Age-Structure and Racial and Ethnic Disparities in Incarceration*

Matt Vogel[1]
Department of Sociology
University at Albany, SUNY

Lauren Porter
Department of Sociology
University at Albany, SUNY

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[1] Primary contact. Email: mvogel@albany.edu. Phone: (518) 442 -5579.

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Abstract:

There are marked disparities in incarceration rates across racial and ethnic groups in the United States. The risk of experiencing incarceration is also intricately linked with age, and there are striking differences in the age-distributions of non-Hispanic black, Hispanic, and non-Hispanic white populations. As such, the comparison of crude incarceration rates across groups may be problematic, since it obscures the contribution of population age-structure to overall incarceration rates. We apply standardization and decomposition procedures to data from the National Prisoners Statistics program and the U.S. Census to estimate the contribution of population age-structure to incarceration disparities. Results indicate that population age-structure accounts for roughly 20 percent of the Hispanic/non-Hispanic white disparity and 8 percent of the non-Hispanic Black/non-Hispanic white disparity.

1. INTRODUCTION

Criminologists have had a longstanding interest in understanding the causes and consequences of racial/ethnic disparities in punishment (Sellin, 1935). At every stage of criminal justice processing, blacks and Hispanics are overrepresented relative to their share of the U.S. population. For instance, although blacks and Hispanics comprise roughly 30 percent of the U.S. population, they account for 56 percent of all U.S. prisoners (Humes et al., 2011). Black-white disparities are particularly alarming, with blacks incarcerated at six times the rate of whites. Nonetheless, the Hispanic-non-Hispanic white disparity in incarceration is formidable as well. Currently, Hispanics are incarcerated at roughly twice the rate of non-Hispanic whites (Mauer and King, 2007).

In general, prior research puts forth two explanations for racial/ethnic disparities in criminal justice involvement: (1) the disparities reflect true differences in the level of criminal involvement across groups, or (2) the disparities reflect differential treatment by the criminal justice system. In this study we consider a third possible explanation for the seeming overrepresentation of blacks and Hispanics in the correctional population. On the one hand, criminologists have long recognized age as a significant predictor of criminality, with offending tending to peak during mid to late adolescence and declining thereafter (Steffensmeier et al., 1989). At the same time, demographers have long understood the importance of age structure in understanding population patterns, especially those pertaining to mortality and morbidity (Kitagawa, 1955; 1964). We argue that age structure could also play a crucial role in shaping racial/ethnic disparities in incarceration rates. Whereas most prior work compares crude rates across black, white, and Hispanic populations (e.g. – Mauer and King, 2007), this approach may be problematic because it assumes that all members of the population are at an equal risk of

experiencing imprisonment. In the U.S., age structures vary considerably across race/ethnicity, as the Hispanic and black populations are younger on average than the white population.

In other words, a direct comparison of overall rates of criminal justice involvement across race/ethnicity may be misleading because the Hispanic and black populations may have a greater proportion of individuals who are "at risk" of incarceration. Thus, we provide a first attempt to discern the contribution of population age-structure to racial and ethnic disparities in incarceration. We draw on estimates from the National Prison Statistics program and the U.S. census to adjust non-Hispanic black and Hispanic incarceration rates to the non-Hispanic white age-structure in 2000 and 2010.[2] We then employ a straightforward decomposition technique to partition the observed racial disparities into two components: that attributable to differences in population age structure and that attributable to all other sources of variation. Our results demonstrate that population age-structure explains a non-trivial portion of the observed racial and ethnic disparities in U.S. incarceration rates. Importantly, a greater proportion of the difference between the white and Hispanic incarceration rates can be attributed to population age-structure than the difference between black and white rates.

1. LITERATURE REVIEW

1.1 Racial and Ethnic Disparities in Punishment

Forty years ago John Hagan (1974) noted that studies on racial disparities in the criminal justice system could be characterized as adopting either a "sociological" or "legalistic" perspective. The most dominant perspective, he argued, was sociological because it emphasized the role of extra-legal characteristics, such as race, in influencing sentencing decisions. Hagan also described a conflicting legalistic perspective, which underscored the importance of legal

[2] For simplicity's sake, we use black, white, and Hispanic from this point on to refer to these population groups, where black refers to non-Hispanic blacks and white refers to non-Hispanic whites.

criteria in predicting sentencing outcomes. According to this perspective, racial and ethnic disparities in punishment simply reflect differences across groups with respect to the level and severity of criminal involvement. After reviewing twenty studies on judicial sentencing practices, Hagan concluded that prior work largely supported a legalistic perspective, noting that "knowledge of extra-legal offender characteristics contributes relatively little to our ability to predict judicial dispositions" (p.379).

Since Hagan's review in 1974, criminologists have amassed an expansive amount of empirical work on the causes of racial/ethnic disparities in incarceration and in sentencing more broadly. Earlier work tended to align with Hagan's conclusions, with scholars arguing that observed racial differences mostly resulted from inadequate controls for legally relevant sentencing criteria, such as prior record and the severity of the offense (Kleck, 1981). However, more recent work has demonstrated that racial/ethnic disparities in punishment are apparent even after controlling for legally relevant factors. After her comprehensive review of 40 studies, Spohn (2000: 481-482) concludes that "earlier refutations of the discrimination thesis were premature," and "although it is irrefutable that the primary determinants of sentencing decisions are the seriousness of the offense and the offender's prior criminal record, race/ethnicity and other legally irrelevant offender characteristics also play a role."

Aggregate level analyses of incarceration patterns have reached similar conclusions. These studies typically investigate whether incarceration disparities are explained by differential involvement at the arrest level (legalistic reasons) or by differential treatment (extra-legal factors). In a series of classic studies, Blumstein (1982; 1993) compared prison data to UCR arrest data and found that between 75-80 percent of the disparity was due to higher arrest rates among blacks. This percentage remained quite stable across studies, despite rapid increases in

imprisonment overall (see Walker et al., 2003). Mauer (2006) notes that the unexplained portion (20-25 percent) "may be alarming in itself," given the sheer number of racial minorities housed in correctional facilities. In a more recent study, Tonry and Melewski (2008) analyzed data for the 2004 correctional population and discovered that only 61 percent of the racial disparity could be attributed to differences at the arrest stage. They conclude that the change between time periods is primarily due to changes in drug sentencing policies, or the "war on drugs" in the mid-1980s, which disproportionately impacted minority drug offenders. As Mauer (2006) observes, blacks constituted 21 percent of all drug arrests in 1980, but constituted 32 percent in 1992, despite self-report surveys indicating roughly similar rates of drug use across groups.

Criminological interest and research into racial disparities in punishment stretches back nearly a century (Sellin, 1935). However, interest in ethnic disparities received little attention until relatively recently. Like blacks, it is argued that a criminal stereotype is disproportionately attached to Hispanics offenders. For example, Portillos (1998) argues that a young Hispanic male tends to be perceived as a "gun wielding, drug selling gangbanger" (p.156). Public opinion polls also show that whites associate increases in Hispanic and/or immigrant populations with increases in crime rates (Pew Research Center, 2006; General Social Survey, 2008). Further, Johnson et al. (2011) show that perceived Hispanic threat influences popular support for judges being able to use ethnicity as a sentencing criterion.

