Convenience Store Robberies in Selected Metropolitan Areas

Risk Factors for Employee Injury

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Circumstances of injury were abstracted from police reports for 1835 convenience store robberies that occurred during 1992 or 1993 in selected metropolitan areas of seven eastern states. Subset analyses were performed using the data (758 robberies) from four states with relatively complete risk factor information. The purpose of this study was to estimate the risk of injury in a robbery situation for various risk factors. The overall risk of employee robbery-related injury could not be estimated because the probability of robbery is unknown. Of the 1835 robberies, 59% of the total robberies occurred at nighttime (9 p.m. to 3 a.m.), 47% occurred in stores previously robbed in the study period, 63% involved the use of a firearm, and 12% were associated with an injury to at least one employee. In the subset analysis of 758 robberies in four states, the employee probability of injury in a robbery was lower with firearm use compared with no weapon or use of a blunt instrument, and the probability of severe injury (defined as death, or an injury necessitating a trip to a hospital) was lower with a firearm compared with the use of a blunt instrument. However, all five fatalities were firearm-related. Other factors that were associated with a lower probability of employee injury included robbery occurrence in stores that had been robbed multiple times, compared with stores robbed only once; having 1 to 999 dollars stolen, compared with having no money stolen; and the presence of a customer(s) in the store at the time of the robbery. The employee risk of injury was not significantly different between one- (0.106) and multiple-employee (0.111) stores. Similarly, the employee risk of severe injury was not significantly different between one- (0.029) and multiple-employee stores (0.022). We conclude that there are several potential risk factors for employee injury in convenience store robberies, some of which are amenable to interventions. Further research on these factors and their relationship to employee injury is indicated.

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Industry programs to prevent convenience store (C-store) robbery and robbery-related injury have focused on training employees in passive behavior (ie, to give up the money without resistance) and on store environmental designs (ED). EDs include cash-handling policies: cash limits and the use of drop safes; security systems: closed-circuit televisions; mirrors, guards, and bullet-resistant shielding; visibility: clear windows, lighting, and visibility of a cashier from outside; store layout: location of cashier, aisle height, and presence of blind aisles; store location: near evening commercial activity and major arteries; and staffing characteristics: number and demographics of employees on duty.

Although evidence from 14 studies is inconsistent as to the effectiveness of specific C-store design features to deter robbery,[1,2] in each of these studies, one or more EDs was significantly related to a decrease in robbery rate. This, in conjunction with the fact that past robberies serve as one of the best predictors for future robberies,[3] indicates that C-store robbery is not entirely a random occurrence and can be prevented by EDs that increase the perception in the perpetrator's mind of an unsuccessful robbery.

Although one could assume that interventions that reduce C-store robbery will also reduce robbery-related injury, this has not been established in previous studies. Thus, the purpose of this paper is to examine one part of this complex problem

by estimating the relationship between selected risk factors and the probability of injury, given a robbery occurrence.

Methods

State Statistical Analysis Centers (SACs) were asked by the Justice Research and Statistics Association about interest in participating in data-collection activities regarding C-store robberies. Of the 48 states queried, 21 expressed interest in participation in this study. From this group, nine states were originally selected, which had the highest number of C-store robberies based on their 1992 Uniform Crime Report data. A report on the methods and general findings of this study has been published elsewhere.[4] The definition of "convenience store" differed slightly among the states, but typically referred to a grocery/miscellaneous-type business that is commonly open after regular business hours for the convenience of the public. They include stores owned or run by large "chain" companies as well as privately owned stores; they may sell gasoline as a secondary function.

Seven of the nine participating state SACs (Florida, Maryland, Massachusetts, Michigan, Pennsylvania, South Carolina, and Virginia) abstracted and coded police report data on a sample of 1835 convenience store robberies and attempted robberies using a standardized format;[4] this data is the basis of the study presented here. The robberies occurred during the years 1992 or 1993 in and around the following selected metropolitan areas: Miami and Tampa, Florida; Baltimore, Maryland; Boston, Massachusetts; Detroit, Michigan; Pittsburgh and Philadelphia, Pennsylvania; Charleston, Columbia, Greenville, and Spartanburg, South Carolina; and Arlington, Chesterfield, and Henrico counties, Virginia. Eighty-six percent of all robberies without information on the number of employees present were from Maryland and South Carolina. Data from Pennsylvania did not provide information on the total number of employees injured. Thus, to avoid possible bias from missing information, injury probability was calculated using data from the states of Florida, Massachusetts, Michigan, and Virginia only. Probability of injury was defined as the number of employees who suffered an injury divided by the total number of employees in the specific risk category.

