the table.

Finally, we estimate the odds of an injury or fatality among only drivers with accidents. The odds that a DWLS 3 driver would be in an accident with injuries or fatalities is 10 percent greater than the odds for validly licensed drivers with accidents and drivers with a suspension but no DWLS offense. The sample size for DWLS 1 and 2 drivers involved in accidents was very small. As a result, there is considerable uncertainty associated with our statistical estimate of the rate of injuries and fatalities in accidents in which they are involved.

In sum, these results suggest that DWLS 3 drivers have a greater probability of involvement in accidents with injuries and fatalities than validly licensed drivers. This difference, while statistically significant, might not be of great practical significance. As shown in Table 3.8, the difference is 33 percent injury/fatally accidents for validly licensed drivers and 36 percent for DWLS 3 drivers. Table 3.13 shows the results of the logistic regression analysis utilized to produce the odds estimates.

Table 3.13

Logistic Regression Estimating the Probability of Injury/Fatality for Drivers Involved in an Accident by DWLS

	Estimate	*S.E.*	*p-value*
(Intercept)	-0.671	0.0080	< 0.0001
Suspension, no DWLS	0.009	0.027	0.737
DWLS 3	**0.110**	**0.038**	**0.004**
DWLS 1 or 2	-0.003	0.099	0.978

The model was fit to all 79,501 drivers with accidents. Bold indicates a statistically significant relationship. Drivers with no suspension and no DWLS offenses are not displayed in the table because they represent the reference category.

DWLS 3 Driver Accident Results Summary and Conclusions

The goal of this research question was to assess whether drivers with DWLS 3 offenses on record were more likely to be involved in accidents than validly licensed drivers. The hypothesis is that unsafe driving leads to accidents and that traffic offenses are indicators of unsafe driving. Further, traffic offenses are related to DWLS 3 offenses and therefore, DWLS 3 drivers should be overrepresented among drivers with accidents, compared to validly licensed drivers. In this chapter, we found support for this argument.

Specifically, we found non-DWLS traffic offenses to be associated with accidents and DWLS offenses to be associated with other traffic offenses. In directly assessing the relationship of DWLS offenses and accidents, we compared the accident records of DWLS 3 drivers with validly licensed drivers and those with suspensions but no DWLS offenses. The results revealed that DWLS 3 drivers were more likely to be involved in an accident (26%) compared to validly licensed drivers (11%) and those with suspensions but no DWLS offenses (17%). DWLS 3 drivers were more similar in their accident involvement to DWLS 1 and 2 drivers (28%) than validly licensed drivers. This was also the case for accidents involving injury or fatality. For drivers with accidents, nine percent of both DWLS 3 drivers and DWLS 1 and 2 drivers were involved in such accidents, compared to six percent of those with suspensions and no DWLS offenses, and four percent of validly licensed drivers.

Using logistic regression statistical analyses, we found that DWLS offenses were more important predictors of involvement in accidents than gender or age. The odds of involvement in an accident for a DWLS 3 driver are 1.6 times greater than those of a suspended driver with no DWLS offense and 2.9 times greater than a validly licensed driver. Among all drivers with accidents, severity of

accidents (injury and fatalities) had the strongest relationship to age and gender of the driver, but DWLS offenses were still significant predictors. We found that the odds of involvement in an injury or fatality accident for a DWLS 3 driver were 10 percent greater than validly licensed drivers with accidents and drivers with a suspension but no DWLS. However, the magnitude of the difference is small and thus may not warrant intervention for this reason alone.

In sum, these results suggest that DWLS 3 offenses may be indicators of unsafe driving that lead to accidents. Thus, strategies addressing the driving of DWLS 3 offenders target a group of drivers at higher risk for accidents than validly licensed drivers and, therefore, may function to reduce accidents overall.

4. Does Impounding Vehicles for DWLS Have a *General Deterrence* Effect?

This research question focuses on whether Seattle's Impound Law created a general deterrence effect in Seattle. We examined rates of DWLS, other driving offenses, and accidents in Seattle relative to Yakima and Federal Way. If a general deterrent effect exists, we would expect to see a decline in rates in Seattle following the Impound Law but no similar decline in the comparison cities post-January 1999.

As discussed in the Methodology chapter, we used statistical time series models that detect changes in rates after the Impound Law went into effect.[41] The time series analysis examines statistical trends in data over time to construct a curve among the monthly points that represents an approximation of the underlying, actual rates, with the "noise" of random monthly fluctuation removed. Because this curve is an estimate based upon the data, there is a margin of error associated with it. The margin of error is relatively wide when there is great month-to-month variation in rates and narrow when the converse is true. The number of available monthly periods also impacts the margin of error. A larger window of time within which to observe rates means we can be more sure of detecting a change due to the law than when we have a smaller time window.

We used Bayesian analyses to assess the time series models because it uses probabilities to provide a direct assessment of a change in rates. (See the Methodology chapter for an in-depth discussion). In the results below, we present probabilities as way to evaluate the strength of the evidence that the Impound Law produced a general deterrent effect. A probability of 50 percent indicates that the statistical model cannot determine whether decreases in rates are larger or smaller in Seattle than in the comparison cities. In other words, the patterns in the data are consistent with no effect for the Impound Law. Probabilities below 50 percent indicate that rate decreases in the comparison cites were larger than in Seattle. Thus, any probabilities below 50 percent would also indicate no deterrent effect for the Impound Law.

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[41] In Appendix C, we provide the descriptive trends in key variables over time without the time series statistical corrections.

Probabilities closest to 100 percent indicate the decreases in Seattle were large relative to Yakima and Federal Way. According to the generally accepted criteria, probabilities greater than 80 percent indicate weak but positive evidence in favor of the law having an effect.[42] Probabilities greater than 90 percent indicate moderate evidence. Probabilities below 80 percent indicate that the law produced no general deterrent effect.

Results

There are five different analyses, one for each type of rate examined. Each analysis compares changes in Seattle rates versus those in Federal Way and Yakima. Table 4.1 below shows the rate of interest and number of drivers for each of the five analyses.

Table 4.1

Time Series Models For the General Deterrence Research Question

Rate of Interest (y)	*Number of Drivers (n)*
DWLS - DOL convictions	Suspended drivers
DWLS - court filings	City population
Other Driving Offenses – DOL convictions	Suspended drivers
Other Driving Offenses - court filings	City population
Accidents - DOL convictions	Suspended drivers

Below, we present the results of the five analyses in two different forms. One form is a graphical display of the estimated change in the odds of DWLS convictions, or the best statistical estimate of the amount of change pre- and post-law, with month-to-month "background noise" removed. The graphs include a margin of error (based upon a 95 percent confidence interval) for the estimated percentage change.

In the second form, we present the Bayesian probability estimate indicating whether any decrease in the odds occurring in Seattle after the Impound Law went into effect was greater than any decrease observed in the comparison cities, Federal Way and Yakima. See Appendix D for the technical details of these analyses and Appendix E for complete statistical results.

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[42] H. Jeffreys (1961). *Theory of Probability* 2nd Ed. Oxford: Oxford Press.

DWLS Convictions Per Suspended Driver

This test is to detect whether there is a decline in DWLS offense rates (consistent with a general deterrent effect) in Seattle, compared to Federal Way and Yakima, following the implementation of the Impound Law. DOL records were used in this analysis because it allowed us to examine the DWLS rates of suspended drivers.

The results of the time series analysis suggest that there may be some influence of the Impound Law on DWLS conviction rates (per 10,000 suspended drivers) following its passage. The odds of DWLS convictions among suspended drivers decreased by an estimated 10 percent in Seattle after the law went into effect. A similar decrease was not observed in Yakima and Federal Way.

Because the rates move up and down so much during the study period, we must allow for a considerable margin of error. Using a 95 percent probability interval, odds of DWLS offenses in Seattle may have decreased as much as 29 percent or increased as much as 9 percent. Taking into account this margin of error, the data indicate that there is an 86 percent chance of a decrease in DWLS conviction rates after the Impound Law was put in place in Seattle. Thus, the most likely explanation for the patterns observed in the data is that there was in fact a decrease in the post-law rates. This evidence, however, is not overwhelming. Recall that in Bayesian analyses, probabilities over 80 percent but below 90 percent offer only weak evidence of an effect.

This finding could be weak evidence of a general deterrent effect or evidence of the change in City Attorney policy that resulted in pursing prosecution in fewer DWLS cases after implementation of the Impound Law. With the available data, it is not possible to determine which of these potential explanations may have produced this apparent decline in DWLS convictions.

Figure 4.1 shows the time series model fit over the raw data. The DWLS rate is the number of suspended drivers convicted of DWLS over the total number of suspended drivers. The dots indicate the rate observed in the raw monthly data. The black horizontal curve indicates the statistical estimate of the actual DWLS rate based upon the time series analysis. The black vertical line indicates January 1999, the date at which the Impound Law went into effect. Month 1 is January 1995, the beginning of the study period, and the data extend for 75 months to March 2001. The gray band indicates the margin of error around this curve (a pointwise 95 percent confidence interval for the rate). Thus, there is a 95 percent chance that the actual monthly trend falls within the gray band.

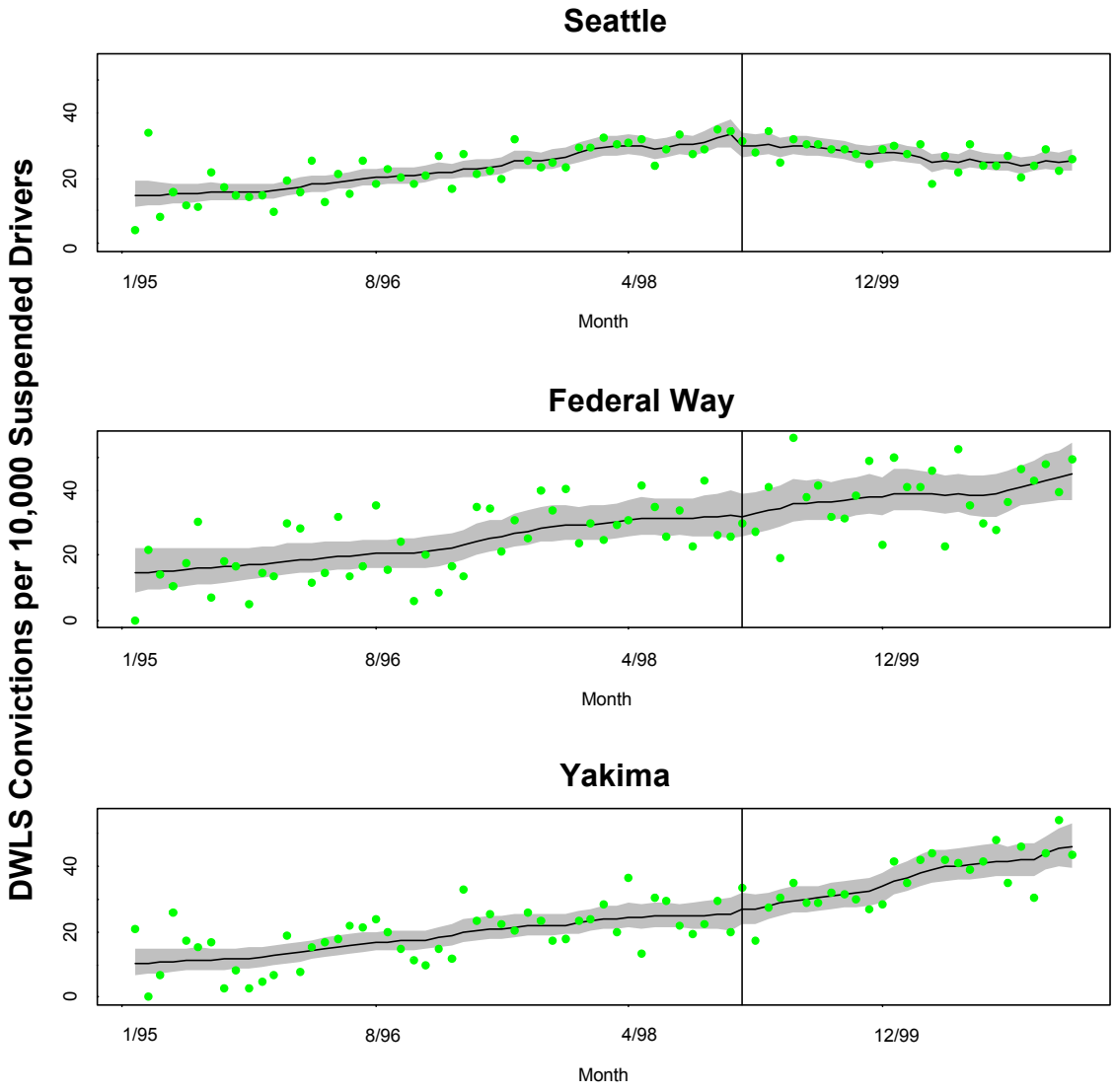

Figure 4.1 - Time Series Analyses of DWLS Convictions Per 10,000 Suspended Drivers (DOL data)

DWLS Court Filings Per 10,000 City Residents

We also examined court (SMC and AOC) data on DWLS charge filings in Seattle, Federal Way, and Yakima. In Figure 4.2, we overlay the raw data with the time series estimate of the actual trend over time. Analyses were restricted to January 1996 until March 2001 for Seattle and Federal Way. Data were unavailable for Yakima until January 1997. For consistency with the DOL models, month one is January 1995 and the dots show the point at which the court data become available for each city.

The results of these analyses revealed that the rate of DWLS charge filings does not appear to have been impacted by the implementation of the Impound Law. That is, the DWLS filing rate appears to have been declining in Seattle prior to the passage of the Impound Law and post-law rates continued to decline at a pace similar to that of Yakima and Federal Way. Thus, we cannot conclude that the Impound Law had a general deterrent effect on DWLS charge filings.

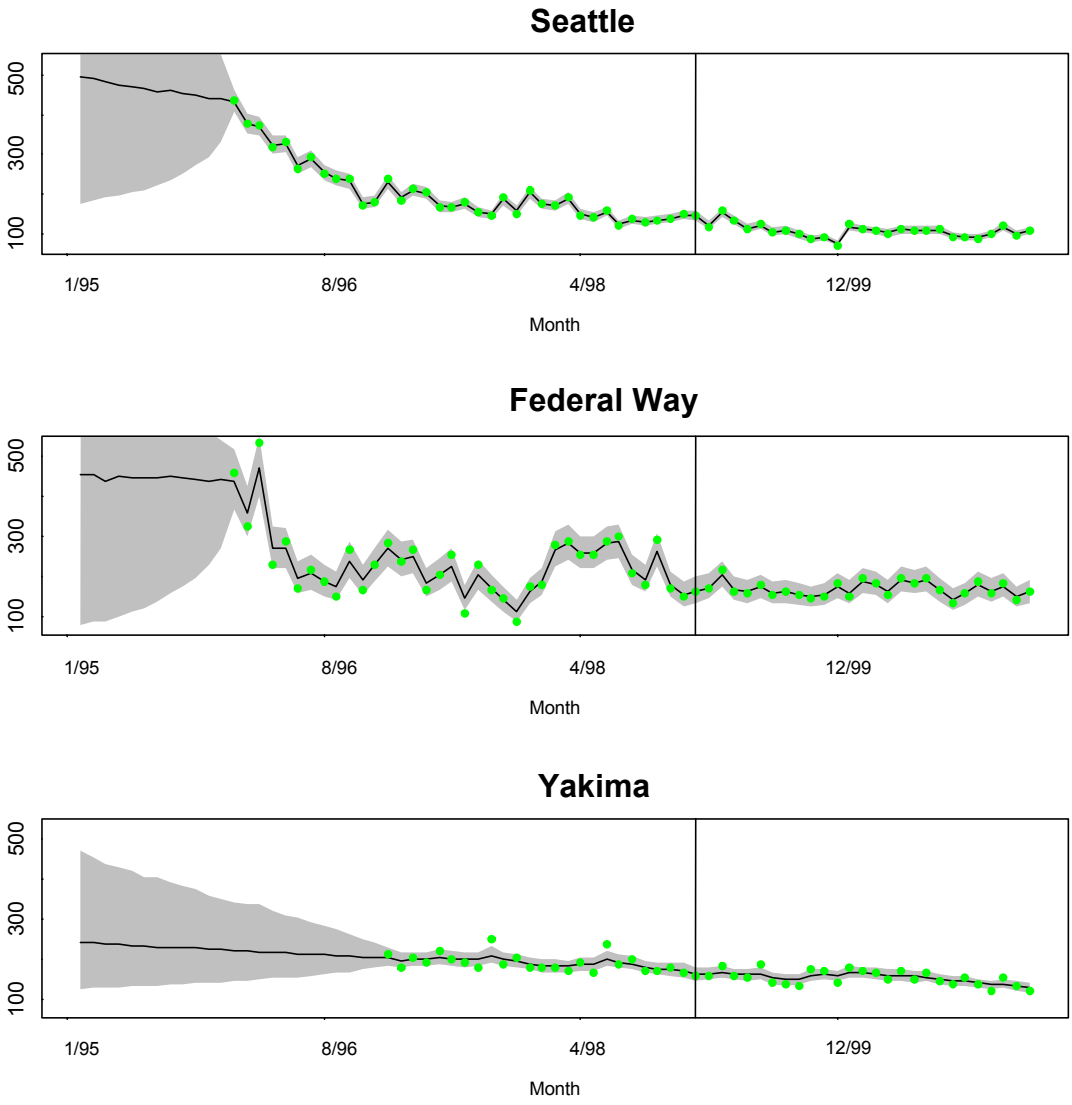

Figure 4.2 - DWLS Rates Per 10,000 City Residents (Court Data)

Other Driving Convictions Per Suspended Driver

In Figure 4.3, we report the results of the time series model examining rates of other driving convictions among suspended drivers to see if they were reduced following the implementation of the Impound Law. Based upon the trends before and after the passage of the Impound Law, the results do not indicate a change in Seattle post-law relative to Federal Way and Yakima. While the statistical analysis estimated a 1 percent drop in other driving offenses following implementation of the Impound Law, the margin of error indicates that the actual rate of other driving offenses could have decreased as much as 16 percent or increased as much as 17 percent.

Given this margin of error, the probability that there was a decrease (whether 1 percent drop or greater) in the odds of other driving offenses for Seattle suspended drivers is 55 percent. Because the odds are nearly equal (55 percent chance of a decrease compared to a 45 percent chance of an increase), this is not convincing evidence of an effect for the Impound Law.[43] Thus, these findings do not support the hypothesis that the Impound Law produced a general deterrent effect on other driving convictions.

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[43] Moreover, there is not solid evidence that rates in Seattle decreased more than those in Federal Way or Yakima. The probability that Seattle had a greater decrease in odds of other driving offenses than Federal Way is 67% and 58% in Yakima. These percentages leave considerable room for doubt that any possible decrease in odds in Seattle outpaced similar changes in the comparison cities.