Thus far, studies suggest that Hispanic ethnicity is a contributing factor to sentencing outcomes and in particular, the decision to incarcerate. For example, Spohn and Holleran (2000) find that Hispanic males are more likely to be imprisoned than non-Hispanic whites and Steffensmeier and Demuth (2001) find that Hispanic defendants in Pennsylvania are more likely to be incarcerated than whites and Hispanics actually face harsher sentencing outcomes than

black defendants, especially for drug crimes (see also Steffensmeier and Demuth, 2000). More recently, Kramer and Ulmer (2009) find that young Hispanic males receive harsher sentences than black and white males of the same age; Doerner and Demuth (2009) find that Hispanic defendants are more likely than any other racial/ethnic group to receive an incarceration sentence, net of prior criminal history; and Warren and colleagues (2012) find that being Hispanic increases the odds of receiving a prison sentence by 23 percent.

However, and similar to research on black/white disparities, research suggests that differential involvement is a non-trivial source of Hispanic/white punishment disparities as well. Hispanics report higher levels of offending than whites, including more serious crimes such as violence (Gibson and Miller, 2010; McNulty and Bellair, 2003; Morenoff, 2005). In particular, native-born Hispanics are more likely to exhibit high levels of offending relative to whites (Kirk, 2008).

At this point the wealth of research indicates that "legally prescribed factors" are the strongest predictors of punishment disparities (Warren et al., 2012: 59). Nonetheless, it is also clear that race/ethnicity matter, and disparities cannot be explained solely by differences in offending between groups (Wakefield and Uggen, 2010). Our study adds to the expansive field of racial/ethnic disparities in punishment, and in incarceration in particular, by proposing a third contributing factor. While aggregate-level research tends to compare crude rates of incarceration across groups, we argue that this method masks the age-specific nature of criminality. Indeed, younger age groups confront a higher risk of incarceration because younger people are more likely to commit crime. Further, age structures are not uniform across racial/ethnic groups. In a sense, our argument can be couched in differential involvement perspectives. However, rather than arguing blacks and Hispanics are incarcerated at a higher rate because they commit more

crime and more serious *types* of crime, we argue that the seeming overrepresentation of these groups in the correctional population may be due, at least in part, to a fundamental difference in population age structure.

1.2 Population Age-Structure and the Distribution of Crime

The relationship between age and criminal involvement is one of the most well-established 'facts' in criminology. The association is so strong that some have argued it is invariant across cultures and time periods (Gottfredson and Hirschi, 1983). The age-crime distribution is characterized by a sharp increase in offending through adolescence that peaks during the late adolescent years and gradually declines thereafter. Although the parameters of the age-crime curve are not identical for all forms of offending, the right-skewed, unimodal shape of the distribution is generally accepted (Steffensmeier et. al, 1989). The ages between 15 and 24 are often considered the prime ages for criminal involvement, with the peak for property crime occurring somewhat earlier than violent crime. For means of illustration, Figure 1 presents age-specific arrest rates for the United States in 2010, as reported in the FBI's Uniform Crime Report. As illustrated, the age-arrest distribution rises during the adolescent years, peaks around age 20, and descends thereafter. Notably, offenders between the ages of 15 and 30 constituted 53 percent of all arrests in 2010, and the vast majority of arrestees (77 percent) were under the age of 40.

[Figure 1 about Here]

As noted by Cohen and Land (1987), an important implication of the age-crime distribution is that an increase in the proportion of a population in their late teens and early adulthood should increase crime rates (p. 173). Indeed, the association between population age-

structure and variation in aggregate crime rates has received considerable attention in the criminological literature (for review see South and Messner, 2000). For instance, the precipitous increase in the U.S. crime rate during the 1960s and early 1970s, and the corresponding decreases in the early 1980s have been linked to the aging of "baby-boom" generation into, and then out of crime-prone ages (Steffensmeier and Harer, 1987; 1991; Cohen and Land, 1987). Likewise, roughly 10 percent of the 'crime-drop' in the 1990s has been attributed to shifts in the demographic composition of the U.S. population (Fox, 2000; Fox and Piquero, 2003). In a related vein, Deane (1989) demonstrates that population age-structure contributes to the higher crude homicide rates observed in the United States relative to other nations. At the most basic level, this research demonstrates that, *ceteris paribus,* young populations have higher rates of crime because young people have a greater risk of engaging in crime.

In addition, relatively large age cohorts have been linked with higher crime rates. Indeed, the age-structure of a population can be viewed in terms of its constituent parts: a series of birth cohorts varying in size. As noted by Easterlin (1978; 1980), there are clear advantages to being born into a small birth cohort. Such individuals will enter into favorable labor market conditions and experience higher relative wages than those born into large birth cohorts. Large cohorts will also increase the dependency ratio. A population with a high dependency ratio indicates that the working adult population supports a relatively large proportion of dependents, and thus economic and social resources may be spread thin. Large cohorts, then, have "fewer parents per child, fewer teachers per child when they reach school age, fewer adults per child for supervision, and fewer entry level jobs per entry level worker when they hit the job market" (O'Brien and Stockard, 2009). Such cohorts should experience social conditions characterized by scarce economic resources and a paucity of informal social control – factors which may aid in

the propagation of criminal behavior. Thus, all else equal, large cohorts should experience higher levels of crime than small cohorts.

Extant research has provided mixed support for this hypothesis. Some studies find that large birth cohort size is associated with cross-national suicide rates (Stockard and O'Brien, 2002), youth homicide rates (O'Brien, Stockard and Issacson, 1999), and age-specific rates of property offending (O'Brien, 1988). For example, O'Brien and Stockard (2009), demonstrate that the shifts in the age-distribution of homicide offenders from 1965 to 2005 is attributed primarily to 'cohort replacement', or shifts in the propensity of cohorts to be involved in homicide (with the notable exception of the crack-cocaine epidemic in the late 1980s and early 1990s). Moreover, they find that the relative cohort size is directly associated with age-period specific homicide rates. On the other hand, other studies have failed to detect any association between relative cohort size and criminal behavior (Steffensmeier et al., 1987; Levitt, 1999). For instance, Levitt (1999) reports no association between cohort size and homicide or violent crime rates, and a modest association between cohort size and property offending. He concludes that none of these results indicate that increases in cohort size are associated with disproportionate increases in overall crime rates (p. 592). Nonetheless, this area of research indicates that relatively large birth cohorts, regardless of age, may boast high rates of crime.