The data items considered in this analysis are injury indicators and potential injury risk factors, including: type of weapon used in the robbery, gender of employee when only one employee was present, time of offense, number of employees present in the store, number of customers present in the store, amount of money stolen, and the number of robberies each store reported in the data.

For the purposes of data abstraction from police records, robbery was defined as the taking of or attempt to take goods or money by force or threat of force. This standardized definition is based on the Federal Bureau of Investigation Uniform Crime Report system. These data do not include larcenies in which goods or money are taken without the use or threat of force. An injury is defined as a complaint of pain, but no visible injury; bruises or scratches; cuts; puncture wounds; death during an assault; or a condition treated at the scene. A severe injury is defined as an injury that required the employee to be taken to the hospital or which resulted in death. An injury event or severe injury event is defined as an injury or severe injury occurring to at least one employee on duty at the time of the robbery.

The Mantel-Haenszel adjusted chi-square method was used to test the association between injury and a risk factor and to calculate confidence intervals for the ratios of injury probability by risk factors. A stratified Mantel-Haenszel chi-square analysis was used to test associations after adjusting for possible confounding factors. All confidence intervals for the ratio of injury probabilities between two subgroups were calculated at the 95% level.

Results

Information was available on gender of a lone employee (ie, only one employee in the store at the time of robbery), type of weapon used, time of robbery, and number of robberies at the same store for over 97% of the robberies (Table 1). Information was not available on the number of employees present for 34% of the robberies, on the number of customers present for 23% of the robberies, and on the amount of money stolen for 55% of the robberies.

Approximately 12% (229 of 1835 for seven states, and 84 of 673 for the subset of four states) of the robberies resulted in an injury event. Severe injury events occurred in 2.1% (38 of 1835) of the larger group and in 3.1% (21 of 673) of the four-state sample. Descriptive data on potential injury risk factors are given in Table 1. When robberies for which risk factor data were unavailable were excluded, only one employee was present in 79% of the robberies, no customers were present in 80%, and an employee was alone with no customers present in 60% of the robberies. When the number of robberies is converted to hourly rates, the results were: nighttime (181 robberies per hour); morning (49 robberies per hour); and daytime (39 robberies per hour). There were 296 stores (24% of the stores in the data) robbed more than once, which accounted for 47% of the robberies. One store had 12 robberies, which was the largest number of robberies per store. The tabular data from the four-state subgroup were similar to that of all seven states.

Information on the number of employees on duty and the number of employees injured for the robberies from Florida, Massachusetts, Michigan, and Virginia is shown in Table 2. The maximum number of employ-

TABLE 1
Number and Percentage* of Robberies by Risk Factors

Risk Factor	Risk Factor Category	Number of Robberies in All Seven States	Number of Robberies in FL, MA, MI, and VA
Number of Employees	1	949 (78.6)	547 (81.3)
	2 or More	259 (21.4)	126 (18.7)
	Unknown†	627 (—)	85 (—)
Number of Customers	0	1128 (80.0)	444 (72.3)
	1 or More	282 (20.0)	170 (27.7)
	Unknown†	425 (—)	144 (—)
Gender of Lone Employees‡	Male	538 (58.6)	300 (56.9)
	Female	380 (41.4)	227 (43.1)
	Unknown†	31 (—)	20 (—)
Weapon Use	None§	313 (17.6)	132 (17.7)
	Sharp Instrument	212 (11.9)	103 (13.8)
	Firearm Used	1123 (63.2)	467 (62.6)
	Other‖	129 (7.3)	44 (5.9)
	Unknown†	58 (—)	12 (—)
Dollars Stolen	0	186 (22.3)	126 (29.9)
	1 to 99	336 (40.3)	145 (34.4)
	100 to 999	257 (30.9)	111 (26.4)
	1000 or More	54 (6.5)	39 (9.3)
	Unknown†	1002 (—)	337 (—)
Time of Day	Morning (3 a.m. to 8 a.m.)	247 (13.5)	73 (9.6)
	Daytime (8 a.m. to 9 p.m.)	502 (27.4)	251 (33.1)
	Nighttime (9 p.m. to 3 a.m.)	1086 (59.2)	434 (57.3)
	Unknown†	0 (—)	0 (—)
Number of Robberies	1	962 (53.2)	407 (55.1)
	2 or more	845 (46.8)	332 (44.9)
	Unknown†	28 (—)	19 (—)