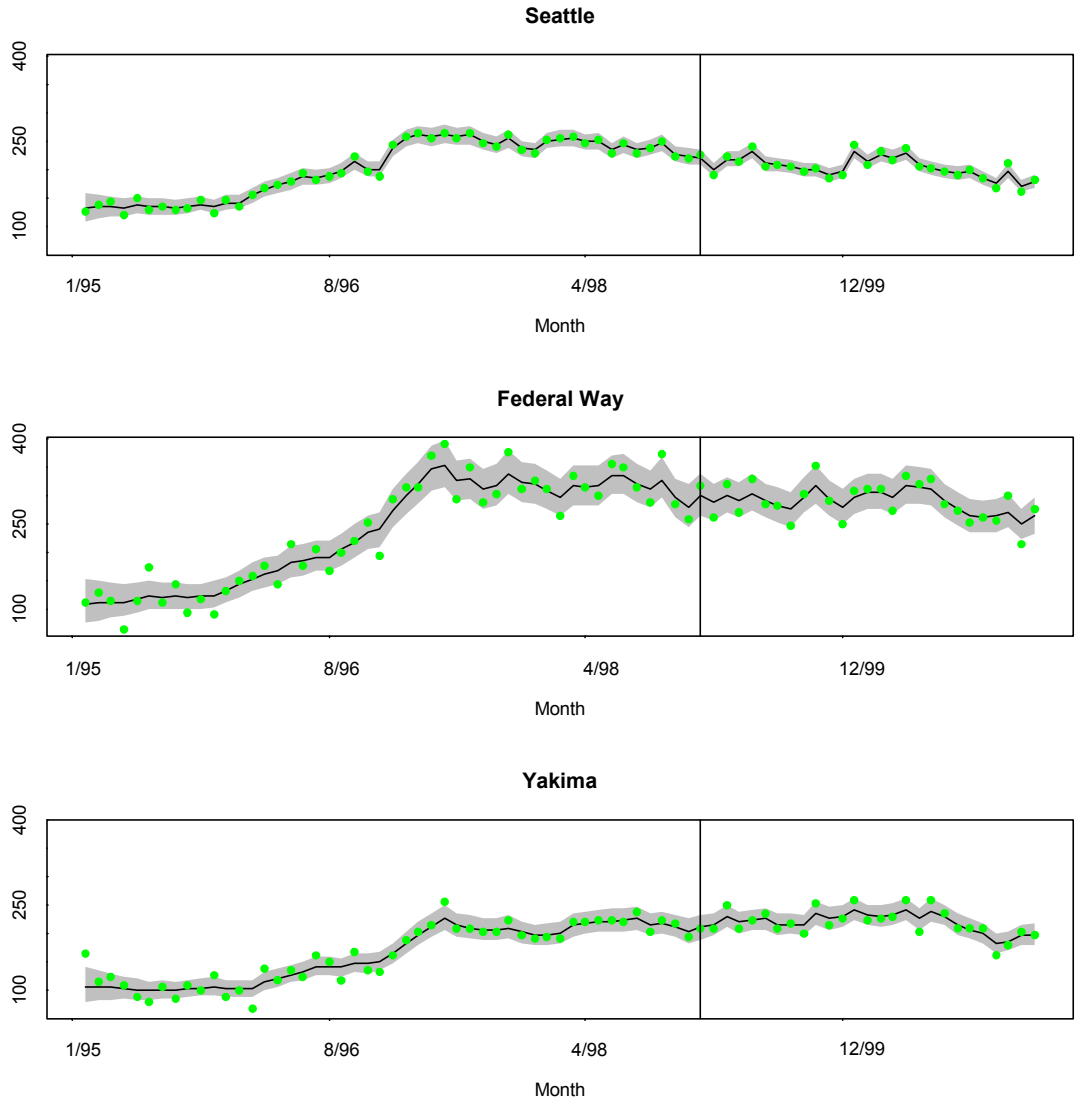

Figure 4.3 - Time Series Model of Other Driving Offenses Per Suspended Driver (DOL Data)

Other Driving Court Charge Filings Per 10,000 City Residents

Figure 4.4 shows the time series model comparing rates of court charge filings for other driving offenses in Seattle, Yakima, and Federal Way. The trend line was been estimated for early periods (and the margin of error is quite large) when court data were not available. Before and after implementation of the Impound Law, the results provide no evidence of a decrease in other driving offenses per 10,000 city residents in Seattle relative to the other cities. The best estimate from the statistical analyses is that court filings actually increased in Seattle by 6

percent. This estimate comes with a wide margin of error, which includes as much as a 47 percent increase or 24 percent decrease. Taking into account this margin of error, the probability of a decrease in charge filing rates in Seattle is 38 percent. This indicates that an increase in the rates of other driving offenses is more likely than a decrease. Thus, we conclude that the Impound Law does not appear to have a general deterrent effect on the rate of court filings in Seattle for other driving offenses.

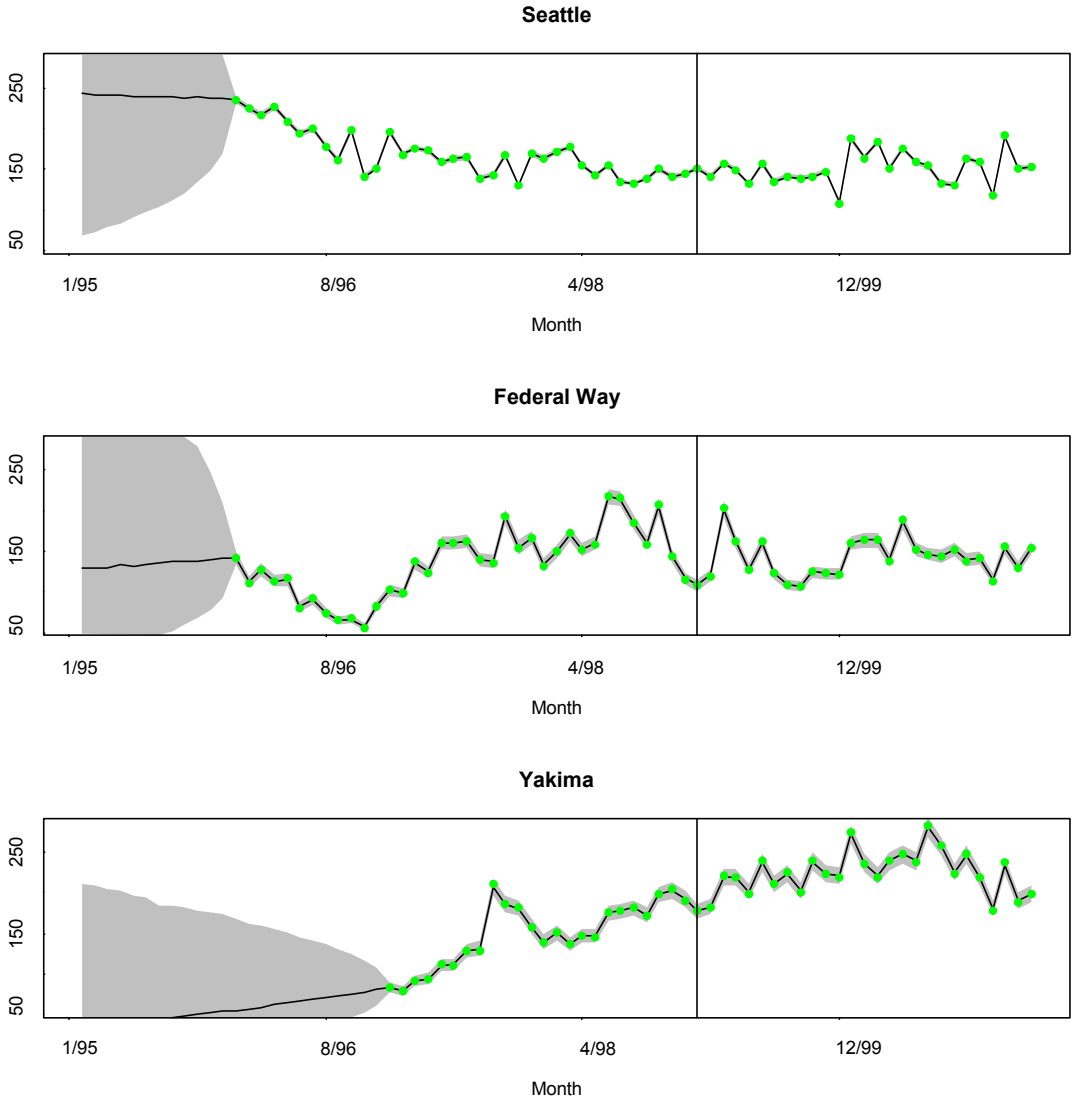

Figure 4.4 - Time Series Model of Other Driving Offenses Per 10,000 City Residents (Court Data)

Accidents Per Suspended Drivers

We also compared accident rates for suspended drivers before and after the passage of the Impound Law to assess whether rates in Seattle declined. Figure 4.5 shows the results of the time series model indicating that there may have been a decrease in rates for Seattle. The estimated odds of accidents among suspended drivers dropped by 16 percent after the Impound Law went into effect. However, the margin of error includes a considerable decrease (a 50 percent reduction) and as well as a 38 percent increase in the odds of accidents post-law. While it is likely (80 percent) that there was a drop in the odds of an accident, it is only weak evidence of a decrease in Seattle accident rates.

Importantly, at the same time the Seattle Impound Law went into effect, accident rates among suspended Yakima drivers dropped. The probability that Yakima's decrease in accidents *exceeded* the Seattle decrease in accident rates is 88 percent. This indicates that rates in Yakima, without the influence of the Impound Law, declined more than those in Seattle. The probability that Seattle had a greater decrease in the accident rate than Federal Way is 61 percent. However, there is substantial variability in the Federal Way estimates so the margin of error makes it difficult to discern whether Seattle rates may have dropped more than those in Federal Way.

The evidence from Yakima, along with the comparatively weak evidence of a drop in Seattle suggests that the Impound Law did not have a notable influence on accident rates in Seattle.

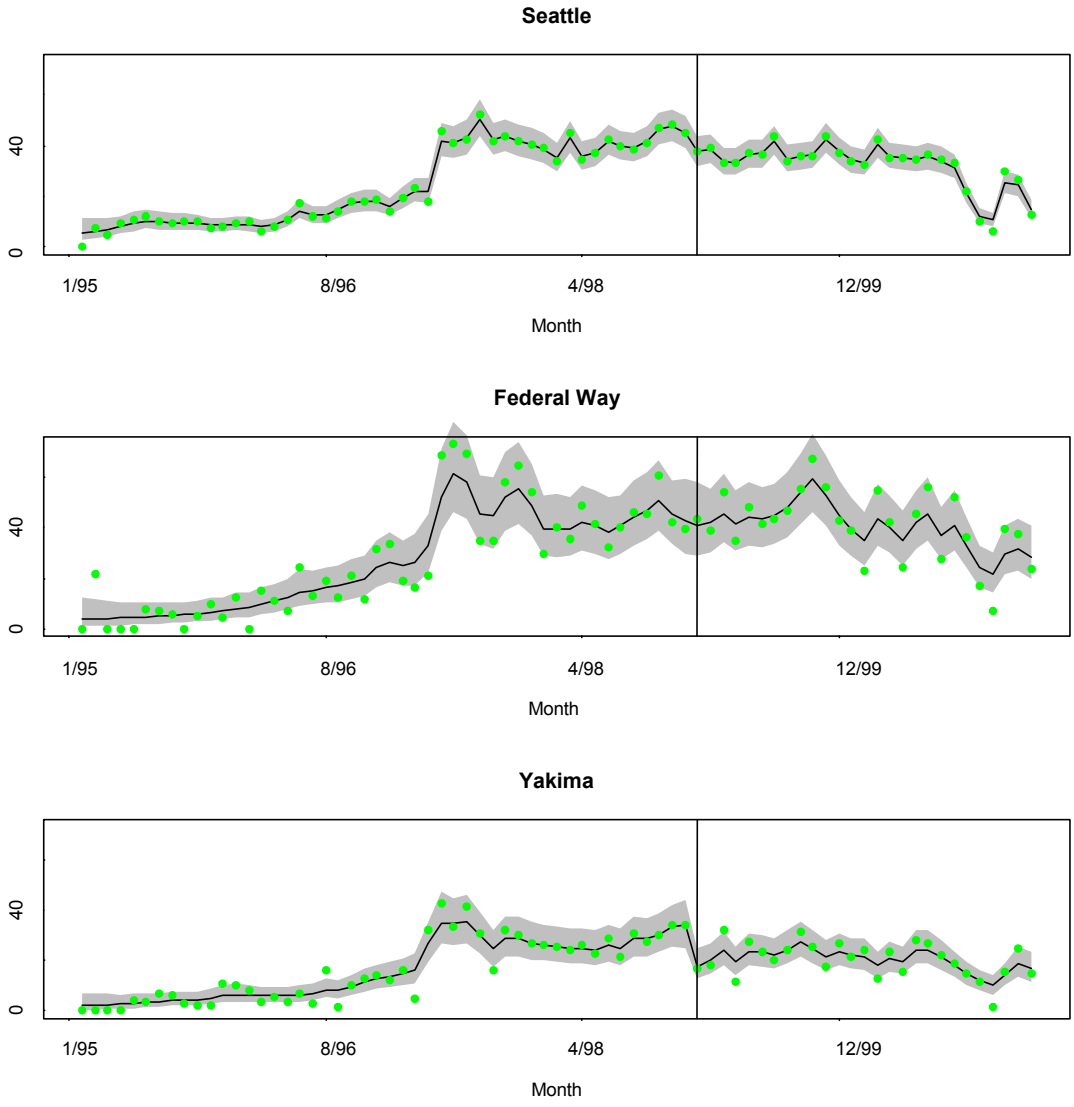

Figure 4.5 - Time Series Model of Accidents Per Suspended Driver (DOL Data)

Statistical Models with Control Variables

To control for pre-existing differences between Seattle, Federal Way, and Yakima, we had planned to include control variables in the statistical models, such as gender distribution, racial distribution, income distribution, and age structure. Unfortunately, because of a high level of correlation between monthly time periods, the data did not include enough time periods to allow additional

variables to be included in the statistical models.[44] The inability to include control variables is a limitation of the analyses of general deterrence. We attempted to minimize difference between Seattle and the comparison cities by selecting locations that were as similar to Seattle as possible. Despite their similarities, differences between Seattle and the comparison cities might have influenced the statistical results to an unknown degree.

General Deterrence Results Summary and Conclusions

DWLS Offenses

Statistical analyses of DWLS rates using time series models indicate that there appears to be no influence of the law on DWLS court filing rates in Seattle compared to Federal Way and Yakima. The data on DWLS conviction rates among suspended drivers does suggest some deterrent effect of the Impound Law but the evidence is weak. This decline might indicate a general deterrent effect, but it could also be due to a change in prosecutor policy following the Impound Law resulting in dismissal of cases against certain DWLS 3 drivers. In sum, we cannot conclude with a high degree of confidence that the observed decrease in DWLS convictions in Seattle was due to the impact of the law and not random monthly rate fluctuations or changes in prosecutor policy.

Other Driving Offenses

Compared to Yakima and Federal Way, it does not appear that the implementation of the Impound Law had a general deterrent impact on rates of either DWLS charge filings or DWLS convictions among suspended drivers.

Accidents

The statistical analyses produced weak evidence of a decline in accident rates in Seattle following the implementation of the Impound Law. But the evidence of a decline in Seattle alone is relatively weak and it is likely that one comparison city

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[44] For each analysis, there were at most 75 monthly time periods or data points. In some models, there were fewer time periods because of unavailable data. Rates at each of these monthly time periods were highly correlated with each other (serial correlation of 0.8). Consequently, the effective number of data points was reduced from 75 to 18. While 18 effective observations are sufficient for conducting the analyses presented above, the statistical models are unable to accommodate the addition of any more variables.

(Yakima) showed a greater decline in accidents than Seattle during this period. Thus, we cannot conclude with a high degree of confidence that any decrease in Seattle accident rates is due to the influence of the Impound Law.

Conclusions

The lack of a clear general deterrent effect in these results may have been due to several factors. One explanation may be that the Impound Law does not have a general deterrent effect. Another possibility is that a general deterrent effect exists but we were unable to detect it. This could be due to contamination of the comparison cities by neighboring jurisdictions with impound laws (and WSP impounds in the case of Yakima). As previously discussed, the general deterrent effect of the Impound Law would need to be large in order to be detectable in the presence of such contamination. Under present conditions a small or moderate general deterrent effect would not be detectable.

In conclusion, these results do not provide clear evidence of the existence of a general deterrent on DWLS charge filings, filings and convictions for other driving offenses, or accidents. There was weak evidence of a decline in DWLS convictions in Seattle, but this change may have been due to a change in prosecutor policy introduced around the same time as the Impound Law. Unfortunately, it is not possible to determine with available data whether there is in fact no general deterrence effect or simply an inability to detect one due to the presence of contamination and other factors.

5. Does Impounding the Vehicles of Persons Arrested for DWLS Have a *Specific Deterrent* Effect?

The question this chapter addresses is whether DWLS drivers who experienced an impound in Seattle were less likely to commit a repeat DWLS offense than DWLS drivers who received an arrest or citation in Federal Way but did not experience an impound. We also examined whether impounds impacted the rate of other traffic offenses and accidents for these same drivers. If a specific deterrent effect exists, we would expect to see a lower rate of DWLS offenses, other traffic offenses, and accidents during the follow-up period for Seattle drivers as compared to Federal Way drivers. The records of drivers identified by the Seattle or Federal Way Police Departments as having a DWLS offense between January 1, 1999 and January 31, 2000 were used to test specific deterrence. Details about the data sources and analytic strategy are provided in the Methodology chapter.

Specific Deterrence Results

In the following sections, we present the results of the analyses of the specific deterrence research question. First, we describe the characteristics of the Seattle drivers and provide a description about the impound program. Next, we compare characteristics of the Seattle sample to those of the Federal Way sample. We then present descriptive data on repeat offenses of the Seattle and Federal Way drivers, including DWLS offenses, other traffic offenses, and accidents. Next, we present the results of statistical comparison of recidivism rates over time and rates of recidivism after controlling for differences between the groups. Finally, we present a summary and conclusions.

Seattle Vehicle Impound Description

In this section, we provide a description of the first DWLS impound for each driver in our Seattle sample. Between January 1, 1999 and January 31, 2000, there were 5,287 individuals driving vehicles impounded for DWLS offenses. As Table

5.1 shows, most drivers of impounded vehicles were not the registered owners.[45] Of the registered owners, 97% were Washington licensed drivers and fewer than half were Seattle residents. A very few owners (2%) were Federal Way residents.

Table 5.1

Drivers and Registered Owners of Vehicles Impounded in Seattle

	N (%)
Driver is registered owner	3489 (34%)
Owner is Washington-licensed driver	5145 (97%)
Owner is Seattle resident	1960 (37%)
Owner is Federal Way resident	98 (2%)

NOTE: Missing data (six drivers for residency and one for Washington license) have been eliminated from this table.

Table 5.2 provides a description of the first impound for each individual during the study period, required length of impound, and outcome of the impound. Most of the DWLS drivers received a citation (83%) rather than arrest (17%). For just over half of the impounded vehicles (53%) there was no period of required hold as a result of the impound offense. Slightly more than one in four impounded vehicles (28%) had a required hold period of 30 days. Hearings were requested in about 16 percent of the cases and 29 percent of the impounded vehicles were eventually auctioned rather than redeemed from the tow company.

[45] SPD's Operation Impound data do not include city of residence of the DWLS drivers who were not registered owners of the impounded vehicles.

