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A Life Table Approach to Estimating Disproportionate Minority Contact in the Juvenile Justice System

Sarah K.S. Shannon and Mathew Hauer

Disproportionate minority contact (DMC) in the U.S. juvenile justice system persists despite substantial efforts to reduce it. The juvenile justice system is comprised of a series of interconnected stages, yet few studies to-date use methods to measure DMC that take the cascading nature of the decision-making process into account. Our study addresses this gap by applying life table analysis to identify the cumulative nature of DMC across multiple stages of the juvenile justice system using data from 2008 to 2010 in Georgia that include white, black, and Hispanic/Latino youth. We then compare these state-level results to life tables from a national sample of black youth and a subnational sample of Hispanic/Latino youth. Our findings show that arrest/referral accounts for the greatest proportion of total system-wide DMC for black youth, but most of the total DMC for Hispanic/Latino youth results from later stages.

Keywords disproportionate minority contact; juvenile justice; life table analysis

Introduction

Despite significant drops in youth crime rates and secure confinement over the past 20 years, racial disparities persist in the U.S. juvenile justice system at

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nearly every stage and in every U.S. state (Kempf-Leonard, 2007; Piquero, 2008; Puzzanchera & Hockenberry, 2015; Sickmund, Sladky, Kang, & Puzzanchera, 2013). More troubling is the fact that disproportionate minority contact (DMC) in rates of secure confinement increased by 15% between black and white youth from 2003 to 2013 despite a 47% decline in the rate of secure confinement nationwide over that time period (Sentencing Project, 2016).

While disconcerting to be sure, the persistence of DMC despite concerted effort to remedy it at discrete stages may be less surprising when viewed in light of the interdependent nature of juvenile justice system processing. The juvenile justice system is comprised of a series of interconnected stages in which youth pass from one to the next, or exit the system via one of several mechanisms. Decisions made by system actors in processing youth through the system at one stage most certainly impact the extent of DMC at subsequent stages. Thus efforts to remediate DMC at one stage, such as secure confinement, may not be as successful if the cumulative effect of DMC at prior stages is not taken into account.

In light of the cascading nature of the decision-making process in the juvenile justice system, a number of scholars have called for more research on how disparities operate through the full flow of juvenile court processing (Bishop & Frazier, 1988, 1996; DeJong & Jackson, 1998; Engen, Steen, & Bridges, 2002; Guevara, Herz, & Spohn, 2006; Hill, Harris, & Miller, 1985; Mears, Cochran, & Lindsey, 2016; McCarthy & Smith, 1986; Rodriguez, 2010). Our study takes up this challenge by applying demographic life table analysis to aggregate data for all youth processed by the juvenile justice system in Georgia between 2008 and 2010. We compare these state-level results to life tables from a national sample of black youth and a subnational sample of Hispanic/Latino youth (Puzzanchera & Hockenberry, 2015). This structural approach is unique in its ability to account for the full juvenile justice process, not just select stages.

Theoretically, we engage with structural-processual perspectives that explicitly hypothesize cumulative effects resulting from the structure of the decision-making process in the juvenile justice system (Engen et al., 2002; Hill et al., 1985; McCarthy & Smith, 1986). These arguments posit that DMC will either decrease or increase in later stages of the system as cases are filtered through sequential decision-making points. In a systematic review of DMC research, Engen and colleagues (2002) in particular encourage more studies that examine Harris and Hill's (1984) structural-processual perspective, which argues that DMC should decrease in later stages as cases become increasingly homogenous and formal criteria for decision-making limit the role of individual bias (Hill et al., 1985). Alternative structural-processual perspectives posit that DMC may increase as legal factors (e.g. offense severity) converge in later stages, making more room for discrimination on the part of system actors stemming from individual bias (McCarthy & Smith, 1986). Our study examines these potential structural-processual patterns of DMC (though not their causes) by using life table methods.

Because research on DMC in the juvenile justice system is a fundamentally comparative endeavor (Kempf-Leonard, 2007), life table analysis is uniquely suited to measuring the cumulative effect of juvenile justice system processing and the interrelated nature of each decision point in the decision flow. To our knowledge, no previous studies have examined aggregate rates of DMC in the juvenile justice system using this method. As we will show, a life table decomposition approach allows us to measure overall system-wide DMC and locate the decision points that account for the greatest proportion of the overall disproportionality in the system (Arriaga, 1984; Shkolnikov, Valkonen, Begun, & Andreev, 2001). Our findings indicate notable differences in which decision points in the process account for the greatest proportion of total disparity for black and Hispanic/Latino youth.

Disproportionate Minority Contact

The fact that minority youth, especially black youth, are overrepresented in the U.S. juvenile justice system is well-established (Kempf-Leonard, 2007). Extensive reviews of available research continue to show that black youth are overrepresented at multiple decision points in the system (Pope, Lovell, & Hsia, 2002; Pope & Leiber, 2005). Efforts to measure, track, and remedy these disparities began in 1988 (Davis & Sorensen, 2013; Leiber, Bishop, & Chamlin, 2011). While the Juvenile Justice and Delinquency Act (JJDPA) initially required states to focus on disproportionate confinement, in practice states and localities were instructed to examine DMC in all the decision points of the juvenile justice system (Leiber, 2002; Leiber & Rodriguez, 2011). The formal language in the JJDPA was changed in 2002 to include all decision points (Davis & Sorensen, 2013; Leiber et al., 2011).

Exactly why DMC exists is somewhat less clear (Kempf-Leonard, 2007). Most scholars agree that both differential involvement in crime and differential treatment contribute to DMC (Engen et al., 2002; Leiber et al., 2011; Piquero, 2008). Some significant differences by race in criminal involvement exist, particularly for black youth (Bishop, 2005; Hawkins, Laub, Lauritsen, & Cothern, 2000; McNulty & Bellair, 2003; Piquero, 2008; Piquero & Brame, 2008; Sampson, Morenoff, & Raudenbush, 2005; Morenoff, 2005), yet multiple reviews of research have found that these differences do not completely explain DMC, indicating that differential treatment in the course of system processing contributes as well (Engen et al., 2002; Bishop, 2005; Pope & Leiber, 2005; Huizinga et al., 2007; Nellis, 2011). Regardless of its causes, more studies that identify how DMC accumulates (or not) throughout the system are needed in order to identify where in the system further investigation or remediation is needed (Bishop & Frazier, 1988, 1996; DeJong & Jackson, 1998; Engen et al., 2002; Guevara et al., 2006; Hill et al., 1985; Mears et al., 2016; McCarthy & Smith, 1986; Rodriguez, 2010).

Table 1 Georgia DMC relative rate index matrix for White and Minority Youth, 2008–2010

Juvenile Justice Stage	Relative Risk Index (RRI)	
	Black/African American	Hispanic/ Latino
Sum arrest and referral	2.36	.26
Petition filed	1.38	1.70
Delinquent findings (adjudication)	1.01	.91
Secure confinement	1.38	1.16
Transfer/waiver to adult court	4.02	2.34

Notes: Disproportionate Minority Contact (DMC) Assessment, Governor's Office for Children and Families, State of Georgia. The RRI is calculated by dividing the rate of involvement for minority youth at a given stage by the same rate for white youth (Source: Hauer & Vaida, 2012).

DMC at the aggregate level is typically measured by the Relative Risk Index (RRI), which divides the rate of involvement for minority youth at a given stage by the same rate for white youth (Feyerherm, Snyder, & Villarruel, 2009). National data show that minority youth are arrested at nearly twice the rate of white youth (RRI = 1.7) (Puzzanchera & Hockenberry, 2015). Minority youth in general are also referred, detained, petitioned, placed in secure facilities, and waived to adult court at higher rates than white youth, though none of these RRIs are as large as that for arrest at the national level (Puzzanchera & Hockenberry, 2015).