* Percentages are given in parentheses and do not include unknowns.
† Unknown: data not available on risk factor.
‡ Lone employee: only one employee present.
§ No weapon was used; however, physical assaults are included.
‖ Includes use of a blunt object and weapons other than firearms and sharp instruments.

ees in any of the robberies was five; 90% of the multiple-employee stores had two employees on duty during the robbery. The maximum number of employee injuries in any of the robberies was two. There were 84 robberies that resulted in 88 employee injuries, and 21 robberies that resulted in 22 severe employee injuries, among the 818 employees involved in the 673 robberies. The individual employee injury and severe injury rates were thus 10.8% (88 of 818) and 2.7% (22 of 818), respectively.

The risk of employee injury was not significantly different between one- (0.106) and multiple-employee (0.111) stores (Table 3). Similarly, the employee risk of severe injury was not significantly different in one- (0.029) than in multiple-employee stores (0.022). The risks of an injury event (ie, any employee injury) per robbery are derived from the data in Table 2. For stores that had one employee on duty at the time of the robbery, the risk of an injury event per robbery was 0.106, and the risk of a severe injury event per robbery was 0.029. For stores that had more than one employee on duty, the risk of an injury event per robbery was 0.206 (26 of 126), and the risk of a severe injury event per robbery was 0.040 (5 of 126).

The probabilities of injury and severe injury by risk factors for the states of Florida, Massachusetts, Michigan, and Virginia are given in Table 3. There was a significantly lower probability of injury when customers were present during the robbery (0.067) than when customers were not present (0.154); when a firearm was used (0.070), compared with when no weapon was used (0.153) or compared with when an object other than a sharp instrument or firearm was used (0.417); when 1 to 999 dollars were stolen (0.103) than when no money was stolen (0.207); and among stores robbed more than once (0.068) than stores robbed only once (0.126). The severe injury probability was significantly lower when a firearm was used (0.025) compared with when an object other than a sharp instrument or firearm was used (0.083); when 1 to 999 dollars were stolen (0.010) than when no money was stolen (0.090); and among stores robbed more than once (0.006) than stores robbed only once (0.045). Note that weapon "use" may have only involved the threat of violence with it. Although they are associated with lower injury rates, firearms were involved with all five fatalities in the data set.

The ratio of the probability of injury (1.04; Table 3) and severe injury (0.76) in stores that had one employee on duty and stores that had multiple employees on duty was stratified by the other risk factors. The ratio of probabilities when adjusted by the risk factors did not differ from the unadjusted ratio of probabilities. However, significant state-to-state variation in the ratio of probabilities concerning the number of employees on duty was found. The ratios of probabilities of multiple-employee stores to one-employee stores were 0.66 for Massachusetts, 0.92 for Michigan, 1.04 for Virginia, and 2.05 for Florida.

Discussion

In this study of robbed convenience stores, employee rates of injury were found to differ according to the presence of customers, type of weapon used, whether money was stolen, and whether the store had previously been robbed. Customers and the perpetrator's use of a firearm

TABLE 2
Number of Employees on Duty During Robbery by Number of Robberies and Number of Employees Injured* and Severely Injured†

Number of Employees on Duty During Robbery	Number of Robberies	Number of Employees at Risk	Number of Robberies in Which One Employee Was Injured	Number of Robberies in Which Two Employees Were Injured‡	Total Number of Injuries
1	547	547	58 (16)	— (—)‡	58 (16)
2 or More	126	271	22 (4)	4 (1)	30 (6)
Total	673	818	80 (20)	4 (1)	88 (22)

* Numbers of employees injured include severe and non-severe injuries.
† Numbers of severe injuries are given in parentheses. Severe injury is defined as an injury that results in being taken to the hospital or in death.
‡ The number of employees injured or severely injured during a robbery did not exceed two.

