Factors Affecting a Recently Purchased Handgun's Risk for Use in Crime under Circumstances That Suggest Gun Trafficking

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ABSTRACT *While many handguns are used in crime each year in the USA, most are not. We conducted this study to identify factors present at the time of a handgun's most recent retail sale that were associated with its subsequent use in crime under circumstances suggesting that the handgun had been trafficked—purchased with the intent of diverting it to criminal use. Handguns acquired in multiple-gun purchases were of particular interest. Using data for 180,321 handguns purchased from federally licensed retailers in California in 1996, we studied attributes of the handguns, the retailers selling them, the purchasers, and the sales transactions. Our outcome measure was a handgun's recovery by a police agency, followed by a gun ownership trace, conducted by the Bureau of Alcohol, Tobacco, Firearms and Explosives, that determined (a) that the recovery had occurred within 3 years of the handgun's most recent purchase from a licensed retailer and (b) that the person who possessed the gun when it was recovered by police was not its most recent purchaser. Altogether, 722 handguns were recovered and had trace results that met the additional criteria. Handguns acquired in multiple-gun, same-day transactions were more likely to be traced than were single-purchase handguns (odds ratio [OR] 1.33, 95% confidence intervals [CI] 1.08 to 1.63). This was not the case for multiple-purchase handguns defined more broadly as multiple handguns purchased by one individual over any 30-day period as used in "one-gun-a-month" laws. Bivariate regressions indicated increased risk of a handgun being traced when it sold new for $150 or less (OR 4.28, 95% CI 3.59 to 5.11) or had been purchased by a woman (OR 2.02, 95% CI 1.62 to 2.52). Handguns sold by retailers who also had a relatively high proportion (≥2%) of purchases denied because the prospective purchasers were prohibited from owning firearms were more likely to be traced than were those sold by other retailers (OR 4.09, 95% CI 3.39 to 4.94). These findings persisted in multivariate analyses. Our findings suggest specific strategies for intervention to prevent gun violence.*

KEYWORDS *Crime, Violence, Firearms*

INTRODUCTION

Approximately 280 million firearms are now in civilian hands in the USA.[1] Most firearms are not used in crime. Yet an estimated 315,000 violent crimes

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involving guns, including 10,886 homicides, were committed in the USA in 2008.[2,3]

Few large-scale studies have been done of potential risk factors for firearms being used in crime. One risk factor is well known; handguns are overrepresented among crime guns, particularly in urban areas. Previous studies further suggest that specific gun type, cost, and concealability are associated with a handgun's risk of involvement in crime, as are purchaser age and sex, and several attributes of the licensed retailer who sells the handgun.[4–7]

Interventions to prevent gun violence by reducing the supply of guns to dangerous people often focus on *gun trafficking*, the rapid and intentional diversion of guns from legal to illegal commerce. The median interval between a gun's retail sale and its recovery in crime in the USA is 5.7 years, but trafficked guns are often used in crime within a few years of purchase, by someone other than the original retail purchaser.[4,8–10] Several lines of evidence suggest that guns used in crime are often bought in multiple-gun transactions,[6,8–10] but the evidence is mixed.[5] A Maryland study found that these multiple-sale handguns were at increased risk of recovery by law enforcement agencies in that state for the first 2 years following purchase, but not thereafter.[6] This increase in risk persisted for at least 5 years for handguns sold in Maryland but recovered by police in nearby Washington, DC, which had banned the purchase of handguns.

Using detailed data for handguns sold in 1996 by federally licensed retailers in California, we examine attributes of the handguns, retailers, purchasers, and sales transactions to identify those that affect the likelihood a handgun will be recovered by a law enforcement agency and subjected to gun ownership tracing by the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF). These traces, done at the request of law enforcement agencies, are a widely used surrogate measure for a gun's use in crime.[5,6,10,11] To focus the results on handguns that may have been trafficked, we specify further that the trace must have occurred within 3 years of the handgun's most recent retail sale and that, at the time of its recovery by a law enforcement agency, the handgun must have been in the possession of someone other than the person identified by the trace as the gun's buyer in 1996.

Our objective is to identify risk factors for use in crime among handguns sold by federally licensed firearms dealers that are amenable to law enforcement or public policy interventions. Given the prior evidence, we were particularly interested in handguns acquired in multiple-gun purchases. We apply two definitions of this term: (1) multiple-gun, same-day transactions and (2) purchases of multiple handguns, one at a time, by the same individual in transactions spread over up to 30 days—a definition used in "one-gun-a-month" laws. Simultaneously, we determine the importance in this large population of risk factors identified in previous studies.