For black youth in particular, the arrest rate is more than double that of white youth (RRI = 2.3) (Puzzanchera & Hockenberry, 2015). As shown in Table 1, RRIs in Georgia show a similar picture for black youth, with an arrest rate 2.4 times higher than white youth. National data on Hispanic/Latino ethnicity across all juvenile justice stages are not available due to differences in data quality and measurement across jurisdictions. As a result, studies of DMC for Hispanic/Latino youth using nationally-representative data have been limited to single stages, such as arrest (Andersen, 2015; Tapia, 2010, 2011). Hockenberry and Puzzanchera (2016) produced RRIs for Hispanic/Latino youth in 2013 using available data from 26 states and the District of Columbia. The results show that in these states Hispanic/Latino youth are 20% more likely than white youth to be referred to juvenile court and 30% more likely than white youth to be placed in secure confinement post-adjudication (Hockenberry & Puzzanchera, 2016). RRIs for Hispanic/Latino youth in Georgia reveal that DMC for these youth is higher at petitioning than at arrest/referral, but, like black youth, highest at the transfer to adult court stage (2.3).

Studies using multivariate analyses to predict DMC typically focus on discrete stages in the system in one or a small number of jurisdictions (DeJong & Jackson, 1998; Huizinga et al., 2007; Kempf-Leonard & Sontheimer, 1995; Leiber, Peck, & Rodriguez, 2016; Maupin & Bond-Maupin, 1999; Rodriguez, 2013; Tapia, 2010, 2011). For example, using data from the National

Longitudinal Survey of Youth 1997, Andersen (2015) finds that Hispanic youth are no more likely than white youth to be arrested net of self-reported delinquency. Some of these studies use indicators of a youth's disposition at prior stages to predict outcomes at later stages of the system (Bishop & Frazier, 1996; Leiber, Peck, & Beaudry-Cyr, 2016; Rodriguez, 2010, 2013). For example, Leiber and colleagues (2016) find that youth previously held in secure detention are significantly more likely to be referred to court than diverted net of demographic characteristics, extralegal, and legal factors. Using a random sample of youth in the Arizona juvenile justice system, Rodriguez (2010) likewise finds that youth who are detained are less likely to have their petition dismissed by the judge and more likely to be sentenced to secure confinement. Further, youth who are under probation supervision are more likely to be subsequently committed to a youth correctional institution (Rodriguez, 2013).

One of the key challenges to identifying the presence and extent of DMC is that the juvenile justice system is an interconnected series of stages, each of which entail decision-making by different agents of social control using diverse sets of criteria for action (Engen et al., 2002). As a result of this interlocking structure, DMC at any given stage is likely influenced by decisions made at previous stages and will impact subsequent stages (Piquero, 2008). Unlike prior research using RRIs or multivariate models, our analysis traces the cumulative nature of DMC for black and Hispanic/Latino youth through complete decision flows encompassing multiple stages within the total juvenile justice system. We contribute to this broader scholarship by using life table analysis, a method particularly suited to measuring the compounding nature of decision flows, in order to advance understanding of DMC.

Structural-Processual Theories of DMC

As Figure 1 illustrates, the juvenile justice system operates as a cascading hierarchy, moving youth through its sequence of interlocking stages. Youth enter the system via arrest or other referral, such as by a parent or school official. Cases can then follow one of several paths toward further involvement or exit from the system. For example, after referral or arrest, youth can be petitioned by the prosecutor to appear in court or be released with no charge. If a youth is petitioned to trial (adjudication hearing), he or she can either be adjudicated delinquent (convicted) and sentenced (perhaps to secure confinement or probation) or be found not guilty and exit the system. This interdependent, systematic flow of juvenile justice processing creates a "snowball" effect of movement by minority and white youth through the system as a whole (Davis & Sorensen, 2013; Kempf-Leonard, 2007).

As Engen et al. (2002) note, studies that examine only single stages may miss cumulative effects that are a byproduct of the system's interdependent structure. In light of this dynamic process, structural-processual theories argue that studies of DMC must account methodologically for the cumulative nature

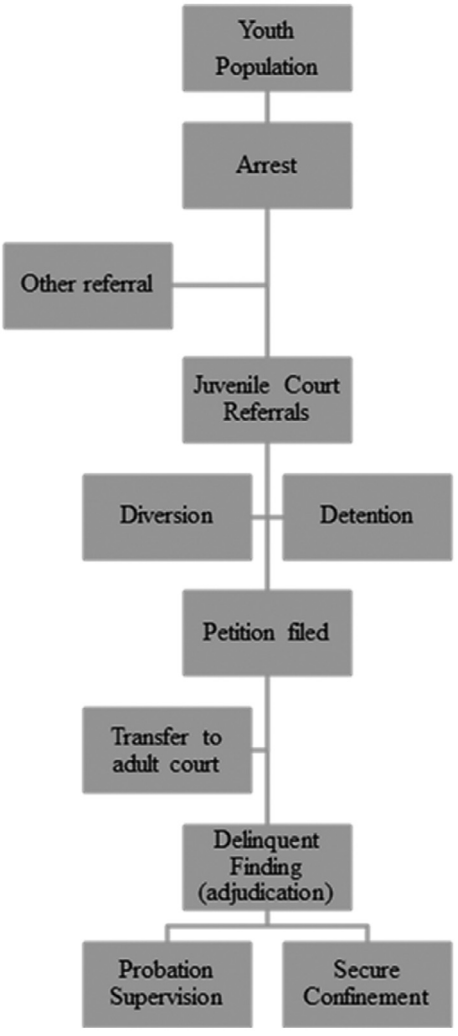

Figure 1 Stages in the juvenile justice system. (Source: Adapted from Feyerherm, et al., 2009).

of decision-making throughout the system as a whole (Bishop & Frazier, 1988; Engen et al., 2002; Hill et al., 1985; McCarthy & Smith, 1986; Tittle & Curran, 1988). These theories posit that DMC can be expected to vary systematically throughout the stages of processing given that different agents of social control operate at each stage, such as police at arrest, prosecutors at petitioning, and judges at adjudication and sentencing (Hill et al., 1985).

Scholars differ on whether to expect DMC to accumulate or diminish over the course of the system. On the one hand, DMC may increase as more information is gathered on individual youth at each stage, perhaps inviting greater bias on the part of decision makers like prosecutors or judges (Tittle & Curran, 1988).

From this perspective, youth become increasingly similar to one another based on legal factors (e.g. offense severity) but remain different from one another along other discriminatory factors like race, ethnicity, gender, and class (McCarthy & Smith, 1986; Tittle & Curran, 1988). As a result, formal legal criteria may decline in prominence in the minds of system actors like prosecutors and judges while the need to differentiate between youth encourages greater reliance on stereotypes by race or ethnicity. Essentially, this perspective argues that decision makers have greater need to call upon individual bias at later stages in order to simplify the decision-making process (McCarthy & Smith, 1986; Tittle & Curran, 1988).

On the other hand, disparity at early stages, such as arrest, may dissipate over subsequent stages of the system as the population at risk in each stage dwindles and becomes more homogenous based on formal legal criteria (Hill et al., 1985). In the early stages, such as arrest, there is greater latitude for discretion and fewer formal criteria for decision-making than at later stages in the system where documentation and accountability standards are more stringent. Agents of social control, such as police, may be more inclined to rely on "simplifying heuristics," or typescripts based on expected behavior by race or other characteristics, in order to make quick decisions with limited information (Hill et al., 1985, p. 140; Moskos, 2009; Oberfield, 2010; Skolnick & Fyfe, 1993).