With respect to age and incarceration in particular, there are three key trends worthy of note. First, the age- incarceration distribution tends to peak at much later ages than the age-arrest distribution. Much of this discrepancy can be attributed to sentencing policies and criminal justice processing. With the exception of those who commit violent offenses, first time offenders are rarely sentenced to jail or prison. It is only after an offender has accumulated multiple convictions that he or she is likely to face a prison sentence. Thus instead of peaking in the early

twenties, the age-incarceration curve peaks at somewhat later ages. Second, sentencing policy directly affects the age-distribution of the incarcerated population. The growth in mandatory minimum and determinant sentencing has substantially lengthened the amount of time that prisoners spend behind bars, shifting the age distribution of the incarcerated population to the right. Third, and related, the U.S. prison population is growing older and has been for quite some time. For instance, the median age of U.S. prisoners has increased by roughly seven years since 1974. Bushway, Smith and Tsao (2011), using an estimable function approach similar to O'Brien and Stockard (2009), demonstrate that the 'aging' of the U.S. state prison population can be attributed primarily to cohort effects. Those born in more recent cohorts have experienced higher incarceration rates, which has contributed to the aging of the U.S. prison population.

1.3 Population Age Structure and the Racial/Ethnic Disparity in Criminal Justice Involvement

There is considerable variation in the age distributions of racial and ethnic groups in the United States. In 2010, the median age for Hispanic males was 26.7 (Table 1). On the other hand, the median age was 40.8 for white males and 30.6 for black males. On average, Hispanic males are roughly 14 years younger than white males and four years younger than black males. The sex-specific age distributions for Hispanic, black, and white populations during 2000 and 2010 are presented in Figures 1 and 2. Notably, the white age distribution resembles a diamond, with the largest proportion of the population clustered between the ages of 40 and 60 (reflecting the baby boomer birth cohort). On the other hand, the Hispanic age-distribution, and to a lesser degree the black population are disproportionately clustered at the youngest ages.

[Table 1 about Here]

[Figure 2 and Figure 3 about Here]

In order to provide a more simplistic comparison of race and ethnic age-distributions, we computed dissimilarity indices, using the 2010 white population as a base. The measure can be interpreted as the proportion of the racial/ethnic group that would need to be redistributed across age-categories to generate an age-structure similar to the white population in 2010. The index is calculated as:

$$D = \tfrac{1}{2}\sum|P_a - p_a| \quad (1)$$

where P_a is the proportion of white males in age group *a* and p_a is the proportion of blacks and Hispanic in age group *a*, respectively. In 2010, the white-Hispanic index of dissimilarity was 46.9 and the white-black index was 26.7. In relative terms, the black and Hispanic age-distributions are more similar to each other than to the white population. Notably though, the age disparities between whites and Hispanics is considerably larger than the age disparity between whites and blacks.

To put these figures in perspective, in 2010 18.6 percent of the Hispanic male population and 17.6 percent of the black male population were between 15 and 24 years old, the ages traditionally associated with the highest levels of offending. In contrast, only 13.1 percent of the white population was in this age-range. Relative to Hispanics and blacks, there are proportionately fewer white males in the crime-prone ages. Given age-crime distribution, the disproportionate clustering of minority populations in these age groups should produce relatively higher *overall* race and ethnic-specific incarceration rates compared to the white population. Therefore the observed racial disparities in criminal justice involvement should be attributed, to some extent, to variation in population age-structure.

Assuming that age-structure is at least partially responsible for the disparities in criminal justice involvement, the population dynamics characterizing the Hispanic, black, and white

populations portend that these disparities will continue to increase. For instance, between 2000 and 2010, the median age of whites increased by 3.4 years, while the median age of blacks increased by 2.1 years, and the median age of Hispanics increased by just 1.3 years. The aging of the white population can be attributed the aging of the baby-boomer birth cohort and the relatively low-levels of fertility among whites. On the other hand, the younger age of the Hispanic population can be attributed to immigration and the relatively higher fertility rate for this group (U.S. Census Bureau, Population Division). For example, the Census Bureau estimates that the white population will drop from 75 percent to roughly 50 percent of the total population by 2040. Further, approximately 90 percent of the total population growth between 2000 and 2010 came from minority groups, with the Hispanic population alone growing by 43 percent. Taken together, these trends indicate that the white population is becoming increasingly "top heavy" relative to the Hispanic and black populations. If these trends persist, disparities in criminal justice involvement between whites and non-whites may continue to grow.

2. UNPACKING THE EFFECTS OF POPULATION AGE-STRUCTURE ON RACIAL DISPARITIES IN CRIMINAL JUSTICE INVOLVEMENT

To briefly summarize, the risk of criminal involvement varies significantly with age. Racial and ethnic groups in the United States have substantially different population age-structures. Therefore, the comparison of crude incarceration rates across racial and ethnic groups may not be the best way to gauge criminal justice disparities. While there is clear reason to anticipate that the relatively younger ages of the Hispanic and black populations are related to the observed disparities in incarceration rates relative to the white population, no study has directly examined the contribution of population age-structure to these disparities.

The current study bridges this gap through two related analyses. First, we adjust the Hispanic and black incarceration rates to the white population. This allows us to determine how the race/ethnic-specific rates would differ if these populations had age-structures equal to the white population. Second, we employ a simple decomposition procedure to determine the proportion of the observed disparity in incarceration rates that can be attributed to variation in population age-structure across racial and ethnic groups. Importantly, these techniques have been used in past research to examine whether population age-structure explains fluctuations in aggregate crime rates over time. However, to our knowledge this is the first instance where age-standardization and decomposition techniques have been used to examine how differential population age-structures contribute to incarceration disparities across racial and ethnic groups in the United States.

The lack of research on the age and racial/ethnic distribution of criminal justice involvement may reflect, to a certain degree, a dearth of requisite data. Much of these data are collected by the Bureau of Justice Statistics, often with the assistance of the Census Bureau. There are three data collection endeavors worth noting– the Survey of Inmates series, the National Correction Reporting Program (NCRP), and the National Prison Statistics (NPS). The Surveys of Inmates in State and Federal Correctional Facilities provides information on the characteristics of a sample of prisoners. There have been six iterations of the survey since 1974, conducted at somewhat irregular intervals. The NCRP collects annual administrative data on prison admissions and releases which include demographic and sentence-related information gleaned from individual prisoner records in participating jurisdictions. In the past these data have suffered from underreporting, low response rates, inconsistent participation across states, as well as issues regarding the definition and terminology used across jurisdictions. Finally, the Bureau

of Justice Statistics reports annual counts of the prison population under federal and state jurisdiction generated from aggregate administrative (i.e. – state level) data. This information is released annually in the BJS *Prisoners* series. These data are advantageous as they provide the most current information on the United States prison population, but the lack of individual data make it difficult to precisely capture the characteristics of the prison population at any given time. It is important to note that each source of incarceration data has its advantages and unique limitations. The Bureau of Justice statistics, as part of the NPS program, draws on these three surveys to estimate annual trends in the demographic composition of the prison population. These estimates, which are discussed in greater detail below, provide the best depiction of the age and racial distributions of the U.S. prison population currently available.