METHODS

Datasets
Data on study handguns and their sellers, purchasers, and sales transactions were obtained from the Dealer's Record of Sale (DROS) file for 1996, provided by the California Department of Justice (CDOJ). Files for later years were used to identify any subsequent sales (see below). All gun tracing records for 1996 through 1999, regardless of the location of the requesting law enforcement agency, were made available by ATF. With few exceptions, guns for which traces are requested have

been recovered in a criminal context.[12] ATF attempts to reconstruct the chain of ownership of the gun from its manufacture to its first retail sale; records for completed traces include information on both the seller and buyer in that transaction.

Forming the Study Population and Identifying Outcome Events

We identified all handguns sold in 1996 from the DROS file, using data from the most recent sale for guns that were sold more than once that year. We then searched DROS records for 1997–1999 to identify subsequent sales of handguns sold in 1996, using manufacturer, serial number, handgun type, and caliber as linking variables. Handguns resold during this follow-up period were omitted from analysis since attributes of the buyer, the transaction, and the retailer would change with the subsequent sale.

Handgun characteristics were then used to link sales records to tracing data. An exact replication of manufacturer, serial number, handgun type, and caliber constituted a successful match. If the handgun matched on manufacturer, serial number, and either caliber or type (but not both), a manual comparison of the records was done, using additional handgun information such as model and barrel length, to determine whether a true match existed.

Our outcome measure was a handgun's recovery by a police agency, followed by a gun ownership trace, conducted by the Bureau of Alcohol, Tobacco, Firearms and Explosives, that determined (a) that the recovery had occurred within 3 years of the handgun's most recent purchase from a licensed retailer and (b) that the person who possessed the handgun when it was recovered by police was not its most recent purchaser. We omitted from analysis those handguns that were not recovered by law enforcement but had been purchased by an individual who had bought at least one traced handgun due to the increased likelihood that an untraced gun purchased by such an individual may also have been used in crime but not recovered by police.

Explanatory Variables

In accordance with the law in several states, we defined a multiple purchase as the purchase of more than one handgun from one or more licensed retailers by an individual within any 30-day period. We identified each handgun as being purchased singly or as part of a multiple sale by linking DROS records using the buyer's last name, first four letters of the first name, date of birth, date of sale, and a unique weapon number assigned by CDOJ. Among multiple-purchase handguns, we identified the subset bought in same-day, multiple-gun transactions. Over the course of 1996, an individual buyer could have bought guns in both single and multiple purchases.

We grouped handguns by type as semi-automatic pistols, revolvers, or derringers and single-shot guns, and categorized caliber as small (.22, .25, .32), medium (.38, .380, 9 mm), or large (.357, .40, .44, .45, .50, 10 mm). Barrel length was defined as short (≤3 in.) or long (>3 in.). We classified handguns as inexpensive if their retail price as a new gun was ≤$150, based on manufacturer. There were eight gun manufacturers that sold only handguns with retail prices of $150 or less in 1996 (Bryco Arms, Davis Industries, Hi-Point Firearms, Jennings Firearms, Lorcin Engineering, Phoenix Arms, Raven Arms, and Sundance Industries). All handguns from these manufacturers were classified as inexpensive. To our knowledge, no other major manufacturers produced handguns in this price range.

Retailer type—dealer, pawnbroker, or importer/manufacturer—was obtained from the DROS data. Retailers were categorized by their total number of handgun

sales during 1996 (1–249, 250–999, ≥1,000) and the percentage of purchase applications that were denied because the prospective purchasers were prohibited from possessing firearms (<1%, 1% to <2%, ≥2%).[5,13] The highest category for the percentage of handgun purchase applications denied is higher than the national average.[14] Most denials stem from previous criminal convictions,[15–17] and a high denial percentage might therefore reflect a clientele at increased risk for committing crimes.[3,8,13] Finally, retailers were grouped according to their proximity to a Youth Crime Gun Initiative (YCGI) city (within 25 mi or farther away). YCGI is an ATF initiative to comprehensively trace all crime guns; participating cities agree to trace all guns recovered from criminal suspects and crime scenes.[4]

Handgun purchaser attributes included gender; age; and an occupation, such as law enforcement officer or firearms instructor, which exempted the purchaser from completing a California Basic Firearms Safety Course. (Proof of completion was otherwise mandatory.)

