



# Violence and beyond: Life-course features of handgun carrying in the urban United States and the associated long-term life consequences

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## ARTICLE INFO

### Keywords:

Handgun carrying  
Firearms  
Violence  
Life chances  
Life-course  
Urban

## ABSTRACT

**Purpose:** Although previous research has made progress in identifying correlates of risky gun-related behavior and its impact on violence and injury, particularly during adolescence, it is not clear how individuals differ in their gun carrying behavior over time or how developmental features of carrying affect experiences and accomplishments later in the life.

**Methods:** Using data from the National Longitudinal Survey of Youth 1997 (NLSY97), we delineated age-specific patterns of handgun carrying in the urban United States and investigated how onset age, duration, and timing of handgun carrying affected criminal offending, substance use, police arrest, and educational and economic achievements in established adulthood.

**Results:** There is important heterogeneity in individuals' handgun carrying behavior over time in the urban United States. Developmental features of handgun carrying are significant predictors of negative life outcomes in a variety of domains.

**Conclusions:** Individuals who carry firearms should not be assumed as of one general type. Efforts to prevent risky gun-related behavior and associated negative long-term consequences can be better targeted if we take into account developmental heterogeneity in such behavior.

## 1. Introduction

Gun violence causes serious mortality and morbidity among adolescents and young adults in the United States. For individuals between 10 and 34, homicide is the third leading cause of death (following unintentional injury and suicide) and 85% of homicide deaths involve a firearm (Centers for Disease Control and Prevention, 2017a). On average, twenty-three 10 to 34 year olds are killed by gunshot assault each day; for each individual that dies of a gunshot assault, five more will survive, undergoing extensive treatment in hospital emergency departments (Centers for Disease Control and Prevention, 2017b). In effect, many young victims of homicide and serious assault have been shot in the past, and thus had to endure physical, emotional and economic consequences due to injury and violence for years. Some of these victims were perpetrators too, indicating the importance of tackling this issue from both a public health and criminal justice perspective.

Individuals younger than 18 years are prohibited from carrying handguns in most states unless under direct supervision by parents or guardians (Molnar, Miller, Azrael, & Buka, 2004; Vaughn, Salas-Wright,

Boutwell, DeLisi, & Curtis, 2017). Nevertheless, data from large-scale national studies reveal notable levels of self-reported gun carrying among American youth. For instance, using data from the Youth Risk Behavior Surveillance System (YRBSS), Grunbaum et al. (2002) found that 5.7% of high school students in the United States reported carrying a firearm in the preceding 30 days in 2001.<sup>1</sup> More recently, using data from the National Survey on Drug Use and Health (NSDUH), Vaughn, Nelson, Salas-Wright, DeLisi, and Qian (2016) estimated that the prevalence of handgun carrying in the past year among adolescents ages 12–17 in the United States was 3.4% (See also Wilkinson & Fagan, 2001 for a review).

Given the extent of handgun carrying behavior among American youth and its well-established contribution to violent injuries (Ash & Kellerman, 2001; Lowry, Powell, Kann, Collins, & Kolbe, 1998; Pickett et al., 2005), considerable research has dedicated to identifying correlates of handgun carrying. Important risk factors include being male, minority background, prior exposure to violence, individual history of substance use, poor academic performance, low self-control and esteem, family poverty, inadequate parenting, neighborhood

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<sup>1</sup> The YRBSS data showed that 7.9% of students reported carrying a gun in the previous 30 days in 1993; 7.6% of students had carried a gun during the previous 30-day period in 1995; and 5.9% of students reported gun-carrying behavior in 1997 (Wilkinson & Fagan, 2001).

disadvantage and disorder, peer delinquency and gang affiliation, and involvement in drug dealing and other criminal activities (Lizotte, Krohn, Howell, Tobin, & Howard, 2000; Molnar et al., 2004; Simon, Richardson, Dent, Chou, & Flay, 1998; Steinman & Zimmerman, 2003; Tigri, Reid, Turner, & Devinney, 2016; Vaughn et al., 2016, 2017; Wallace, 2017). Although corresponding preventive interventions based on risk-factor research have been implemented at different socio-ecological levels, their effects are modest at best (Bushman et al., 2016; Wilkinson & Fagan, 2001).

To further improve the effectiveness of preventive interventions against risky gun carrying, three important issues call for additional research. First, heterogeneity in handgun carrying behavior needs to be better understood. Although the overall prevalence of handgun carrying behavior among youth is known, it is not yet clear how that prevalence varies by age. Also, different sociodemographic groups may exhibit distinct age-graded patterns of handgun carrying. From a life-course perspective, onset age, duration, and timing of carrying are important features for understanding heterogeneity in handgun carrying but as of yet are understudied. Second, existing research has mainly examined the immediate or short-term impact of handgun carrying on injury and violence during adolescence or emerging adulthood. Additional research is needed to investigate its long-term consequences in established adulthood as many life transitions are completed. Third and related, it is necessary to examine how developmental features of handgun carrying are related to life outcomes in multiple domains. For instance, if handgun carrying is correlated with educational and economic underachievement beyond emerging adulthood, addressing gun carrying behavior may have longer term benefits than solely those related to youth injury and violence prevention. The current investigation aims to address these three important issues.

### 1.1. Handgun carrying in a life-course perspective

The life-course perspective emphasizes the importance of treating behavior as constantly changing as various needs, interests, opportunities, and events impinge upon actors as individuals age (Baltes, 1987). To date, criminologists have agreed on the significance of studying initiation, length/duration, timing, and escalation and de-escalation of offending behavior, investigating distinct origins and consequences associated with each of these developmental features (Farrington, 2005; Piquero, Farrington, & Blumstein, 2003; Sampson & Laub, 2005; Thornberry & Krohn, 2005). Accordingly, individual behavior, including handgun carrying, should not simply be treated as a dichotomy of “yes” versus “no”; rather, it is imperative to take into account developmental heterogeneity or age-specific patterns when studying a particular behavior.

With regard to handgun carrying, we consider age of onset, duration, and developmental stage potentially important. Early onset of handgun carrying represents a marker for serious and extensive involvement in law-violating behavior (Spano, 2012). Life-course theories suggest that an earlier onset of antisocial behavior indicates a greater likelihood of combination and interaction of risks from multiple domains including neuropsychological deficit and difficult temperament, ineffective parenting, and adverse position in the social structure (Moffitt, 1993; Thornberry & Krohn, 2005). For instance, children who grew up in disadvantaged and disordered neighborhoods were frequently exposed to violence; intertwined with negative temperament and inadequate parental attachment and supervision, these individuals are likely to initiate their gun carrying very early in life. As an individual ages into adolescence, greater peer influence should be taken into account. In addition to self-protection, status-seeking or imitation become important reasons for the initiation of handgun carrying when

youth are striving for “age-appropriate autonomy” (Conger, 1991); adolescent peer networks are partially closed to adult authority (e.g. parents or teachers) while valuing behaviors that demonstrate separation or rebellion from adult authority. Additionally, social contagion of fear and violent identities contribute to an expansion of gun carrying behavior among adolescents (Wilkinson & Fagan, 1996). Eventually, individuals who initiate handgun carrying during adulthood are more likely to go through deliberation and possess required knowledge and skills to handle a firearm than are early initiators. In short, we hypothesize that an earlier onset of handgun carrying is related to heightened risk in criminal offending as well as other adversities in the life-course.