Hill and colleagues (1985) argue that rates of DMC should progressively decline across processing stages for two reasons. The first is that as cases are filtered through increasingly formal criteria and information about individual youth accumulates, decision makers are forced become more selective based on organizational and structural constraints. Second, these scholars credit the narrowing of bias to the social psychology of attribution. For example, white youth who have made it deeper into the system despite lower odds of further involvement at entry to the system may be deemed more culpable by court actors in later stages by virtue of having survived earlier filtering stages (Hill et al., 1985). As a result, rather than minority youth experiencing greater bias in later stages, white youth catch up to minority youth in the likelihood of moving further into the system as stages progress. Our data and method preclude us from examining the presence or influence of such overt or implicit biases in the juvenile justice system, but a rich line of research on "street-level bureaucrats," including police officers and court actors, demonstrates that such officials often use cognitive shortcuts based on perceptions of "deservingness" when deciding how to respond to clients in light of limited information and resources (Bridges & Steen, 1998; Harris, 2008, 2009; Leiber et al., 2016; Lipsky, 1980/2010; Maynard-Moody & Portillo, 2010; Moskos, 2009; Oberfield, 2010; Skolnick & Fyfe, 1993).

Due to data and methodological limitations, few studies have been able to examine structural-processual theories through the full scope of the juvenile justice system (Engen et al., 2002). A handful of studies have examined cumulative effects of earlier stages on later stages using multivariate modeling

techniques, but these studies typically examine only one or two stages at a time (Leiber & Fox, 2005; Rodriguez, 2010). Our analysis improves on prior studies by using methods that are equipped to measure total DMC in a given decision flow within the system as well as quantify the proportion that each individual stage in that flow accounts for in the total disparity. In examining the juvenile justice system holistically, we expect to see that DMC has a cumulative effect between earlier and later stages, either increasing or decreasing, as predicted by structural-processual perspectives.

Data and Method

Georgia provides a useful case study for examining DMC for several reasons. First, Georgia is a racially and ethnically diverse state. A substantial percentage of the population is black (31.5%) and a growing number of residents are of Hispanic/Latino ethnicity (9.3% of the population in 2014, up from 5.3% in 2000) (U.S. Census Bureau, 2016). Second, Georgia's juvenile arrest rates are very similar to the national average. In 2012, Georgia's total arrest rate for juveniles was 3,812 per 100,000 as compared to the U.S. rate of 3,940 (National Center for Juvenile Justice, 2015). Georgia's juvenile arrest rate for violent crime was 169 per 100,000, somewhat lower than the national rate of 182 per 100,000. Juveniles were arrested at a slightly higher rate for property crimes (916 per 100,000) as compared to youth nationwide (883 per 100,000) (National Center for Juvenile Justice, 2015). Finally, in 2010 Georgia's rate of juvenile confinement—220 per 100,000 youth ages 10 to 17—was on par with the national average (225 per 100,000) (Sickmund et al., 2013). Thus with respect to juvenile justice populations, Georgia provides ample racial and ethnic diversity and reflects similar rates of juvenile justice involvement as other states in the nation.

We draw data for our state-level analysis from the Georgia Juvenile Justice Data Clearinghouse (Georgia Criminal Justice Coordinating Council, 2015), an aggregate data-set for all 159 counties in the state pooled from 2008 to 2010. These data capture the full universe of youth in Georgia's juvenile justice system, including non-Hispanic black, non-Hispanic white, and Hispanic/Latino youth. Our data-set includes the number of youth arrested, referred, petitioned, adjudicated as delinquent, committed to the Department of Juvenile Justice (DJJ), confined, and transferred to adult court for the whole state across these years.

Given that these aggregate data are pooled over three years, we are not able to follow individual youth through the system in this analysis. As a result, we do not have data on prior involvement in the justice system or for offense severity/type. This significant data limitation precludes us from drawing conclusions about any causal factors underlying DMC at any given stage. For example, without data on prior arrests, charges, or other criminal justice involvement on the part of these youth, we cannot determine whether DMC

any given stage is due to differential involvement in criminal behavior on the part of any subgroup of youth. However, we proceed with the available data because our analysis is primarily concerned with providing a high-level view of the structural flow of youth through the system rather than a causal analysis of DMC. Nevertheless, our results should be interpreted with this important caveat in mind.

We use juvenile justice data for youth aged 15 to 20 in order to match U.S. Census Bureau (2016) data for the initial population at-risk.[1] This age range also covers the majority of the population in our juvenile justice data-set. We include youth up to age 20 since some youth may be in the system past the age of 18 due to ongoing litigation. Juvenile arrest rates in Georgia show no significant fluctuations over the time period our data are drawn from, nor were there any major changes in juvenile justice policy in the state between 2008 and 2010 that might impact our findings (Georgia Bureau of Investigation, 2013).[2] For simplicity, we combine arrests and other referrals into a singular stage representing the total universe of youths entering the system in these years. Because youth can enter the system either through arrest or through referral, such as from a parent or school official, these are not distinct stages bur rather parallel points of entry to the system.

To examine the generalizability of our findings, we compare our life table results for black youth in Georgia to life tables using national data for 2012 obtained from the National Disproportionate Minority Contact Databook (Puzzanchera & Hockenberry, 2015). This data-set includes information from 42 states representing 84% of the juvenile population aged 10 to 17 nationwide (National Juvenile Court Data Archive, 2015). The data in the national data-set are not collected uniformly but rather rely on state and county agency reports, which can be quite heterogeneous (Puzzanchera & Hockenberry, 2015). As a result, the national data-set uses data only from states that report case dispositions (which can include multiple counts of crimes committed) (Puzzanchera & Hockenberry, 2015). As noted, nationwide data by ethnicity are not available but we utilize subnational data available from the National Disproportionate Contact Databook for 26 states in 2013 to compare our results for Hispanic/Latino youth in Georgia with a broader sample of states (Hockenberry & Puzzanchera, 2016). The youth in this subnational sample are also aged 10—17 and represent 75% of the U.S. Hispanic youth population. Data from Georgia are not included in either the 42-state sample for black and white youth or the 26-state sample for Hispanic/Latino youth (Hockenberry & Puzzanchera, 2016;

1. Data are available for Georgia's juvenile justice system for youth age 13 and over. However, the U.S. Census Bureau does not publish estimates by single year of age but rather by age groups such as 10—14, 15—17, and 18—19.

2. As we discuss in the conclusion, the Georgia Legislature passed a reform bill in 2013 aimed at reducing juvenile incarceration (Pew Charitable Trusts, 2013). This change, however, took place after the time period in our analysis and does not impact our findings. Future research should track how these reforms impact DMC.

Puzzanchera & Hockenberry, 2015). The age group included in the national and subnational data sets is markedly different than our Georgia data, making comparisons between the two geographic scales suggestive at best. Nevertheless, these are the best available data and can provide at least an illustrative comparison given that there is a three year overlap between the age ranges in the three samples (15—17).

Life table techniques allow for analysis of both incremental and cumulative effects within a given depreciation process. Typically used by demographers to model mortality by calculating the expected rate of death between chronological ages (Siegel, Swanson, & Shryock, 2004) life tables can be adapted from their traditional use to calculate other interdependent processes in which some individuals "survive" to the next stage while others do not. Examples include business closures (Nucci, 1999), automobile registration rates (Vaupel et al., 1998), the service life of household goods (Pennock & Jaeger, 1957), and nursing home admissions (Kemper & Murtaugh, 1991; Liang & Tu, 1986; McConnel, 1984).