We hypothesized that gun traffickers who sell many guns illegally might be inclined to purchase multiple handguns of the same make, model, and caliber. To capture the number of handguns purchased in 1996 and purchases of essentially identical types of handguns by individual purchasers, we created a variable to describe the number and uniformity of the handguns bought. All handguns purchased by a single individual were compared on manufacturer, handgun type, and caliber classification. Guns had to match on all three variables to be considered alike. We then determined if all, some, or none of each individual's purchased handguns were alike, and all handguns purchased by that individual were assigned to that category.

Statistical Analysis

We performed separate analyses for all handguns (single- and multiple-purchase) and for multiple-purchase handguns only. Unadjusted odds ratios and their 95% confidence intervals were calculated for each explanatory variable. We then performed a sequence of logistic regression models, adding groups of variables in stages to those already in the model to estimate adjusted odds ratios for a handgun being recovered and traced. The first stage included only the purchase timing variable (single purchase, same-day multiple purchase, or 30-day multiple purchase) and handgun attribute variables. The second stage added retailer variables, and the third stage added purchaser variables. All analysis was done using PC SAS version 8.[18]

This study was approved by the Institutional Review Board of the University of California, Davis.

RESULTS

The DROS file identified 209,485 handgun sales in California in 1996 by licensed retailers (Figure 1). After exclusions (see figure legend), data for 180,321 handguns (86.1% of all handguns sold in 1996) were available for analysis. Of these handguns, 135,192 (75.0%) were bought singly and 45,129 (25.0%) were part of multiple-handgun purchases. Of the multiple-purchase handguns, nearly half (45.7%) were part of same-day purchases. Among all guns, 722 (0.4%) were traced by ATF following recovery of the gun by the police from someone other than the retail purchaser within three years of the purchase.
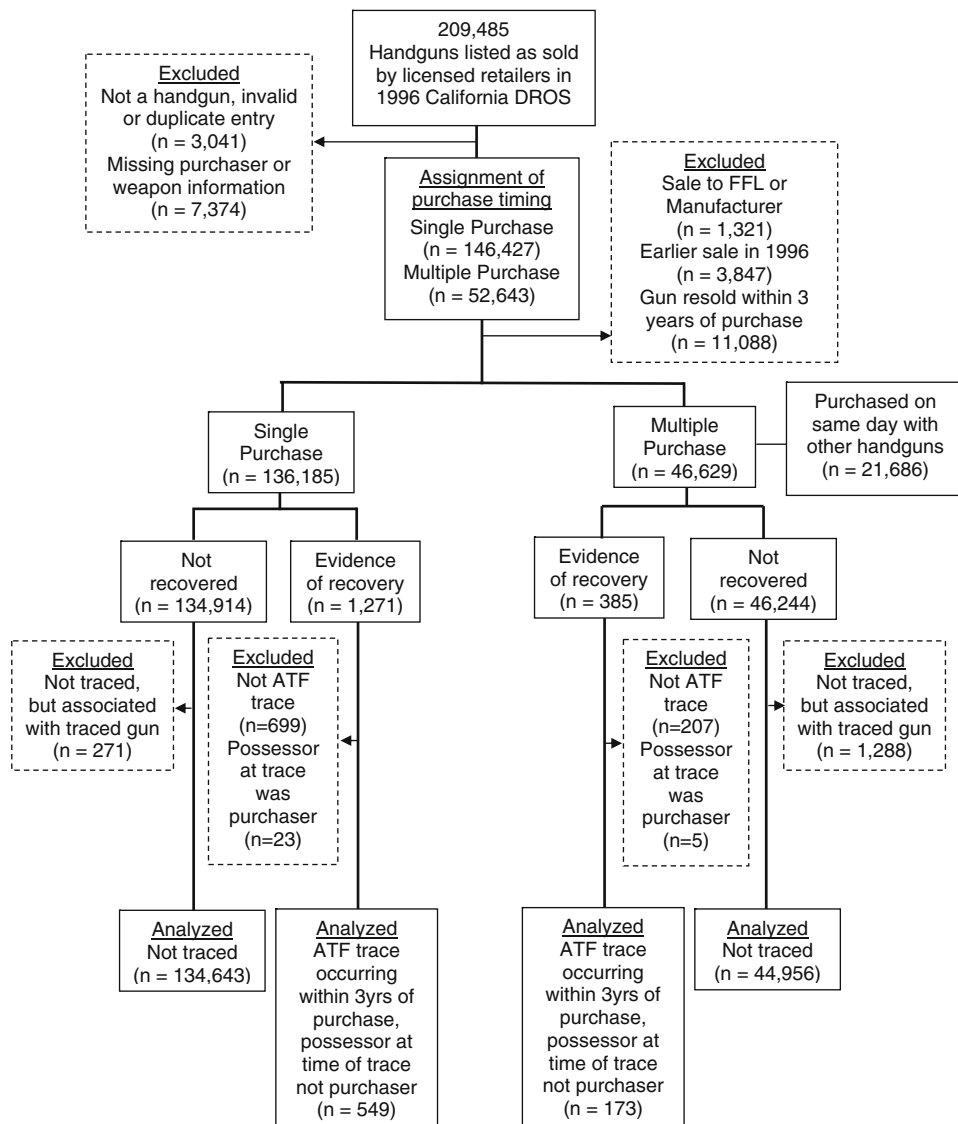
FIGURE 1. Study subject flow chart. Prior to assigning purchase timing (single or multiple), we excluded sale records that were not for handguns, that were duplicate or invalid entries, or were missing key variables. Following purchase timing assignment, we excluded sales to other retailers, earlier sales of guns sold more than once in 1996, and all guns resold within 3 years after purchase. We identified 182,814 handguns; 136,185 (74.5%) acquired in single purchases and 46,629 (25.5%) in multiple purchases. Among the multiple purchase handguns, nearly half (21,686 guns, 46.5%) were bought on the same day with others. Among handguns not recovered by a law enforcement agency, we excluded those which had been purchased by a buyer who had also purchased a traced gun. We also excluded ATF traced handguns where the possessor of the weapon at the time of the trace was the purchaser of the gun. Our final sample was 180,321 handguns (86.1% of all handgun sales in 1996).