3. METHODS

3.1 Data

In order to determine the contribution of population age structure to racial disparities in incarceration, we utilize data from the National Prisoners Statistics (NPS) program and population estimates from the 2000 and 2010 decennial censuses. The NPS program, which began in the 1920s, provides annual data on prisoners in the United States at yearend. While the Bureau of Justice Statistics sponsors the survey, data collection is performed by the United States Census Bureau.[3] The BJS releases annual estimates of the number of prisoners under federal and state jurisdiction. As noted, these data represent one of the most comprehensive overviews of prisoners in the United States (Guerino, Harrison & Paul, 2012; West & Sabol, 2009; West, 2001). The NPS distinguishes between prisoners held in custody and prisoners under jurisdiction. To have custody over a prisoner, a state of federal prison must actually hold a person in one of

[3] More detailed information on the data collection procedures can be found at http://www.bjs.gov/

their facilities. Jurisdiction over a prisoner means that the officials have legal authority over an individual, regardless of where he or she is incarcerated. Not all states distinguish between jurisdiction and custody, making it difficult to estimate the unique count of individuals housed in correction facilities. As such, we make use of the jurisdictional data, which includes counts of individual held in prisons, penitentiaries, correctional facilities, halfway houses, boot camps, farms, training or treatment centers, and hospitals. These counts also include persons held in local jails and various other state and federal facilities. It is important to note that these data reflect all individuals currently under federal jurisdiction, rather than new admissions. Thus the incarceration rates generated from these data may be better represented as rates of confinement.[4]

The NPS reports a wealth of information on the characteristics of the population currently confined and/or under jurisdiction. The data include estimates of the incarcerated population by age, sex, and race/Hispanic origin. These estimates are based on data collected through the NPS survey (NPS-1a) [5] and adjusted to be consistent with counts provided by the Federal Justice Statistics Program, the NCRP, and the Survey of Inmates in Jails. [6] Importantly, the methodology used by the NCRP improved substantially in 2010, and the most recent data overcome many of the limitations noted in the previous section. Given these improvements, however, it is difficult to directly compare the 2010 NPS data with earlier estimates.[7]

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[4] A potential issue here is that the population base used in the dominator of the rates may not accurately reflect the demographic composition of the population at the time an inmate first entered prison. However, the median sentence length is just over 2 years, so it is unlikely that this will significantly bias the results presented here.

[5] The NPS-1a data collection instrument is available at: http://bjs.ojp.usdoj.gov/content/pub/pdf/nps1a_10.pdf

[6] See Guerino, Harrison, & Sabol (2011), pages 8-9, for detailed information on the BJS methodology for estimating age-by-race-by sex counts.

[7] Therefore, we are reluctant to discuss changes between 2000 and 2010. Rather, the use of the two times points can be taken as further evidence of the contribution of age-structure to incarceration disparities, rather than the contribution of *changes in* population age-structure to *changes in* incarceration disparities.

3.2 Analytic Strategy

3.2.1 Estimating Race-Specific Incarceration Rates

We began by estimating the crude incarceration rates for the white, black, and Hispanic male population over the age of 18 in 2000.[8] These rates reflect the non-adjusted, overall incarceration rates observed in 2000 and 2010, as reported by the NPS program. Table 2 and Table 3 present the age-specific male incarceration data for 2000 and 2010. In these tables, P_a refers to the number of males in each race/ethnicity in each age-group *a*, P refers to the race/ethnicity-specific population of males over the age of 18, P_a/P refers to the proportion of the race/ethnic specific male population over the age of 18 in each age group, and E_a is the estimated number of race/ethnic specific males under federal or state jurisdiction in each age group as reported through the NPS. The age-by-race-specific incarceration rates, denoted as $T_{a,}$ are computed as:

$$T_a = \frac{Ea}{Pa} \text{ x } 100{,}000 \tag{2}$$

These rates can be interpreted as the number of male prisoners in each race/ethnic group under federal or state jurisdictions per 100,000 males in each race/ethnic group in the population. For instance, there were 326.6 white males between the ages of 18 and 19 under state or federal jurisdiction in 2000 per every 100,000 white males in this age group in the general population. The race-specific incarceration rates are estimated as:

$$T = \frac{\sum Ea}{P} \text{ x } 100{,}000 \tag{3}$$

This reflects the total number of males in each race/ethnic group per every 100,000 males in the population. Consistent with prior research, we find that the crude Hispanic incarceration rate is roughly double the white rate in both 2000 and 2010 while the black incarceration rate is seven

[8] The NPS only reports on adult populations, hence our decision to focus only on individuals over the age of 18. As such, our estimates of the total incarceration rate will differ from incarceration rates reported elsewhere that use the *entire* population in the denominator.

times higher than the white rate at both points. As mentioned above, the age-incarceration distribution peaks later than the age-arrest distribution. In both 2000 and 2010, the peak of the distribution is in the 30-34 age range for each group. At both time points, the majority of individuals in each race/ethnic group were under forty years old. Notably, while there are clear differences in overall incarceration rates, the general shapes of the age-incarceration curves are consistent across racial and ethnic groups at both time points (Figure 4 and Figure 5).

[Table 2 and Table 3 about Here]

3.2.2 Age-Standardized Incarceration Rates

In the next step in the analysis, we attempted to eliminate the confounding effect of population age by adjusting the crude black and Hispanic incarceration rates to the white population. These age-adjusted incarceration rates can be interpreted as the hypothetical incarceration rates that would have occurred if the observed age-specific rates for the Hispanic and black populations were associated with a population whose age distribution was equal to that of the white population (McGehee, 2003).[9]

We adjusted the Hispanic and black incarceration rates in 2000 and 2010 using a direct standardization technique. In the procedure, the standardized rate, t_1 is computed as:

$$t_1 = \frac{\sum taPa}{P} \; x \; 1000 \qquad (4)$$

where t_a is the age-specific incarceration rate for Hispanics, P_a represents the white population in each age group, and P is the total white population (the capital letters are used to identify the standard population). Essentially, each Hispanic age-specific incarceration rate is multiplied by

[9] Note that the standard population for the 2000 calculation is the 2000 non-Hispanic white population, and in 2010 is the 2010 non-Hispanic white population. The difference in NPS methodology between 2000 and 2010 make it difficult to directly compare across years.

the white population in that age group. The sum of t_aP_a reflects the number of Hispanic prisoners under state or federal jurisdiction that we would expect to observe if the Hispanic population had an age distribution identical to the white population. Dividing this sum by the white population generates the adjusted incarceration rate. It is important to note that adjusted rate has no intrinsic meaning. It is only meaningful when compared with other adjusted rates calculated on the same standard. In order to compare the standardized and non-standardized rates, we computed relative differences between the crude and adjusted white and Hispanic incarceration rates in 2000 and 2010. The same procedure was used to generate the age-adjusted black incarceration rates in 2000 and 2010.