Table 5.2

Outcomes of Impounds in Seattle Sample (First Impound per Driver Between January 1, 1999 and January 31, 2000)

Outcome	*N (%)*
Driver arrested at impound	890 (17%)
DWLS 1	109
DWLS 2	150
DWLS 3	631
Driver cited at impound	4397 (83%)
DWLS 1	107
DWLS 2	292
DWLS 3	3998
Total	5287 (100%)
Length of required impound	
None	2795 (53%)
15 days	722 (14%)
30 days	1467 (28%)
60 days	102 (2%)
90 days	201 (4%)
Total	5287 (100%)
Court hearing requested	826 (16%)
Car was auctioned	1537 (29%)

Note: Categories in the table are not mutually exclusive. Percentages may not add to 100 due to rounding.

In Table 5.3, we provide more details about the 1,537 cars that were auctioned following impound for the sample of 5,287 Seattle drivers. This refers to auctions that occurred as a result of the first impound during the study period and does not any subsequent impounds. In most cases, the DWLS driver was not the registered owner of the auctioned vehicle. Thirty-eight percent of the DWLS drivers owned the car that was auctioned as the result of the impound. Race distribution of the drivers of the auctioned cars was similar to the distribution of the Seattle sample overall. Whites made up 55 percent of the total Seattle DWLS sample and they represented 56 percent of those for whom an impound resulted in a vehicle auction. Black drivers represented 38 percent of the total Seattle sample and 38 percent of those driving a vehicle that was auctioned as the result of the impound. The gender of the drivers in the Seattle sample was also similar to the distribution of gender for drivers of auctioned vehicles. Males represented 80 percent of the Seattle sample and 81 percent of the drivers of auctioned vehicles.

Table 5.3

Cars Auctioned in Seattle Sample (First Impound per Driver Between January 1, 1999 and January 31, 2000)

Auctioned Cars	*N (%)*
Total impounded cars auctioned	1537 (100%)
Driver was registered owner	586 (38%)
Driver race	
White	858 (56%)
Black	589 (38%)
Other	87 (6%)
Driver gender	
Male	1240 (81%)
Female	297 (19%)
Driver age	
<25	378 (25%)
25-34	533 (35%)
35+	624 (41%)
Driver Offense	
DWLS 1	89 (6%)
DWLS 2	151 (10%)
DWLS 3	1297 (84%)
Car year of manufacture	
1983 or earlier	728 (47%)
1984-1988	613 (40%)
1989-1993	158 (10%)
1994-1998	33 (2%)
1999 and later	4 (0%)
Number of driver impounds	
1 (no repeat impounds)	1232 (80%)
2 or more	305 (20%)

Notes: Percentages in this table are based on the number of drivers for whom a car was auctioned and the number of drivers with non-missing data. They may not add to 100 due to rounding. Driver's age and race were unknown for 13 such drivers, and the car year of manufacture was unknown for 4 drivers.

Most of the auctioned vehicles were older models, with 87 percent older than 1988. Twenty percent of those driving a vehicle that was auctioned committed at least one repeat DWLS offense during the one year follow-up period.

DWLS drivers, spouses, and registered owners have the opportunity to request a hearing based on hardship or for request of early release of impounded vehicles. These impound hearings are administrative and conducted by magistrates. Table 5.4 shows the outcome of the impound hearings.[46] For those participating

[46] As shown on Table 5.2, the Operation Impound database indicated that hearings were requested in 826 cases but it contained outcome data for only 683 hearings.

in the administrative impound hearing, 54 percent were granted early release of the impounded vehicle.

Table 5.4

Outcome of Administrative Impound Hearings (First Impound per Driver Between January 1, 1999 and January 31, 2000)

Outcome	*N (%)*
Hardship criteria met as laid out in ordinance	237 (35%)
Administrative fees waived	74 (11%)
Storage fee waived	18 (3%)
Towing fee waived	15 (2%)
Early release granted	366 (54%)
Defendant a no-show	69 (10%)
Total number of requested hearings	683

Note: Percentages represent the share out of the total 683 hearings. They do not add to 100% because categories are not mutually exclusive.

Relicensing Program

In order to assist Seattle DWLS drivers in complying with the legal obligations necessary for the reinstatement of their driving privileges, SMC developed a relicensing program that arranges with DWLS drivers a schedule for repayment over time of all fines and fees owed to the court. Of the 5,287 Seattle DWLS drivers, 61 (1.2%) participated in the relicensing program following their first impound during the study period.[47] Table 5.5 shows the characteristics of these individuals compared to the remainder of the Seattle DWLS drivers. A significantly greater proportion of Black drivers participated in the relicensing program (77%) compared to those who did not (37%). Participants and non-participants were roughly similar in gender, age, degree of DWLS offense, vehicle ownership, and whether the impounded vehicle was auctioned. There was a significant difference in the number of repeat impounds among those participating in the relicensing program. Of non-participants, 14 percent had at least one repeat impound during the one year follow-up period compared to 4 percent of program participants.

[47] SMC provided us a list of drivers in our sample who had also participated in the relicensing program. A total of 94 drivers or 1.8 percent of the sample had participated but 33 of these drivers had only participated in the relicensing program after their second, third (or more) impound. For purposes of examination of recidivism, we focused on the 61 drivers who participated in the program after their first impound but before any subsequent impound.

Table 5.5

Characteristics of Seattle Drivers and Participation in SMC's Relicensing Program

	Not in program n = 5226	*In program n = 61*
Gender		
Male	4,183 (80%)	43 (70%)
Female	1,043 (20%)	18 (30%)
Race		
White	2,889 (55%)*	12 (20%)
Black	1,950 (37%)	47 (77%)*
Asian	330 (6%)	1 (2%)
Native American	44 (1%)	1 (2%)
Age		
<16	15 (0%)	0 (0%)
16-19	420 (8%)	5 (8%)
20-24	1,071 (21%)	16 (26%)
25-29	1,059 (20%)	11 (18%)
30-34	869 (17%)	8 (13%)
35-39	725 (14%)	8 (13%)
40-49	805 (15%)	9 (15%)
50+	249 (5%)	4 (7%)
DWLS at 1st impound		
DWLS 1	214 (4%)	2 (3%)
DWLS 2	439 (8%)	3 (5%)
DWLS 3	4,573 (88%)	56 (92%)
Registered owner[1]	1,777 (34%)	21 (34%)
Required hold period[1]		
None	2,774 (53%)*	21 (34%)
15 days	712 (14%)	10 (16%)
30 days	1,441 (27%)	26 (43%)*
60 days	102 (2%)	0 (0%)
90 days	197 (4%)	4 (7%)
Car auctioned[1]	1,517 (29%)	20 (33%)
Repeat impounds		
0	4,488 (86%)	59 (97%)*
1	610 (12%)*	1 (2%)
2 or more	128 (2%)	1 (2%)*

Percentages are based on non-missing data and may not add to 100 due to rounding. Race and age (date of birth) was unknown for 13 drivers. None of these 13 participated in the program. * Statistically significant ($p < .05$) using chi-square tests. 1 First impound during the study period.

Characteristics of Seattle and Federal Way Sample

Our sample for testing specific deterrence consists of 5,287 individuals from Seattle and 955 from Federal Way reported by the respective police departments to have at least one DWLS offense between January 1, 1999 and January 31, 2000. In Seattle, the vehicles driven by these individuals were impounded. In Federal Way, vehicles were not impounded and drivers were either arrested or received

a citation for the DWLS offense. In this section, we describe how Seattle drivers compared the Federal Way drivers in terms of demographic characteristics, and histories of DWLS, other traffic offenses, and accidents, and type of first DWLS offense during the study period.

Demographic Characteristics

There was a significant difference in gender distribution between the Federal Way and Seattle drivers. Males made up 76 percent of the drivers in Federal Way and 80 percent of the drivers in Seattle. There were also significant differences in age and race. Seattle drivers were somewhat older, with an average age of 31 for Seattle drivers and 29 for Federal Way drivers. There was a greater proportion of black drivers in the Seattle sample compared to Federal Way, which has a greater proportion of white and Hispanic drivers. See Table 5.6 for the demographic distribution of the sample.

Table 5.6

Demographic Characteristics of the Sample

	Federal Way *n = 955*	*Seattle* *n = 5287*
Gender		
Male	729 (76%)	4226 (80%)*
Female	224 (24%)*	1061 (20%)
Race		
White	605 (64%)*	2901 (55%)
Black	246 (26%)	1997 (38%)*
Hispanic	62 (7%)*	0 (0%)
Asian	34 (4%)	331 (6%)
Native American	4 (0%)	45 (1%)
Age		
<16	0 (0%)	15 (0%)
16-19	118 (12%)*	425 (8%)
20-24	235 (25%)*	1,087 (21%)
25-29	203 (21%)	1,070 (20%)
30-34	148 (16%)	877 (17%)
35-39	128 (13%)	733 (14%)
40-49	94 (10%)	814 (15%)*
50+	27 (3%)	253 (5%)*

* Differences are statistically significant ($p < .05$) using chi-square tests. Percentages in this table are based on non-missing data. Gender was unknown for 2 Federal Way drivers. Race was unknown for 13 Seattle drivers and 4 Federal Way drivers. Date of birth was used to calculate age as of January 1, 1999 and was unknown for 13 Seattle drivers and 2 Federal Way drivers.

History of DWLS, Other Traffic Offenses, and Accidents

In addition to demographic characteristics, Seattle and Federal Way drivers may differ in their history of DWLS and other traffic offenses as well as accidents before the implementation of the Impound Law.[48] Differences in these histories are important because individuals with accidents and offenses in the past may be more likely to have accidents and offenses in the future, regardless of the potential impact of new law.

As Table 5.7 shows, Seattle drivers were more likely to have DWLS filings before the implementation of the Impound Law than Federal Way drivers. In the 12 months prior to their first DWLS offense in the study period, 26 percent of Seattle drivers had a DWLS filing compared to 20 percent of Federal Way drivers. Seattle drivers were also more likely to have filings for other traffic offenses. In the previous 12 months, 34 percent of Seattle drivers had filings for other traffic offenses compared to 28 percent of Federal Way drivers. Because of these pre-existing differences alone, we would expect to see a larger proportion of Seattle drivers than Federal Way drivers with repeat DWLS and other traffic offenses following the implementation of the Impound Law. Given this, it is important to control for these pre-existing offense histories before drawing conclusions about the impact of vehicle impounds.

Federal Way drivers were more likely to be involved in accidents (13%) than Seattle drivers (10%) in the 12 months prior to the implementation of the Impound Law. Thus, we would expect a larger proportion of Federal Way drivers to have accidents following the implementation of the Impound Law than Seattle drivers. Thus, it is important to control for these differences in accident history in making comparisons between the groups. Because of the significant differences between Seattle and Federal Way drivers in demographic characteristics, DWLS, other traffic, and accident histories, these factors will be taken into account in statistical analyses.

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[48] While we had police records on DWLS offenses since January 1, 1999, we were unable to obtain police records for DWLS arrest/citations prior to this date. Thus, we do not have data on DWLS arrest/citation history.

Table 5.7

Driver History of DWLS Offenses, Other Traffic Offenses, and Accidents Before Their First DWLS Offense Between January 1, 1999, and January 31, 2000

	Federal Way N = 955	*Seattle N = 5287*
Within 48 months prior to 1st offense		
Filing for DWLS in any degree	307 (32%)	2527 (48%)*
DWLS 1 filing *1*	21	168
DWLS 2 filing *1*	47	357
DWLS 3 filing *1*	287	2343
Within 12 months prior to 1st offense		
Filing for DWLS in any degree	190 (20%)	1375 (26%)*
DWLS 1 filing *1*	7	80
DWLS 2 filing *1*	34	148
DWLS 3 filing *1*	168	1217
Within 48 months prior to 1st DWLS		
Filing for any other traffic offense	488 (51%)	3683 (70%)*
Criminal driving offense filing*1*	205	1694
Traffic infraction filing*1*	476	3637
Within 12 months prior to 1st DWLS1		
Filing for any other traffic offense	265 (28%)	1800 (34%)*
Criminal driving offense filing*1*	90	564
Traffic infraction filing*1*	246	1763
Any accident (DOL records)2		
Within 20 months before 1st offense	161 (19%)*	792 (16%)
Within 12 months before 1st offense	111 (13%)*	513 (10%)

Notes: * p < .05 using chi-square test. The asterisk indicates the significantly higher value.
1 These rows are not mutually exclusive, e.g., an individual may have a DWLS filing in more than one degree and an individual may have both criminal and infraction filings during the same period of time. 2 Only drivers for whom we had DOL records were included in this row; 867 Federal Way drivers and 5,099 Seattle drivers.[49]

First DWLS During the Study Period

Table 5.8 shows the distribution of the type of first DWLS offense during the study period of the drivers in Federal Way and Seattle, according to police data. The distribution is very similar--88 percent of Seattle drivers had a DWLS 3 offense compared to 89 percent of Federal Way drivers. Likewise, the distribution of DWLS 1 and 2 offenses was nearly evenly split among drivers in the two city samples.

[49] DOL provided data to us in April and May of 2002 and many DOL accident records are purged after five years. DOL accident data are incomplete before May 1, 1997. Thus, because our sample contains cases with a first DWLS offense between January 1, 1999 and January 31, 2000, the longest "pre-" period was 20 months. We used this length in all cases in order to standardized this period for all drivers.

Table 5.8

Type of DWLS for First Offense Between January 1, 1999 and January 31, 2000

	Federal Way *n = 955*	*Seattle* *n =5287*
DWLS 1	30 (3%)	216 (4%)
DWLS 2	77 (8%)	442 (8%)
DWLS 3	848 (89%)	4629 (88%)

Note: A chi-square test found no significant difference in these proportions between Seattle and Federal Way drivers.

Repeat DWLS and Other Driving Offenses During the One Year Follow-Up Period

The next step in assessing whether a specific deterrence effect was produced by impounds is to compare recidivism of Seattle and Federal Way drivers. These descriptive comparisons, however, must be interpreted with caution because (as shown in the previous section) the groups were significantly different in gender, age, and racial distribution, as well as history of DWLS, other traffic offenses, and accidents.

In examining the observed proportions of drivers with offenses during the follow-up period, we used data for each driver for 12 months from the date of their first offense after the Impound Law went into effect. For example, a driver with a DWLS offense on April 1, 1999 was followed until March 31, 2000. Thus, each individual was "at-risk" for a subsequent offense for the same length of time. We describe differences between Seattle and Federal Way on each of the three outcome measures below.

DWLS Impounds and Citations/Arrests During the One Year Follow-Up Period

The majority of drivers had only their target DWLS offense (no recidivism) during the follow-up period. A greater percentage of Seattle drivers had subsequent offenses (14%) than Federal Way drivers (12%).[50] This difference is small but is not what we would expect to see if the Impound Law had a specific deterrent effect. This difference however may be related to pre-existing differences (demographics and previous DWLS offenses) between groups, which

[50] See Appendix F for a description of the characteristics of drivers with more than one repeat DWLS offense and those with DWLS offenses in both cities.

will be taken into account in subsequent statistical analyses. Table 5.9 provides the distribution of DWLS offenses for the groups.

Table 5.9

Drivers With Repeat DWLS Impound or Arrest/Citation 12 Months After Their First DWLS Offense Between January 1, 1999, and January 31, 2000

Recidivism	*Federal Way N = 955*	*Seattle N = 5287*
During 12 month follow-up period		
No Repeat Offense	840 (88%)	4547 (86%)
One Repeat Offense	104 (11%)	611 (12%)
Two or More Repeat Offenses	11 (1%)	129 (2%)*

* Differences are statistically significant ($p < .05$) using chi-square test.

Charge Filings for DWLS During the One Year Follow-Up Period

Court data are another source of information about DWLS recidivism useful because they are not restricted to only the cities of Federal Way and Seattle (as are the data on impound and arrest/citation offenses). We examined charge filings for DWLS offenses during the one year follow-up period. If the Impound Law had a specific deterrent effect, we would expect to see fewer charge filings for Seattle drivers relative to Federal Way drivers during the follow-up period.

Table 5.10 shows the filings for DWLS during the one year follow-up period. These filings represent repeat offenses and do not include a filing that may have occurred as a result of their first impound during the study period. In Seattle, more drivers had DWLS filings against them (22%) during the follow-up period than Federal Way drivers (20%). This is opposite of what we would expect to see if the Impound Law had a specific deterrent effect on drivers in Seattle. However, pre-existing differences between the Seattle and Federal Way groups may have an influence on these group proportions. This possibility will be examined below using statistical analyses.

Table 5.10

Drivers With Court Filings for DWLS Offenses 12 Months After Their First DWLS Offense Between January 1, 1999, and January 31, 2000

	Federal Way N = 955	*Seattle N = 5287*
During 12 month follow-up period		
Filing for DWLS in any degree	192 (20%)	1183 (22%)
DWLS 1	8	71
DWLS 2	23	143
DWLS 3	171	1022

Notes: A chi-square test was conducted and a significant difference was not detected between the proportions of any DWLS filings for the groups. All drivers are included here because we cannot distinguish drivers with missing data and those who legitimately have no court records (see Methods Chapter).

Charge Filings for Other Driving Offenses During the One Year Follow-Up Period

We also examined charge filings for non-DWLS driving offenses (made up of criminal driving offenses and traffic infractions) during the one year follow-up period. If DWLS impounds had a deterrent effect on non-DWLS driving offenses, we would expect to see a lower proportion of Seattle drivers compared to Federal Way drivers with these offenses during the follow-up period.

Table 5.11 shows the percentage of drivers with court filings for non-DWLS driving offenses during the follow-up period. The table shows that a greater share of Seattle drivers (23%) had other traffic offenses than Federal Way drivers (20%). These proportions are not consistent with specific deterrence.

Table 5.11

Drivers With Court Filings for Other Driving Offenses After Their First DWLS Offense Between January 1, 1999, and January 31, 2000

	Federal Way N = 955	*Seattle N = 5287*
During 12 month follow-up period		
Filing for any other traffic offense	194 (20%)	1195 (23%)
No other traffic offense	761	4092
Criminal offense only	82	183
Traffic infraction only	59	786
Both criminal offense & traffic infraction	53	226

Notes: A chi-square test was conducted and a significant difference was not detected between the proportions of any other traffic offense for the groups.

Accidents During the Eight-Month Follow-Up Period

Finally, we examined the relationship between DWLS offenses and accidents during the follow-up period for Seattle and Federal Way drivers. If there were a specific deterrent effect of DWLS impounds on accidents, we would expect to see a smaller proportion of accidents for Seattle drivers compared to Federal Way drivers.

Because DOL data were only available for all drivers for the eight months of the follow-up period, we have displayed the data using this truncated time period. As shown in Table 5.12, a greater percent of Seattle drivers (8%) had an accident during the follow-up period than Federal Way drivers (6%). This difference however was not statistically significant.

Table 5.12

Drivers Who Were Involved in an Accident After Their First Offense Between January 1, 1999, and January 31, 2000

	Federal Way *N = 867*	*Seattle* *N = 5099*
Any accident		
During the 8 months follow-up period	50 (6%)	386 (8%)

Notes: A chi-square test was conducted and no difference was detected between these proportions.