In a bivariate analysis for all handguns (Table 1), multiple-purchase handguns bought on the same day with others were more likely to be traced than were single-purchase handguns (odds ratio [OR] 1.33, 95% confidence interval [CI] 1.08 to 1.63). Conversely, handguns purchased by the same individual within 30 days of

TABLE 1   Tracing within 3 years of purchase, following recovery by law enforcement from a person other than the gun's purchaser, for handguns purchased legally in California in 1996

Explanatory variable	Number (%) of guns		OR[a]	95% CI[b]	p value
	Traced N=722	Not traced N=179,599			
Related to purchase					
Timing					
Same-day multiple	111 (0.5)	20,492 (99.5)	1.33	1.08–1.63	<0.0001
30-day multiple	62 (0.3)	24,464 (99.8)	0.62	0.48–0.81	<0.0001
Single purchase	549 (0.4)	134,643 (99.6)	1.00	(Referent)	–
Related to handgun					
Type					
Derringer and single shot	47 (0.4)	11,114 (99.6)	1.36	0.98–1.88	0.3900
Semi-automatic pistol	511 (0.4)	115,828 (99.6)	1.42	1.19–1.69	0.0381
Revolver	164 (0.3)	52,648 (99.7)	1.00	(Referent)	–
Caliber					
Small (.22, .25, .32)	105 (0.3)	32,741 (99.7)	1.11	0.87–1.40	0.0587
Medium (.38, .380, 9)	421 (0.5)	79,229 (99.5)	1.83	1.55–2.17	<0.0001
Large (.357, .40, .44, .45, .50, 10)	196 (0.3)	67,593 (99.7)	1.00	(Referent)	–
Barrel length					
Short (≤3 in.)	278 (0.6)	49,515 (99.4)	1.65	1.42–1.92	<0.0001
Long (>3 in.)	439 (0.3)	129,000 (99.7)	1.00	(Referent)	–
Price					
≤$150	159 (1.4)	11,115 (98.6)	4.28	3.59–5.11	<0.0001
>$150	563 (0.3)	168,484 (99.7)	1.00	(Referent)	–
Related to retailer					
License type					
Importer or manufacturer	46 (0.7)	6,227 (99.3)	2.01	1.49–2.71	0.0152
Pawnbroker	80 (0.7)	11,707 (99.3)	1.86	1.47–2.35	0.0468
Dealer	595 (0.4)	161,638 (99.6)	1.00	(Referent)	–
Within 25 mi of YCGI[c] city					
Yes	500 (0.5)	93,725 (99.5)	2.06	1.76–2.42	<0.0001
No	222 (0.3)	85,874 (99.7)	1.00	(Referent)	–
Number of gun sales in 1996					
≥1,000	302 (0.5)	59,241 (99.5)	1.86	1.54–2.26	<0.0001
250–999	263 (0.4)	63,000 (99.6)	1.53	1.25–1.86	0.1597
1–249	157 (0.3)	57,358 (99.7)	1.00	(Referent)	–
Denials, % of sales+denials					
≥2%	167 (1.1)	15,556 (98.9)	4.09	3.39–4.94	<0.0001
1 to <2%	244 (0.5)	45,625 (99.5)	2.04	1.72–2.41	0.9295
<1%	311 (0.3)	118,418 (99.7)	1.00	(Referent)	–
Related to purchaser					
Gender					
Female	89 (0.8)	11,698 (99.2)	2.02	1.62–2.52	<0.0001
Male	633 (0.4)	167,844 (99.6)	1.00	(Referent)	
Age, years					
21–24	186 (1.0)	18,136 (99.0)	4.86	3.97–5.95	<0.0001
25–29	140 (0.6)	23,429 (99.4)	2.83	2.28–3.52	0.0043
30–39	202 (0.4)	46,035 (99.6)	2.08	1.71–2.53	0.0889
40+	194 (0.2)	91,969 (99.8)	1.00	(Referent)	–
Safety course exemption					
Law enforcement	36 (0.2)	17,632 (99.8)	0.49	0.35–0.69	<0.0001