While early onset of antisocial behavior is often associated with a prolonged duration of involvement, the strength of that connection is modest (Thornberry & Krohn, 2001, 2005). Among earlier initiators some will persist, but many others will desist; similarly, among later initiators some will try out and desist relatively quickly, but others will continue. Two developmental processes are important in understanding the prolonged duration of handgun carrying and its impact on long-term consequences. First, there is stability in the risk factors that lead to handgun carrying. For instance, families experiencing extreme levels of structural disadvantage do not often escape from that adversity, and the development of children raised under such circumstances is constantly compromised; there is continuity in inadequate parenting, introduced by the constancy of the social environment in which these families often find themselves (Patterson, Reid, & Dishion, 1992). Also, negative temperament and neuropsychological deficits are found relatively stable in the life-course (Caspi, Bem, & Elder, 1989; DeLisi & Vaughn, 2014; Moffitt, Lynam, & Silva, 1994).

The second process pertains to developmental consequences of earlier events. Handgun carrying generates a range of negative consequences that set up a temporal contagion process. These negative consequences then evoke undesirable, reciprocal relationships with the surrounding environment, which, in turn, reinforce the continuity of handgun carrying. For instance, Loughran, Reid, Collins, and Mulvey (2016) found that despite materially worse outcomes in exposure to violence both as a victim and witness, gun carrying led to lower *perceptions* of risks and costs and higher *perceived* rewards of criminal offending. Other collateral consequences include that handgun carrying elicits coercive and punitive responses from parents or the school system, which set individuals further apart from conventional institutions (e.g. through conflict in parent-child relationship or school expulsion/failure). Young carriers are also likely to be rejected by conventional peers and thus have to affiliate with delinquent ones. Given that peers replace parents as major sources of social approval and support during adolescence (Uchino, 2004), delinquent peers (especially gang members) help define and endorse pro-gun carrying attitudes and behaviors, which eventually contribute to unstructured routine activities or deviant life styles, and the formation of deviant self-identity (Lizotte et al., 2000; Tigri et al., 2016; Watkins, Huebner, & Decker, 2008; Wilkinson & Fagan, 2001). Moreover, the *drug involvement* model associates gun-carrying with the use and distribution of drugs (Blumstein, 1995; Steinman & Zimmerman, 2003). On the one hand, drug use affects the physiological functioning of an individual, leading to decreases in self-control and increases in aggression, and perhaps indirectly, gun carrying; on the other hand, young people's involvement in drug sales facilitates gun possession and carrying.

However, there is also a social process that may explain a brief involvement or desistance from handgun carrying. As the age of onset increases, the strength of the causal force diminishes. That is, “the causal factors are less numerous, less extreme, and less intertwined. Because of that, they are also less likely to be highly stable over time”

(Thornberry & Krohn, 2005, p.201). When causal factors of carrying are not reaching an extraordinary level, positive changes are possible, thus providing *turning points* in one's handgun carrying trajectory. Relatedly, the causal factors that give rise to the initial handgun carrying may not be intensely coupled. Although the deficits in particular areas (e.g. having a difficult temperament) do put individuals at risk for handgun carrying, compensating assets in other life domains (e.g. having good parents or educational resources) reduce their likelihood of experiencing the tight interweaving of adversities brought about by feedback effects from earlier carrying.

Moreover, developmental stages of handgun carrying synthesize life-course information about the behavior.<sup>2</sup> From both a theoretical and practical standpoint, individuals' trajectories of handgun carrying can be categorized into three stages: *Carrying a handgun before 18 only* (or “*adolescent carriers*”) reflects a relatively early onset and mostly illegal carrying record; however, the length of carrying is limited for individuals in this group. They are likely to experience risk of weapon or gun carrying early in life, but compensating factors and/or traumatic events (e.g. violent injuries) could have deflected them from a persistent pattern of carrying. *Carrying a handgun at or after 18 only* (or “*adult carriers*”) reflects a relatively late onset and perhaps mixed legal and illegal carrying record. Individuals in this group are likely to exhibit a longer duration of carrying than those in the previous group because initiating gun carrying beyond adolescence implies a more deliberate choice that derives from self-interests rather than simply being influenced by a friend or for temporary amusement. Given the immediate facilitating effects of weapon or gun carrying on violence, we argue that negative consequences associated with this subset of carriers are likely to emerge in the aggression or violence domain; these individuals are less likely to endure adversities in other life domains such as educational or economic arenas than the other two groups. Additionally, *carrying a handgun across both stages* (or “*persisters*”) indicates both an early onset and a prolonged involvement in the behavior. Although there exists the possibility that early illegal carrying converts into law-abiding carrying that satisfies minimum age and other eligibility requirements, we suspect that such continuity reflects tight interweaving of risks, and sustained engagement in drug sales and/or other criminal activities that involve substantial violence and emphasize self-protection. These individuals tend to experience the worst outcomes in a variety of life domains.

## 1.2. Research on developmental heterogeneity in handgun carrying

In the previous section, we discussed the theoretical underpinnings of developmental heterogeneity in handgun carrying and how it may affect long-term consequences. Empirical research on this issue, however, is very limited, indicating the need for further investigation. Here we highlight several studies that have informed the current study.

Using data from the Rochester Youth Development Study, Lizotte, Howard, Krohn, and Thornberry (1996) conducted an early investigation of longitudinal patterns of illegal gun carrying among young urban males. They assessed the magnitude and consistency in carrying when study subjects were between about 15 and 20 years of age. They reported that 22% of the sample carried a hidden, illegal gun at some point during the study period, and carrying patterns were rather heterogeneous. While more than half (53.2%) of those who ever carried did so in only one wave, about 25% carried in three waves or more. The

probability of carrying did not fade in time. For instance, about one-third of these subjects carried from one wave to another and this percentage was about the same regardless of the length of time between waves. They also found that roughly the same number of people carried for each wave of data, but the carriers tended to be different people. Lizotte et al. (1996) argued that a relatively small number of illegal guns may be passed around in the cohort. Moreover, in examining the immediate effects of gun carrying on delinquency, they found that those who carried hidden, illegal guns were much more likely to be involved in all forms of delinquency than those who did not carry.

Steinman and Zimmerman (2003) explicitly called for exploring heterogeneity in gun-carrying behavior. They contended that previous studies failed to distinguish youth who occasionally carry a gun from those who regularly do so, but modeled gun-carrying as a dichotomous “ever” vs. “never” outcome. “This failure to differentiate patterns of gun-carrying may be significant, as other adolescent risk behaviors have experimental and persistent patterns, each with its own distinct origins and consequences” (p.356–357). To address this issue, they interviewed a sample of 705 African-American youths annually from 9th through 12th grade, and differentiated episodic and persistent gun-carrying.<sup>3</sup> They found that episodic gun-carrying (15% of their sample) was three times as common as persistent gun-carrying (5%). Thus, studies that dichotomized gun-carrying as “ever” vs. “never” may be largely discussing episodic gun-carrying. Yet, similar risk factors (e.g. fighting and selling drugs) characterized both episodic and persistent gun-carrying, suggesting that episodic and persistent patterns of gun-carrying may differ by a matter of degree rather than being qualitatively distinct phenomena.

More recently, using data from the National Longitudinal Survey of Adolescent Health, Wallace (2017) explored the stability of weapon carrying over time—assessing whether carrying a weapon to school as a juvenile is predictive of bringing a handgun to school or work in early adulthood. Although there was a general decline in weapon carrying behavior over time among the sample, prior weapon carrying in adolescence was a key correlate of adult handgun carrying in the school or workplace beyond easy access to guns in the home, demonstrating that, like many antisocial behaviors, past actions are strong predictors of current behavior.