Most relevant to this analysis, life tables have to been used to analyze criminal justice processes such as the lifetime likelihood of incarceration (Bonczar & Beck, 1997), racial disparities in the cumulative risk of imprisonment for men aged 30 to 34 (Pettit, 2012; Pettit & Western, 2004; Western, 2006), and the cumulative risk of parental incarceration for black and white children (Wildeman, 2009). Life tables are also amenable to calculating the prevalence of correctional populations for which data are limited or unavailable, including the number of former prisoners and former felons living in the United States at the national and state levels (Shannon et al., in press; Uggen, Manza, & Thompson, 2006). Life tables permit researchers and policy makers to examine criminal justice processes holistically, identify the stages that contribute most to overall disparity in the system, and focus remedial efforts accordingly.

Conceptually, life tables follow a hypothetical cohort of 100,000 people (called a life table population) as a step-wise function, moving from one age to the next (Siegel et al., 2004). In the juvenile justice context, each year of age in a traditional life table can be conceived of as a stage of the juvenile justice system's hierarchy of decision points. While the intervals between each stage may be of uneven duration, the same logic applies—individuals can only move to subsequent stages of the justice system if they have survived all previous stages of its structural flow, much like in the context of mortality.

The life table population is diminished each successive year by applying the expected death rate and reducing the cohort accordingly. Key to the demographic life table is the probability of death (q_x) within each interval for individuals at each age (Siegel et al., 2004). Equation (1) demonstrates the calculation of (q_x).

$$q_x = \left(\frac{M_x}{1 + (1 - a_x) * M_x} \right) \tag{1}$$

where M_x is deaths divided by the population at risk, and a_x is an adjustment value typically set at the mean point in the interval at which people die.[3] These probabilities of death for each age are then applied to the life table population of 100,000 people ($_nl_x$), allowing for estimation of the number of person-years survived between x and $x + 1$ ($_nL_x$) and the cumulative number of person-years lived after age x (T_x). Once these values are obtained, the average life expectancy at each age (e_0) is calculated by dividing the cumulative person-years (T_x) by the life table population ($_nL_x$).

Life expectancy represents the average number of additional years of life to be expected beyond any given age. We conceptualize life expectancy in our analysis as the average number of stages each racial or ethnic group will experience beyond any given decision point in the juvenile justice system. This calculation represents the expectation of the number of cumulative justice system stages a youth is expected to experience. The cumulative nature of these calculations accounts for the interdependent nature of each stage. Survival in our analysis takes the form of successful movement from one stage to the next (e.g. being arrested or referred, petitioned, found delinquent, confined, and the like). Conversely, we conceptualize failure (death) in our analysis as exiting the system at any given stage via such mechanisms as lack of arrest or adjudication, or diversion. Specifically, we apply life table analysis to one distinct decision flow in the juvenile justice system: arrest/referral through secure placement.[4] Alternative flows can also be examined using this same method.

Life table techniques can also facilitate the comparison of expectancies between two different populations using a decomposition process. In our case, we are interested in how non-Hispanic white youth compare with non-Hispanic black and Hispanic/Latino youth in their rates of "survival" in the system. As Arriaga (1984) notes, a change in life expectancy at any given age (or stage, in our analysis) does not mean that death rates stay the same in magnitude or direction at every age. The same may be true in the juvenile justice system; a change in expectancy at one stage does not imply similar expectancies at any other decision point. This is significant for our analysis since, as structural-processual theories argue, different social actors are involved at each decision point in the juvenile justice system with varying goals, all of which may impact racial or ethnic disproportionality in disparate ways. By taking the interdependent nature of the juvenile justice system's stages into account

3. a_x is typically assumed as half of the interval or .5 (so for a calendar year of January 1—December 31, .5 roughly equates to July 1). However, our analysis does not contain a discrete time variable associated with stages in the juvenile justice system since no one can exit halfway through a stage. As a result, we set a_x to zero.

4. As previous studies have made clear (Leiber et al., 2016; Rodriguez, 2010, 2013), secure detention plays a key role in DMC. Our aggregate data do not allow us to link which particular youth in the sample were detained prior to further processing. As a result, it is not possible for us to evaluate this stage as part of a larger decision flow in our current analysis. We encourage future researchers with appropriate data to pursue this important line of inquiry.

mathematically, life table decomposition facilitates the measurement of overall DMC as well as the identification of stages that account for substantial portions of that total disparity.

Mathematically, this decomposition process entails calculating a series of ratios between racial/ethnic groups that comprise both the direct effect of DMC at each stage and its indirect effect on subsequent stages. For example, a change in the exit rate at the arrest/referral stage has both a direct effect on the arrest/referral stage itself and an indirect effect on all subsequent stages in the system for each group of youth. Equation (2) displays the calculation of these direct and indirect effects (Arriaga, 1984; Preston, Heuveline, & Guillot, 2001). Superscripts 1 and 2 throughout the equation refer to populations 1 and 2, in which population 1 is the reference group (in our case white youth) and subscript 2 is the comparison group (in our case either black or Hispanic/Latino youth).

$$ {}_n\Delta_x = \frac{l_x^1}{l_0^1} * \left(\frac{{}_nL_x^2}{l_x^2} - \frac{{}_nL_x^1}{l_x^1}\right) + \frac{T_{x+n}^2}{l_0^1} * \left(\frac{l_x^1}{l_x^2} - \frac{l_{x+n}^1}{l_{x+n}^2}\right) \tag{2} $$

The first term on the right-hand side of Equation (2), $\left(\frac{l_x^1}{l_0^1}\right) * \left(\frac{{}_nL_x^2}{l_x^2} - \frac{{}_nL_x^1}{l_x^1}\right)$, represents the direct effect; that is, the effect that a change in exit rates between one stage (x) and the next ($x + n$) has on the differences in total DMC. This is comprised of two calculations. First, the difference is taken between the two populations (e.g. white and black youth) in the ratio of the number of person-stages experienced at each stage (${}_nL_x$) to the number of survivors (${}_nl_x$). Then, this difference is multiplied by the ratio of the number of survivors at a given stage x (${}_nl_x^1$) (e.g. arrest) to the initial life table population (${}_nl_0^1$) for the reference population (in our case white youth).

The combined indirect and interaction effects are expressed in the second term on the right-hand side of Equation (2), $\frac{T_{x+n}^2}{l_0^1} * \left(\frac{l_x^1}{l_x^2} - \frac{l_{x+n}^1}{l_{x+n}^2}\right)$, representing the effect that a change in exit rates between stages x and $x + n$ has on subsequent stages. These effects are comprised of two calculations. We first take the difference between two ratios: (1) the number of survivors for each racial/ethnic group at each stage $\left(\frac{l_x^1}{l_x^2}\right)$ (e.g. number of white survivors divided by number of black survivors) and, (2) the number of survivors at stage x to $x + n$ $\left(\frac{l_{x+n}^1}{l_{x+n}^2}\right)$ for each population. This difference is then multiplied by the total person-stages experienced in population 2 (e.g. black youth) at stage x to $x + n$ divided by the number of survivors in population 1 (e.g. white youth) at stage 0 $\left(\frac{T_{x+n}^2}{l_0^1}\right)$.

As this formula illustrates, the decomposition approach accounts for the interdependencies between any given stage and its previous, as well as subsequent stages in the system. These calculations produce a comprehensive estimate of the effect that differential rates of exit from the juvenile justice

system by race/ethnicity at each stage has on the total disproportionality in the system. We can then further calculate the proportion that each stage in the system contributes to the total disproportionality by dividing ${}_n\Delta_x$ for each stage by the sum of ${}_n\Delta_x$ for all stages $\left(\sum_x {}_n\Delta_x\right)$ producing a percentage contribution for each stage to the overall differences in expectancy. Utilizing Arriaga's (1984) approach to decomposition (Shkolnikov et al., 2001), we identify the stages in our focal decision flow that contribute most to the total DMC between white and minority youth within the juvenile justice system as a whole.