TABLE 1 *(Continued)*

| | Number (%) of guns | | | | |
| | Traced | Not traced | | | |
Explanatory variable	$N = 722$	$N = 179,599$	OR[a]	95% CI[b]	*p* value
Professional	55 (0.5)	10,656 (99.5)	1.24	0.94–1.63	0.0004
None	631 (0.4)	151,311 (99.6)	1.00	(Referent)	–
Number and uniformity of all handguns purchased in 1996					
>1 handgun: all alike	42 (0.7)	6,152 (99.3)	1.58	1.15–2.18	0.0002
>1 handgun: some alike	41 (0.4)	11,652 (99.7)	0.82	0.60–1.13	0.1072
>1 handgun: none alike	196 (0.3)	59,014 (99.7)	0.77	0.65–0.91	0.0008
Purchased only 1 handgun	443 (0.4)	102,779 (99.6)	1.00	(Referent)	–

Missing data—handgun type: 9 not traced; caliber: 36 not traced; barrel length: 5 traced, 1,084 not traced; retailer license type: 1 traced, 27 not traced; gender: 57 not traced; age: 30 not traced; number and uniformity of guns purchased: 2 not traced

[a]Odds ratio
[b]Confidence interval
[c]Youth Crime Gun Initiative

another handgun purchase, but not on the same day, were less likely to be traced (OR = 0.62, 95% CI 0.48 to 0.81). Pistols, handguns of medium caliber, and those with short barrels were more likely than other handguns to be traced. Handguns selling new for $150 or less were four times as likely to be traced as were more expensive handguns (OR 4.28, 95% CI 3.59 to 5.11).

Handguns sold by a pawnbroker or importer/manufacturer were twice as likely to be traced as handguns sold by gun dealers. Handguns sold by retailers with denial percentages of 2% or greater were four times as likely to be traced as were handguns sold by retailers with denial percentages of 1% or less (OR 4.09, 95% CI 3.39 to 4.94). Handguns sold by dealers with high sales volume and handguns sold by dealers in close proximity to a city that participated in the YCGI gun tracing program had higher risk of being traced than other handguns. Handguns purchased by females were twice as likely to be traced as were those purchased by males (OR 2.02, 95% CI 1.62 to 2.52), and risk that a handgun would be traced decreased as the age of the purchaser increased. Handguns purchased by individuals who bought more than one gun during the year, and whose purchased handguns were all alike, were more likely to be traced than were handguns purchased by single-gun purchasers (OR 1.58, 95% CI 1.15 to 2.18).

A sequence of logistic regression models for all handguns, with related variables added in stages, is shown in Table 2. Across all models, a handgun's having been purchased on the same day with others, a low selling price, the retailer variables mentioned above, the gender and age of the buyer, and uniformity among all handguns purchased by the buyer were associated with an increase in risk for being traced. We tested for interactions between purchase timing and selected variables (price, gender, number and uniformity of purchases, denial percentage of retailer, number of retailer gun sales); none were identified.