TABLE 3
Individual Probability of Injury* and Severe Injury† and Ratio of Probabilities by Risk Factors

Risk Factor	Risk Factor Category‡	Number of Employees	Number of Injured Employees (Severely Injured)	Probability of Injury (Severe Injury)	Ratio of Probabilities	95% Confidence Interval of Ratio‡
Number of Employees	1	547	58 (16)	0.106 (0.029)	1.00 (1.00)	— (—)
	2 or More	271	30 (6)	0.111 (0.022)	1.04 (0.76)	0.69 to 1.58 (0.30 to 1.90)
Number of Customers	0	430	66 (14)	0.154 (0.033)	1.00 (1.00)	— (—)
	1 or More	209	14 (3)	0.067 (0.014)	**0.44** (0.44)	**0.26 to 0.74** (0.13 to 1.46)
Gender of Lone Employee	Male	300	26 (6)	0.087 (0.020)	1.00 (1.00)	— (—)
	Female	227	29 (10)	0.128 (0.044)	1.47 (2.20)	0.89 to 2.43 (0.83 to 5.81)
Weapon Use	Firearm Used	515	36 (13)	0.070 (0.025)	1.00 (1.00)	— (—)
	Sharp Instrument	105	10 (2)	0.095 (0.019)	1.36 (0.76)	0.70 to 2.67 (0.17 to 3.27)
	None§	137	21 (3)	0.153 (0.022)	**2.19** (0.87)	**1.33 to 3.62** (0.25 to 3.00)
	Other‖	48	20 (4)	0.417 (0.083)	**5.96 (3.30)**	**3.78 to 9.41 (1.12 to 9.73)**
Dollars Stolen	0	155	32 (14)	0.207 (0.090)	1.00 (1.00)	— (—)
	1–99	165	18 (2)	0.109 (0.012)	**0.53 (0.13)**	**0.31 to 0.89 (0.04 to 0.46)**
	100–999	146	14 (1)	0.096 (0.007)	**0.46 (0.08)**	**0.26 to 0.83 (0.02 to 0.35)**
	1000 or More	49	6 (0)	0.122 (0.000)	0.59 (—)	0.27 to 1.29 (—)
Time of Day	Morning (3 a.m. to 8 a.m.)	77	8 (1)	0.104 (0.013)	1.00 (1.00)	— (—)
	Day (8 a.m. to 9 p.m.)	311	46 (10)	0.148 (0.032)	1.42 (2.48)	0.71 to 2.85 (0.35 to 17.5)
	Night (9 p.m. to 3 a.m.)	430	34 (11)	0.079 (0.026)	0.76 (1.97)	0.36 to 1.59 (0.27 to 14.3)
Number of Robberies	1	446	56 (20)	0.126 (0.045)	1.00 (1.00)	— (—)
	2 or More	352	24 (2)	0.068 (0.006)	**0.54 (0.13)**	**0.35 to 0.85 (0.04 to 0.42)**

* Numbers of injured include severe and non-severe injuries. Probability is defined as the number of (severe) injuries divided by the total number of employees in the specific risk category.
† Numbers of severely injured are given in parentheses. Severe injury is defined as an injury which results in being taken to the hospital or death.
‡ The risk factor category listed first is used as the reference group for ratio of probabilities. Ratios for which the confidence interval does not include 1 are given in bold.
§ No weapon was used; however, physical assaults are included.
‖ Includes use of a blunt object and weapons other than firearms and sharp instruments.

were associated with a lower chance of employee injury, as was the stealing of money. The number of employees present, gender of a lone employee, and time of day did not significantly influence the percentage of employee injuries in a robbery. Although it did not influence the rate of employee injury per robbery, the hourly rate of robberies from 9 p.m. to 3 a.m. was found to be approximately four times that of the rest of the day.

Caution needs to be taken in interpreting these results, for several reasons. As previously noted, these data are all conditional on a robbery occurring; thus the overall risk of robbery-related injuries to C-store employees cannot be estimated. Only the probability of injury conditional on a robbery occurring can be estimated from these data. Small sample size, especially regarding severe in-

juries, reduced the power of the study to detect significant differences. The number of multiple injuries was particularly small, thus preventing a separate analysis of the association between risk factors and injury separately for single and multiple injuries. The definition of severe injury had to be made very broad with available data; eg, we could not determine the clinical severity of employees who were taken to a hospital. Data on other potential confounding factors, such as the number of robbers and employee actions during the robbery, were unavailable. The results in the analyses performed here do not adjust for the possible correlation or dependence between employees in the same store and assume that the likelihood of injury to one employee was independent of that to another. In addition, the fact that some stores appear in the data more than once was not accounted for in the statistical analysis. As noted previously,[4] biases could have occurred because the accuracy of the primary police report data was not verified, and there was no data available for a large number of robbery reports. Finally, the small number of multiple-employee stores in some states did not provide adequate precision for state-specific estimates of risk of injury and trends in injury risk, because multiple-employee stores were not consistent among states.