Results

Life table calculations for Georgia's juvenile justice system ending with secure confinement are summarized in Table 2 for white (non-Hispanic), black (non-Hispanic), and Hispanic/Latino youth. The initial population at risk is the total population of each racial or ethnic group aged 15 to 20. The first three columns provide data on the initial population at each stage of the decision flow (lx), the number of "survivors" who will enter into the subsequent stage (ndx), and the probability of surviving to the next stage (nqx). The next three columns depict the standard life table population of 100,000 youth (${}_nl_x$), the survivors (${}_nL_x$), and the total person-years lived (T_x) at each stage. These values are necessary to calculate the expectancies (e_0), or the number of expected stages that youth will experience beyond the current stage, which are displayed for each stage in the third column from the right. This is akin to life expectancy in standard life tables. The final two columns show the disproportionality in expectancies that each stage accounts for out of the total system wide disparity, which is given by the sum of the difference in expectancies for each racial/ethnic group.

The expectancy for black youth at entry to the system is .227, which is 2.3 times greater than the expectancy for white youth (e_0 = .099). This indicates that black youth are expected to experience double the number of stages in the juvenile justice system than are white youth upon entry to the system. This ratio changes, however, as youth move through the system. Black youth are about 1.3 times more likely experience subsequent stages at the petitioning stage (.396/.309). At the adjudication stage, black youth are slightly more likely (1.07 times) to experience subsequent stages than are white youth (e_0 = .542 and e_0 = .504, respectively). A sharper disparity emerges again in the final stage in this decision flow as the expectancy for black youth sentenced to secure confinement is 1.3 times greater than for white youth (.366/.280 = 1.31).

The life table expectancies for Hispanic/Latino youth in Georgia reveal a different pattern from that of black youth. The expectancy at entry to the system for Hispanic/Latino youth is actually lower than that of white youth (e_0 = .070 vs. .099 for whites). This indicates that Hispanic/Latino youth are

Table 2 Life table calculations and decomposition for secure confinement of minority juveniles in Georgia, 2008–2010

	Population (lx)	Survivors (ndx)	Probability of survival (nqx)	Life table population ($_nl_x$)	Survivors ($_nL_x$)	Total person-years(T_x)	Expectancy (e_0)	Difference in expectancy ($_n\Delta_x$)	% of total DMC
White									
Population at Risk (mid-2009)	1,241,238	102,083	.076	100,000	7,599	9,944	.099	*n/a*	*n/a*
Arrest and Referral	102,083	26,342	.205	7,599	1,559	2,345	.309	*n/a*	*n/a*
Petitioned	26,342	17,135	.394	1,559	614	786	.504	*n/a*	*n/a*
Delinquent findings (adjudication)	17,135	2,787	.140	614	86	172	.280	*n/a*	*n/a*
Secure confinement	2,787	2,787	1.000	86	86	86	1.000	*n/a*	*n/a*
Black or African American									
Population at Risk (mid-2009)	802,133	155,610	.162	100,000	16,248	22,681	.227	.127	53.32
Arrest and Referral	155,610	53,785	.257	16,248	4,173	6,434	.396	.033	13.71
Petitioned	53,785	35,325	.396	4,173	1,654	2,260	.542	.035	14.69
Delinquent findings (adjudication)	35,325	7,917	.183	1,654	303	606	.366	.043	18.28
Secure confinement	7,917	7,917	1.000	303	303	303	1.000		
Sum of difference in expectancy								.238	100

Hispanic/Latino									
Population at Risk (mid-2009)	312,975	15,898	.048	100,000	4,834	6,979	.070	−.029	−68.68
Arrest and Referral	15,898	6,742	.298	4,834	1,440	2,145	.444	.047	108.86
Petitioned	6,742	4,002	.372	1,440	536	706	.490	.007	16.88
Delinquent findings (adjudication)	4,002	752	.158	536	85	170	.316	.018	42.94
Secure confinement	752	752	1.000	85	85	85	1.000		
Sum of difference in expectancy								.043	100

expected to experience about one-third fewer stages than whites at the point of entry to the system. But the expectancies for petitioning by ethnicity reveal that once in the system, Hispanic/Latino youth are likely to experience more subsequent stages than are whites. The expectancy for Hispanic/Latino youth at petitioning is 1.4 times higher than for white youth (.444/.309 = 1.44). Once Hispanic/Latino youth reach the adjudication stage, however, they are about as likely as white youth to experience subsequent stages (e_0 = .504 and .490). The expectancy for Hispanic/Latino youth at secure confinement is 1.13 times higher than for white youth (.316/.280 = 1.13).

Moving beyond these stage-level indicators to a holistic measure of disproportionality that accounts for the interdependence between stages, the final two columns of Table 2 show results from applying Arriaga's (1984) decomposition to our life tables for white and minority youth in Georgia. The sum of the difference in life expectancy $\left(\sum_x {}_n\Delta_x\right)$ is a net compositional effect summing the differences in expectancy for all stages of this system flow. The ${}_n\Delta_x$ at each stage reveals the disproportionality in expectancies that an individual stage accounts for out of the total system wide disparity. The total difference between white and black youth $\left(\sum_x {}_n\Delta_x\right)$ shows that black youth disproportionately experience an additional .24 stages in this decision flow overall. We can then divide the difference in expectancy at each stage by the total difference between groups in order to assess the proportion of the system-wide disparity that any given stage accounts for. For example, dividing ${}_n\Delta_x$ = .127 at the arrest/referral stage by $\sum_x {}_n\Delta_x$ = . 238 shows that just over half (53%) of the total disparity between white and black youth in Georgia's juvenile justice system occurs at the arrest and referral stage ((.127/.238 = .53) * 100 = 53). Subsequent stages in the system each account for far less of the total disparity for black youth, the next highest being secure confinement at 18%.

The decomposition results for white and Hispanic/Latino youth also shown in Table 2 follows a very different pattern than for black youth. The total difference in stage expectancies for Hispanic/Latino and white youth is .043, indicating that Hispanic/Latino youth are also overrepresented in this juvenile justice system flow as a whole compared to whites, though at a much lower rate overall than black youth (.043 vs. .238, respectively). However, the petitioning stage accounts for a greater proportion of DMC for Hispanic/Latino youth than does the arrest/referral stage. As Table 2 indicates, there are countervailing results between the arrest/referral and petitioning stages for Hispanic/Latino youth. Intake of Hispanic/Latino youth into the system via arrest and referral is lower than for white youth, as shown by ${}_n\Delta_x$ = −.029. The negative direction of this estimate indicates underrepresentation of Hispanic/Latino youth at arrest/referral. This apparent advantage, however, is essentially erased at the petitioning stage, with ${}_n\Delta_x$ = .047. The net impact of these two early stages of the system accounts for 40% of the total DMC for

Hispanic/Latino youth (-68.68 + 108.86 = 40.18). While the adjudication stage accounts for only about 17% of the total disparity, the secure confinement stage accounts for an additional 43% of the overall disparity. Thus rather than disparity decreasing in later stages, the final stage in this decision flow for Hispanic/Latino youth indicates that DMC is just as salient at the sentencing stage as at petitioning.

We next compare our results for Georgia in Tables 2 to life table and decomposition analyses using national data for black and white youth, as shown in Table 3.