Findings for multiple-purchase handguns only were similar (results not shown; available on request). Handguns that were part of same-day multiple purchases were twice as likely to be traced as were those from purchases spread over 30 days (OR 2.1, 95% CI 1.57 to 2.92).

TABLE 2 Multivariate regression results for all handguns

Variable	Handgun variables			Handgun and retailer variables			Handgun, retailer, and purchaser variables		
	OR[a]	95% CI[b]	p value	OR	95% CI	p value	OR	95% CI	p value
Related to purchase									
Timing									
Same-day multiple	1.29	1.03–1.56	0.0247	1.22	0.99–1.50	0.0587	1.29	0.97–1.71	0.0840
30-day multiple	0.70	0.54–0.91	0.0076	0.72	0.55–0.93	0.0125	0.83	0.61–1.15	0.2610
Single purchase	1.00	(Referent)		1.00	(Referent)		1.00	(Referent)	
Related to handgun									
Type									
Derringer and single shot	0.87	0.62–1.22	0.4106	0.92	0.65–1.29	0.6174	0.87	0.62–1.23	0.4238
Semi-automatic pistol	1.11	0.91–1.35	0.3097	1.08	0.88–1.31	0.4728	0.95	0.78–1.16	0.6162
Revolver	1.00	(Referent)		1.00	(Referent)		1.00	(Referent)	
Caliber									
Small	0.59	0.45–0.77	0.0001	0.56	0.43–0.74	<0.0001	0.62	0.47–0.82	0.0007
Medium	1.39	1.16–1.67	0.0005	1.28	1.06–1.54	0.0106	1.25	1.04–1.51	0.0187
Large	1.00	(Referent)		1.00	(Referent)		1.00	(Referent)	
Barrel length									
≤3 in.	1.29	1.08–1.54	0.0048	1.25	1.05–1.49	0.0134	1.30	1.09–1.56	0.0042
>3 in.	1.00	(Referent)		1.00	(Referent)		1.00	(Referent)	
Price									
≤$150	4.25	3.44–5.26	<0.0001	3.64	2.92–4.54	<0.0001	3.12	2.50–3.90	<0.0001
>$150	1.00	(Referent)		1.00	(Referent)		1.00	(Referent)	
Related to retailer									
License type									
Importer or manufacturer				1.99	1.46–2.71	<0.0001	2.01	1.47–2.73	<0.0001
Pawnbroker				1.56	1.20–2.02	0.0009	1.49	1.14–1.93	0.0032
Gun dealer				1.00	(Referent)		1.00	(Referent)	
Within 25 mi of YCGI[c] city									
Yes				1.70	1.43–2.03	<0.0001	1.69	1.41–2.01	<0.0001

	OR[a]	CI[b]	p	OR[a]	CI[b]	p
No	1.00	(Referent)		1.00	(Referent)	
Number of gun sales in 1996						
1,000+	1.79	1.43–2.24	<0.0001	1.62	1.29–2.03	<0.0001
250–999	1.69	1.37–2.08	<0.0001	1.57	1.27–1.94	<0.0001
1–249	1.00	(Referent)		1.00	(Referent)	
Denials, % of sales+denials						
≥2%	3.05	2.48–3.76	<0.0001	2.71	2.20–3.34	<0.0001
1 to <2%	1.59	1.34–1.89	<0.0001	1.50	1.26–1.79	<0.0001
<1%	1.00	(Referent)		1.00	(Referent)	
Related to purchaser						
Gender						
Female				1.50	1.19–1.90	0.0005
Male				1.00	(Referent)	
Age, years						
21–24				4.01	3.25–4.94	<0.0001
25–29				2.49	1.99–3.11	<0.0001
30–39				1.92	1.57–2.35	<0.0001
40+				1.00	(Referent)	
Safety course exemption						
Law enforcement				0.53	0.38–0.76	0.0004
Professional				1.32	1.00–1.74	0.0541
None				1.00	(Referent)	
Number and uniformity of all handguns purchased in 1996						
>1 handgun: all like this gun				1.54	1.06–2.26	0.0250
>1 handgun: some like this gun				1.03	0.69–1.52	0.8958
>1 handgun: none like this gun				0.91	0.73–1.14	0.4104
Purchased only 1 handgun				1.00	(Referent)	

Groups of variables were added to the model in stages: (1) related to handgun; (2) related to retailer; (3) related to purchaser. Purchase timing was included throughout.