Time to Recidivism

In this section, we present a comparison of Seattle and Federal Way drivers that examines the rates of recidivism over time. Using survival analysis, we created statistical plots of the rate at which drivers in two groups committed their first repeat offense, allowing some ability to assess the issue of incapacitation. If there is a period of incapacitation for Seattle drivers following an impound (either because a driver's own vehicle is impounded or other owners deny a driver access to their vehicles) following an impound, it would take Seattle drivers longer to engage in a repeat DWLS offense than drivers in Federal Way. For example, if rates of recidivism are similar for Seattle and Federal Way drivers in the beginning of the follow-up period but diverge over time (i.e. the rate for Seattle drivers increases relative to that for Federal Way), this may suggest the presence of an incapacitation in the beginning of the follow-up period for Seattle drivers. Below, we present the results of the survival analyses showing the "time to failure" of Seattle versus Federal Way drivers.

DWLS Offenses

If a specific deterrent effect exists, we would expect to see a lower rate of DWLS recidivism at the end of the follow-up period among Seattle drivers compared to drivers in Federal Way. In Figures 5.1 and 5.2, for each city we plot the share of drivers that had a repeat DWLS offense by a certain day after the initial offense.[51] For a particular day on the horizontal axis, the value of the curve on the vertical axis is the percentage of the drivers who had a repeat offense by that time. The gray bars provide estimated 95-percent confidence intervals (or margin of error) for the percentage for each time point. At time points where the gray bars do not overlap for the cities, this indicates that the difference in recidivism by drivers in the two cities is statistically significant.

Figure 5.1 shows the results for repeat DWLS arrests/citations in Federal Way and repeat DWLS impounds in Seattle. For the beginning of the follow-up period, Seattle and Federal Way drivers reoffended at a similar rate. However, over time the rate of DWLS reoffending among Seattle drivers increased relative to Federal Way drivers. This may suggest the presence of an incapacitation period (lack of access to a vehicle) that temporarily reduced the repeat offending of Seattle drivers.

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[51] The curves are estimated by calculating one minus the estimated Kaplan-Meier survival function separately for Seattle and Federal way. "Survival" in this setting should be interpreted as not recidivating or having an accident. For more information, see: Hosmer, D.W. & Lemeshow, S. (1999). *Applied Survival Analysis: Regression Modeling of Time to Event Data*. New York: John Wiley and Sons.

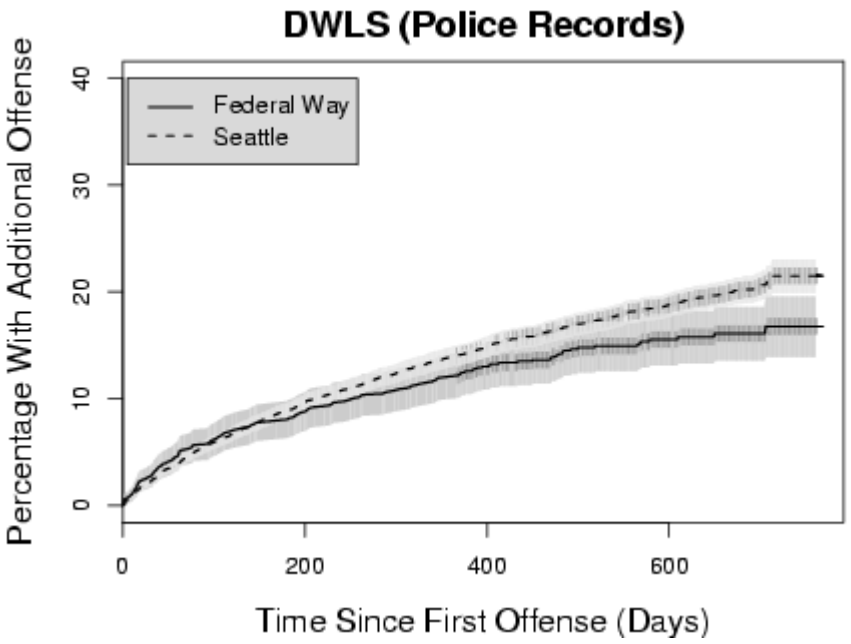

Figure 5.1 - Time to First Repeat DWLS Offense During the Study Period

Figure 5.2 shows the rate of DWLS charge filings in court records for Seattle and Federal Way drivers. Compared to the police data, Federal Way and Seattle drivers were more similar in reoffending rates for a longer period of time. Over time, like the police data, court filings also showed a higher rate of reoffenses for Seattle drivers than for Federal Way drivers. Again, this early similarity in offending rate between Seattle and Federal Way drivers that diverges over time might indicate a period of incapacitation for impounded Seattle drivers. This might have served to depress their repeat offending earlier in the follow-up period.

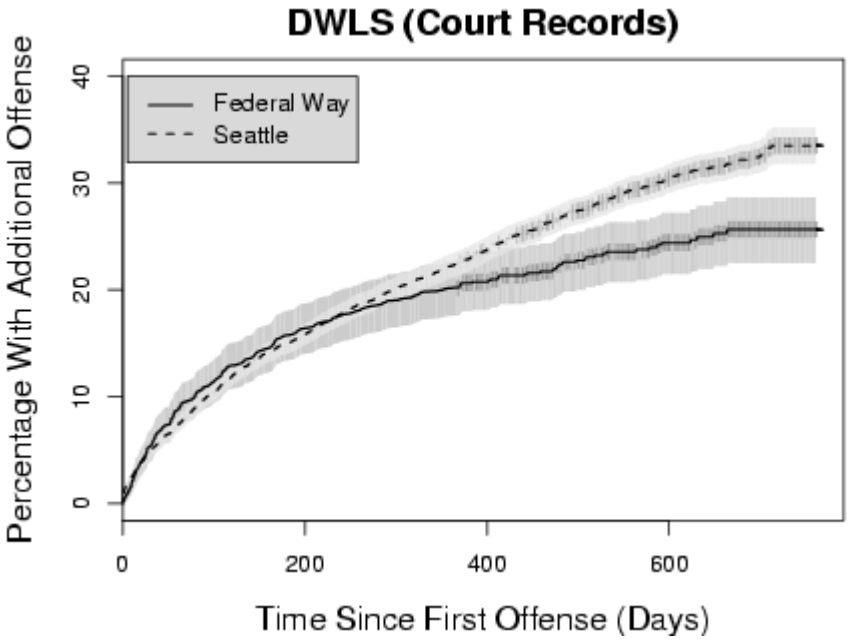

Figure 5.2 - Time to First Repeat DWLS Offense During the Study Period

Taken together, these findings indicate that Seattle drivers are slower to commit a repeat DWLS offense than Federal Way drivers but over time their rate of recidivism is higher than Federal Way drivers. These findings do not support the existence of a specific deterrent effect of the Impound Law and suggest the presence of a period of incapacitation following an impound.

Other Traffic Offenses

If impounds have a specific deterrent effect on other traffic offenses, we would expect to see a lower rate of other driving offenses among Seattle drivers compared to Federal Way drivers at the end of the follow-up period. Figure 5.3 displays rates of court charge filings during the follow-up period. Like the court filings for DWLS offenses, Seattle and Federal Way drivers are relatively similar in their rates of filings for other traffic offenses in the short term but over time more Seattle drivers had such filings than drivers in Federal Way. This may suggest the presence of a short-term incapacitation effect that suppressed repeat traffic offenses among Seattle drivers during the beginning of the follow-up period. At the end of the follow-up period, an increase in recidivism among Federal Way drivers narrows the gap but it is not eliminated. These findings do not support a hypothesis that the Impound Law has a specific deterrent effect on non-DWLS traffic offenses.

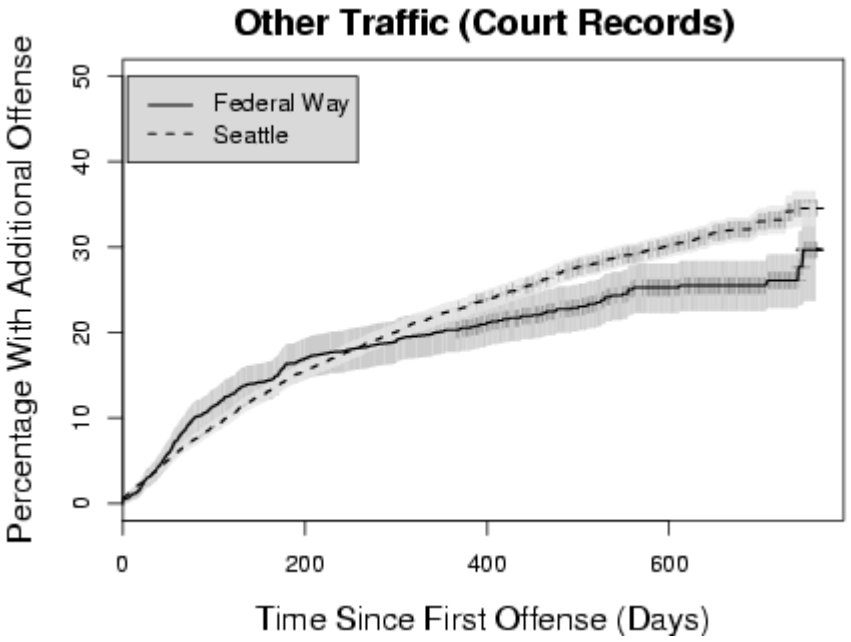

Figure 5.3 - Time to First Non-DWLS Traffic Offense After Initial DWLS Offense During the Study Period

Accidents

If impounds produced a specific deterrent effect on accidents, we would expect to see a lower rate of accidents among Seattle drivers compared to Federal Way drivers during the follow-up period. As indicated in Figure 5.4, this is not the case. Over time, there is no appreciable difference in the accident rates for Seattle and Federal Way drivers.[52] Thus, there is no evidence of a specific deterrent effect of the Impound Law on accidents among Seattle drivers. Because the rate of accidents among Federal Way and Seattle drivers is consistent over time, there is no suggestion of an incapacitation effect in the accident data.

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[52] The increase in the Federal Way accident curve at then end of the follow-up is due to an uncharacteristically but coincidentally high frequency of accidents among the very small number individuals for whom DOL had data until March 2001. The estimate at the end of the follow-up period is unstable because it is based on few cases.

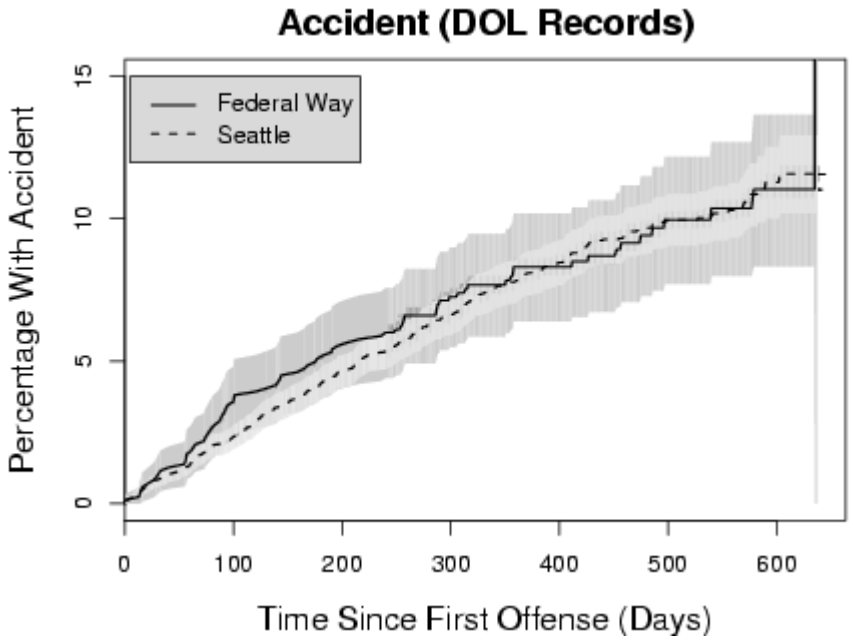

Figure 5.4 - Time to First Accident After Initial DWLS Offense During the Study Period

Statistical Tests Adjusting for Pre-Existing Differences Between Seattle and Federal Way Drivers

In the test of specific deterrence, we conducted survival analysis statistical tests using control variables to adjust for pre-existing differences between Seattle and Federal Way drivers. This allows a comparison of recidivism while holding constant other potentially important differences between drivers.[53] The variables we used in these analyses were:

- whether the driver was a member of the Seattle or Federal Way group
- black, white, or other race[54]
- age
- gender
- degree of first DWLS offense during the study period

[53] For purposes of comparison, we also analyzed these models using logistic regression. The results of these models are consistent with the key findings of those presented in the text using survival analysis methods. See Appendix G for the logistic regression results.

[54] Other race categories were not broken out separately because a small representation of other races in the two city samples prevents the use of this variable in statistical analyses.

- accident history
- DWLS court charge filing history
- other traffic offense court charge filing history

See Appendix H for a complete description of how these variables were defined.

In the tables of results presented below, the rows provide a summary of the findings for each variable. The columns are, respectively, the coefficient, exponential of the coefficient, p-value of the hypothesis test that the coefficient is zero, and the lower and upper bounds of the 95 percent confidence interval (margin of error) for the exponentiated coefficient. Complete statistical results are presented in Appendix I.

In the first column, the coefficient indicates whether the variable has a positive or negative association with the outcome variable. The exponentiated coefficient is the key to determining the importance of the relationship of a particular variable to recidivism. Specifically, this value represents the rates of recidivism on any given day during the follow-up period. For example, in Table 5.13, the exponentiated coefficient of the Seattle variable (indicating drivers who belonged to this group rather than the Federal Way group) is estimated to be 1.13, indicating that when all other variables in the model are held constant, Seattle drivers recidivated at a rate about 1.13 times as large as Federal Way drivers. Below, we will discuss these rates as percentages.[55] Continuing the example from Table 5.13, this would mean that on any given day the rate of recidivism for Seattle drivers was 13 percent higher than for drivers in Federal Way. The p-value indicates whether this difference is statistically significant. All estimates are accompanied by a margin of error; the 95 percent confidence intervals provided in the last two columns of each table. The interval in the two columns provides a range of plausible recidivism ratios because of the margin of error.

DWLS

If the Impound Law produced a specific deterrent effect on DWLS offenses, while holding other factors constant, we would expect to see a significantly lower rate of DWLS recidivism among Seattle drivers compared to Federal Way drivers.

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[55] These are calculated as absolute value of (1 - exponentiated coefficient). Thus, 1 - 1.13 = -.13. Absolute value is 0.13 or 13%.

The results for DWLS recidivism are provided in Tables 5.13 and 5.14. Given the apparent discrepancies between data sources (discussed in the Methodology chapter), we used history variables taken from the same source as the outcome we are examining. Because the police data contained no history variables, they were not included in the model summarized in Table 5.13.

As Table 5.13 shows, there are several factors that significantly influence the rate of repeat DWLS offenses for both Seattle and Federal Way drivers. Repeat offense rates are significantly lower for drivers with a DWLS 3 offense compared to those with an initial DWLS 1 or 2. Black drivers had a higher rate of DWLS offenses in both cities compared to white drivers. The rate of reoffense of black drivers was 1.675 times higher (about 68%) than that of whites. Males also had a higher rate (1.386 times or 39%) of reoffense than females.

This suggests that the higher rate of repeat DWLS offenses among Seattle drivers we saw earlier in Table 5.9 (14 percent of Seattle drivers with a repeat DWLS offense compared to 12 percent among Federal Way drivers), may be due to the greater proportions of males, blacks, and DWLS 1 and 2 offenders among Seattle compared to Federal Way drivers.[56]

Even while holding these important variables constant, no significant difference was detected between Federal Way and Seattle drivers in the rates of repeat DWLS arrests and citations (Federal Way) and impounds (Seattle). This finding does not support the hypothesis that DWLS impounds had a specific deterrent effect on repeat DWLS offenses.

Table 5.13

Cox Survival Model: DWLS (Police Arrest/Citation and Impound Records)

	coef	*exp(coef)*	*p-value*	*lower .95*	*upper .95*
Seattle	0.122	1.130	0.18	0.947	1.348
DWLS 3	**-0.347**	**0.707**	**0.00**	**0.602**	**0.829**
Black	**0.516**	**1.675**	**0.00**	**1.482**	**1.893**
Other race	-0.101	0.904	0.44	0.698	1.170
Male	**0.327**	**1.386**	**0.00**	**1.178**	**1.632**
Age	-0.004	0.996	0.27	0.990	1.003

Note: Bold indicates statistically significant association with repeat DWLS offenses ($p < .05$). The reference group for the Seattle driver variable is Federal Way group membership. For DWLS 3, it is DWLS 1/2 drivers. For black and other race variables, the reference category is white drivers.

Table 5.14 presents the results for DWLS charge filings. There were several variables with a significant relationship to recidivism, as measured by DWLS

[56] See Tables 5.6 and 5.8 for the distribution of these groups.

charge filings. Like DWLS reoffense in police data, black drivers had higher rates of charge filings compared to whites and males had higher rates compared to females. However, degree of DWLS offenses did not impact the rates of DWLS charge filing. Charge filing rates were significantly higher among younger compared to the older drivers.[57] Finally, history of charge filings played an important role. The rates of DWLS charge filings in the follow-up period were highest among those with at least one previous filing for a traffic offense or DWLS offense in any degree.

While holding these other important variables constant, there was no significant difference in rates of DWLS charge filing between Seattle and Federal Way drivers. Consequently, this analysis provides no support for the existence of a specific deterrent effect of the Impound Law on DWLS charge filings.

A study of a similar impound law in California found an interaction between prior offenses and impounds.[58] Thus, we conducted a sub-group analysis, which compared the recidivism of Federal Way and Seattle drivers with prior DWLS offenses and drivers with no prior offenses. As Table 5.14 shows, the interaction was not significant for prior DWLS 1 and 2 offenses or for DWLS 3 offenses but it was in the same direction as the California finding. When we combined prior DWLS record into a single variable like the California study (filing for DWLS in any degree) we did find a significant interaction ($p = .03$). That is, for Seattle drivers with a prior record of DWLS court filings were less likely to commit a repeat offense (31%) than Federal Way drivers with a prior record (37%).

In sum, the results do not show an overall effect for the Impound Law on DWLS filings, but subgroup analysis suggests that repeat offenders may be more impacted by the law than first time offenders.

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[57] Note that although the hazard ratios are close to one, this is for a one year change in age. Individuals who differ in age by substantially more than this would have significantly larger differences in recidivism rates.

[58] DeYoung, D. J. (1999). An evaluation of the specific deterrent effect of vehicle impoundment on suspended, revoked, and unlicensed drivers in California. *Accident Analysis and Prevention, 31*: 45-53.