As indicated by the sum of the difference in expectancy, overall system disparity for black youth aged 10—17 in the U.S. juvenile justice system is .148. As in Georgia, the greatest source of total disparity between black and white youth nationally occurs at arrest/referral in the decision flow leading to secure confinement (64%). Petitioning and adjudication account for smaller percentages of the total disparity (about 8% each) but sentencing to secure placement accounts for about 20% of the total disparity, as is the case in Georgia (18%). Given the age differences between the two samples caution is warranted in drawing conclusive comparisons between Georgia (15—20) and the U.S. system as a whole (10—17). Nevertheless, the similarity in these patterns is striking and merits further examination in future research.

Finally, we compare our results for Hispanic/Latino youth in Georgia with a subnational sample from 26 U.S. states as shown in Table 4. As in Georgia, Hispanic/Latino youth in this broader sample are overrepresented in the total system. System-wide DMC for these youth is .099 as shown by the sum of the difference in expectancy. Like Georgia, the pattern of stages that account for greater proportions of total DMC is different for Hispanic/Latino youth than for black youth. Arrest/referral only accounts for about 5% of overall DMC, while adjudication accounts for the largest proportion of system-wide DMC at about 40%. Petitioning accounts for 21% and secure placement about 34% of total system DMC for Hispanic/Latino youth in this subnational sample. As a result, later stages in the system are more salient for Hispanic/Latino youth than for black youth in terms of cumulative DMC.

Discussion and Conclusion

Our analysis advances research on patterns in DMC by race and ethnicity in two ways. First, our analysis shows that patterns of cumulative disparity throughout the juvenile justice system appear to differ in notable ways by minority group. Taken together, these life tables at both the state level in Georgia and at the national/subnational level in the United States show that black and Hispanic/Latino youth face very different patterns of DMC in the juvenile justice system. It is clear in both sets of life tables that the arrest/referral stage accounts for the highest proportion of system-wide DMC for black youth but the lowest proportion of total DMC for Hispanic/Latino youth. In both the

Table 3 Decomposition of differences in stage expectancy for White and Black Youth in the United States juvenile justice system

Juvenile Justice Decision Point	White ${}_nl_x$	Black or African-American ${}_nL_x$	T_x	e_0	${}_nl_x$	${}_nL_x$	T_x	e_0	${}_n\Delta_x$	%
Population at Risk	100,000	5,721	7,396	.074	100,000	12,576	16,845	.168	.095	63.96
Sum of Arrest and Referral	5,721	1,110	1,676	.293	12,576	2,850	4,269	.339	.012	7.83
Juveniles Petitioned	1,110	411	566	.510	2,850	987	1,420	.498	.012	7.89
Delinquent findings (adjudication)	411	78	155	.378	987	216	432	.438	.030	20.32
Placement	78	78	78	1.000	216	216	216	1.000		
Sum of difference in expectancy									.148	100

Table 4 Decomposition of differences in stage expectancy for White and Hispanic/Latino Youth in a subnational sample

Juvenile Justice Decision Point	White				Hispanic/Latino					
	${}_nl_x$	${}_nL_x$	T_x	e_0	${}_nl_x$	${}_nL_x$	T_x	e_0	${}_n\Delta_x$	%
Population at Risk	100,000	2,311	3,467	.035	100,000	2,617	4,021	.040	.005	5.05%
Sum of Arrest and Referral	2,311	775	1,155	.500	2,617	898	1,404	.536	.021	21.28%
Juveniles Petitioned	775	274	381	.491	898	348	506	.564	.039	39.73%
Delinquent findings	274	53	106	.387	348	79	158	.454	.034	33.95%
Placement	53	53	53	1.000	79	79	79	1.000		
Sum of difference in expectancy									.099	100

Georgia and national samples, secure confinement accounts for the second-highest contributor to system-wide DMC for black youth. In contrast, for Georgia, petitioning and secure confinement combined account for about 80% of total DMC for Hispanic/Latino youth. In the subnational sample, adjudication and secure confinement account for over 70% of total DMC for this group of youth.

In light of these differences, our findings suggest that states and local jurisdictions should closely examine how DMC accumulates differentially between minority groups. Where data are available, life table decomposition techniques could be applied to compare additional subgroups of interest, including by gender and citizenship status (e.g. foreign- vs. native-born). States and local jurisdictions should be encouraged and supported in improving data quality and availability, particularly as it relates to race and ethnicity.

Second, our analysis of cumulative DMC for black youth provides some provisional support for Hill et al.'s (1985) structural-processual theory that DMC diminishes as youth move further through the cascading system of stages. For black youth, earlier stages in the system are responsible for the highest proportion of the total system-wide disparity. Our life table results demonstrate that disparities at arrest and referral account for more than half of the system-wide DMC for black youth in Georgia and nationally. Our analysis is limited in that we cannot identify causal mechanisms underlying these patterns for black youth without data on prior criminal behavior and system involvement. Yet our results are in line with ample prior research indicating that this stage is highly salient in the study of DMC and black youth. Clearly DMC at the arrest and referral stage warrants continued study as to its underlying causes. Prior research implicates both differential involvement in crime and differential treatment by police are contributing factors to DMC for black youth (Engen et al., 2002; Hawkins, 2005; Hawkins et al., 2000; Pope & Leiber, 2005; McNulty & Bellair, 2003; Nellis, 2011; Piquero, 2008; Piquero & Brame, 2008; Pope & Leiber, 2005; Sampson et al., 2005; Morenoff, 2005).

This is not to assert that DMC does not accumulate at later stages. In fact, our life table results for Hispanic/Latino youth (Table 2) show that the petitioning stage and the secure confinement stage are responsible for roughly equal proportions of the total DMC for these youth in Georgia (40 and 43%, respectively). For a broader subnational sample, adjudication and secure confinement account for the highest proportions of total DMC for Hispanic/Latino youth. It appears that whatever advantage Hispanic/Latino youth have at arrest and referral is offset by DMC at subsequent stages. This pattern is perhaps a better fit with the structural-processual hypothesis that DMC increases as youth progress through the system (McCarthy & Smith, 1986; Tittle & Curran, 1988). Future research using appropriate data should investigate the causal factors at work that account for the apparent disparities in adjudication, petitioning, and sentencing for Hispanic/Latino youth where data on ethnicity are available.

It is also important that future studies examine DMC over time, particularly as states enact legal changes that impact any given stage in the system.

For example, Georgia passed significant reforms in 2013 aimed at decreasing juvenile incarceration. The reforms are intended to increase community-based alternatives to incarceration for less serious crimes and reserve secure confinement for youth convicted of the most serious offenses (Pew Charitable Trusts, 2013). According to data from Georgia's DJJ, the 49 counties participating in the first phase of reform between October 2013 and June 2014 experienced a 62% reduction in out-of-home placements (Boggs & Worthy, 2015). Data should be collected and analyses performed on the impacts of these major policy changes on DMC at the secure confinement stage as well as in the system as a whole over time. Studies in other states have shown mixed results from policy interventions aimed at decreasing DMC. For example, analysis of data from Pennsylvania before and after large-scale DMC reduction efforts show a significant decline in the processing of minority youth at multiple stages of the system, including adjudication and secure confinement (Donnelly, 2015). But a similar analysis in Iowa before and after a mandate to reduce DMC in 1989 found no change in disparities in referrals to further processing after intake (Leiber et al., 2011).