While not directly addressing *developmental* heterogeneity in handgun carrying, Wilkinson and Fagan (2001) presented information concerning distinct carrying patterns. Through in-depth interviews with a sample of 377 active gun offenders from two New York City neighborhoods, they observed that “respondents' carrying habits reflect the newness of the gun, the newness of having a gun, routine activities, involvement in an ongoing conflict or ‘beef’, and the level of police presence in the neighborhood” (p.119). More recently, Vaughn et al. (2017) made an important contribution by identifying subgroups of handgun carriers using a pooled, cross-sectional sample of 12- to 17-year-olds from the National Study on Drug Use and Health (NSDUH). Through latent profile analysis of 10 indicators of externalizing behavior, they classified carriers into four categories: *Low risk* (47.9%), *alcohol and marijuana users* (20.2%), *fighters* (19.4%), and the *severe subset* (12.5%). Importantly, these subgroups differed on demographic, behavioral, and psychosocial characteristics as well as the frequency of handgun carrying and arrest history. “Study findings suggest not only different etiologies but also possibly invite different prevention and intervention strategies” (p.32). They concluded that research on handgun carrying should continue to explore the issue of heterogeneity, rather than assuming all youth fit one type of profile. Additional studies demonstrated that variations in gun carrying were related to the local prevalence of gun ownership and rate of youth violence (Cook &

<sup>2</sup> Descriptive statistics from the NLSY97 longitudinal urban sample provided preliminary evidence for our arguments: Individuals who carry a handgun across both stages (or persistent carriers) exhibit the earliest onset (mean age = 13.7 years) and the longest duration (mean duration = 4.2 waves of data collection); adolescent carriers have a mean onset age of 14.1 years, and the shortest duration (mean duration = 1.3 waves of data collection); adult carriers exhibit the latest onset (mean age = 22.1 years) and a mean duration of 2.5 waves of data collection.

<sup>3</sup> Episodic gun-carrying was defined as carrying a gun during one or two waves of the study, whereas persistent gun-carrying involved carrying a gun during three or four waves.

Ludwig, 2004), and state gun law environment (Xuan & Hemenway, 2015).

To sum up, we concur with Vaughn et al. (2017) that “although much has been learned about handgun carrying among adolescents generally, there has been little analysis on its heterogeneity. Multiple line of inquiry suggests there are good reasons to believe that adolescents who carry handguns in the United States are more varied than what is typically portrayed in the research literature” (p.22). Understanding heterogeneity is not only important from a theoretical or research standpoint, but also matters tremendously when deciding how best to allocate resources to prevent gun-related violence.

### 1.3. The current study

Against this background, the current study specifically explores developmental heterogeneity or age-specific patterns of handgun carrying. In addition, we advance prior work in three other aspects. First, extant research on youth and guns mainly relies on three sources of data: (1) nationally representative samples of adolescents in schools, (2) selected samples of youth from high-risk, disadvantaged communities, and (3) target samples of criminal justice or criminally involved offenders. The limited scope of each data source, however, hinder our understanding of the entirety of handgun carrying among American youth (Wilkinson & Fagan, 2001). Using data from a nationally representative sample of youth from carefully screened housing units (Moore, Pedlow, Krishnamurty, & Wolter, 2000), the current study assures a comprehensive understanding of handgun carrying patterns. Second, previous research on longitudinal patterns of gun carrying has covered only a relatively short period of life span, and most often, the early adolescent years. For instance, Lizotte et al. (1996) examined 7 waves of the RYDS data when the subjects were, on average, between 15 and 20 years old. Similarly, Steinman and Zimmerman (2003) collected data from high school students annually between 9th and 12th grade. Wallace (2017) covered a span of 7 years with 3 waves of the Add Health data; however, the long time lapse between Wave 2 and 3 interviews (approximately 6 years) prohibited characterizing carrying patterns with high specificity. For the current study, we assembled 15 annual waves of data on handgun carrying, spanning from early adolescence to established adulthood. Given the aforementioned, age-specific patterns depicted with our data will significantly enhance our understanding of handgun carrying over time. Last but not least, we extend prior work by investigating how life-course features of gun carrying are related to long-term consequences in a variety of life domains. Despite its immediate impact on injury and violence, especially among adolescents, gun carrying may lead to *cumulative disadvantage* in other life domains.

## 2. Methods

### 2.1. Data and sample

The data for the current study come from the National Longitudinal Survey of Youth 1997 (NLSY97). Coordinated by the U.S. Bureau of Labor Statistics, the NLSY97 consists of a nationally representative sample of 8984 American youth born between 1980 and 1984. Respondents were between ages 12 and 16 years old as of December 31, 1996. The NLSY97 cohort was selected from a two-stage sampling design with households as the primary unit and eligible respondents as the secondary unit. Specifically, the overall sample comprises two independent probability samples: (1) a cross-sectional sample of 6748 respondents and (2) an oversample of 2236 African-American and Hispanic respondents. The NLSY97 cohort has been surveyed annually between 1997 and 2011 and, since then, biennially. At the time of this analysis, 16 waves of data are publicly available. The overall retention rate over the 16 waves of data collection is 79.5%.

For the current study, we only included respondents who resided in

an *urban* area as of the survey date of Wave 1 data collection.<sup>4,5</sup> Legault and Lizotte (2009) characterized demographics of legal and illegal gun ownership and use in the United States. They suggested that the average legal gun owner/user was socialized into the gun culture through gun-owning parents in a rural area; on the contrary, illegal gun owners/users do not tend to be rural and the socialization mainly came from deviant peers, not the family. In addition, illegal gun carriers overwhelmingly preferred handguns for their concealability and power (Bjerregaard & Lizotte, 1995; Sheley & Wright, 1995; Wright & Rossi, 1986). Given that the handgun carrying questions were asked in the delinquency section of the NLSY97 self-administered questionnaire, preceded and followed by other law-violating behaviors, we perceive handgun carrying as a generally risky behavior in this study (see also Branas, Richmond, Culhane, Ten Have, & Wiebe, 2009; Dodson, 2016; Loughran et al., 2016; Webster, Cerda, Wintemute, & Cook, 2016 for treating handgun carrying as a generally risky behavior).

Although we were not able to conclusively distinguish between legal and illegal handgun carrying with the NLSY97 data, several appealing features of the NLSY97 data are worth mentioning. First, the data are nationally representative; the results drawn from the NLSY97 are general to the U.S. and are not constrained by sample selectivity (e.g. school or offender sample). Second, although other large-scale studies such as the National Survey on Drug use and Health (NSDUH) or data from the CDC's Youth Risk Behavior Surveillance System (YRBSS) are appropriate for trend analyses of weapon or gun carrying behavior in the U.S., only the NLSY97 allows investigating the developmental features of individuals' handgun carrying from one year to the next, spanning early adolescence to established adulthood. Third, the NLSY97 data are rich, containing a large number of measures from questions covering a wide range of relevant topics.