Table 5.14

Cox Survival Model: DWLS (Court Charge Filing Records)

	coef	*exp(coef)*	*p*	*lower .95*	*upper .95*
Seattle	0.152	1.164	0.180	0.932	1.456
DWLS 3	0.025	1.025	0.760	0.875	1.200
Black	**0.154**	**1.166**	**0.002**	**1.057**	**1.287**
Other race	-0.033	0.967	0.720	0.805	1.162
Male	**0.278**	**1.321**	**0.000**	**1.162**	**1.502**
Age	**-0.009**	**0.991**	**0.000**	**0.986**	**0.996**
Prior DWLS 1/2	**1.523**	**4.584**	**0.000**	**3.060**	**6.869**
Prior DWLS 3	**1.014**	**2.758**	**0.000**	**2.072**	**3.671**
Prior other traffic	**0.514**	**1.673**	**0.000**	**1.488**	**1.881**
Seattle x prior DWLS 1/2	-0.352	0.704	0.100	0.461	1.073
Seattle x prior DWLS 3	-0.295	0.744	0.058	0.549	1.010

Notes: Prior DWLS 1/2, Prior DWLS 3, and Prior other traffic are based on court charge filing records. Bold indicates statistically significant association with recidivism ($p < .05$). The reference group for the Seattle driver variable is Federal Way group membership. For DWLS 3, it is DWLS 1/ 2 drivers. For black and other race variables, the reference category is white drivers. For prior DWLS 1/2, prior DWLS 3, and prior other traffic, the reference group is drivers without those offenses.

In sum, police and court charge filing records do not indicate a significant difference in the DWLS recidivism rates for drivers from the two cities. These findings suggest that the Impound Law did not produce a specific deterrent effect on repeat DWLS offenses in Seattle relative to Federal Way. Differences shown earlier in observed percentage comparison between Federal Way and Seattle drivers appear to have been due to pre-existing differences in the factors that significantly predict recidivism.

Other Traffic Offenses

If the Impound Law had a specific deterrent effect for other traffic offenses, we would expect that rates of other traffic offenses would be lower for Seattle relative to Federal Way drivers.[59] In Table 5.15, we present the results of the analysis examining factors associated with charge filings for Seattle and Federal Way drivers. There were several significant variables. Rates of other traffic offenses during the follow-up period were significantly *higher* for DWLS 3 drivers than for DWLS 1 and 2 drivers. A history of charge filings for traffic offenses was also an important predictor of recidivism. Males and younger

[59] Other traffic offenses represent a combined variable of traffic infractions and criminal driving offenses. The results do not different when traffic infractions and criminal driving offenses are analyzed separately.

drivers had significantly higher filing rates than females and older drivers. There were no differences by race in charge filings for other traffic offenses.

The findings present no support of a specific deterrent effect of impounds in Seattle compared to Federal Way. In fact, rates of filings were significantly higher for Seattle drivers than Federal Way drivers during the follow-up period. A sub-group analysis (examining the interaction between impounds and prior record of other traffic offenses) showed that Seattle drivers with a prior record of other traffic offenses had a significantly lower rate of other traffic offenses than Federal Way drivers with a prior record. This suggests that repeat traffic offenders may be more sensitive to the impound sanction than first time traffic offenders.[60] In sum, we observed no specific deterrent effect of impounds on other traffic offenses overall. Sub-group analysis showed evidence of a specific deterrent effect for Seattle drivers with prior records compared to Federal Way drivers with prior records.

Table 5.15

Cox Survival Model: Other Traffic Offenses (Court Charge Filing Records)

	coef	*exp(coef)*	*se(coef)*	*z*	*p*	*lower .95*	*upper .95*
Seattle	**0.678**	**1.970**	**0.166**	**4.072**	**0.000**	**1.421**	**2.730**
DWLS 3	**0.375**	**1.455**	**0.093**	**4.047**	**0.000**	**1.213**	**1.745**
Black	-0.025	0.975	0.052	-0.486	0.630	0.881	1.079
Other race	0.057	1.059	0.085	0.670	0.500	0.896	1.252
Male	**0.159**	**1.173**	**0.061**	**2.597**	**0.009**	**1.040**	**1.323**
Age	**-0.016**	**0.984**	**0.003**	**-6.058**	**0.000**	**0.979**	**0.989**
Prior DWLS 1/2	0.187	1.206	0.100	1.862	0.063	0.990	1.468
Prior DWLS 3	0.044	1.045	0.051	0.868	0.390	0.946	1.155
Prior other traffic	**1.639**	**5.152**	**0.171**	**9.561**	**0.000**	**3.681**	**7.210**
Seattle x prior other traffic	**-0.825**	**0.438**	**0.184**	**-4.493**	**0.000**	**0.306**	**0.628**

Notes: Prior DWLS 1/2, Prior DWLS 3, and Prior other traffic are based on court charge filing records. Bold indicates statistically significant association with recidivism ($p < .05$). The reference group for the Seattle driver variable is Federal Way group membership. For DWLS 3, it is DWLS 1/ 2 drivers. For black and other race variables, the reference category is white drivers. For prior DWLS 1/2, prior DWLS 3, and prior other traffic, the reference group is drivers without those offenses.

Accidents

If impounds produced a specific deterrent effect on accidents, we would expect to see a lower rate of accidents in the follow-up period for Seattle compared to

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[60] We also conducted an analysis examining the interaction between the Seattle and Prior DWLS variables. This interaction was not significant.

Federal Way drivers. As Table 5.16, shows, there is no notable difference between Seattle and Federal Way drivers regarding accidents. For both groups, rates of accidents during the follow-up period are significantly higher among younger drivers and those with prior involvement in accidents. DWLS degree or history of DWLS offenses, gender, and race were not related to accidents. When we hold constant these important background characteristics, the results indicate no significant difference between Seattle drivers and Federal Way drivers in rates of involvement in accidents. Thus, the findings do not support the hypothesis that the Impound Law produced a specific deterrent effect on accidents.

Table 5.16

Cox Survival Model: Accidents

	coef	*exp(coef)*	*p*	*lower .95*	*upper .95*
Seattle	0.034	1.035	0.820	0.775	1.381
DWLS 3	0.190	1.209	0.230	0.886	1.650
Black	0.118	1.126	0.200	0.939	1.350
Other race	0.034	1.035	0.830	0.753	1.421
Male	-0.099	0.906	0.350	0.736	1.115
Age	**-0.015**	**0.985**	**0.002**	**0.976**	**0.995**
Prior DWLS 1/2	0.100	1.106	0.580	0.775	1.577
Prior DWLS 3	-0.007	0.993	0.940	0.827	1.192
Prior other traffic	0.147	1.158	0.140	0.952	1.409
Prior accident	**0.609**	**1.839**	**0.013**	**1.137**	**2.975**
Seattle x prior accident	-0.105	0.900	0.690	0.532	1.524

Notes: Prior DWLS 1/2, Prior DWLS 3, Prior other traffic, and Prior accidents are based on court charge filing data. Bold indicates statistically significant association with the outcome variable ($p < .05$). The reference group for the Seattle driver variable is Federal Way group membership. For DWLS 3, it is DWLS 1/2 drivers. For black and other race variables, the reference category is white drivers. For prior DWLS 1/2, prior DWLS 3, and prior other traffic, the reference group is drivers without those offenses.

DWLS Recidivism Among Seattle Drivers Only

Although we did not find significant differences between Seattle and Federal Way drivers in DWLS offenses, other traffic offenses, or accidents during the follow-up period, there may be important differences among Seattle drivers. That is, the experience of an impound may influence the behavior of certain groups of Seattle drivers differently than other groups of Seattle drivers. Moreover, different features of the impound program might have a greater impact on recidivism. For example, we might expect a specific deterrent effect of impounds (lower recidivism) among those drivers who were the registered owner of an impounded car, those who were driving an impounded car that was auctioned, those that were arrested (as opposed to receiving a citation) at the

time of impound, and those driving vehicles that were held for longer periods of time. Drivers in the aforementioned groups could be considered to have suffered greater punishment as a result of the impound and therefore be less likely to reoffend than other Seattle drivers. Our findings indicated that drivers with prior histories of DWLS and other traffic offenses were more likely to reoffend than drivers without such histories. Further, there may be lower recidivism rates among those who participated in SMC's relicensing program, designed to assist drivers in meeting their court obligations (which can speed the reinstatement of their license and thus avoid future DWLS offenses).

To examine these issues, we conducted an analysis of repeat DWLS impounds among Seattle drivers only. In addition to demographic characteristics and prior DWLS and traffic offense history, we included additional variables applicable to the impound program. These were:

- length of the required impound period
- whether the driver was the registered owner of the vehicle
- whether the impounded vehicle was auctioned
- whether the driver was arrested at the time of impound
- whether the driver participated in the relicensing program

Because the length of hold periods and DWLS degree were highly related (see Table 5.17), we were unable to perform statistical analyses with both variables in the same model. Thus, we conducted the analyses in two phases. The first was a survival analysis assessing repeat impounds with all variables mentioned above except length of the required hold period. In the second phase, we conducted two additional survival analyses including hold periods, one for DWLS 3 drivers and one for DWLS 1 and 2 drivers. First we will present the results from the analysis containing no hold periods.

Table 5.17

Length of Hold Period and DWLS Degree Among Seattle Drivers Only

	DWLS 3 *n = 4629*	*DWLS 1/2* *n = 658*
0 Day Hold	2791	4
15 Day Hold	721	1
30 Day Hold	1117	350
60 Day Hold	0	102
90 Day Hold	0	201

In Table 5.18 are the results of the analysis showing the factors that predict repeat impounds among all Seattle drivers. While controlling for other factors, age did

not influence the rate of repeat impound. Similar to the analyses comparing Seattle drivers with Federal Way, black drivers and male drivers had higher rates of repeat impounds than white drivers and female drivers. Those with prior court filings for DWLS 3 and DWLS 1 and 2 offenses were more likely to have a repeat offense than those without such a prior record. DWLS 3 drivers were not different in their rates of recidivism compared to DWLS 1 and 2 drivers.

We found support for the hypothesis that specific deterrence might differ between drivers who were registered owners and those who were not. Rates of recidivism were lower among drivers who were the registered owner of the impounded vehicle compared to those who were driving a vehicle registered to someone else.[61] Recall that 34 percent of Seattle DWLS drivers were the registered owners of the impounded vehicle, indicating that the Impound Law might have its intended impact on this minority of drivers. The results also indicated that participants in the relicensing program had a lower rate of recidivism than individuals who did not participate in this program. Because this study is not an evaluation of the relicensing program, we cannot draw conclusions about whether this reduced recidivism was due to the program per se or to some unique characteristic(s) of the few Seattle drivers (61 or 1.2%) who participated in the relicensing program.

Two other hypotheses about characteristics of the impound program that may differentially impact driver behavior largely were not supported. There was no significant difference between those drivers for whom a car was auctioned compared to those driving non-auctioned cars, even while holding constant whether drivers were the registered owners of the auctioned vehicle.[62] Also, there was no difference between drivers who were arrested at the time of impound and those that were given a citation by police.

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[61] We could not compare registered owners in Seattle to those in Federal Way because we did not have vehicle registration information for DWLS drivers in the latter city.

[62] We conducted an additional analysis examining the interaction between ownership and auction and found no significant relationship.

Table 5.18

Cox Survival Model: Repeat DWLS Impound Among Seattle Drivers Only

	coef	*exp (coef)*	*p*	*lower .95*	*upper .95*
DWLS 3	-0.199	0.820	0.064	0.664	1.012
Black	**0.439**	**1.551**	**0.000**	**1.357**	**1.772**
Other Race	-0.114	0.893	0.440	0.671	1.188
Male	**0.312**	**1.366**	**0.001**	**1.142**	**1.634**
Age	-0.002	0.998	0.480	0.991	1.004
Car auctioned	0.135	1.145	0.055	0.997	1.314
Registered owner	**-0.307**	**0.736**	**0.000**	**0.635**	**0.854**
Relicensing program	**-1.232**	**0.292**	**0.006**	**0.121**	**0.704**
Prior DWLS 1/2	**0.511**	**1.667**	**0.000**	**1.313**	**2.116**
Prior DWLS 3	**0.477**	**1.611**	**0.000**	**1.399**	**1.855**
Prior traffic	0.104	1.110	0.160	0.961	1.283
Driver arrested	0.036	1.037	0.660	0.880	1.222

Note: Bold indicates a statistically significant association with recidivism ($p < .05$). 1 = Positive values in this column indicate that the variable is associated with higher rates of recidivism and negative values indicate an association with lower recidivism.

Next, we present the two separate models for DWLS 3 and for DWLS 1 and 2 drivers that include hold periods.

Table 5.19 presents the results for DWLS 3 drivers and they do not differ from the results displayed in Table 5.18. That is, black and male drivers and those with a history of DWLS filings have significantly higher rates and registered owners and relicensing participants have significantly lower rates of recidivism. There is some inconsistency in the findings surrounding the length of the hold period and recidivism. It might be expected that longer hold periods would be associated with lower recidivism because they could be viewed as greater punishment than shorter hold periods. The findings do not support this. There was no difference in recidivism among those driving an impounded vehicle with a 15-day hold period compared to those with no hold period. However, rates of repeat offending were *higher* among those driving an impound vehicle with required hold periods of 30 days, compared to those driving vehicles with no hold periods. It is unclear why a 30-day hold might be associated with higher recidivism rates while a shorter period was not. We controlled for demographic characteristics and prior DWLS and other traffic offenses, which rules out these factors as potential explanations.[63] It could be that there is something unique

[63] As discussed in the first chapter, hold periods are assigned by SPD based on previous DWLS convictions. Consistent with our other analyses in this chapter, the table presented above shows previous court charge filings for DWLS offenses. We conducted an additional statistical analysis using DWLS convictions in place of charge filings to assess whether the results would differ depending on the data source. They did not differ from those presented above.

about DWLS 3 drivers who receive a 30-day hold period that is associated with recidivism yet is not captured in our data.

Table 5.19

Cox Survival Model: Repeat DWLS Impounds Among Seattle DWLS 3 Drivers Only

	coef	*exp (coef)*	*p*	*lower .95*	*upper .95*
Black	**0.384**	**1.468**	**0.000**	**1.268**	**1.699**
Other Race	-0.191	0.826	0.230	0.604	1.128
Male	**0.313**	**1.368**	**0.001**	**1.132**	**1.653**
Age	-0.003	0.997	0.470	0.990	1.005
15 day hold	-0.115	0.892	0.310	0.716	1.111
30 day hold	**0.231**	**1.260**	**0.011**	**1.054**	**1.507**
Car auctioned	0.144	1.155	0.063	0.992	1.346
Registered owner	**-0.310**	**0.733**	**0.000**	**0.625**	**0.861**
Relicensing program	**-1.152**	**0.316**	**0.010**	**0.131**	**0.763**
Prior DWLS 1/2	**0.588**	**1.801**	**0.000**	**1.301**	**2.493**
Prior DWLS 3	**0.428**	**1.534**	**0.000**	**1.294**	**1.818**
Prior traffic	0.130	1.139	0.110	0.969	1.339
Driver arrested	0.051	1.052	0.600	0.869	1.274

Note: Bold indicates a statistically significant association with recidivism ($p<.05$). 1 = Positive values in this column indicate that the variable is associated with higher rates of recidivism and negative values indicate an association with lower recidivism.

In Table 5.20, we present the results of the analysis predicting repeat impounds for DWLS 1 and 2 drivers, including hold periods. The relicensing program variable could not be included in this analysis because only five participants were DWLS 1 and 2 drivers. The results show that the only significant predictor of repeat impounds was whether the driver was black. That is, black DWLS 1 and 2 drivers had significantly higher rates of repeat impounds than white DWLS 1 and 2 drivers.

Table 5.20

Cox Survival Model: Repeat DWLS Impounds Among Seattle DWLS 1 and 2 Drivers Only

	coef	*exp (coef)*	*p*	*lower .95*	*upper .95*
Black	**0.603**	**1.827**	**0.001**	**1.293**	**2.582**
Other Race	0.342	1.408	0.350	0.692	2.865
Male	0.043	1.044	0.880	0.595	1.833
Age	0.001	1.001	0.930	0.984	1.018
60 day hold	0.137	1.147	0.600	0.684	1.922
90 day hold	0.161	1.174	0.470	0.759	1.817
Car auctioned	0.025	1.025	0.890	0.733	1.433
Registered owner	-0.296	0.744	0.140	0.501	1.105
Prior DWLS 1/2	0.218	1.243	0.350	0.785	1.968
Prior DWLS 3	0.307	1.359	0.210	0.840	2.198
Prior traffic	0.097	1.102	0.590	0.773	1.569
Driver arrested	-0.074	0.929	0.660	0.672	1.284

Note: Bold indicates a statistically significant association with recidivism ($p<.05$). 1 = Positive values in this column indicate that the variable is associated with higher rates of recidivism and negative values indicate an association with lower recidivism.

Specific Deterrence Results Summary and Conclusions

The goal of this research question was to assess whether impounding vehicles in Seattle lead to a decrease in recidivism compared to conditions where drivers receive a citation or arrest for DWLS offenses. Recidivism was measured by repeat DWLS offenses, but accidents and other driving offenses following impound were also examined. In this section, we summarize the results presented above and draw conclusions based on these results about the specific deterrent effect of the Impound Law.

DWLS Recidivism of Seattle and Federal Way Drivers

In Seattle and Federal Way police data, DWLS recidivism was *more* common for Seattle drivers (14%) than Federal Way drivers (12%). In statistical analysis controlling for pre-existing differences between the groups, such as race and gender, we found no significant difference between Seattle and Federal Way drivers in rates of repeat DWLS arrest/citations (Federal Way) and impounds (Seattle).

In examining statewide court records of DWLS charge filings, in the percentage comparisons we found *more* DWLS recidivism for Seattle drivers (22%) than for Federal Way drivers (20%). Using statistical analysis to hold pre-existing group differences constant, we found no significant difference overall between Seattle and Federal Way drivers.

For both of these DWLS outcomes, the statistical analyses revealed that the higher percentage of Seattle drivers among repeat offenders was due to pre-existing differences between drivers from the two cities. With the inclusion of control variables, the lack of a significant difference between Seattle and Federal Way drivers suggests that the Impound Law did not have a specific deterrent effect on DWLS recidivism.

A California study examining the impacts of a similar impound law (using similar statistical techniques) did find specific deterrent effects, but that study differed in some key ways from the present evaluation.[64] The California study utilized a historical comparison group (DWLS drivers before the implementation of the law compared a group of DWLS drivers after implementation of the law) and we used a contemporaneous comparison group from a non-impound city. Moreover, the California study utilized convictions to measure recidivism, whereas we utilized police and charge filing data. It is unknown how the results would compare if the comparison groups and outcome measures of the two studies were the same.[65] In short, we cannot determine what might explain the difference in findings for the California study compared to our evaluation. It could potentially be due to difference such as study populations (California cities versus Seattle and Federal Way), implementation of the law, and research methodology (comparison groups and outcome measures). Most likely, it is due to a combination of these factors.

While we did not find an overall specific deterrent effect, a sub-group analysis showed results similar to the California study. Drivers with a prior record of DWLS court filings (in any degree) in Seattle had a significantly lower rate of recidivism than those with a prior record in Federal Way. This suggests that

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[64] DeYoung, D. J. (1999). An evaluation of the specific deterrent effect of vehicle impoundment on suspended, revoked, and unlicensed drivers in California. *Accident Analysis and Prevention, 31*: 45-53. The California study used an analysis of variance technique but the author reports that the results do not differ when analyzed using Cox proportional harzards survival models, the statistical technique we used.

[65] In preliminary assessment, we also found fewer DWLS convictions for Seattle drivers compared to Federal Way drivers but these results are not considered reliable because of a change in prosecutor policy after the implementation of the Impound Law that could account entirely for the difference in convictions.

repeat DWLS offenders may be more sensitive to the impound sanction than first time offenders.