In light of our findings for Hispanic/Latino youth at the secure confinement stage, one important question to examine is whether Hispanic/Latino youth experience the same or better results from these policy changes as black and white youth. Focusing exclusively on one stage or one racial/ethnic group may have unintended, negative consequences for other stages or other minority groups at the same stage. While these reform efforts could help address DMC for black youth at this stage, it is also possible that system-wide DMC could be exacerbated or remain stable, particularly if such policy interventions focus on one stage without taking the structural nature decision-making in the system as a whole into account. Discouraging findings that DMC for black youth has increased at secure confinement nationwide despite substantial efforts in many states to decrease juvenile incarceration illustrate this point (Sentencing Project, 2016). Similarly, reducing DMC in secure confinement for black youth may open up opportunity for expansion of DMC at this stage for Hispanic/Latino youth if system-wide DMC is left unaddressed. Indeed, prior studies have shown such unintended effects. For example, efforts to address DMC in Iowa resulted in an apparent overcorrection, penalizing white youth more harshly rather than lessening disparities for minority youth (Leiber et al., 2011). In Virginia, the influence of offense severity and prior record for non-white youth increased post-intervention, raising the odds of secure detention by 60% for non-white youth but not for white youth (Maggard, 2015). Given the interdependencies inherent between stages in the system, our analysis suggests that careful attention to those stages that account for higher proportions of total DMC for specific minority groups, while monitoring for unintended consequences for other stages and groups, is needed in order to address disproportionality in the whole system and alleviate the stages where it is most acute.

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References

Andersen, T. S. (2015). Race, ethnicity, and structural variations in youth risk of arrest. *Criminal Justice & Behavior, 42*, 900-916.

Arriaga, E. E. (1984). Measuring and explaining the change in life expectancies. *Demography, 21*, 83-96.

Bishop, D. M. (2005). The role of race and ethnicity in juvenile justice processing. In D. F. Hawkins & K. Kempf-Leonard (Eds.), *Our children, their children* (pp. 23-82). Chicago, IL: University of Chicago Press.

Bishop, D. M., & Frazier, C. E. (1996). Race effects in juvenile justice decision-making: Findings of a statewide analysis. *The Journal of Criminal Law and Criminology, 86*, 392-414.

Bishop, D. M., & Frazier, C. E. (1988). The influence of race in juvenile justice processing. *Journal of Research in Crime & Delinquency, 25*, 242-263.

Boggs, M. P., & Worthy, W. T. (2015). *Report to the Georgia Council of Criminal Justice Reform*. Retrieved February 21, 2017, from http://www.gjp.org/wp-content/uploads/2014-2015-CJRC-Report.pdf

Bonczar, T. P., & Beck, A. J. (1997). *Lifetime likelihood of going to state or federal prison*. Washington, DC: U.S. Department of Justice.

Bridges, G. S., & Steen, S. (1998). Racial disparities in official assessments of juvenile offenders: Attributional stereotypes as mediating mechanisms. *American Sociological Review, 63*, 554-570.

Davis, J., & Sorensen, J. R. (2013). Disproportionate minority confinement of juveniles: A National examination of black-white disparity in placements, 1997—2006. *Crime & Delinquency, 59*, 115-139.

DeJong, C., & Jackson, K. C. (1998). Putting race into context: Race, juvenile justice processing, and urbanization. *Justice Quarterly, 15*, 487-504.

Donnelly, E. A. (2015). The disproportionate minority contact mandate: An examination of its impacts on juvenile justice processing outcomes (1997—2011). *Criminal Justice Policy Review*. Retrieved February 21, 2017, from http://journals.sagepub.com/doi/abs/10.1177/0887403415585139

Engen, R. L., Steen, S., & Bridges, G. S. (2002). Racial disparities in the punishment of youth: A theoretical and empirical assessment of the literature. *Social Problems, 49*, 194-220.

Feyerherm, W., Snyder, H., & Villarruel, F. (2009). Chapter 1: Identification and monitoring. In Office of Juvenile Justice and Delinquency Prevention, *Disproportionate minority contact technical assistance manual* (pp. 1-1-1-54). Washington, DC: U.S. Department of Justice.

Georgia Bureau of Investigation. (2013). *2012 summary report: Uniform crime reporting (UCF) program*. Retrieved February 21, 2017, from https://gbi.georgia.gov/sites/gbi.georgia.gov/files/related_files/site_page/2012%20Crime%20Statistics%20Summary%20Report.pdf

Guevara, L., Herz, D., & Spohn, C. (2006). Gender and juvenile justice decision making: What role does race play? *Feminist Criminology, 1*, 258-282.

Harris, A. (2008). The social construction of "sophisticated" adolescents: How judges integrate juvenile and criminal justice Decision-Making Models. *Journal of Contemporary Ethnography, 37*, 469-506.

Harris, A. (2009). Attributions and institutional processing: How focal concerns guide decision-making in the juvenile court. *Race and Social Problems, 1*, 243-256.

Harris, A. R., & Hill, G. D. (1984). Bias in status processing decisions. In A. R. Harris (Ed.), *Rationality and collective belief* (pp. 1-89). Norwood, NJ: Ablex.

Hawkins, D. F., Laub, J. H., Lauritsen, J. L., & Cothern, L. (2000). *Race, ethnicity, and serious and violent juvenile offending*. Washington, DC: Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention. NCJ 181202.

Hauer, M., & Vaida, G. (2012). *Disproportionate minority contact (DMC) assessment*. Atlanta, GA: Governor's Office for Children and Families.

Hill, G. D., Harris, A. R., & Miller, J. L. (1985). The etiology of bias: Social heuristics and rational decision making in deviance processing. *Journal of Research in Crime and Delinquency, 22*, 135-162.

Hockenberry, S., & Puzzanchera, C. (2016). Delinquency cases involving Hispanic youth, 2013. Retrieved February 21, 2017 from http://www.ncjj.org/Publication/Delinquency-Cases-Involving-Hispanic-Youth-2013.aspx

Huizinga, D., Thornberry, T., Knight, K., Lovegrove, P., Loeber, R., Hill, K., & Farrington, D. (2007). *Disproportionate minority contact in the juvenile justice system: A study of differential minority arrest/referral to court in three cities: A report to the office of juvenile justice and delinquency prevention*. Washington, DC: National Criminal Justice Reference Service.

Kemper, P., & Murtaugh, C. M. (1991). Lifetime use of nursing home care. *New England Journal of Medicine, 324*, 595-600.

Kempf-Leonard, K. (2007). Minority youths and juvenile justice: Disproportionate minority contact after nearly 20 years of reform efforts. *Youth Violence and Juvenile Justice, 5*, 71-87.

Kempf-Leonard, K., & Sontheimer, H. (1995). The role of race in juvenile justice in Pennsylvania. In K. Kempf-Leonard, C. Pope, & W. Feyerherm (Eds.), *Minorities in Juvenile Justice* (pp. 98-127). Thousand Oaks, CA: Sage.

Leiber, M. J. (2002). Disproportionate minority confinement (DMC) of youth: An analysis of state and federal efforts to address the issue. *Crime & Delinquency, 48*, 3-45.

Leiber, M. J., Bishop, D., & Chamlin, M. B. (2011). Juvenile justice decision-making before and after the implementation of the disproportionate minority contact (DMC) mandate. *Justice Quarterly, 28*, 460-492.

Leiber, M. J., & Fox, K. C. (2005). Race and the impact of detention on juvenile justice decision making. *Crime & Delinquency, 51*, 470-497.