### 2.2. Measures

#### 2.2.1. Handgun carrying: Since the date of the last interview

A key measure of interest was whether a respondent carried a handgun since the date of the last interview. At Wave 1, the subjects were asked: “Have you ever carried a handgun? When we say handgun, we mean any firearm other than a rifle or shotgun.” Those who answered yes to that question were subsequently asked: “Have you carried in the past 12 months?” Individuals who answered yes to the second question were coded “1” for Wave 1. Beginning in Wave 2 till Wave 15, individuals responded to: “Have you carried a handgun since the last

<sup>4</sup> There are two ways of defining urban residence with the NLSY97 data, both of which rely on the standard Census Bureau definitions. The first variable (CV\_MSA) identifies the respondent's residence status related to a metropolitan area. For instance, Ewing, Brownson, and Berrigan (2006) included only members of the NLSY97 cohort living in metropolitan areas in their study of obesity and urban built environment. The second variable (CV\_URBAN-RURAL) directly indicates whether the respondent lives in an urban or rural area (as defined by the Census Bureau). One major advantage associated with using the second variable is that the urban and rural designation is applied at a finer level than metropolitan areas, such that populations and areas within a metropolitan area may be assigned both urban and rural components; on the other hand, the units that define metropolitan areas are counties. In addition, critiques of the metropolitan area nomenclature include potential underestimation of the population living in rural areas due to the annexation of mostly rural counties that border a metropolitan area (Johnson-Webb, Baer, & Gesler, 1997). For these reasons, we adopted the second definition in the current study. See Hall, Kaufman, and Ricketts (2006) for a detailed review of available definitions of urban and rural for American geographic subunits and their respective strengths and weaknesses.

<sup>5</sup> We investigated the issue that individuals may move in and out of an urban area across waves of data collection. Our analysis, however, showed that residence in an urban area was a relatively stable phenomenon in the NLSY97 cohort. For instance, the correlation of urban residence between Wave 1 and 2 was above 0.91 and that correlation was still above 0.68 between Wave 1 and 7. We also suspect that residing in an urban versus rural area earlier in life might have a greater impact on life-course features of handgun carrying. Thus, we consider categorizing residence in an urban versus rural area using Wave 1 information was adequate for the current study. Since Wave 8, the NLSY97 adopted a different standard in categorizing residence in an urban or a rural area.



**Table 1**  
Descriptive statistics of the NLSY97 urban sample.

	Full sample			Ever carried a handgun						Diff.
				No			Yes			
	N	Raw %	Weighted %	N	Raw %	Weighted %	N	Raw %	Weighted %	
Handgun carrying	6749	100%	100%	4906	73%	73%	1843	27%	27%	
Gender										
Male	3432	51%	51%	2023	41%	42%	1409	76%	77%	***
Female	3317	49%	49%	2883	59%	58%	434	24%	23%	***
Race										
Black	1908	28%	17%	1350	28%	17%	558	30%	20%	**
Hispanic	1711	25%	16%	1237	25%	16%	474	26%	17%	
Other	73	1%	2%	54	1%	2%	19	1%	1%	
White	3057	45%	65%	2265	46%	66%	792	43%	62%	**
Region										
Northeast	1236	18%	19%	996	20%	21%	240	13%	13%	***
North Central	1398	21%	23%	1029	21%	24%	369	20%	23%	
South	2310	34%	32%	1599	33%	30%	711	39%	36%	***
West	1805	27%	26%	1282	26%	26%	523	28%	29%	^

Abbreviation: Diff. = statistical difference. Chi-square tests (adjusted for design effects) were used to compare differences in sociodemographic characteristics between urban non-handgun carrying and handgun-carrying respondents.

\*\*\*  $p < 0.001$ .

\*\*  $p < 0.01$ .

^  $p < 0.10$ .

interview on [date of last interview]? When we say handgun, we mean any firearm other than a rifle or shotgun.” Responses were coded “1” for yes, and “0” for no at each wave. Answers to this series of questions allowed us to compile a history of each individual's handgun-carrying status from Wave 1 when participants were between the ages of 12 and 18 to Wave 15 when participants were between the ages of 26 and 32.

### 2.2.2. Handgun carrying: ever prevalence

To investigate whether the respondents who ever carried a handgun were different from those who never carried a handgun up until Wave 15 of the NLSY97 on socio-demographic and geographic characteristics, we compiled information from two sets of questions. As mentioned above, at Wave 1, the respondents were asked: “Have you ever carried a handgun? When we say handgun, we mean any firearm other than a rifle or shotgun.” The exact same question was asked between Waves 2 and 9 for participants who did not provide an answer in previous rounds of data collection. Thus, individuals who answered yes to this question (through Waves 1–9) or self-reported handgun carrying between Waves 1 and 15 consisted of “ever handgun carriers”. As Table 1 shows, approximately 27% of the NLSY97 urban sample ever carried a handgun.

### 2.2.3. Handgun carrying: age of onset, duration, and developmental stages

We explored three key developmental features of handgun carrying among a subset of ever carriers. Participants who answered yes to the “ever” question but reported not carrying a handgun between Waves 1 and 15 were excluded from the analysis.<sup>6</sup> We call this sub-sample the NLSY97 longitudinal urban sample.

**2.2.3.1. Age of onset.** At Wave 1, for the respondents who reported ever carrying a handgun, they were asked: “How old were you when you first carried a hand gun?” The same question was asked between Waves 2 and 5 for participants who did not provide an answer in previous rounds of data collection. For individuals who initiated handgun

carrying after Wave 5, the age at which they first responded yes to “handgun carrying: Since the date of the last interview” were recorded as the onset age.<sup>7</sup> Age 8 was used as a minimum value for this variable because onset prior to this age was rare and may not convey reliable and meaningful information.

**2.2.3.2. Duration.** We calculated the duration of handgun carrying among the NLSY97 longitudinal urban sample as the total number of waves they reported yes to “handgun carrying: Since the date of the last interview”. Thus, the minimum value for this variable is 1, and the maximum value can be as large as 15.

**2.2.3.3. Developmental stages.** We divided subjects' duration of handgun carrying into three developmental stages: < 18 only, ≥ 18 only, and across both stages. We name the three groups, respectively, “adolescent carriers”, “adult carriers”, and “persisters”. Specifically, the minimum age of handgun carrying equals subjects' onset age and the maximum age equals the age when they last reported yes to “handgun carrying: Since the date of the last interview”. The respondents were assigned to the “adolescent carriers” category, if their maximum age is smaller than 18; the respondents were assigned to the “adult carriers” category, if their minimum age is larger or equivalent to 18. For individuals whose minimum age is smaller than 18 and maximum age is larger or equivalent to 18, they were assigned to the “persisters” category.

### 2.2.4. Adult outcomes

Since we are interested in the long-term consequences of handgun carrying in established adulthood across multiple life domains, outcome variables tapping violent offending, illegal drug sale, substance use, police arrest, educational achievement, and legitimate income were assessed. To preserve temporal order, outcomes were measured either at Wave 15 or 16 depending on data availability.

**2.2.4.1. Violent offending.** At Wave 15, the respondents were asked: “Since the last interview on [date of last interview], have you attacked someone with the idea of seriously hurting them or have had a situation

<sup>6</sup> We also excluded participants who had missing information on the key measure of “handgun carrying: Since the date of the last interview” for more than half of the 15 waves. There were no statistically significant differences between the NLSY97 longitudinal urban sample ( $n = 1585$ ) and those excluded from the analysis ( $n = 258$ ) with respect to race and geographic location. However, males were more likely to be excluded from the analysis ( $p < 0.05$ ).

<sup>7</sup> As a cross-check, we ensured that each subject's onset age is smaller or equivalent to the age when they first reported yes to “handgun carrying: Since the date of the last interview”.

end up in a serious fight or assault of some kind?” Responses were coded “1” for yes, and “0” for no. It is worth noting that the universe for this question was restricted; it was asked only of respondents who had ever reported being arrested and also a control group of approximately 10% of the respondents for comparison.