3.2.3 Decomposing the Differences in Rates

In order to determine the overall contribution of population age-structure to the race and ethnic differences in incarceration rates, we employed a simple technique to decompose the *absolute* difference in incarceration rates into two components: that which can be attributed population age structure and that due to all other sources of variation (Kitagawa, 1955; 1964). To begin, the difference between the Hispanic and white incarceration rates can be expressed as:

$$t - T = \sum \frac{1}{2}\left(\frac{pa}{p} + \frac{Pa}{P}\right)(ta - Ta) + \sum \frac{1}{2}(ta + Ta)\left(\frac{pa}{p} - \frac{Pa}{P}\right) \quad (5)$$

In this equation, *P* and *p* refer to the total population for whites and Hispanics respectively. T_a and t_a refer to the age-specific incarceration rates for whites and Hispanics and P_a and p_a refer to the population of whites and Hispanics in each age group *a*. t-T refers to the absolute difference in crude incarceration rates between the white and the Hispanic population. The first component is the weighted average of the absolute difference between the age-specific incarceration rates across groups using their average age composition as weights. This can be interpreted as the

absolute difference in crude incarceration rates attributable to differences in the actual rates (in other words, the portion of the variation that *cannot* be explained by differences in age structure). The second component is the weighted average of the absolute differences in age-compositions across groups, using the average age-specific incarceration rates as weights. This factor reflects the portion of the difference in incarceration rates that can be attributed to differences in population age-structure between groups. These components can then be compared with the total difference in the crude incarceration rates to estimate the proportion of the difference due to age-structure and the proportion of the difference due to other sources of variation.[10]

$$\sum \frac{1}{2}\left(\frac{pa}{p} + \frac{Pa}{P}\right)(ta - Ta) / (t - T) = \text{Proportion Due to Differences in Rates} \quad (6)$$

and

$$\sum \frac{1}{2}(ta + Ta)\left(\frac{pa}{p} - \frac{Pa}{P}\right) / (t - T) = \text{Proportion Due to Differences in Age Structure} \quad (7)$$

An alternative decomposition strategy common in the criminological literature (e.g. – Steffensmeier & Harer, 1986; Levitt, 1999) is to estimate the contribution of population age-structure to the *relative* difference in incarceration rates. In this technique, the contribution of population-age structure is estimated as the difference between the crude and adjusted Hispanic incarceration rates or $t - t_1$. The contribution of population age-structure to the relative difference in incarceration rates can then be estimated by dividing this figure by the total difference in crude rates between Hispanics and whites or $(t\text{-}t_1) / (t\text{-}T)$. In general, the weighted average approach presented in equation 5 will produce more conservative estimates of the contribution of population age-structure to the race and ethnic disparities in incarceration.[11]

[10] Note that this general framework can be expanded to incorporate differences in gender, or variation across time. However, given the data limitations with the NPS prior to 2010, we are reluctant to directly compare across years.

[11] For a detailed discussion of the key differences between these decomposition strategies, we refer the reader to Kitagawa (1964 p. 309-311).

4. RESULTS

Table 4 presents the results of the age-standardization and decomposition procedures. The second row in this table presents the crude (non-adjusted) incarceration rates for each race/ethnic group in 2000 and 2010. The third and fourth rows present the total difference in incarceration rates between whites and the other race/ethnic groups and the percent difference in the crude incarceration rates between whites and the other groups respectively. These figures indicate that black males were incarcerated at 7.6 times the rate of white males and Hispanic males were incarcerated at 1.8 times the rates of white males in 2000. In 2010, non-Hispanic blacks were incarcerated at 6.9 times the rate of whites and Hispanics were incarcerated at 2.5 times the rate of whites.

[Table 4 about Here]

The age-standardized rates demonstrate that a non-trivial portion of these disparities can be attributed to differences in population age-structure. For instance, the incarceration rate for a population experiencing the same age-specific incarceration rates as the Hispanic population with an age-distribution equal to the white population would be 14 percent lower than the crude Hispanic incarceration rate in 2000 [(1745.2-1496.2)/1745.2] and 18 percent lower than the Hispanic crude incarceration rate in 2010. Similarly, the incarceration rate for a population experiencing the same age-specific incarceration rates as the black population with an age-distribution equal to the white population would be 13.2 percent lower than the black crude incarceration rate in 2000 and 11.6 percent lower than the black crude incarceration rate in 2010. Notably the differences between the crude and adjusted rates are larger for Hispanics than

blacks, suggesting that population age-structure may have a greater effect on the incarceration disparity between Hispanics and whites.

To put this in perspective, the disparities in incarceration rates between Hispanic males and white males would have been roughly 22 percent lower in 2000 [(1.83-1.43)/1.83] and 26 percent lower in 2010 if the Hispanic population had an age structure equal to white population. Likewise, the disparity between blacks and whites would have been roughly 15 percent lower in 2000 and 13 percent lower in 2010 if the black population had an age structure equal to white population. Thus, holding constant the prevailing age-specific incarceration rates, a sizeable portion of the racial and ethnic disparities in incarceration can be attributed to differences in population age-structure across groups.

The results of the decomposition analysis comport with the age-standardization procedures and underscore the importance of population age-structure in the observed racial and ethnic disparities in incarceration. More importantly, these analyses demonstrate that age differences play a much larger role in the Hispanic/white disparity than the black/white disparity. 20.8 percent of the difference in crude incarceration rates between Hispanic males and non-Hispanic white males could be attributed to difference in population age-structure .The 2010 data indicates that 18.7 percent of the disparity in incarceration rates between Hispanics and white males could be attributed to population age-structure. Conversely, roughly 8 percent of the difference in crude incarceration rates between blacks and whites could be attributed to population age-structure at both time points.

5. DISCUSSION

There are clear and persistent racial and ethnic disparities in U.S. imprisonment rates. These trends are frequently attributed to either the differential treatment of minority populations by the criminal justice system or to differential involvement across groups. The causes and consequences of racial disparities in punishment have been at the forefront of criminological research. Yet, most of this research and related commentary focuses on the disparity in crude incarceration rates between groups. We argue that this comparison is problematic, given that the risk for incarceration is intricately linked to age, and the age-distribution of the U.S. population varies substantially across racial and ethnic groups. As such, the comparison of crude incarceration rates may overstate the magnitude of these disparities.

This study takes a first step toward understanding the role of population age structure in the observed racial and ethnic disparities in incarceration. Results of standardization and decomposition procedures demonstrate that the relatively younger age of the black and Hispanic populations contributes to the observed racial and ethnic disparities in incarceration. Notably, around 20 percent of the Hispanic/white and 8 percent of the black-white disparity can be attributed to differences in population age-structures. To be sure, our findings reaffirm the presence of racial disparities in criminal justice involvement, but indicate the comparison of crude incarceration rates may mask a key demographic reason for these differences.

Importantly, these analyses reveal that a larger portion of the ethnic disparity in incarceration is attributable to population age-structure. The prevailing demographic trends in the United States suggest that, all else equal, Hispanic disparities in incarceration should continue to increase over the course of the next decade. Currently 29.4 percent of the Hispanic male population is under the age of 15, compared to 24 percent of the black male population and 17.3 percent of the white male population. In relative terms, almost twice many young Hispanic males

will enter into the high-crime ages over the next decade than young white males. Assuming stable population dynamics and stable race and age-specific incarceration rates, these results indicate that incarceration *disparity* between Hispanics and whites should increase. Similarly, the gap between Hispanics and blacks should decrease, as relatively more Hispanics become concentrated in the high-crime years. More importantly, these age trends indicate that not only should disparities in incarceration increase between Hispanics and whites, but growing disparities between groups should also be evidenced in other stage of the criminal justice system, as well as in rates of homicide, criminal offending, and criminal victimization.