[a]Odds ratio
[b]Confidence interval
[c]Youth Crime Gun Initiative

The effect of applying several risk factors serially is shown in Figure 2. Only 0.4% of all handguns in the study were traced under the conditions that met our definition of an outcome event. Among the 1,783 handguns that were purchased on the same day as others, and from a retailer with an increased percentage of denials (Level 2 in Figure 2), 25 (1.4%) were recovered by police and traced to a purchaser different from the possessor—a risk ratio of 3.5.

DISCUSSION

For handguns sold by licensed dealers in California in 1996, several specific factors predicted a greater likelihood that a handgun would be later recovered by police within three years of its sale and that the gun's purchaser and its possessor at the time of its recovery would not be the same person. Multiple-purchase handguns bought on the same day with others were at greater risk of being traced than were single-purchase handguns. This was not true for multiple purchase handguns bought over a period of up to 30 days. Gun traffickers may purchase several guns at once, on the same day, to maximize operational efficiency.
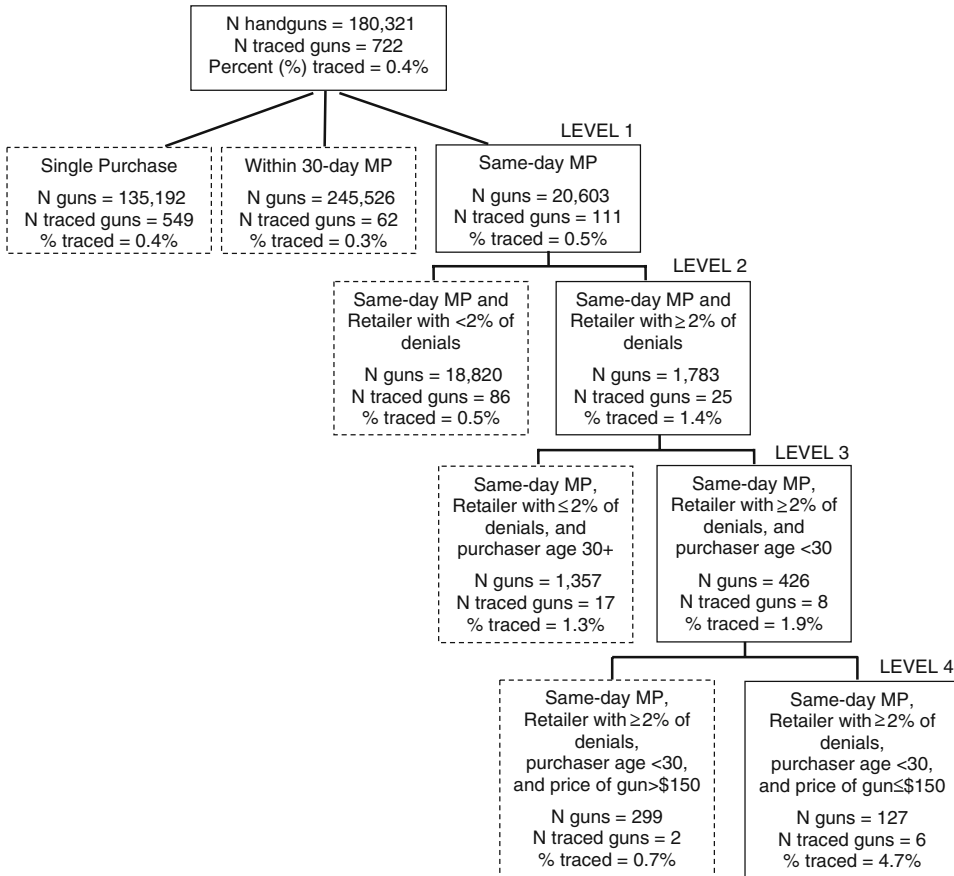
FIGURE 2. Effect of applying several risk factors serially. *LEVEL 1* same-day multiple purchase; *LEVEL 2* same-day multiple purchase and retailer with denials ≥2% of all prospective purchases; *LEVEL 3* same-day multiple purchase, increased denials, and purchaser age <30; *LEVEL 4* same-day multiple purchase, increased denials, purchaser age <30, and price of gun ≤$150.