**2.2.4.2. Drug sale.** At Wave 16, the respondents were asked: “Since the last interview on [date of last interview], have you sold or helped to sell marijuana (pot, grass), hashish (hash) or other hard drugs such as heroin, cocaine or LSD?” Responses were coded “1” for yes, and “0” for no. The universe for this question was again restricted; it was asked only of respondents who had ever reported being arrested and also a control group of approximately 10% of the respondents for comparison.

**2.2.4.3. Substance use.** At Wave 15, the respondents were asked, since the date of last interview, if they 1) had a drink of an alcoholic beverage, 2) used marijuana, even if only once, and 3) used any drugs like cocaine, crack, heroin, crystal meth, or other substance not prescribed by a doctor, in order to get high or to achieve an altered state. Following Sweeten (2012), we summed the three dichotomous variables and created a variety scale of substance use that ranged between 0 and 3. Higher scores indicated more instances of substance use.

**2.2.4.4. Police arrest.** At Wave 16, the respondents were asked: “Since the last interview on [date of last interview], have you been arrested by the police or taken into custody for an illegal or delinquent offense (do not include arrests for minor traffic violations)?” Those who answered yes to that question were subsequently asked: “In total, how many times have you been arrested since the last interview on [date of last interview]?” Based on the two questions, we created a count measure of police arrest.

**2.2.4.5. Educational achievement.** The respondents' highest degree received as of the last round of data collection was categorized into 4 levels: without a high-school diploma (“0”), high-school diploma (“1”), Associate/Junior college or Bachelor's degree (“2”), or Master's degree and above (“3”).<sup>8</sup>

**2.2.4.6. Legitimate income.** At Wave 16, the respondents' income from wages, salary, commissions, or tips from all jobs was categorized into 8 levels: none (“0”), less than \$5000 (“1”), between \$5001 and \$10,000 (“2”), between \$10,001 and \$25,000 (“3”), between \$25,001 and \$50,000 (“4”), between \$50,001 and \$100,000 (“5”), between \$100,001 and \$250,000 (“6”), or more than \$250,000 (“7”).

## 2.2.5. Control variables

We included theoretically informed variables in the analysis in order to control for individual characteristics and prior behaviors that may be related to both handgun carrying and life outcomes. To preserve temporal order, control variables were measured at the baseline interview.

We created dummy indicators for *male* (reference group is female), *African-American* and *Hispanic* race/ethnicity (reference group is white).<sup>9</sup> Geographic location was also indicated by dichotomous variables: *North Central*, *South*, and *West* (reference group is Northeast). The respondent's *age* was a continuous variable, and was controlled for potential cohort effects. *Two-parent family* indicated whether the respondent lived with both biological parents (1 = yes, 0 = no). *Parental education* indicated the highest grade completed by parents. *Family*

<sup>8</sup> As a robustness check, we also ran analyses using the highest grade completed by the respondents. The same substantive findings were observed.

<sup>9</sup> The “other” group was dropped from the outcome analysis due to its very small sample size.

*affluence* was a ratio of household income to poverty level; values above (below) 1 indicated incomes exceeded (fell short of) the poverty line in the previous year.

*Victim of bullying* indicated whether the respondent was ever the victim of repeated bullying before age 12 (1 = yes, 0 = no). *Seen shot* asked whether the respondent saw someone get shot or shot at with a gun before age 12 (1 = yes, 0 = no). *Delinquency* was a variety scale of 10 delinquent acts<sup>10</sup>; scores ranged from 0 to 10 and higher scores indicated more instances of delinquency. *Substance use* was a variety scale of 3 acts<sup>11</sup>; scores ranged from 0 to 3 and higher scores indicated more instances of substance use. *Peer gang affiliation* measured what percent of the respondent's peers belonged to a gang that did illegal activities; responses were indicated on a five-point scale from “almost none (1)”, “about 25% (2)”, “about half (3)”, “about 75% (4)” to “almost all (5)”.

## 2.3. Data analysis

The analysis for the current study proceeded in three main steps using Stata (Version 15.0; StataCorp 1985–2017). First, we depicted age-specific prevalence of handgun carrying across gender and race/ethnicity using the NLSY97 urban sample. We also explored whether ever handgun carriers were different from never carriers on socio-demographic and geographic factors. Second, using our NLSY97 longitudinal urban sample, we estimated each subject's *age of onset*, *duration*, and *development stage* of handgun carrying, and assessed if these life-course features of handgun carrying varied by socio-demographic groups and geographic locations. Third, the three life-course features of handgun carrying were linked to life outcomes in established adulthood through logistic, negative binomial, or ordinary least squares regression models contingent on the nature of the outcome measures. The data were screened for patterns of missingness, and we found little evidence that the assumption of “missing at random” was violated. We thus employed the technique of multiple imputation (mi impute chained; number of imputations = 20) to deal with missing data in the present study (Allison, 2001).<sup>12</sup>

## 3. Results

### 3.1. Age-specific prevalence of handgun carrying in the urban U.S.

Table 1 reveals that 27% of the NLSY97 urban respondents reported ever handgun carrying during the study period. These respondents were disproportionately male, Black, and living in the South, whereas being female, White, and living in the Northeast was negatively related to handgun carrying. While knowing the cumulative prevalence of handgun carrying is meaningful, it is critical to move beyond the static comparison and explore how handgun carrying behavior is distributed from a life-course perspective.<sup>13</sup>

<sup>10</sup> The 10 items included in the delinquency score index were: ever run away, ever carried a handgun, ever belonged to a gang, ever purposely damaged or destroyed property, ever stolen something worth < 50 dollars, ever stolen something worth > 50 dollars (including a car), ever committed other property crimes, ever attacked someone with the idea of seriously hurting them, ever sold or helped sell drugs, and ever arrested by the police or taken into custody.

<sup>11</sup> The 3 items included in the substance use score index were: ever smoked a cigarette, ever had a drink of an alcoholic beverage, and ever used marijuana.

<sup>12</sup> We excluded subjects from the regression model if they had missing information on a particular outcome, although outcome measures at Wave 15 or 16 were included in the imputation model.

<sup>13</sup> Because not all subjects were the same age at the start of the study (i.e. multiple age cohorts), there were different number of observations at each age point. For example, we used observations from the younger individuals to delineate age-specific patterns in the very early years, and used observations from the older individuals to describe age-specific patterns in the later years. In this way, we covered a 20-year span with only 15 years of data. This may limit our conclusions somewhat, because the prevalence of handgun carrying at any given point was only supported by the people who had data at that age. Such strategy, however, is rather common when analyzing longitudinal data (e.g. Bushway, Thornberry, & Krohn, 2003; Pyrooz, 2014).

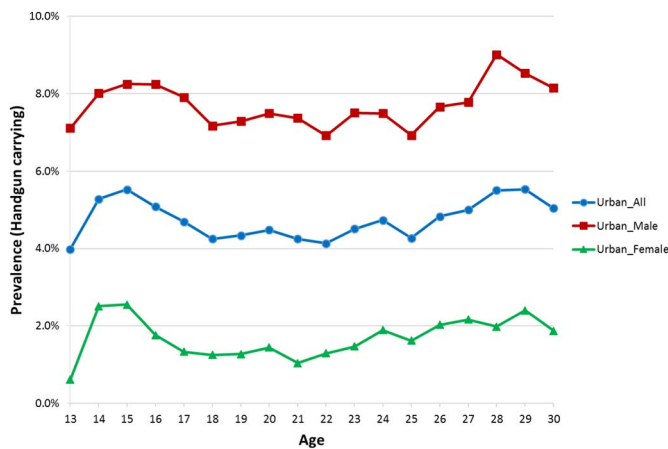


Fig. 1. Age-specific prevalence of handgun carrying in the urban United States. Note: Each data point reflects the prevalence of handgun carrying at Age<sub>t</sub>.