The pitfalls of using demographic trends to forecast future trends in the criminal justice system are well documented in the empirical literature (Cohen & Land, 1987; Levitt, 1999; Fox & Piquero, 2003). While the association between population age and rates of offending is relatively straightforward, there are a number of countervailing factors that obscure the link between population age-structure and incarceration. Unlike criminal involvement, incarceration rates are determined to a large degree by policy factors such as determinant sentencing and mandatory minimums. As noted by Bushway and colleagues, this does not mean that there is no association between population age and incarceration rates, rather the link may be more complex than that between age and arrest (2011 p. 10).

To be sure, these findings do not challenge the existence of discriminatory practices in sentencing, nor do they contradict evidence of differential involvement. Rather, these analyses are meant to highlight the importance of population dynamics in understanding incarceration disparities between groups. Although our study analyzes incarceration data in particular, we expect that disparities in other stages of criminal justice processing, from arrest to sentencing outcomes, may be in part attributable to age structure differences as well. However, further

research is clearly needed to investigate the contribution of age-structure to punishment disparities.

We would be remiss not to acknowledge several key limitations of the current analysis. First and foremost, given the dearth of data available on age-specific incarceration rates across race and ethnicity, our analyses were based on *estimates* of age and race specific incarceration rates. While these data reflect the best currently available to researchers, the findings need to be interpreted with caution. As the quality of the data continues to improve, the findings reported here will need to be reevaluated. Also, the lack of consistent estimates across years makes it difficult to examine longitudinal trends with the NPS data. The demographic processes influencing the racial and ethnic populations in the United States have seemingly clear implications for criminal justice involvement, but the lack of requisite data makes it difficult to examine these trends over time. Given the recent improvements in the BJS data collection, these seem to be tasks that can be reasonably accomplished with data gleaned from the National Correction Reporting Program in the near future.

We should also reiterate several conceptual issues that might limit the results presented here. First, our measure of incarceration captures all individuals currently under state of federal jurisdiction. Insofar as blacks and Hispanics receive longer sentences than whites, the incarceration rates, especially those at the older age-groups, may be biased. Similarly, demographic lag poses a threat as a number of prisoners in the analyses may have been incarcerated at a time when the racial distribution of the population looked much different. Given the shifting nature of the U.S. Hispanic population, this might be especially problematic for the analyses focused on the Hispanic population.

Limitations aside, this analysis provides preliminary evidence that population age-structure plays a significant role in incarceration disparities across racial and ethnic groups in the United States. While there are clear racial and ethnic disparities in incarceration, the magnitude of these differences may be exaggerated by comparing crude rates. Importantly, age-structure seems to be a more salient mechanism in explaining the Hispanic/white disparity than the black/white disparity. Given the current age distributions of racial and ethnic groups in the United States, these disparities will likely increase over the course of the next decade.

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Table 1: Median Age by Sex and Race/Ethnicity 2000 and 2010

	2000			2010		
	NH White	NH Black	Hispanic	NH White	NH Black	Hispanic
Male	37.4	28.5	25.4	40.8	30.6	26.7
Female	39.8	31.7	26.3	42.0	34.0	27.9
Both Sexes	38.6	30.2	25.8	43.3	32.4	27.3

Table 2: Male Population, Estimated Prisoners under State and Federal Jurisdiction, and Estimated Incarceration Rates per 100,000 by Age and Race/Ethnicity in 2000

	Non-Hispanic White				Non-Hispanic Black				Hispanic			
Age Range	(N)[1]	(N/N..)	(E)	(T)	(N)[1]	(N/N..)	(E)	(T)	(N)[1]	(N/N..)	(E)	(T)
18-19	2,595.8	0.037	8.4	323.6	572.8	0.053	16.3	2845.8	723.2	0.061	6.8	940.2
20-24	5,865.1	0.083	56.5	963.3	1,247.9	0.116	98.1	7861.2	1,875.1	0.158	38.7	2063.8
25-29	6,038.6	0.086	67.1	1111.1	1,182.5	0.110	119.1	10071.5	1,826.1	0.154	41.3	2261.5
30-34	6,723.2	0.095	81.9	1218.2	1,212.1	0.113	109.4	9025.6	1,668.1	0.141	40.0	2397.7
35-39	7,836.0	0.111	79.2	1010.7	1,302.5	0.121	101.7	7808.0	1,474.5	0.125	30.4	2061.8
40-44	8,058.0	0.114	58.3	723.5	1,245.7	0.116	64.6	5185.9	1,178.5	0.010	24.8	2104.3
45-54	14,080.4	0.199	60.3	428.3	1,857.3	0.173	49.2	2649.0	1,550.9	0.131	17.8	114.8
55+	19,422.9	0.275	23.7	122.0	2,101.3	0.196	11.3	537.8	1,530.4	0.129	6.6	431.2
N..	70,619.9	1.000	435.4	616.5	10,722.1	1.000	569.7	5313.3	11,826.9	1.000	206.4	1745.1

1 – Population estimates presented in thousands

Table 3: Male Population, Estimated Prisoners under State and Federal Jurisdiction, and Estimated Incarceration Rates per 100,000 by Age and Race/Ethnicity in 2010

	Non-Hispanic White				Non-Hispanic Black				Hispanic			
Age Range	P_a[1]	P_a/P	(E_a)	(T_a)	P_a[1]	P_a/P	(E_a)	(T_a)	P_a[1]	P_a/P	(E_a)	(T_a)
18-19	2,612.7	0.042	3,900	149.3	694.6	0.055	10,400	1497.4	955.1	0.055	5,300	554.9
20-24	6,308.8	0.101	42,800	678.4	1484.3	0.117	75,200	5066.5	2,302.3	0.132	44,800	1945.9
25-29	6,170.6	0.099	64,700	1048.5	1290.1	0.102	94,900	7351.5	2,276.1	0.131	62,300	2737.1
30-34	5,799.4	0.093	64,300	1108.7	1202.4	0.095	95,700	7959.4	2,143.1	0.123	62,400	2911.7
35-39	6,025.4	0.096	58,800	975.8	1191.2	0.094	78,300	657.2.9	1,970.8	0.113	49,900	2532.0
40-44	6,623.0	0.106	61,200	923.1	1227.8	0.097	68,200	5554.8	1,763.7	0.101	37,700	2137.6
45-54	15458.0	0.025	102,600	662.7	2538.9	0.200	101,100	3982.2	2,735.2	0.163	46,600	1703.3
55+	27,366.3	0.438	30,900	112.9	3060.3	0.241	36,300	1186.2	2,621.8	0.156	17,500	647.5
Total	76, 371.1	1.000	429,200	561.9	12,690.2	1.00	560,100	4413.7	16,768.7	1.000	326,500	1874.7