In addition, the one- to multiple-employee comparisons may be biased, because it is not known whether the number of employees present in each store was influenced by known or perceived robbery or employee injury risks. For example, it is possible that owners of stores with high robbery and injury risk have hired additional employees at times of high risk for robbery and employee injury. If this were true, the multiple-employee stores would be represented disproportionately in this data set, and their employees would have a higher injury risk than one-employee stores for this reason alone. Clearly, this is a problem with observational data vs controlled trial data and is not unique to this observational data set. In addition, other possible scenarios could bias the results in the other direction. Finally, missing information required a detailed analysis of only part of the original data set.

The interpretation of the limited data is difficult, partly because the use of violence in a robbery setting may have several different motivations.[5] One obvious reason for violence, however, would be to overcome resistance to the attempted robbery. Zimring and Zuehl found that the risk of homicide was substantially higher in commercial robberies when the victim resisted than in those in which the victim offered no resistance.[6] If one considered the successful stealing of money as an imperfect surrogate for employee nonresistance, this might explain the reduced injury rates in the robberies in which money was stolen. The role of customers in reducing the chance of employee injury may be multifactorial. However, one common theory is that customers may be viewed as potential witnesses, and thus a disincentive to the use of violence in the robbery situation. This would also agree with the virtually universal finding of increased rates of robbery during late-night hours when business is typically slow.[7] Similarly, one could hypothesize several reasons for a lower injury rate among repeatedly robbed stores, including the use of better environmental designs for personnel protection and an "experienced" nonresistance policy. However, it is likely that the relationships among the observed differences and employee injury are both variable and complex, making simple interpretations suspect.

Robberies that represent an escalation of shoplifting may include a special case of injury resulting from employee resistance. Three of this study's authors (Dr Amandus, Dr Malcan, and Mr Hendricks) have reviewed 260 reports of recent C-store robberies that occurred in Virginia.[2] A typical robbery in which only goods were taken occurred when a robber used force to take the goods after being confronted by an employee. These incidents are still defined as robberies because the definition of robbery incorporates goods or money taken by force or threat of force. However, they likely involve a different motivation and potential employee injury threat, and thus add to the complexity in data interpretation, as noted above. Further research is needed where the circumstances of the robberies can be categorized, because effective prevention programs may differ among different robbery situations. Unfortunately, this categorization could not be made with the present data.

Despite incomplete knowledge regarding the causal factors of C-store robbery and employee injury, various interventions have been introduced to reduce both events. Because of the high injury risk to C-store employees at night, several state and local government agencies have proposed or required stores that have been robbed to employ two or more employees or guards, install bullet-resistant shielding around the cash register station, or close at night.

Previous studies have reported somewhat inconsistent results on the effectiveness of these interventions, and particularly on whether the presence of two or more employees deterred robbery.[1,2] Hunter[8] evaluated environmental designs in 110 Florida C-stores and found that the number of employees was not correlated with the robbery rate. Calder and Bauer[9] found an inverse association between the number of employees and the number of robberies in a study of 189 stores in San Antonio, Texas, but did not adjust for store proximity to high crime focal points. Figlio and Aurand[3] reported a 20% decrease in robbery rates in stores with multiple employees on the third (nighttime) shift, but only in stores that had been robbed during the previous year. Figlio did not have information on

other store designs but did adjust for proximity to high crime areas.

Clifton and Callahan[10] noted that the number of robberies increased 135% in 47 stores in Gainesville, Florida after passage of an ordinance requiring training, visibility, and lighting standards; this number then decreased 65% after passage of a second ordinance requiring the presence of two or more employees, guards, bullet-resistant shielding, or closing at night. It was not determined whether the decrease in the number of robberies was a result of factors in the second ordinance, or to the latent effects of complying with the first ordinance.

The literature thus remains unclear on which EDs are most effective and specifically whether the presence of two or more employees at night will deter robbery in C-stores. There is no information on the effect of two or more employees on overall injury rates. The study presented here found that the employee risk of injury and severe injury in a robbed store was essentially the same in single- and multiple-employee stores. If there were similar injury rates given a robbery among single- and multiple-employee stores, there would obviously be an increase in the number of injuries in multiple-employee robbed stores, compared with single-employee robbed stores because there would be additional employees at risk in the former; this was confirmed in our data.

In conclusion, this study notes several factors that are related to the employee injury rate in robbed convenience stores and suggests possible causal explanations for the findings. The results must be treated cautiously because of the limitation of the data. Obviously, a more fundamental understanding of the circumstances is needed. Because of this, and because of the limitations of the data, these findings should best serve as focus points for future research.

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