Fig. 1 shows that between 4% and 6% of the respondents carried a handgun at a specific age spanning early adolescence to established adulthood. Not surprisingly, the prevalence was consistently higher among males than females. There was a temporary peak, among both males and females, in the prevalence of handgun carrying around age 15; the prevalence then declined gradually during late adolescence and early adulthood. Beginning at approximately age 22, we observed a relatively steady increase in the prevalence of handgun carrying.

We depicted the prevalence of handgun carrying spanning early adolescence to adulthood across racial/ethnic groups in Fig. 2. Interestingly, for urban Black and Hispanic subjects, their age-specific patterns of handgun carrying generally followed a bell-shaped curve, whereas a U-shaped curve was seen for urban white subjects. It appears that urban minorities were more likely to carry a handgun during adolescence and early adulthood and less likely to carry a handgun during established adulthood than white subjects.

### 3.2. Correlates of life-course features of handgun carrying

Table 2 reports that, among the NLSY97 longitudinal urban sample, the mean age of initiating handgun carrying is 18.2 years. On average, individuals carried a handgun for 2.7 rounds of data collection, and slightly more than half of this subset (52.4%) reported handgun carrying during adulthood only. Fig. 3 presents a dynamic picture: Between 15.4% and 20.6% of this subset carried handguns at a specific age, and we again observed a temporary peak in the prevalence of handgun carrying around age 15. Respondents reported first-time

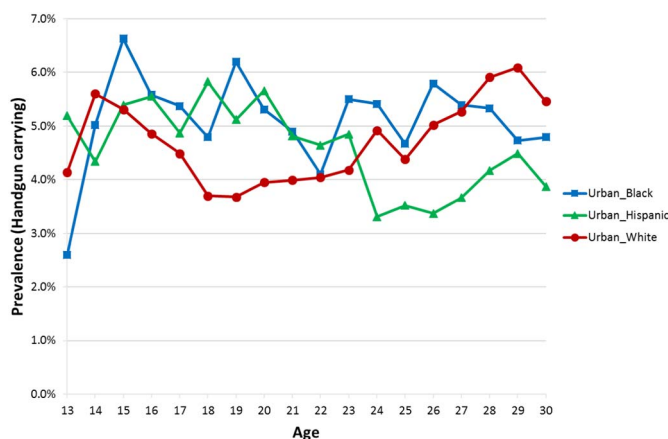


Fig. 2. Age-specific prevalence of handgun carrying in the urban United States across racial groups.

handgun carrying spanning late childhood to adulthood, though they were most likely to initiate during mid- and late-adolescence. The fact that handgun carrying onset was not limited to a narrow age bandwidth reiterates the importance of investigating heterogeneity among handgun carriers.

More specifically, Table 2 shows that on average males initiated handgun carrying approximately 1.5 years earlier than females in the urban United States. Compared to non-Black subjects, Black respondents had a marginally significant later onset age. With respect to duration, urban males carried handguns for a longer period of time (1.1 years longer) than urban females. Table 2 also suggests that the developmental stage of handgun carrying was related to being male (versus female) and Black (versus non-Black). Urban females and Black respondents were likely to carry during adulthood only, whereas urban males and non-Black respondents tended to carry some time before the age of 18.

### 3.3. Life-course features of handgun carrying and long-term consequences

Although previous research has examined the immediate or short-term impact of handgun carrying mainly from an injury and violence prevention perspective, carrying a firearm may have long-term impact in other life domains. We therefore examined how life-course features of handgun carrying were associated with criminal acts, substance use, police arrest and educational and economic achievement in established adulthood. Table 3 reports descriptive statistics for the key variables used in the regression models.

Table 4A reports how life-course features of handgun carrying were related to violent offending and drug sale in established adulthood. Duration seems particularly important when considering criminal acts: While holding control variables constant, for a one-unit increase in duration, the odds of committing violence and drug sale increased by a factor of 1.209 and 1.154 respectively. In addition, compared to adolescent carriers, adult carriers exhibited a marginally significant ( $OR = 3.911, p = 0.057$ ) higher likelihood of violent offending.

Table 4B shows how life-course features of handgun carrying were associated with substance use and police arrest. As regards substance use, a later onset of handgun carrying was related to a marginally significant increased incidence rate of substance use, although the effect size is not large ( $IRR = 1.009, p = 0.056$ ). In addition, compared to adolescent carriers, adult carriers ( $IRR = 1.132, p = 0.039$ ) also had a higher risk of substance use. For police arrest, the timing of handgun carrying matters: Compared to adolescent carriers, persistent carriers had a substantially higher risk of being arrested ( $IRR = 2.611, p = 0.010$ ).

Table 4C presents how life-course features of handgun carrying affected educational and economic achievement among the NLSY97 longitudinal urban sample. For both highest degree received and legitimate income earned in the previous year, age of onset and timing are important: While holding control variables constant, for a one-unit increase in onset age, the highest degree received and legitimate income earned were predicted to increase by 0.014 and 0.029 unit respectively; compared to adolescent carriers, adult carriers exhibited higher achievement in both educational ( $b = 0.154, p = 0.004$ ) and economic ( $b = 0.285, p = 0.032$ ) arenas. In summary, we observed that life-course features of handgun carrying were associated with long-term consequences in multiple life domains, confirming the significance of studying handgun carrying behavior from various perspectives.

## 4. Discussion

While gun-related violence is widely recognized as a leading public health and criminal justice issue with significant consequences for American society, understanding when and how people carry a firearm is a prerequisite for effective preventive interventions. In the meantime, gun carrying may also affect life outcomes in many other domains.

**Table 2**  
Correlates of handgun carrying features among the NLSY97 longitudinal urban sample ( $N = 1585$ ).

	Age of onset	Diff.	Duration	Diff.	Developmental stage			Diff.
					Adolescent carriers	Adult carriers	Persisters	
Overall	18.19	–	2.69	–	20.5%	52.4%	27.1%	–
Gender								
Male	17.80	***	2.96	***	18.8%	50.1%	31.1%	***
Female	19.39	***	1.86	***	25.8%	59.4%	14.7%	***
Race								
Black	18.57	–	2.66	–	21.0%	56.3%	22.7%	–
Hispanic	18.08		2.55		19.9%	51.4%	28.8%	
White	17.98		2.79		20.8%	49.9%	29.3%	
Region								
Northeast	18.17		2.49		20.3%	52.8%	26.9%	
North Central	18.15		2.74		21.8%	51.1%	27.1%	
South	18.26		2.64		21.9%	52.6%	25.6%	
West	18.12		2.81		17.8%	52.8%	29.4%	

Abbreviation: Diff. = statistical difference (adjusted for design effects).

Note: Results for the “other” group are not reported due to its very small sample size.

\*\*\*  $p < 0.001$ .