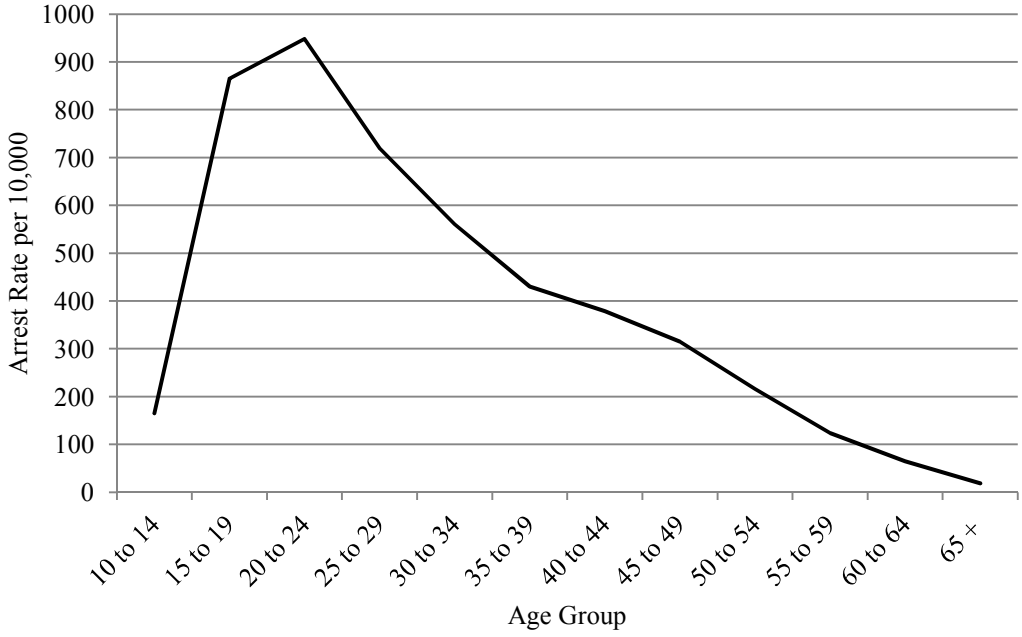
1 – Population estimates presented in thousands

Table 4 – Components of Age Standardization and Decomposition Procedures

	2000[a]			2010[a]		
	NH-White	NH-Black	Hispanic	NH-White	NH-Black	Hispanic
P	76, 371.1	10,722.1	11,826.9	76, 371.1	12,690.2	16,768.7
Crude Incarceration Rate: $\sum E_a / P$	616.5	5313.1	1745.2	561.9	4413.7	1947.1
Dif. in CIR	-----	4696.8	1128.6	-----	3851.7	1385.1
% Dif. in CIR	-----	7.61	1.83	-----	6.85	2.46
Expected Number of Prisoners: $\sum taPa$[b]	-----	3, 257.1	2, 252.2	-----	2978.5	1215.3
Age Adjusted Rate: $\sum taPa / P$	616.5	4612.1	1496.2	561.9	3900.0	1591.2
Dif. in Adjusted Rate	-----	3995.6	879.6	-----	3338.1	1029.3
% Dif. in Adjusted Rate	-----	6.48	1.43	-----	5.94	1.83
Difference due to Rate	-----	4307.1	893.3	-----	3555.8	1059.7
Difference due to Age	-----	389.6	235.3	-----	295.9	252.9
% Dif. in CIR due to Rate[c]	-----	0.92	0.792	-----	0.923	0.813
% Dif. in CIR due Age[c]	-----	0.08	0.208	-----	0.077	0.187

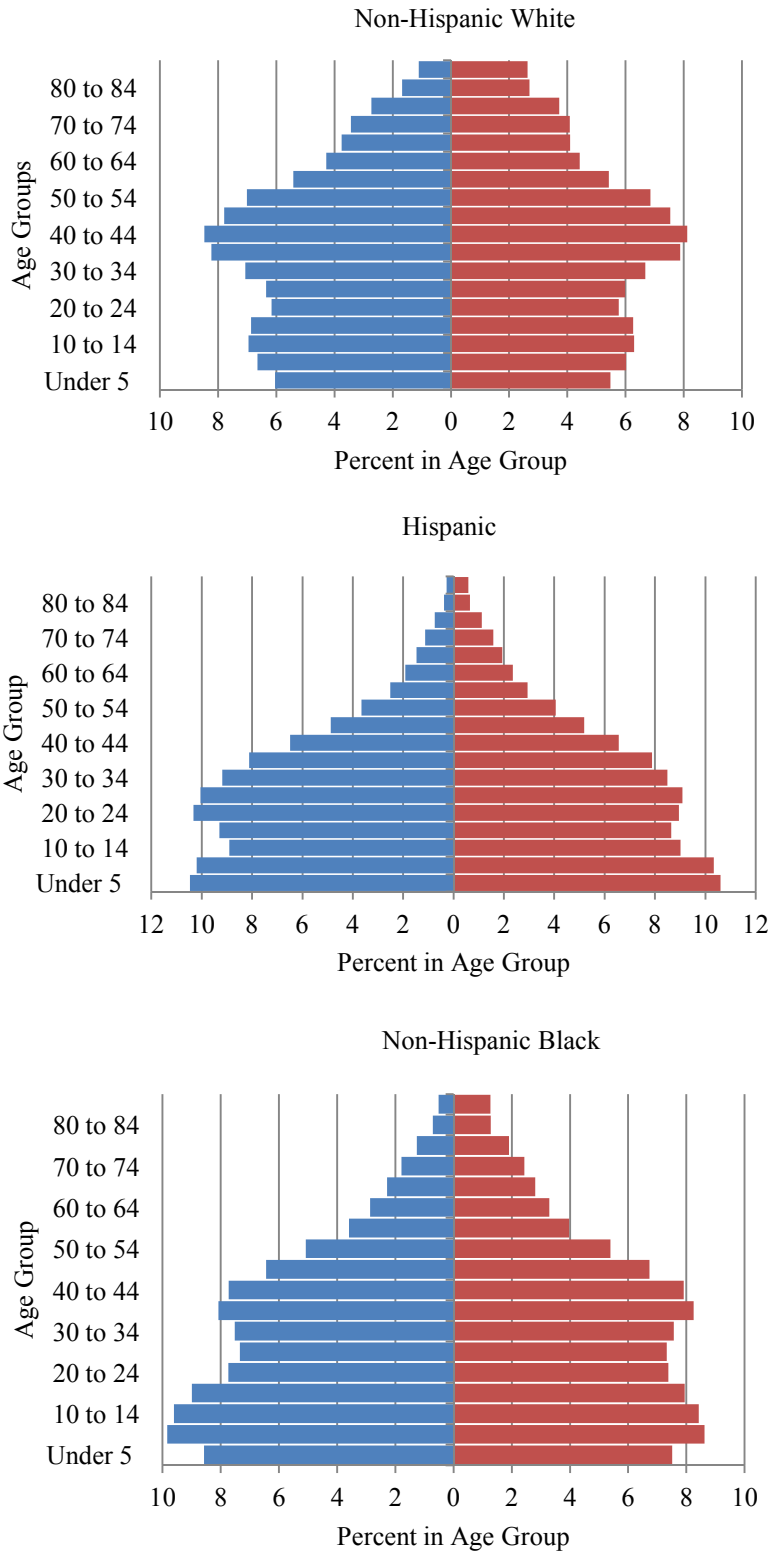
a – Given differences in NPS survey methodology, direct comparison of 2000 and 2010 estimates must be interpreted with caution
b– In Thousands
c - Relative to the non-Hispanic white population