Other Traffic Offenses of Seattle and Federal Way Drivers

In the observed percentages, we found Seattle drivers were more likely to have other traffic offenses (23%) than Federal Way drivers (20%) during the follow-up period. While controlling for key factors, we found in multivariate analysis that Seattle drivers had a significantly higher rate of other traffic offenses compared to Federal Way drivers. This indicates no support for the hypothesis that vehicle impounds have a specific deterrent effect on other traffic offenses. In a sub-group analysis, we found evidence of a specific deterrent effect for Seattle drivers with prior records compared to Federal Way drivers with prior records.

Accidents of Seattle and Federal Way Drivers

In the accident analysis, we found accidents were *more* likely among Seattle drivers (8%) than among Federal Way drivers (6%). In the multivariate analysis, again we found that controlling for other potentially predictive factors eliminated the difference between Seattle and Federal Way drivers. These results indicate that the Impound Law does not have a specific deterrent effect on accidents.

Specific Deterrence Conclusions

The study did not find evidence of an overall specific deterrent effect of the Impound Law among impounded Seattle DWLS drivers and non-impounded DWLS drivers from Federal Way. Initial differences between Seattle and Federal Way drivers on all outcome measures appear to have been due to pre-existing differences that were eliminated when we conducted statistical tests utilizing control variables to equalize the groups on these pre-existing differences.

To further explore whether specific deterrence might be operating with certain groups of Seattle drivers, we conducted additional statistical analyses among the Seattle drivers only. We found that black and male Seattle drivers and those with prior DWLS court filings were more likely to have a repeat impound compared to white and female drivers and those without a history of DWLS court filings.

Consistent with expectations based on specific deterrence theory, we found that DWLS drivers who were the registered owners of impounded vehicles were less

likely to engage in repeat offending than DWLS drivers who did not own the impounded vehicle they were driving. This suggests that the Impound Law might have a greater impact if applied to DWLS offenders driving their own vehicles, rather than to all DWLS offenders regardless of vehicle ownership. We also found that participation in the relicensing program was associated with lower rates recidivism compared to those who did not participate. Because this study is not an evaluation of the relicensing program, we cannot draw conclusions about whether this reduced recidivism was due to program per se or to some unique characteristic(s) of the few Seattle drivers (61 or 1.2%) who participated in the relicensing program.

Finally, we assessed whether longer hold periods might be associated with lower rates of repeat DWLS impounds. For DWLS 1 and 2 drivers, we found that the length of hold period did not impact the likelihood of repeat impounds, other factors being equal. Among DWLS 3 drivers, we found that 30-day hold periods were associated with higher rates of recidivism than those with no hold periods. This finding is not consistent with specific deterrence theory. We controlled for prior DWLS record and demographic characteristics so these factors were eliminated as a possible explanation. Consequently, this relationship may be due to other characteristics of these DWLS 3 drivers that were not captured in our data.

In sum, in comparison of DWLS drivers in Seattle and Federal Way, we did not find evidence that experiencing an impound produced a specific deterrent effect. Among only Seattle drivers, we did find that impounds might have a greater specific deterrent effect among registered owners and that participation in the relicensing program may reduce the likelihood of repeat DWLS impounds.

6. Summary and Conclusions

Dangerousness of DWLS 3 Drivers Results

Are DWLS 3 drivers more likely to be involved in accidents than validly licensed drivers? The hypothesis was that unsafe driving causes to accidents and that unsafe driving also leads to traffic offenses. Traffic offenses lead to license suspensions, which in turn lead to DWLS offenses. Not all traffic offenses lead to license suspensions and DWLS offenses, however. Consequently, we tested whether DWLS 3 offenses were an indicator of unsafe driving, mediated by traffic offenses. Our research found support for this hypothesis.

We compared accident histories for four groups of drivers: (1) validly licensed drivers (those with no suspension or DWLS offense), (2) those with a suspension but no DWLS offense, (3) those with a DWLS 1 or 2 offense, and (4) those with a DWLS 3 offense. DWLS 3 drivers (26%) were more likely to have been in an accident than validly licensed drivers (11%) and those with a suspension but no DWLS offense (17%), and nearly as likely to have been in an accident as DWLS 1 and 2 drivers (28%). DWLS 3 drivers (9%) were also more likely to have been in an accident resulting in injury and fatality as validly licensed drivers (4%) and those with suspensions but no DWLS offense (6%), and as likely to have been in such accidents as DWLS 1 and 2 drivers (9%).

According to logistical regression analyses, DWLS offenses were more important predictors of involvement in accidents than gender or age. The odds of involvement in an accident for a DWLS 3 driver are 1.6 times greater than those of a suspended driver with no DWLS offense and 2.9 times greater than a validly licensed driver. Among those who had accidents, severity of accidents (injury and fatalities) had the strongest relationship to age and gender of the driver, but DWLS offenses were still significant predictors. Among those in accidents, the odds of involvement in an accident resulting in injury or fatality were 10 percent greater for a DWLS 3 driver than they were for validly licensed drivers. However, the magnitude of the difference is small.

In sum, these results suggest that DWLS 3 offenses may indeed be indicators of unsafe driving that lead to accidents. Strategies addressing the driving of DWLS 3 offenders target a group of drivers at higher risk for accidents than those without DWLS records and may therefore help reduce accidents overall.

General Deterrence Results

If the Impound Law had a general deterrent effect, there would have been a decline in rates of DWLS, other traffic offenses, and accidents in Seattle relative to the comparison cities.

DWLS Offenses

Statistical analyses of DWLS rates using time series models showed no influence of the law on DWLS court filing rates in Seattle compared to Federal Way and Yakima. Among suspended drivers, the data on DWLS conviction rates suggests some deterrent effect of the Impound Law, but the evidence is weak. This decline might indicate a general deterrent effect, but it could also be due to random monthly fluctuation or change in prosecutor policy following implementation of the Impound Law that resulted in dismissal of cases against certain DWLS 3 drivers. Consequently, we cannot conclude with a high degree of confidence that the observed decrease in DWLS convictions in Seattle was due to the impact of the law.

Other Driving Offenses

The Impound Law does not appear to have had a general deterrent impact on the rates of either DWLS charge filings or convictions for other driving offenses in Seattle compared Yakima and Federal Way.

Accidents

The statistical analyses produced weak evidence of decreasing accident rates in Seattle following implementation of the Impound Law. Nevertheless, one comparison city, Yakima, showed a greater decline in accidents than Seattle during this period. Therefore, we cannot conclude with a high degree of confidence that any decrease in Seattle accident rates was due to the Impound Law.

Conclusions

The lack of a clear general deterrent effect in these results may have been due to several factors. One explanation may be that the Impound Law does not have a general deterrent effect. Another possibility is that a general deterrent effect exists, but statistical analyses were unable to detect it. This could be due to

contamination of the comparison cities by neighboring jurisdictions with impound laws (and WSP impounds in the case of Yakima). A general deterrent effect of the Impound Law would need to be large in order to be detected in the presence of such contamination. Under present conditions a small or moderate general deterrent effect would not be observable.

Overall, these results do not provide clear evidence of a general deterrent on DWLS charge filings, filings and convictions for other driving offenses, or accidents. There was weak evidence of a decrease in DWLS convictions in Seattle, but this may have been due to a change in prosecutor policy around the same time as the implementation of the Impound Law. It is not possible to determine with the available data whether there was no general deterrence effect or simply an inability to detect one due to the presence of contamination and other factors.

Specific Deterrence Results

For the Impound Law to have had a specific deterrent effect, it would have to lead to a decrease in recidivism for Seattle drivers who experienced an impound as compared to Federal Way drivers who received only a citation or arrest for DWLS offenses. We measured recidivism through repeat DWLS offenses but also examined accidents and other driving offenses following impound. We summarize both descriptive relationships and statistical analyses of the data below.

DWLS Recidivism of Seattle and Federal Way Drivers

We analyzed DWLS recidivism in two ways. First, we used police data on repeat DWLS arrests and citations in Federal Way and on DWLS impounds in Seattle. These data showed DWLS recidivism was greater for Seattle drivers (14%) than for Federal Way drivers (12%). Second, we examined statewide court records of DWLS charge filings. These data, too, showed more DWLS recidivism for Seattle drivers (22%) than for Federal Way drivers (20%).

Survival analysis showed that the greater DWLS recidivism in the Seattle group could be explained by pre-existing characteristics of drivers from the two cities. When we controlled for age, gender, and other important variables, we found virtually no difference in DWLS recidivism between the drivers. Put another way, we found no evidence that the Impound Law had any effect, positive or negative, on DWLS recidivism in Seattle.

Our findings are contrary to a California study that examined the impacts of a similar impound law using similar statistical techniques but differing in some key ways from the present evaluation.[66] The California study featured a historical comparison of DWLS drivers before the implementation of an impound law with those after it. We used a contemporaneous comparison of drivers from an impound city and a non-impound city, which eliminates historical effects unrelated to the impound law. Moreover, the California study used convictions to measure recidivism, whereas we used police and charge filing data. In short, we cannot determine the reason for the difference in findings and those from the California study. It may be due to differences in the study populations, implementation of the law, research methodologies, or some combination of these.

While we found no overall specific deterrent effect, a sub-group analysis comparing drivers in Seattle and Federal Way with prior records of DWLS filings (in any degree) to those without, we observed a specific deterrent effect among those with prior DWLS records. This is consistent with sub-group analysis findings from the California study and suggest that repeat offenders may be more sensitive to the impound sanction than first time offenders.

Other Traffic Offenses of Seattle and Federal Way Drivers

In the observed percentages, we found Seattle drivers (23%) were more likely to have court driving offense filings for other traffic offenses than those in Federal Way (20%). When using statistical analysis to control for pre-existing differences between the two groups, we found that Seattle drivers had a significantly higher rate of other traffic offenses during the follow-up period than Federal Way drivers. In other words, there is no support for the hypothesis that impounds had an overall specific deterrent effect on other traffic offenses. In sub-group analysis, we found that Seattle drivers with prior court filings for other traffic offenses had a significantly lower rate of other traffic offenses than Federal Way drivers with a prior record. This suggests that repeat traffic offenders may be more sensitive to the impound sanction than first time traffic offenders.

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[66] DeYoung, D. J. (1999). An evaluation of the specific deterrent effect of vehicle impoundment on suspended, revoked, and unlicensed drivers in California. *Accident Analysis and Prevention, 31*: 45-53. The California study used an analysis of variance technique, but DeYoung also reports that his results did not differ when analyzed using Cox proportional harzards survival models, the statistical technique we utilized.

Accidents of Seattle and Federal Way Drivers

Seattle DWLS drivers (8%) are more likely than Federal Way DWLS drivers (6%) to be involved in an accident during the study's follow-up period. Using multivariate analysis to control for differences between the two groups, we found no support for a hypothesis that impounds reduced accidents among DWLS drivers.

Specific Deterrence Conclusions

We did not find evidence that the Seattle Impound Law deterred repeat offenses by Seattle DWLS drivers who experienced an impound as compared to DWLS drivers from Federal Way. To explore whether specific deterrence could be observed among certain groups of Seattle drivers, we conducted additional statistical analyses among Seattle drivers only. We found that black and male Seattle drivers and those with a history of DWLS court filings were more likely to have a repeat impound compared to white and female drivers and those without a prior DWLS court record.

Consistent with expectations based on specific deterrence theory, we found that DWLS drivers who were the registered owners of impounded vehicles were less likely to engage in repeat offending than DWLS drivers who were not driving their own vehicles. If the Impound Law were more narrowly tailored to only registered owners, our data indicate that it would apply to a minority of DWLS drivers (34%). This suggests that, in its current form, the Impound Law might not have its intended impact overall because it is being applied to all DWLS drivers, regardless of vehicle ownership. The impound sanction may not be relevant (or at least less relevant) to non-owner drivers.

We also found that participation in the relicensing program was associated with lower rates recidivism among Seattle drivers compared to those who did not participate. Because this study is not an evaluation of the relicensing program, we cannot draw conclusions about whether this reduced recidivism is due to the program or to the characteristics of the 61 Seattle drivers (1.2% of all DWLS Seattle drivers) who participated in it during this period. Consequently, we cannot speculate about whether policy or program changes that lead to increased participation of DWLS drivers in the relicensing program alone would decrease recidivism.

Finally, we assessed whether longer hold periods might be associated with lower rates of repeat DWLS impounds. For DWLS 1 and 2 drivers, we found that the length of hold period did not affect the likelihood of repeat impounds, other

factors being equal. Among DWLS 3 drivers, we found that 30-day hold periods were associated with *higher* rates of recidivism than no hold periods. This finding is not consistent with what we might expect based on specific deterrence theory. This relationship remained even in statistical analysis controlling for prior DWLS record and demographic characteristics. It is possible that this finding is attributable to other characteristics of DWLS 3 drivers not captured in our data.

In sum, in comparing DWLS drivers in Seattle and Federal Way, we did not find evidence that experiencing an impound produced an overall specific deterrent effect. There was some evidence of a specific deterrent effect when we compare Seattle and Federal Way drivers with prior records of DWLS offenses in any degree. Among only Seattle drivers, we did find that impounds might have a specific deterrent effect among registered owners and that participation in the relicensing program may reduce the likelihood of repeat DWLS impounds.

Overall Conclusions

The ability of the study to fully answer the three research questions was limited by the nature of the available data. For example, the lack of income data meant that we were unable to address several issues initially outlined by the Seattle Legislative Department, e.g. whether income was related to the accident involvement of DWLS 3 drivers or influenced our findings about specific deterrence. The available data also suffered from some weaknesses. For example, DOL data does not contain all accidents but only those that were reported by citizens or police officers. Individuals driving with a suspended license are probably less likely to report accidents to DOL, resulting in a bias in the data. Moreover, the presence of impound activities around the state restricted our choice of comparison cities for examining general deterrence impacts.

Due to such limitations, the results of this study must be interpreted with caution. They do, however, provide some basis for assessing the policy questions posed about the applicability and effectiveness of Seattle's Impound Law. The results suggest that, if involvement in accidents is the primary criterion, DWLS 3 drivers may be appropriate targets of the Impound Law. According to these results, however, arguments in favor of the Impound Law cannot be based on evidence of a general deterrent effect or a specific deterrent effect. The findings do suggest that if the law were more narrowly tailored to apply to only registered owners and to those with prior DWLS records, it may be more effective at reducing repeat DWLS offenses.

A. Relationship Between License Status and DWLS Offenses in DOL Data

As noted earlier, because the DOL data for this study were only available after October 1, 1995, it is possible that drivers entered the study period with their license having been suspended earlier. These drivers would be at risk for a DWLS offense, even though our records show no corresponding prior suspension. This means that we were not able to establish a relationship between suspensions and DWLS offenses for individual drivers.

Between October 1, 1995 and September 30, 2000, 45,045 drivers were suspended and 13,561 drivers were cited for DWLS. In the data, however, those with a DWLS offense are not necessarily the same drivers as those that show a license suspension. As Table A.1 indicates, we actually found a larger total number of more DWLS offenses among supposedly non-suspended drivers than among drivers whose record showed a suspension during the study period. Of the 644,964 drivers whose records showed no suspension during the study period, 8,431 (1.3%) were cited for a DWLS offense. The fact that data on suspensions and data on DWLS come from different DOL data files may have also contributed to the apparent disconnect between suspensions and DWLS citations.

Table A.1

Percentage of Drivers with a DWLS Offense and License Status

	Drivers	*DWLS*	*Percent*
No suspension during study period	644,964	8,431	1.3%
Any suspension	45,045	5,130	11.4%

B. DWLS Impounds and Arrest/Citations and Degree of Original License Suspension

The following table uses data from DOL for degree of suspension prior to the study period, and police department data on the level of DWLS for the first offense during the study period. There were discrepancies between the two data sources, e.g., some drivers were not represented in the DOL data to have had a prior suspension, even though the police data recorded their offense as a DWLS (and in Seattle a vehicle was impounded). There were also disagreements between the level of suspension and the degree of DWLS, e.g., DOL records indicated an individual was suspended in the third degree but police data indicate that the driver's offense was DWLS 1 or DWLS 2.[67]

We have highlighted the cells that are possible combinations given accurate data, or those for which we appear to have agreement between DOL and police data. According to the available data, 6% of DWLS 3 drivers in Federal Way and 8% DWLS 3 drivers in Seattle had a license originally suspended in the second degree. However, with the considerable amount of disagreement between DOL and police data we do not confidence in figures that result from this comparison overall.[68] As this table indicates, there are a large number of individuals, 58 in Federal Way and 250 in Seattle, for whom DOL records showed no suspension yet the drivers were cited or arrested for DWLS offenses.

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[67] For example, for 23 (79%) of the DWLS 1 offenses in Federal Way, DOL records indicated something other than a first-degree license suspension, including no suspension on record.

[68] DOL records do contain a "reason for suspension" code. However, these did not provide us much assistance in determining the degree of original suspension because the codes tend to be vague. For example, one common description for reason for suspension is "multiple offenses." We do not know whether these offenses are minor or serious. Multiple minor offenses would lead to a 3rd degree suspension, whereas serious offenses would lead to more serious suspension degree.

Table B.1

Highest Degree of Suspension Before the Study Period and Type of DWLS for First Offense During the Study Period

	DWLS Offense In Police Data			
DOL License Suspension	*DWLS 1*	*DWLS 2*	*DWLS 3*	*Total*
Federal Way				
None	2 (7%)	3 (4%)	53 (7%)	58 (7%)
1st degree	**6 (21%)**	0 (0%)	2 (0%)	8 (1%)
2nd degree	6 (21%)	**37 (51%)**	**44 (6%)**	87 (10%)
3rd degree	15 (52%)	32 (44%)	**667 (87%)**	714 (82%)
Total	29 (100%)	72 (100%)	766 (100%)	867 (100%)
Seattle				
None	5 (2%)	9 (2%)	236 (5%)	250 (5%)
1st degree	**75 (35%)**	5 (1%)	6 (0%)	86 (2%)
2nd degree	51 (24%)	**287 (66%)**	**340 (8%)**	678 (13%)
3rd degree	82 (38%)	130 (30%)	**3873 (87%)**	4085 (80%)
Total	213 (100%)	431 (100%)	4455 (100%)	5099 (100%)

Note: This table does not include those individuals in our sample for whom DOL could provide no driving record.

C. Trends in Court Filings and Conviction Rates for Seattle, Federal Way, and Yakima

The following are descriptive graphing of the trends in key variables in the respective cities over time. These graphs have the advantage of being straightforward and allow us to see overall trends in rates. They do not however take into account differences in rates within and between the cities in a systematic way. This is accomplished by the time series analyses presented in the body of the report.