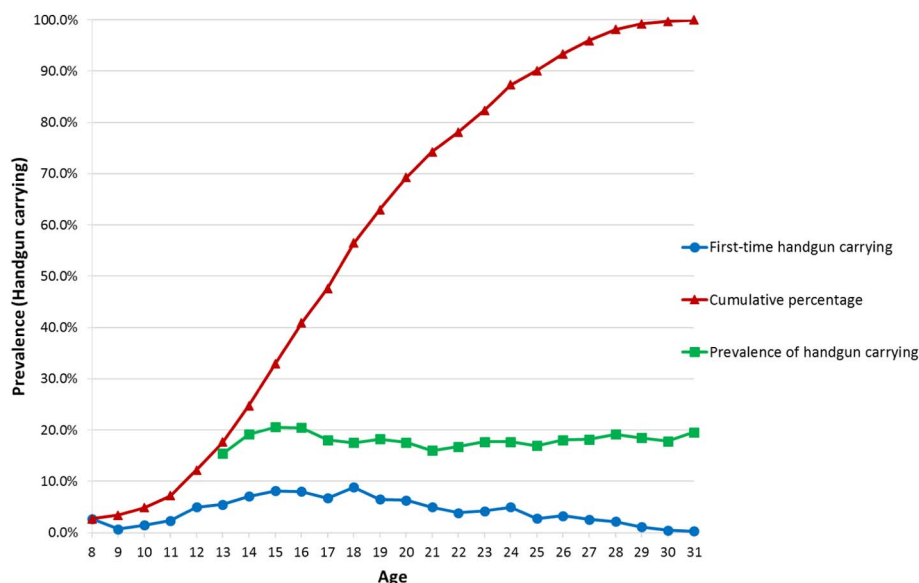
^  $p < 0.10$ .

Motivated by theoretical advances in life-course criminology and concerns about heterogeneity in gun carrying behavior, the current study engaged in several longitudinal exercises to unpack age-specific patterns and long-term consequences of handgun carrying using the NLSY97 data.

As the first study to delineate age-specific patterns of handgun carrying in the urban United States from one age to the next, spanning early adolescence to established adulthood, several noteworthy findings have emerged. First, between 4% and 6% of the respondents reported carrying handguns at a specific age point during the study period. Unlike many risky behaviors, the age-prevalence curve of handgun carrying did not follow a bell-shaped distribution that is positively skewed. This is not entirely surprising given that handgun carrying can be law-abiding once an individual meets the minimum age and other eligibility requirements. This finding reflects the complexity of studying handgun carrying in the life course, calling for future research that is capable of distinguishing between legal and illegal carrying over time. Yet, we did observe a temporary peak, among both males and females, in the prevalence of carrying around age 15. We suspect that the temporary peak reflects: a) at-risk adolescents mimic gun-carrying behavior of early initiators for status-seeking, amusement or simple peer

pressure, and b) the corresponding social contagion of fear of gun violence. The misperception of safety and rewards associated with gun carrying also contributes to the observed uptick in the prevalence.

Another interesting finding is that urban minorities generally followed a bell-shaped age-prevalence curve of handgun carrying, whereas urban whites followed a U-shaped curve over time. Relatedly, minority youth appeared more likely to carry handguns during adolescence and early adulthood and less likely to carry handguns during established adulthood than white youth. A tentative explanation for this discrepancy is that urban minorities are over-represented in two of the strongest correlates of risky gun behavior—gang affiliation and illicit drug sale during adolescence and young adulthood (Blumstein, 1995; Lizotte et al., 2000; Watkins et al., 2008). Coupled with racial disparities in educational resources and school discipline practices (Farkas, 2003), compensating assets that are generally available for white juveniles are not accessible to many of the minority youth. Given the heightened risk associated with adolescent gun carrying, a large proportion of minority youth eventually voluntarily or involuntarily desist from carrying a firearm. We suspect that the late increase in the prevalence among urban whites reflects a general willingness of legal carrying. Future research may also explore if there exists a “dynamic



**Fig. 3.** Age-specific cumulative and dynamic prevalence of handgun carrying among the NLSY97 longitudinal urban sample.



**Table 3**  
Descriptive statistics for the NLSY97 longitudinal urban sample (N = 1585).

Variables	Mean (proportion)	S.D.	Min	Max	Wave
<b>Adult outcomes</b>					
Violence*	0.05	0.22	0	1	15
Drug sale*	0.09	0.28	0	1	16
Arrest	0.15	1.16	0	33	16
Drug use	1.04	0.74	0	3	15
Educational achievement	0.94	0.79	0	3	16
Income	2.94	1.81	0	7	16
<b>Handgun carrying features</b>					
Age of onset	18.19	5.02	8	31	1–15
Duration	2.69	2.24	1	15	1–15
<b>Developmental stage</b>					
Adolescent carriers	0.21	0.40	0	1	1–15
Adult carriers	0.52	0.50	0	1	1–15
Persisters	0.27	0.44	0	1	1–15
<b>Baseline controls</b>					
Male	0.76	0.43	0	1	1
Black	0.29	0.46	0	1	1
Hispanic	0.26	0.44	0	1	1
White	0.44	0.50	0	1	1
Age	14.27	1.49	12	18	1
North east	0.12	0.33	0	1	1
North central	0.20	0.40	0	1	1
South	0.39	0.49	0	1	1
West	0.28	0.45	0	1	1
Victim of bullying	0.26	0.44	0	1	1
Seen shot	0.21	0.40	0	1	1
Delinquency	2.37	2.41	0	10	1
Substance use	1.32	1.19	0	3	1
Two-parent family	0.42	0.49	0	1	1
Parental education	12.02	3.12	1	20	1
Family affluence	2.48	2.31	0	16.27	1
Peer gang affiliation	1.87	1.16	1	5	1

\* Indicates that the universe for this measure was restricted; it was asked only of respondents who had ever reported being arrested and also a control group of approximately 10% of the respondents for comparison.

**Table 4A**  
Logistic regression of violence and drug sale on handgun carrying features among the NLSY97 longitudinal urban sample.

Variables	Violence (N = 698)			Drug sale (N = 668)		
	OR (s.e.)	OR (s.e.)	OR (s.e.)	OR (s.e.)	OR (s.e.)	OR (s.e.)
Age of onset	1.050 (0.057)	–	–	1.004 (0.035)	–	–
Duration	–	1.209 (0.083)**	–	–	1.154 (0.062)**	–
Adult carriers	–	–	3.911 (2.764)	–	–	1.168 (0.615)
Persisters	–	–	2.141 (1.612)	–	–	1.834 (0.855)

Abbreviation: OR = odds ratio, s.e. = standard error.

Note: Baseline controls were included when estimating the regression models. For brevity, those coefficients are not reported here.

\*\* p < 0.01.

\* p < 0.10.

equilibrium” of illegal gun carrying across racial/ethnic groups during adolescent years.

When exploring socio-demographic correlates of “ever handgun carrying” in the urban United States, we observed that being male, Black, and living in the South led to a higher likelihood of carrying, whereas being female, white, and living in the Northeast was negatively related to ever carrying. These findings are consistent with previous studies that have addressed similar issues. Prior research, however, has not examined socio-demographic correlates of “life-course features of handgun carrying”. In our study, we found that urban males had an earlier onset age, a longer duration, and a precocious timing than those

**Table 4B**  
Negative binomial regression of substance use and arrest on handgun carrying features among the NLSY97 longitudinal urban sample.