Leiber, M. J., Peck, J. H., & Beaudry-Cyr, M. (2016). When does race and gender matter? The interrelationships between the gender of probation officers and juvenile court detention and intake outcomes. *Justice Quarterly, 33*, 614-641.
Leiber, M. J., Peck, J. H., & Rodriguez, N. (2016). Minority threat and juvenile court outcomes. *Crime & Delinquency, 62*, 54-80.
Leiber, M. J., & Rodriguez, N. (2011). The implementation of the disproportionate minority confinement/contact (DMC) mandate: A failure or success? *Race and Justice, 1*, 103-124.
Liang, J., & Tu, E. J.-C. (1986). Estimating lifetime risk of nursing home residency: A further note. *The Gerontologist, 26*, 560-563.
Lipsky, M. (1980/2010). *Street-level bureaucrats: Dilemmas of the individual in public services*. New York, NY: Russell Sage Foundation.
Maggard, S. (2015). Assessing the impact of the juvenile detention alternatives initiative (JDAI): Predictors of secure detention and length of stay before and after JDAI. *Justice Quarterly, 32*, 571-597.
Maupin, J. R., & Bond-Maupin, L. J. (1999). Detention decision-making in a predominantly Hispanic region: Rural and non-rural differences. *Juvenile and Family Court Journal, 50*, 11-23.
Maynard-Moody, S. W., & Portillo, S. (2010). Street-level bureaucracy theory. In R. Durant (Ed.), *Oxford handbook of American bureaucracy* (pp. 252-277). Oxford: Oxford University Press.
McCarthy, B. R., & Smith, B. L. (1986). The conceptualization of discrimination in the juvenile justice process: The impact of administrative factors and screening decisions on juvenile court dispositions. *Criminology, 24*, 41-64.
McConnel, C. E. (1984). A note on the lifetime risk of nursing home residency. *The Gerontologist, 24*, 193-198.
McNulty, T. L., & Bellair, P. E. (2003). Explaining racial and ethnic differences in serious adolescent violent behavior. *Criminology, 41*, 701-730.
Mears, D. P., Cochran, J. C., & Lindsey, A. M. (2016). Offending and racial and ethnic disparities in criminal justice. *Journal of Contemporary Criminal Justice, 32*, 78-103.
Morenoff, J. D. (2005). Racial and ethnic disparities in crime and delinquency in the United States. In M. Rutter & M. Tienda (Eds.), *Ethnicity and causal mechanisms* (pp. 139-173). New York, NY: Cambridge University Press.
Moskos, P. (2009). *Cop in the hood: My year policing Baltimore's eastern district*. Princeton, NJ: Princeton University Press.
National Center for Juvenile Justice. (2015, December 13). *Juvenile arrest rates by offense, sex, and race*. Retrieved from http://www.ojjdp.gov/ojstatbb/ezaucr/asp/ucr_display.asp
National Juvenile Court Data Archive. (2015). *Juvenile court statistics*. Retrieved from http://www.ojjdp.gov/ojstatbb/njcda/
Nellis, A. (2011). *Addressing the collateral consequences of convictions for young offenders*. Washington, DC: National Association of Criminal Defense Lawyers.
Nucci, A. R. (1999). The demography of business closings. *Small Business Economics, 12*, 25-39.
Oberfield, Z. W. (2010). Rule following and discretion at government's frontlines: continuity and change during organization socialization. *Journal of Public Administration Research and Theory, 20*, 735-755.
Pennock, J., & Jaeger, C. (1957). Estimating the service life of household goods by actuarial methods. *Journal of the American Statistical Association, 52*, 175-185.
Pettit, B. (2012). *Invisible men: Mass incarceration and the myth of black progress*. New York, NY: Russell Sage Foundation.
Pettit, B., & Western, B. (2004). Mass imprisonment and the life course: Race and class inequality in U.S. Incarceration. *American Sociological Review, 69*, 151-169.

Pew Charitable Trusts. (2013). *Georgia's 2013 juvenile justice reform: New policies to reduce secure confinement, costs, and recidivism*. Retrieved February 21, 2017, from http://www.pewtrusts.org/~/media/legacy/uploadedfiles/pcs/content-level_pages/reports/georgia20201320juvenile20justice20reform20summary20briefjuly2013pdf.pdf.

Piquero, A. R. (2008). Disproportionate minority contact. *The Future of Children, 18*, 59-79.

Piquero, A. R., & Brame, R. W. (2008). Assessing the race-crime and ethnicity-crime relationship in a sample of serious adolescent delinquents. *Crime & Delinquency, 54*, 390-422.

Pope, C. E., & Leiber, M. J. (2005). Disproportionate minority confinement/contact (DMC). In D. F. Hawkins & K. Kempf-Leonard (Eds.), *Our children, their children* (pp. 351-389). Chicago, IL: University of Chicago Press.

Pope, C. E., Lovell, R. D., & Hsia, H. M. (2002). *Disproportionate minority confinement: A review of the research literature from 1989 through 2001*. Washington, DC: U.S. Department of Justice.

Preston, S. H., Heuveline, P., & Guillot, M. (2001). *Demography: Measuring and modeling population processes*. Malden, MA: Blackwell.

Puzzanchera, C., & Hockenberry, S. (2015). *National disproportionate minority contact databook*. Developed by the National Center for Juvenile Justice for the Office of Juvenile Justice and Delinquency Prevention. Retrieved February 21, 2017 from http://www.ojjdp.gov/ojstatbb/dmcdb/

Rodriguez, N. (2013). Concentrated disadvantage and the incarceration of youth: Examining how context affects juvenile justice. *Journal of Research in Crime and Delinquency, 50*, 189-215.

Rodriguez, N. (2010). The cumulative effect of race and ethnicity in juvenile court outcomes and why preadjudication detention matters. *Journal of Research in Crime and Delinquency, 47*, 391-413.

Sampson, R. J., Morenoff, J. D., & Raudenbush, S. (2005). Social anatomy of racial and ethnic disparities in violence. *American Journal of Public Health, 95*, 224-232.

Sentencing Project. (2016). *Racial disparities in youth commitments and arrests*. Retrieved February 21, 2017, from http://www.sentencingproject.org/publications/racial-disparities-in-youth-commitments-and-arrests/.

Shannon, S. K. S., Uggen, C., Schnittker, J., Thompson, M., Wakefield, S., & Massoglia, M. (in press). The growth, scope, and spatial distribution of people with felony records in the United States, 1948 to 2010. Forthcoming at Demography.

Shkolnikov, V. M., Valkonen, T., Begun, A., & Andreev, E. M. (2001). Measuring intergroup inequalities in length of life. *Genus, 57*, 33-62.

Sickmund, M., Sladky, T., Kang, W., & Puzzanchera, C. (2013). *Easy access to the census of juveniles in residential placement*. Retrieved February 21, 2017, from http://www.ojjdp.gov/ojstatbb/ezacjrp/

Siegel, J. S., Swanson, D. A., & Shryock, H. S. (2004). *The methods and materials of demography*. Atlanta, GA: Elsevier/Academic Press.

Skolnick, J. H., & Fyfe, J. J. (1993). *Above the law: Police and the excessive use of force*. New York, NY: The Free Press.

Tapia, M. (2010). Untangling race and class effects on juvenile arrests. *Journal of Criminal Justice, 38*, 255-265.

Tapia, M. (2011). Gang membership and race as risk factors for juvenile arrest. *Journal of Research in Crime and Delinquency, 48*, 364-395.

Tittle, C. R., & Curran, D. A. (1988). Contingencies for dispositional disparities in juvenile justice. *Social Forces, 67*, 23-58.

Uggen, C., Manza, J., & Thompson, M. (2006). Citizenship, democracy, and the civic reintegration of criminal offenders. *The ANNALS of the American Academy of Political and Social Science, 605*, 281-310.

U.S. Census Bureau. (2016). *American community survey*. Retrieved February 21, 2017, from www.factfinder.census.gov.
Vaupel, J. W., Carey, J. R., Christensen, K., Johnson, T. E., Yashin, A. I., Holm, N. V., & Liedo, P. (1998). Biodemographic trajectories of longevity. *Science, 280*, 855-860.
Western, B. (2006). *Punishment and inequality in America*. New York, NY: Russell Sage Foundation.
Wildeman, C. (2009). Parental imprisonment, the prison boom, and the concentration of childhood disadvantage. *Demography, 46*, 265-280.