In the descriptive graphs that follow, we plot monthly trends in Seattle compared to Federal Way and Yakima. Because the number of offenses and accidents can be quite small in any given month, monthly rates are susceptible to severe month-to-month variation; that is, they "yo-yo" up and down from month to month. Consequently, trend lines are difficult to observe. To highlight the underlying trends, we corrected for the extreme monthly variation by using a "moving window" of average rates. This results in the same general trend but removes the yo-yo effect, making trends easier to observe.[69]

DWLS Convictions Per 10,000 Suspended Drivers

First, we present the DOL data for all DWLS convictions during the study period for the three cities. Figure 4.1 shows the number of DWLS convictions per 10,000 suspended drivers for Seattle, Federal Way, and Yakima for March 1995 through March 2001.[70] This graph indicates that DWLS convictions appear to have peaked in early 1999 in Seattle and declined thereafter. Rates in the comparison

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[69] The technique used was a tri-cube spline adjustment, where the unadjusted weighting factor (w_i) of a given month i is given by the formula:

$$w_i = (1 - (|x - x_i| / \sigma)^3)^3, \text{ where } |x - x_i| \leq \sigma$$

where x is the unadjusted rate within any month and σ is a fixed value. We used a value of σ = 2.5, which allowed each of two months before and after month i to be taken into account. We then standardized the resulting coefficients so that the sum of all standardized weights was 1. The resulting weights are approximately 0.040 for the second month before and after month i, 0.285 for the first month before and after month i, and 0.348 for month i.

[70] The first monthly period was adjusted to March 1995 because data from earlier months were needed to smooth the curve trend.

cities do not appear to follow a similar trend. This decline in DWLS conviction following the implementation of the Impound Law could be due to a change in the Seattle City Attorney's policy that increased the dismissal of charges against DWLS offenders.

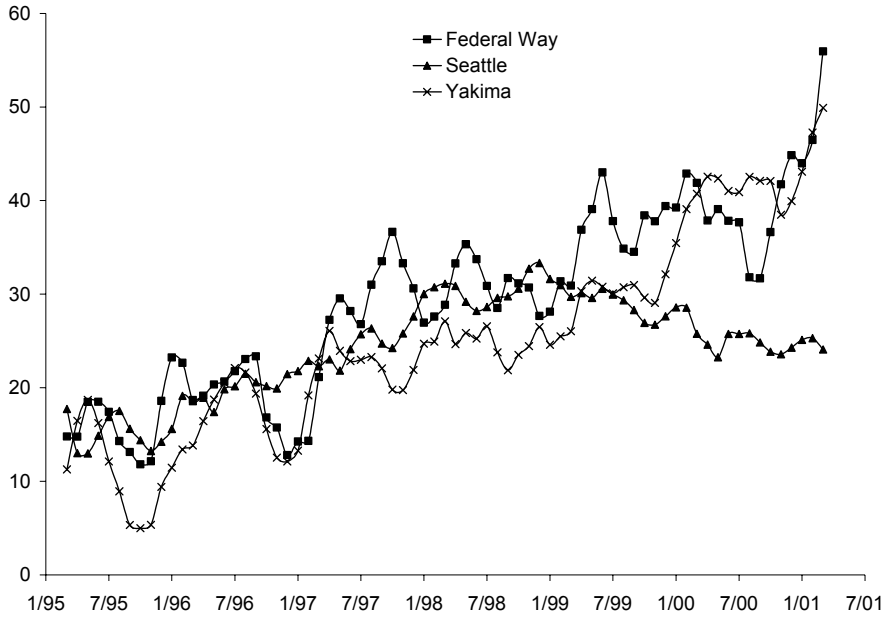

Figure C.1 - Number of Driving While License Suspended (DWLS) Convictions Per 10,000 Suspended Drivers, 1995-2001 (DOL Data)

DWLS Court Charge Filings Per 10,000 City Residents

Figure C.2 shows the number of charges filed for DWLS (in the 1st, 2nd, or 3rd degree) per 10,000 residents in Federal Way, Seattle, and Yakima between March 1996, and March 2001.[71] While there is fluctuation early in the study period, Seattle charge filing rates appear to decline from early 1999 through the end of the study period. Rates in Yakima and Federal Way show more monthly fluctuation.

[71] Data for Yakima were not available from AOC prior to January 1997.

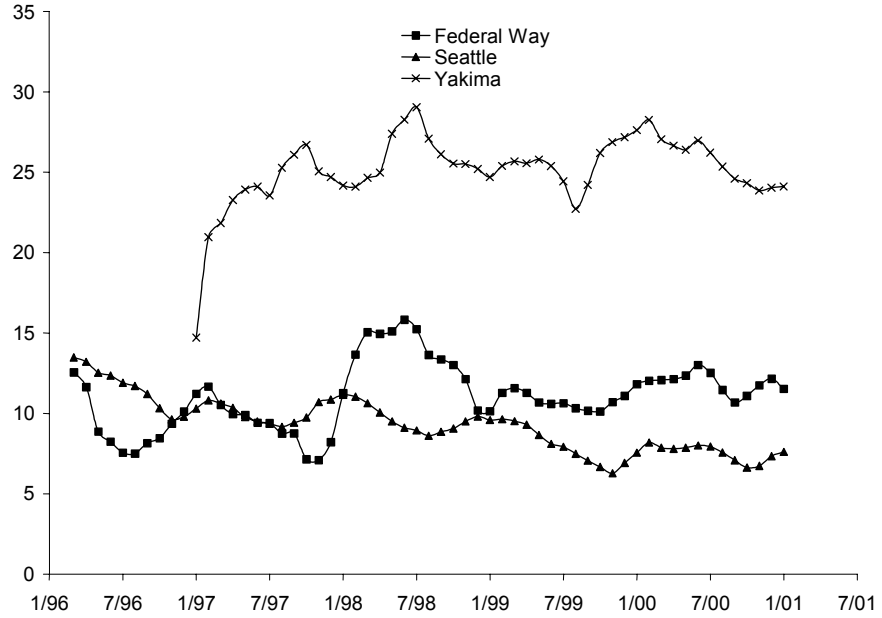

Figure C.2 - Number of Charge Filings for DWLS Per 10,000 city residents, 1996-2001 (Court Data)

Other Driving Offenses Per 10,000 Suspended Drivers

Figure C.3 shows the number of suspended drivers in DOL data who were convicted for any one of three categories of non-DWLS driving offenses, per 10,000 suspended drivers. The three categories were: criminal offenses requiring suspension of license, criminal offenses not requiring suspension of license, and traffic infractions. The graph shows a general downward trend in Seattle before the implementation of the Impound Law that continues, with a brief increase and decline in the first half of 2000. Federal Way shows more fluctuation but also follows a pattern of decline. Rates in Yakima remain relative steady but show a decline near the end of the study period.

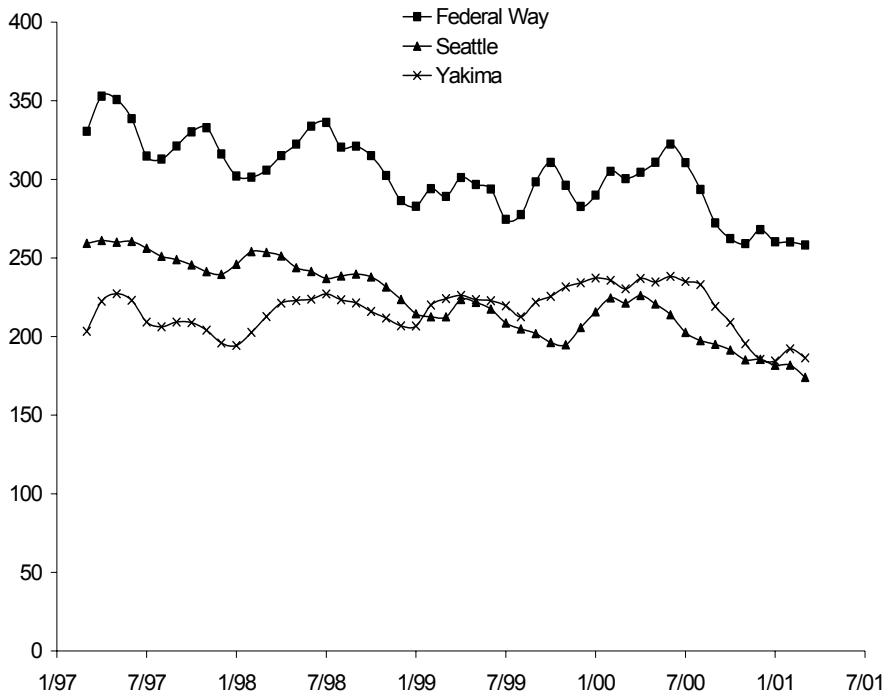

Figure C.3 - Number of Other Driving Convictions, Per 10,000 Suspended Drivers, 1997-2001 (DOL Data)

Other Driving Offense Charge Filings Per 10,000 City Residents

Figure C.4 gives the number of charge filings for other driving offenses per 10,000 city residents in the three cities. The rate of filings appear to decline throughout the beginning of the study period, level off from the latter half of 1998 through early 2000, and fluctuate up and down near the end of the study period. Rates in Yakima show an upward climb, falling off in latter 2000. Federal Way shows an early increase and then considerable fluctuation throughout the study period.

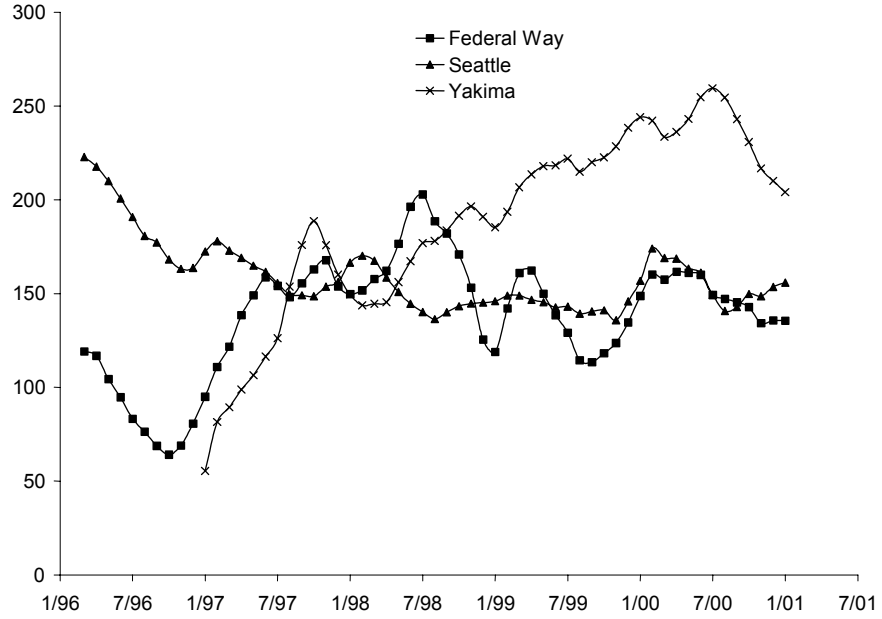

Figure C.4 - Number of Other Driving Charges Filed Per 10,000 City Residents, 1996-2001 (Court Data)

Accidents

Figure C.5 shows the number of suspended drivers who were involved in an accident per 10,000 suspended drivers in Federal Way, Seattle, and Yakima. Note that accident data were incomplete before 1997 and after September 2000. The Seattle trend shows an increase in the early study period, followed by a leveling and increase in latter 1998, when a decline begins. While there is some fluctuation, Seattle rates remain relatively constant from early 1999 through the end of the study period. Federal Way rates show considerable fluctuation throughout the study period and Yakima rates show an approximate decline.

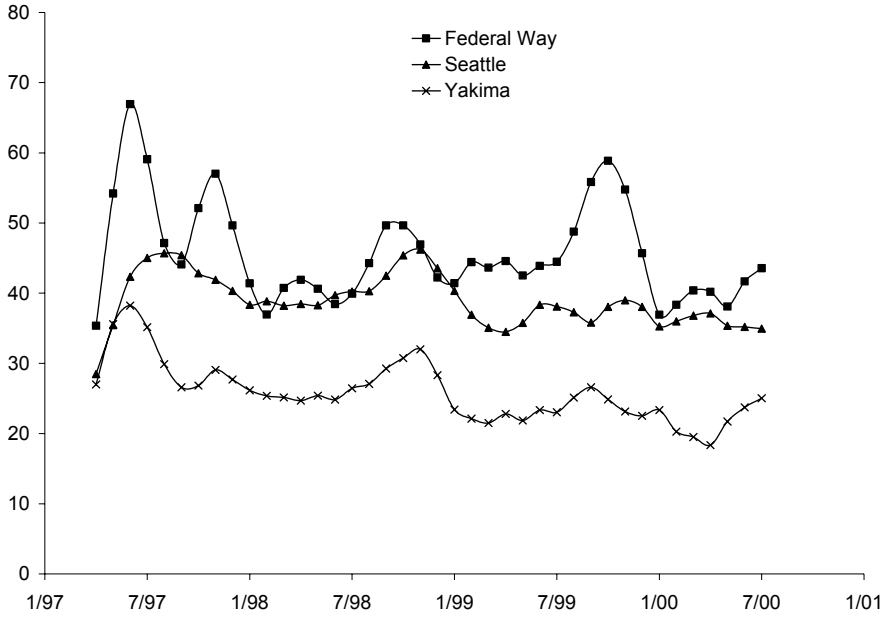

Figure C.5 - Number of Accidents Per 10,000 Suspended Drivers, 1997-2000 (DOL Data)

D. Technical Details of the General Deterrence Time Series Analyses

For the five general deterrence models, we used a logistic regression time series model of the form:

$$y_{ij} \sim \text{Binomial}(n_{ij}, p_{ij})$$

$$\log \frac{p_{ij}}{1 - p_{ij}} = \theta_j + \beta_j I(i \geq 49) + \varepsilon_{ij}$$

To allow for a first-order autoregressive component, we model the random error terms as:

$$\varepsilon_{1j} \sim N(0, \sigma_j^2)$$

$$\varepsilon_{ij} \sim N(\phi \varepsilon_{i-1,j}, \tau_j^2)$$

Quantifying the intervention effect was based on the statistics shown below.

Table D.1

Statistics Technical Details for General Deterrence Research Question

Statistic	*Interpretation*
$\exp(\beta_1)$	The odds-ratio for the intervention effect: $\dfrac{\dfrac{P(Y=1 \mid \text{post - law})}{1-P(Y=1 \mid \text{post} - \text{law})}}{\dfrac{P(Y=1 \mid \text{pre} - \text{law})}{1-P(Y=1 \mid \text{pre} - \text{law})}}$ Odds-ratio of 1 indicates no effect, Odds-ratio of ½ indicates that the odds of the event post-intervention are half what they were pre-law.
$P(\beta_1 < 0)$	Indicates whether there is a rate reduction in Seattle post-law
$P(\beta_1 < \beta_2)$	Probability that any post-law shifts are greater in Seattle than in Federal Way
$P(\beta_1 < \beta_3)$	Probability that any post-law shifts are greater in Seattle than in Yakima

E. Statistical Results for the Five General Deterrence Time Series Models

Table E.1

DWLS Convictions Per 10,000 Suspended Drivers (DOL Data)

Statistic	*Mean Estimate*	*Standard error*	*95% Interval*
$\exp(\beta_1)$	0.8956	0.09627	(0.713, 1.088)
$P(\beta_1 < \beta_2)$	67%		
$P(\beta_1 < \beta_3)$	80%		
$P(\beta_1 < 0)$	86%		

Table E.2

DWLS Per 10,000 City residents (Court Records)

Statistic	*Mean Estimate*	*Standard error*	*95% Interval*
$\exp(\beta_1)$	1.035	0.1698	(0.741,2 1.423)
$P(\beta_1 < \beta_2)$	52%		
$P(\beta_1 < \beta_3)$	38%		
$P(\beta_1 < 0)$	46%		

Table E.3

Other Driving Offenses Per 10,000 Suspended Drivers (DOL Data)

Statistic	*Mean Estimate*	*Standard error*	*95% Interval*
$\exp(\beta_1)$	0.9923	0.08612	(0.8353, 1.170)
$P(\beta_1 < \beta_2)$	67%		
$P(\beta_1 < \beta_3)$	58%		
$P(\beta_1 < 0)$	55%		

Table E.4

Other Driving Offenses Per 10,000 City residents (Court Data)

Statistic	*Mean Estimate*	*Standard error*	*95% Interval*
$\exp(\beta_1)$	1.062	0.1795180	(0.7563, 1.471)
$P(\beta_1 < \beta_2)$	32%		
$P(\beta_1 < \beta_3)$	23%		
$P(\beta_1 < 0)$	38%		

Table E.5

Accidents Per 10,000 Suspended Drivers (DOL Data)

Statistic	*Mean Estimate*	*Standard error*	*95% Interval*
$\exp(\beta_1)$	0.8423	0.2233	(0.5032, 1.379)
$P(\beta_1 < \beta_2)$	61%		
$P(\beta_1 < \beta_3)$	12%		
$P(\beta_1 < 0)$	80%		

F. Characteristics of Drivers with More Than One Repeat DWLS Offense in the One Year Follow-Up Period

The following table provides a description of the characteristics of individuals with more than one repeat DWLS offense during the one year follow-up period. These individuals represent two percent of Seattle drivers (126 of 5,287) and one percent of Federal Way drivers (7 of 955).

Table F.1

Characteristics of Drivers with More than One Repeat DWLS Impound or Arrest/Citation During the One Year Follow-Up Period

	Federal Way *N = 7*	*Seattle* *N = 126*
Gender		
Male	5 (71%)	111 (88%)
Female	2 (29%)	15 (12%)
Race		
White	4 (57%)	39 (31%)
Black	3 (43%)	77 (61%)
Other	0 (0%)	10 (8%)
Age		
<16	0 (0%)	1 (1%)
16-19	1 (14%)	22 (17%)
20-24	1 (14%)	22 (17%)
25-29	1 (14%)	17 (13%)
30-34	2 (29%)	20 (16%)
35-39	1 (14%)	19 (15%)
40-49	1 (14%)	19 (15%)
50+	0 (0%)	6 (5%)
First offense		
DWLS 1	3 (43%)	13 (10%)
DWLS 2	0 (0%)	20 (16%)
DWLS 3	4 (57%)	93 (74%)

Note: Significance tests were not done on this table because the number of Federal Way drivers in each cell is too small to meet the criteria for chi-square significance testing.

Table F.2 classifies the 87 Federal Way drivers and the 725 Seattle drivers with repeat offenses by their first offense during the study period and shows the type of DWLS offense they committed during the follow-up period. For those 133 Seattle and Federal Way drivers with more than one repeat DWLS offense during the follow-up period, only the initial reoffense is shown. The majority of the first

offenses were for DWLS 3 as were the majority of repeat offenses in Seattle (80%) and Federal Way (82%).

Table F.2

Comparison of First Offenses and First Repeat Impound or Arrest/Citation During the One Year Follow-Up Period

	First Repeat Offense		
1st offense	*DWLS 1*	*DWLS 2*	*DWLS 3*
Seattle (N = 481)			
DWLS 1	36 (5%)	2 (0%)	2 (0%)
DWLS 2	4 (1%)	55 (8%)	17 (2%)
DWLS 3	2 (0%)	23 (3%)	577 (80%)
Federal Way (N =83)			
DWLS 1	3 (4%)	0 (0%)	1 (1%)
DWLS 2	0 (0%)	5 (6%)	4 (5%)
DWLS 3	0 (0%)	2 (2%)	67 (82%)

Note: Percentages in this table are based on non-missing data and may not add to 100 due to rounding. Offense type was unknown for seven Seattle drivers and for five Federal Way drivers.