Variables	Substance use (N = 1363)			Police arrest (N = 1343)		
	IRR (s.e.)	IRR (s.e.)	IRR (s.e.)	IRR (s.e.)	IRR (s.e.)	IRR (s.e.)
Age of onset	1.009 (0.004)	–	–	0.972 (0.033)	–	–
Duration	–	1.016 (0.010)	–	–	0.977 (0.084)	–
Adult carriers	–	–	1.132 (0.067)*	–	–	1.618 (0.609)
Persisters	–	–	1.071 (0.074)	–	–	2.611 (0.951)**

Abbreviation: IRR = incidence rate ratio, s.e. = standard error.

Note: Baseline controls were included when estimating the regression models. For brevity, those coefficients are not reported here.

\*\* p < 0.01.

\* p < 0.05.

ˆ p < 0.10.

**Table 4C**  
OLS regression of educational achievement and income on handgun carrying features among the NLSY97 longitudinal urban sample.

Variables	Highest degree (N = 1577)			Income (N = 1364)		
	b (s.e.)	b (s.e.)	b (s.e.)	b (s.e.)	b (s.e.)	b (s.e.)
Age of onset	0.014 (0.004)***	–	–	0.029 (0.010)**	–	–
Duration	–	–0.008 (0.008)	–	–	0.027 (0.025)	–
Adult carriers	–	–	0.154 (0.053)**	–	–	0.285 (0.131)*
Persisters	–	–	–0.010 (0.052)	–	–	–0.018 (0.142)

Abbreviation: b = regression coefficient, s.e. = standard error.

Note: Baseline controls were included when estimating the regression models. For brevity, those coefficients are not reported here.

\*\*\* p < 0.001.

\*\* p < 0.01.

\* p < 0.05.

of females. Moreover, to a large extent, racial-ethnic status and geographical location did not influence how handgun carrying behavior unfolded in the life-course. Accordingly, racially or geographically tailored preventive interventions should focus on persuading people not to involve in risky gun-related behavior in the beginning.

In effect, life-course features of handgun carrying are related to adversities in adulthood across racial/ethnic groups and geographical locations. While onset age of handgun carrying appears not important in determining violent behavior, perhaps after many years, in adulthood, a prolonged duration increases an individual's likelihood of committing violence in the long-term. Negative feedback from earlier carrying may have contributed to sustained involvement in violence. Although not statistically significant, the odds ratios associated with developmental timing of carrying on violence were large, suggesting potential immediate, facilitating effects of handgun carrying on aggression.<sup>14</sup> As regards drug sale, cumulative effects are also noticeable. Individuals who carried handguns for a prolonged period of time exhibited a significantly enhanced risk of involving in illicit-drug business. This confirms the intertwining of guns and drug dealing (Fagan & Wilkinson, 1998; Goldstein, 1985).

To some extent, life-course features of handgun carrying influence

<sup>14</sup> Despite the large effect sizes, the insignificant results might be due to the low prevalence of violent offending in established adulthood and the reduced sample size.

adult substance use in unexpected ways. We did not expect to see that initiating late (marginally significant) and carrying during adulthood only (compared to adolescent carriers) would lead to higher incidence rates for substance use.<sup>15</sup> One possible explanation is that handgun carrying in an urban area re-structures a previously conforming adult's life style, increasing his or her level of substance use henceforth. Future research should continue to explore this relationship. Not surprisingly, carrying handguns across both developmental stages leads to a substantially higher risk of being arrested in established adulthood than carrying during adolescence only. This suggests that individuals who initiated early (mostly illegally) and sustained handgun carrying behaviors are likely to be under scrutiny of law enforcement agencies.

With respect to educational and economic achievement, early involvement in handgun carrying seems notably harmful. Not only is a later onset associated with significant increases in the highest degree received and legitimate income in adulthood, carrying handguns during adulthood only also predicts better outcomes when compared to the other two categories. The results are not surprising given that educational and economic capitals need to be accumulated through a continuing process. Negative repercussions from early carrying (e.g. isolation from conventional peers, unstructured routine activities and deviant life styles, or involvement in delinquency and drug use), however, are likely to lead to cumulative disadvantage in these life domains. Future research should make efforts to uncover the proposed intervening or mediating mechanisms between life-course features of handgun carrying and life chances in adulthood.

Despite the many strengths of this study, there are limitations. First, we were not able to conclusively distinguish between legal and illegal handgun carrying using the NLSY97 data. Given that the handgun carrying questions were asked in the delinquency section of the NLSY97 self-administered questionnaire, we consider handgun carrying a generally risky behavior in the urban United States. Future research, however, should aim to collect data that are capable of differentiating between legal and illegal handgun carrying over time. It is imperative to gather knowledge on age-specific patterns of firearm carrying and investigate life outcomes associated with both legal and illegal carrying.<sup>16</sup> Second, our assessments of handgun carrying were based on self-reported answers and did not capture specific reasons or situational/contextual factors that would likely shed light on carrying. While some youth may avoid disclosing handgun carrying for fear of punitive action, there is also evidence that over-reporting risky behavior may be more common than under-reporting among youth (Steinman & Zimmerman, 2003; Vaughn et al., 2017). Nonetheless, the overall prevalence of handgun carrying found in the study is similar to those of other studies, suggesting the reliability of our measurement approach. Another limitation is that the universe for our measures of adult violent offending and drug sale was restricted to respondents who had ever reported being arrested and a small comparison group. On the one hand, this leads to reduced statistical power in the two regression models; on the other hand, the conclusions drawn from the two models are not directly applicable to the overall NLSY97 longitudinal urban sample.

## 5. Conclusions

Much of the research on risky gun-related behavior has given attention to the teenage years, identifying correlates or risk factors among high-risk youth. This research largely assumed that adolescents who carried firearms are of one general type. Results from the current study, however, indicate that developmental heterogeneity in handgun

carrying exists and, very importantly, these developmental features affect long-term life outcomes in a variety of domains among “ever carriers”. Thus, our findings are important not only for establishing the relevance of the life-course perspective in studying risky gun-related behavior, but also for encouraging targeted prevention and intervention strategies based on age-specific information. Efforts to prevent risky gun carrying and associated negative consequences over time could be better targeted if we had answers to additional questions: Do identified risk factors of gun carrying have varying importance at different life stages? What risk factors are related to each of the developmental features of handgun carrying? How distinct developmental features of gun carrying can be summarized in a more succinct way? Estimating developmental trajectories of gun carrying may be particularly useful here. Who continues adolescent gun carrying into adulthood and who initiates carrying as an adult? Do the self-reported reasons for initiation and carrying vary depending on the age of a subject? What the mediating or intervening mechanisms are between gun carrying and life outcomes in the long-term? How intermediate feedback from different life arenas influences the continuity of gun carrying? How socio-demographic factors moderate the impact of gun carrying on life chances? And what factors protect individuals from the risky carrying behavior and its immediate and enduring effects? We believe that the current study will help motivate answers to these questions and has made a solid first step to uncover heterogeneity in handgun carrying and its long-term impact from a life-course perspective.

## Acknowledgments

The authors would like to thank Alan Lizotte, Therese Richmond, Charles Branas, Christopher Morrison, and Sara Jacoby for their helpful comments on earlier versions of this paper. We would also like to thank the editors of J CJ and the anonymous reviewers.

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<sup>15</sup> The results held even if we controlled for concurrent economic and educational achievement in addition to our baseline controls tapping individual propensity of committing risky behaviors.

<sup>16</sup> To some extent, our regression models on long-term consequences might be perceived as conservative tests of negative outcomes of illegal handgun carrying.

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