Handguns purchased by individuals who bought multiple similar guns were 58% more likely to be used in crime than were handguns purchased by individuals who purchased only one handgun in 1996. This is a substantial difference. A case from our data illustrates the point: One purchaser bought 100 handguns in three transactions (two same-day multiple purchases and one single purchase). All handguns were Lorcin 9 mm pistols, costing $150 or less when purchased new. Nine of these handguns were traced by ATF within three years following purchase; another 10 appeared in a separate California database of guns recovered and held as evidence.

Koper[6] identified an increase in risk of tracing for multiple-purchase handguns, irrespective of the timing of the multiple purchase, in the first two years following purchase. Our study considered additional factors relating to the retailer and the purchaser, and one year of sales data with a three-year follow-up. These variations may explain the differences between the two studies. Webster and colleagues have recently shown that one-gun-a-month statutes are not associated with less intrastate gun trafficking.[19] Studies in other jurisdictions would be useful in identifying subsets of multiple-purchase handgun transactions that are disproportionately associated with guns that are later used in crime.

Several of the factors we associated with handguns' risk for being traced have been identified previously. These include a low selling price,[20,21] a female purchaser,[5] a younger buyer,[4,5] and a high percentage of denied sales and sales volume for the retailer.[5,13]

Others of our findings have not previously been reported. Risk for being traced was nearly twice as great for handguns sold by retailers licensed as manufacturers and importers as for those sold by gun dealers. We conducted a post hoc analysis of trace completion rates by retailer type to investigate the possibility that some traced handguns were linked to these firms only because the retailer actually selling the gun had not been identified. Completion rates were the same for traces for all three categories of retailers. Some of those licensed as manufacturers or importers have been the subject of site visits conducted by one of the authors for another study,[13] and all of these were functioning as retail sellers. This remains a subject for further investigation.

Our findings are subject to several limitations. We used a handgun's appearance in ATF's trace records, a proxy for use in crime, as our measure of outcome. To help focus our findings on activities associated with gun trafficking, we defined outcome events restrictively as traces occurring within three years of purchase and involving purchasers and possessors who were different people. ATF estimates the median time from sales to trace is nearly twice as long,[4] and our results should not be generalized to the larger population of recovered crime guns. Studies of that larger population have yielded similar results, however.[3,10]

Handgun sales records did not include the selling price or distinguish new from used guns. Our classification of guns as to cost was necessarily based on their selling price as new guns. We were not able to identify handguns that were sold used at much less than their original price, resulting in misclassification of some inexpensive guns as expensive.

The handguns in this study were purchased nearly 13 years ago. However, recent tracing data are not available, and it is unlikely that gun markets have changed substantially since that time. Four states—California, Maryland, Virginia, and New Jersey—now restrict handgun purchases to no more than one within a 30-day period. The remaining states do not limit the number of guns that can be purchased at one time; our findings likely reflect the current situation in those states.

Legitimate gun collectors may also buy many guns over the course of a year, and California's handgun sales records do not differentiate these purchasers from others. Our uniformity variable was devised in part in the belief that collectors would be less likely than purchasers for gun trafficking operations to buy many essentially identical handguns at once, but this belief has never been empirically tested. The mixed results that we and Koper have obtained may be due in part to an inability to distinguish multiple purchases by legitimate collectors from other multiple purchases.

Our findings provide some specific directions for future intervention and research. Handguns that are bought on the same day with others, are inexpensive, are purchased by young people or women, are acquired in purchases that involve multiple identical guns, or are sold by retailers whose clienteles include a disproportionate number of persons with significant criminal histories appear to be more likely than others to be used in crime. Law enforcement agencies and policymakers may wish to take such patterns into account in designing future monitoring and intervention programs and violence prevention policies. For example, some local and state law enforcement agencies have units that combat illegal gun sales and rely upon the same type of data used in this study—archives of handgun sales records and ATF traces of crime guns. ATF requires licensed retailers to report the sale of multiple handguns to the same individual within five business days, and these reports are already used to develop leads for gun trafficking investigations. Our findings should help these units to consider which of the thousands of crime gun traces to follow up with an investigation of possible trafficking.

Our findings are relevant to potential legislative initiatives as well. A ban on the sale of low-quality (and therefore inexpensive), highly concealable handguns, for example, has been associated with a decrease in firearm homicides.[21] In addition, a large gun dealer's voluntary decision to discontinue sales of these low-quality handguns led to a dramatic reduction in the rate at which guns sold by that dealer were diverted to the criminal market.[22] Future research efforts should examine further the relationship between multiple-gun purchases, particularly guns bought on the same day, and risk for use in crime, and should seek data directly from persons involved in illegal gun commerce.

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