We classified individuals in the sample as either Seattle or Federal Way drivers based on where their first offense occurred during the study period. Some of these drivers (46) committed a reoffense in the other city. Thirty-two committed their first offense in Federal Way, 14 in Seattle. Table F.3 shows the characteristics of these 46 drivers.

Table F.3

Demographic Characteristics of Drivers With DWLS Impound or Arrest/Citation in Both Seattle and Federal Way

	Location of 1st Offense	
	Federal Way	*Seattle*
Characteristic	*N = 32*	*N =14*
Gender		
Male	27 (84%)	13 (93%)
Female	5 (16%)	1 (7%)
Race		
White	16 (50%)	2 (14%)
Black	14 (44%)	11 (79%)
Other	2 (6%)	1 (7%)
Age		
< 16	0 (0%)	1 (7%)
16-19	8 (25%)	4 (29%)
20-29	11 (34%)	3 (21%)
30-39	6 (19%)	4 (29%)
40-49	6 (19%)	2 (14%)
50+	1 (3%)	0 (0%)
First offense		
DWLS 1	3 (14%)	1 (7%)
DWLS 2	1 (5%)	2 (14%)
DWLS 3	17 (81%)	11 (79%)
Repeat Offenses		
1 repeat offense	21 (66%)	7 (50%)
2 or more	4 (12%)	7 (50%)

G. Specific Deterrence Logistic Regression Results

In addition to survival models, which consider how rates of recidivism change as a function of covariates, it is also if interest to examine an outcome variable that states whether or not recidivism occurred by a particular time. That is, did a higher proportion of Federal Way drivers recidivate after one year compared to Seattle drivers? We explored such questions using logistic regression, which can be used to model dichotomous (i.e. yes/no) outcome variables in a manner analogous to standard linear regression.

Logistic Regression Results

The outcome predicted in each model below is whether a driver committed a repeat DWLS or other traffic offense within one year of the first DWLS offense during the study period. In the case of accidents, the outcome is whether an accident occurred within eight months of the first DWLS offense in the study period. Because of the unavailability of accident data after September 30, 2000, restricting the follow-up period to eight months allows all drivers to be included in the analysis.

The results of these models do not differ substantively with those from the survival models presented in the text. That is, in the DWLS outcomes, there were no significant differences between Seattle and Federal Way drivers in the police and court filing in the follow-up period. The tables of results are presented below.

Table G.1

Logistic Regression: DWLS (Police Records)

	coef	*exp(coef)*	*Se(coef)*	*z*	*p*
(Intercept)	-1.963	0.140	0.195	-10.065	0.000
Seattle	0.101	1.106	0.108	0.933	0.351
DWLS 3	**-0.302**	**0.740**	**0.104**	**-2.901**	**0.004**
Black	**0.568**	**1.764**	**0.077**	**7.365**	**0.000**
Other race	0.049	1.050	0.150	0.325	0.745
Male	**0.337**	**1.401**	**0.100**	**3.385**	**0.001**
Age	-0.007	0.993	0.004	-1.746	0.081

Note: Bold indicates statistically significant association with the outcome variable ($p<.05$).

Table G.2

Logistic Regression: DWLS (Court Records)

	coef	*exp(coef)*	*se(coef)*	*z*	*p*
(Intercept)	-2.034	0.131	0.186	-10.932	0.000
Seattle	-0.100	0.905	0.093	-1.080	0.280
DWLS 3	0.011	1.011	0.110	0.097	0.923
Black	**0.180**	**1.197**	**0.068**	**2.656**	**0.008**
Other race	-0.004	0.996	0.121	-0.034	0.973
Male	**0.329**	**1.390**	**0.085**	**3.880**	**0.000**
Age	**-0.014**	**0.986**	**0.003**	**-3.971**	**0.000**
Prior DWLS 1/2	**0.925**	**2.522**	**0.117**	**7.880**	**0.000**
Prior DWLS 3	**0.813**	**2.255**	**0.065**	**12.448**	**0.000**
Prior other traffic	**0.615**	**1.850**	**0.076**	**8.118**	**0.000**

Note: Prior DWLS 1/2, Prior DWLS 3, and Prior other traffic are based on court charge filing records. Bold indicates statistically significant association with the outcome variable (p<.05).

Table G.3

Logistic Regression: Other Traffic Offenses (Court Records)

	coef	*exp(coef)*	*se(coef)*	*z*	*p*
(Intercept)	-2.027	0.132	0.187	-10.844	0.000
Seattle	-0.022	0.979	0.091	-0.237	0.813
DWLS 3	**0.268**	**1.308**	**0.115**	**2.328**	**0.020**
Black	-0.077	0.926	0.068	-1.130	0.258
Other race	0.024	1.024	0.114	0.207	0.836
Male	**0.231**	**1.260**	**0.080**	**2.879**	**0.004**
Age	**-0.016**	**0.984**	**0.003**	**-4.698**	**0.000**
Prior DWLS 1/2	0.039	1.040	0.130	0.302	0.763
Prior DWLS 3	0.078	1.081	0.064	1.210	0.226
Prior other traffic	**1.144**	**3.140**	**0.081**	**14.211**	**0.000**

Note: Prior DWLS 1/2, Prior DWLS 3, and Prior other traffic are based on court charge filing records. Bold indicates statistically significant association with the outcome variable (p<.05).

Table G.4

Logistic Regression: Accidents (DOL Records)

	coef	*exp(coef)*	*se(coef)*	*z*	*p*
(Intercept)	-2.793	0.061	0.373	-7.496	0.000
Seattle	-0.036	0.965	0.158	-0.224	0.822
DWLS 3	0.333	1.395	0.231	1.442	0.149
Black	0.187	1.206	0.122	1.528	0.126
Other race	-0.006	0.994	0.216	-0.026	0.979
Male	-0.019	0.981	0.143	-0.131	0.896
Age	**-0.026**	**0.974**	**0.007**	**-3.975**	**0.000**
Prior DWLS 1/2	0.163	1.177	0.280	0.581	0.561
Prior DWLS 3	-0.135	0.873	0.118	-1.148	0.251
Prior other traffic	**0.420**	**1.523**	**0.167**	**2.520**	**0.012**
Prior accident	**0.551**	**1.736**	**0.134**	**4.109**	**0.000**

Note: Prior DWLS 1/2, Prior DWLS 3, Prior other traffic, and Prior accident are based on DOL conviction data. Bold indicates statistically significant association with the outcome variable (p<.05).

H. Definition of Control Variables Used in Specific Deterrence Survival Analysis Models

The following is a listing of variables used in the specific deterrence survival models.

1. Seattle: A dichotomous variable indicating (1) whether a driver was a member of the Seattle sample. All others (0) belong to the Federal Way sample.
2. Race: A categorical variable of driver race with three categories: White, Black, and Other. The "Other" category combines the original "Other" category with "Asian" because relatively small sample sizes in both were causing convergence problems in our model fitting algorithms. In all models, White is not included in the tables because it was treated as the reference (or comparison) category.
3. Age: A continuous variable calculated as of January 1, 1999.
4. Male: A dichotomous variable indicating (1) whether a driver was a male. All others (0) are female drivers.
5. DWLS 3: A dichotomous variable indicating (1) whether the first offense during the study period was a DWLS 3. All others (0) represent a single combined category of DWLS 1 and 2. There were too few DWLS 1 offenders (particularly among the Federal Way group) to constitute a useful individual category.
6. Accident: A continuous variable of the number of accidents in the 20 months prior to the first DWLS offense in the study period.
7. DWLS 1 & 2 Charge Filing History: A dichotomous variable indicating (1) whether a driver had at least one DWLS 1 or 2 charge filed (as the most serious DWLS offense) in the 48 months prior to the first offense in the study period. All others (0) had no such filings.
8. DWLS 3 Charge Filing History: A dichotomous variable indicating (1) whether a driver had at least one DWLS 3 charge filed (as the most serious DWLS offense) in the 48 months prior to

the first offense in the study period. All others (0) had no such filings.

9. Other Traffic Charge Filing History: A dichotomous variable indicating (1) whether a driver had at least one other traffic charge filing in the 48 months prior to the first offense in the study period. All others (0) had no such filings. Other traffic is defined as traffic infractions and criminal traffic offenses not requiring suspension.

For the Seattle sample only

1. Hold Time: A categorical variable in days (0, 15, 30, 60, 90) for the length of the required impound period.
2. Owner: A dichotomous variable indicating (1) whether the driver was the registered owner of the vehicle. All others (0) were not.
3. Auction: A dichotomous variable indicating (1) whether the vehicle was auctioned as the result of the first impound offense. All others (0) were not.
4. Arrested: A dichotomous variable indicating (1) whether the driver was arrested at the time of the first impound offense. All others (0) received a citation.
5. Relicensing: A dichotomous variable indicating (1) whether a driver participated in the relicensing program. All others (0) did not.

I. Complete Statistical Results for Cox Proportional Hazards Models Testing Specific Deterrence

This appendix presents the complete statistical results for the survival analysis models testing specific deterrence summarized in this chapter. Interpretation of each of these tables is provided in the text. In the tables below, the row represent findings for each variable. The columns, from left to right, are the estimated coefficient from the Cox proportional hazards model, the exponential of the coefficient, the standard error of the coefficient, the z score, p-value of the hypothesis test that the coefficient is zero, and the lower and upper bounds of the 95% confidence interval (margin of error) for the exponentiated coefficient.

Table I.1

Cox Survival Model: DWLS (Police Arrest/Citation and Impound Records)

	coef	*exp(coef)*	*se(coef)*	*Z*	*p*	*lower .95*	*upper .95*
Seattle	0.122	1.130	0.090	1.356	0.18	0.947	1.348
DWLS 3	**-0.347**	**0.707**	**0.082**	**-4.251**	**0.00**	**0.602**	**0.829**
Black	**0.516**	**1.675**	**0.062**	**8.258**	**0.00**	**1.482**	**1.893**
Other race	-0.101	0.904	0.132	-0.768	0.44	0.698	1.170
Male	**0.327**	**1.386**	**0.083**	**3.928**	**0.00**	**1.178**	**1.632**
Age	-0.004	0.996	0.003	-1.101	0.27	0.990	1.003

Note: Bold indicates statistically significant association with the outcome variable (p<.05).

Table I.2

Cox Survival Model: DWLS (Court Charge Filing Records)

	coef	*exp(coef)*	*se(coef)*	*z*	*p*	*lower .95*	*upper .95*
Seattle	0.152	1.164	0.114	1.337	0.180	0.932	1.456
DWLS 3	0.025	1.025	0.081	0.305	0.760	0.875	1.200
Black	**0.154**	**1.166**	**0.050**	**3.052**	**0.002**	**1.057**	**1.287**
Other race	-0.033	0.967	0.094	-0.355	0.720	0.805	1.162
Male	**0.278**	**1.321**	**0.065**	**4.252**	**0.000**	**1.162**	**1.502**
Age	**-0.009**	**0.991**	**0.003**	**-3.413**	**0.000**	**0.986**	**0.996**
Prior DWLS 1/2	**1.523**	**4.584**	**0.206**	**7.380**	**0.000**	**3.060**	**6.869**
Prior DWLS 3	**1.014**	**2.758**	**0.146**	**6.951**	**0.000**	**2.072**	**3.671**
Prior other traffic	**0.514**	**1.673**	**0.060**	**8.598**	**0.000**	**1.488**	**1.881**
Seattle x prior DWLS 1/2	-0.352	0.704	0.216	-1.631	0.100	0.461	1.073
Seattle x prior DWLS 3	-0.295	0.744	0.156	-1.895	0.058	0.549	1.010

Notes: Prior DWLS 1/2, Prior DWLS 3, and Prior other traffic are based on court charge filing records. Bold indicates statistically significant association with the outcome variable ($p < .05$).

Table I.3

Cox Survival Model: Other Traffic Offenses (Court Charge Filing Records)

	coef	*exp(coef)*	*se(coef)*	*z*	*p*	*lower .95*	*upper .95*
Seattle	**0.678**	**1.970**	**0.166**	**4.072**	**0.000**	**1.421**	**2.730**
DWLS 3	**0.375**	**1.455**	**0.093**	**4.047**	**0.000**	**1.213**	**1.745**
Black	-0.025	0.975	0.052	-0.486	0.630	0.881	1.079
Other race	0.057	1.059	0.085	0.670	0.500	0.896	1.252
Male	**0.159**	**1.173**	**0.061**	**2.597**	**0.009**	**1.040**	**1.323**
Age	**-0.016**	**0.984**	**0.003**	**-6.058**	**0.000**	**0.979**	**0.989**
Prior DWLS 1/2	0.187	1.206	0.100	1.862	0.063	0.990	1.468
Prior DWLS 3	0.044	1.045	0.051	0.868	0.390	0.946	1.155
Prior other traffic	**1.639**	**5.152**	**0.171**	**9.561**	**0.000**	**3.681**	**7.210**
Seattle x prior other traffic	**-0.825**	**0.438**	**0.184**	**-4.493**	**0.000**	**0.306**	**0.628**

Notes: Prior DWLS 1/2, Prior DWLS 3, and Prior other traffic are based on court charge filing records. Bold indicates statistically significant association with the outcome variable ($p < .05$).

Table I.4

Cox Survival Model: Accidents

	coef	*exp(coef)*	*se(coef)*	*z*	*p*	*lower .95*	*upper .95*
Seattle	0.034	1.035	0.147	0.231	0.820	0.775	1.381
DWLS 3	0.190	1.209	0.159	1.199	0.230	0.886	1.650
Black	0.118	1.126	0.093	1.278	0.200	0.939	1.350
Other race	0.034	1.035	0.162	0.210	0.830	0.753	1.421
Male	-0.099	0.906	0.106	-0.932	0.350	0.736	1.115
Age	**-0.015**	**0.985**	**0.005**	**-3.033**	**0.002**	**0.976**	**0.995**
Prior DWLS 1/2	0.100	1.106	0.181	0.554	0.580	0.775	1.577
Prior DWLS 3	-0.007	0.993	0.093	-0.078	0.940	0.827	1.192
Prior other traffic	0.147	1.158	0.100	1.464	0.140	0.952	1.409
Prior accident	**0.609**	**1.839**	**0.245**	**2.484**	**0.013**	**1.137**	**2.975**
Seattle x prior accident	-0.105	0.900	0.269	-0.392	0.690	0.532	1.524

Notes: Prior DWLS 1/2, Prior DWLS 3, Prior other traffic, and Prior accidents are based on court charge filing data. Bold indicates statistically significant association with the outcome variable ($p < .05$).

Table I.5

Cox Survival Model: Repeat DWLS Impounds Among Seattle Drivers Only

	coef	*exp (coef)*	*se (coef)*	*z*	*p*	*lower .95*	*upper .95*
DWLS 3	-0.199	0.820	0.107	-1.852	0.064	0.664	1.012
Black	**0.439**	**1.551**	**0.068**	**6.456**	**0.000**	**1.357**	**1.772**
Other Race	-0.114	0.893	0.146	-0.779	0.440	0.671	1.188
Male	**0.312**	**1.366**	**0.091**	**3.407**	**0.001**	**1.142**	**1.634**
Age	-0.002	0.998	0.003	-0.700	0.480	0.991	1.004
Car auctioned	0.135	1.145	0.070	1.921	0.055	0.997	1.314
Registered owner	**-0.307**	**0.736**	**0.076**	**-4.054**	**0.000**	**0.635**	**0.854**
Relicensing program	**-1.232**	**0.292**	**0.449**	**-2.743**	**0.006**	**0.121**	**0.704**
Prior DWLS 1/2	**0.511**	**1.667**	**0.122**	**4.199**	**0.000**	**1.313**	**2.116**
Prior DWLS 3	**0.477**	**1.611**	**0.072**	**6.618**	**0.000**	**1.399**	**1.855**
Prior traffic	0.104	1.110	0.074	1.416	0.160	0.961	1.283
Driver arrested	0.036	1.037	0.084	0.434	0.660	0.880	1.222

Note: Bold indicates a statistically significant association with recidivism ($p<.05$). Prior DWLS 1/2, Prior DWLS 3, Prior other traffic, and Prior accidents are based on court charge filing data.

Table I.6

Cox Survival Model: Repeat DWLS Impounds Among Seattle DWLS 3 Drivers Only

	coef	*exp (coef)*	*se (coef)*	*z*	*p*	*lower .95*	*upper .95*
Black	**0.384**	**1.468**	**0.075**	**5.139**	**0.000**	**1.268**	**1.699**
Other Race	-0.191	0.826	0.159	-1.203	0.230	0.604	1.128
Male	**0.313**	**1.368**	**0.097**	**3.238**	**0.001**	**1.132**	**1.653**
Age	-0.003	0.997	0.004	-0.724	0.470	0.990	1.005
15 day hold	-0.115	0.892	0.112	-1.020	0.310	0.716	1.111
30 day hold	**0.231**	**1.260**	**0.091**	**2.536**	**0.011**	**1.054**	**1.507**
Car auctioned	0.144	1.155	0.078	1.859	0.063	0.992	1.346
Registered owner	**-0.310**	**0.733**	**0.082**	**-3.783**	**0.000**	**0.625**	**0.861**
Relicensing program	**-1.152**	**0.316**	**0.450**	**-2.560**	**0.010**	**0.131**	**0.763**
Prior DWLS 1/2	**0.588**	**1.801**	**0.166**	**3.547**	**0.000**	**1.301**	**2.493**
Prior DWLS 3	**0.428**	**1.534**	**0.087**	**4.931**	**0.000**	**1.294**	**1.818**
Prior traffic	0.130	1.139	0.082	1.580	0.110	0.969	1.339
Driver arrested	0.051	1.052	0.098	0.520	0.600	0.869	1.274

Note: Bold indicates a statistically significant association with recidivism (p<.05). Prior DWLS 1/2, Prior DWLS 3, Prior other traffic, and Prior accidents are based on court charge filing data.

Table I.7

Cox Survival Model: Repeat DWLS Impounds Among Seattle DWLS 1 and 2 Drivers Only

	coef	*exp (coef)*	*se (coef)*	*z*	*p*	*lower .95*	*upper .95*
Black	**0.603**	**1.827**	**0.176**	**3.416**	**0.001**	**1.293**	**2.582**
Other Race	0.342	1.408	0.362	0.944	0.350	0.692	2.865
Male	0.043	1.044	0.287	0.151	0.880	0.595	1.833
Age	0.001	1.001	0.009	0.085	0.930	0.984	1.018
60 day hold	0.137	1.147	0.263	0.520	0.600	0.684	1.922
90 day hold	0.161	1.174	0.223	0.722	0.470	0.759	1.817
Car auctioned	0.025	1.025	0.171	0.143	0.890	0.733	1.433
Registered owner	-0.296	0.744	0.202	-1.466	0.140	0.501	1.105
Prior DWLS 1/2	0.218	1.243	0.234	0.928	0.350	0.785	1.968
Prior DWLS 3	0.307	1.359	0.245	1.251	0.210	0.840	2.198
Prior traffic	0.097	1.102	0.180	0.536	0.590	0.773	1.569
Driver arrested	-0.074	0.929	0.165	-0.447	0.660	0.672	1.284

Note: Bold indicates a statistically significant association with recidivism (p<.05). Prior DWLS 1/2, Prior DWLS 3, Prior other traffic, and Prior accidents are based on court charge filing data.