Figure 1 – Arrest Rates by Age-Groups 2010



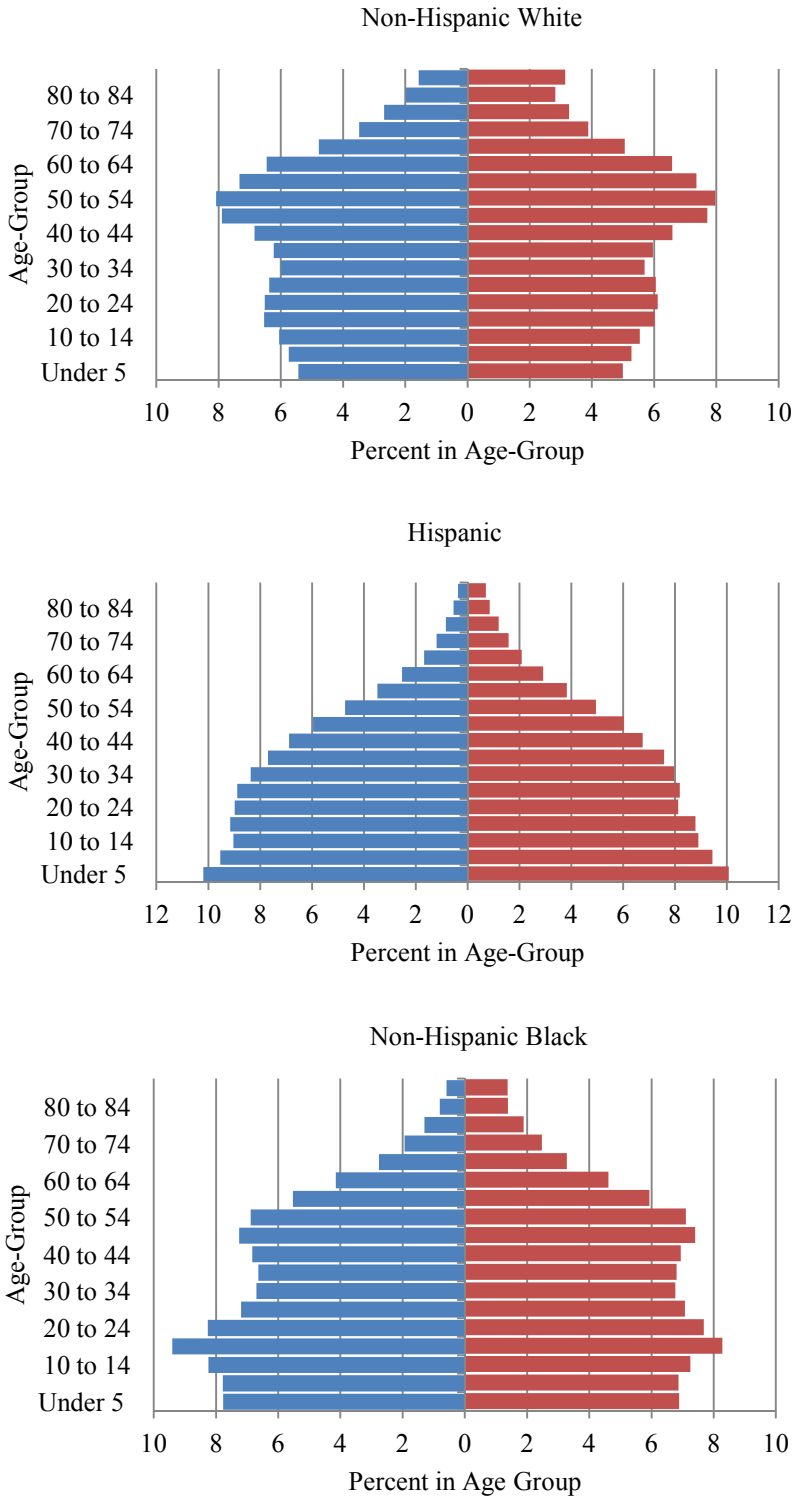
Source: 2010 Uniform Crime Report and 2010 Decennial Census

Figure 2 – Population Age Distributions by Race – 2000



Source: 2000 Decennial Census

Figure 3: Population Age Distributions by Race – 2010



Source: 2010 Decennial Census

Figure 4: Incarceration Rates per 100,000 by Race and Age Group: 2000

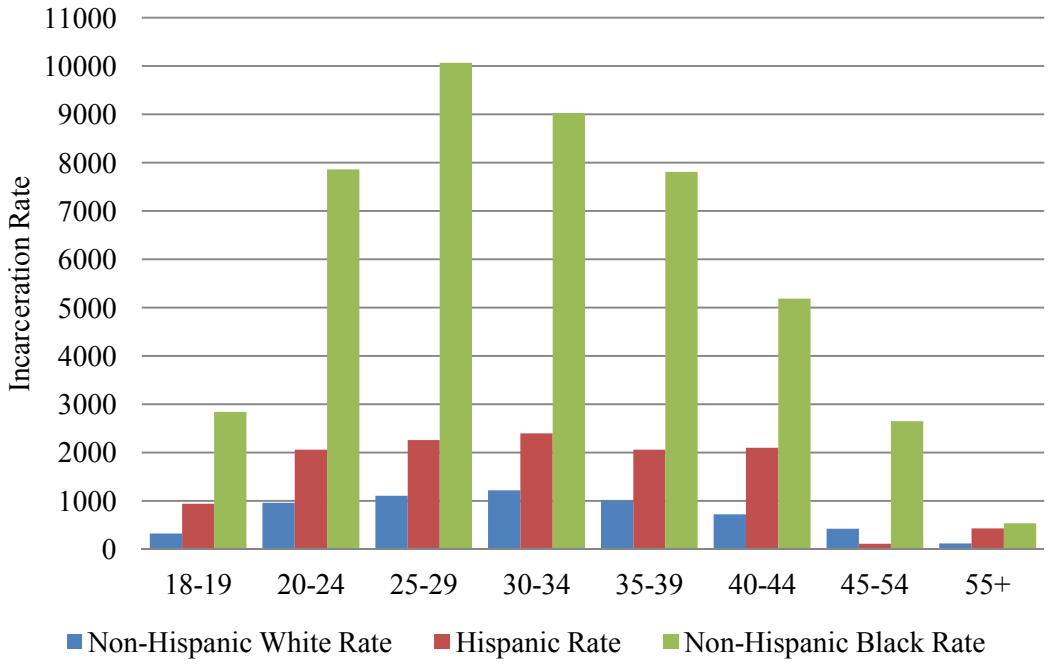


Figure 5: Incarceration Rates per 100,000 by Race and Age Group: 2010