Juvenile Justice Encounters in an ASD Population

By

Paul Turcotte

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Abstract

Juvenile Justice Encounters in an ASD Population

Paul Turcotte MPH[1], Craig Newschaffer PhD[1,2], Lindsay Shea MS, DrPH[2]

[1]Drexel University School of Public Health, [2]A.J. Drexel Autism Institute

Background: Past research has shown that individuals in the juvenile justice system have high rates of behavioral and mental diagnoses. However, there are few papers that examined rates of autism spectrum disorder (ASD) contact with the juvenile justice system.

Aims: The purpose of this study is to investigate rates of juvenile justice system contact in a population-based sample of youth with ASD, compare these rates to general population rate, examine these trends over time and describe the distribution of crimes committed by young offenders with ASD compared to the like-aged general population.

Methods: Data used to identify the population with ASD were collected through enrollment in Medical Assistance and other Public Welfare programs. Youth with an ASD diagnosis between the ages of 10 and 21 in calendar years 2005 and 2011 were identified using at least one Medicaid claim for ASD in those years, and linked by a state juvenile justice office.

Results: Negative binomial regression was used adjust rates for basic demographic characteristics and to contrast adjusted rates in the populations. Regression analysis showed that individuals in the ASD group were 6.13 times as likely to come into contact with the justice system and the risk of offending from 2005-2011 increased significantly. Should these patterns persist, the implication is that individuals with ASD in our sample are at a higher risk for juvenile justice system contact than the general population. More research is needed to identify the reasons behind these patterns as to appropriately inform potential policy and program recommendations.

Introduction

Autism Spectrum Disorders

Autism Spectrum Disorders (ASD) are an increasingly more common lifelong developmental disability, with 1 in 68 children now being identified with an ASD diagnosis, according to the latest estimates form the CDC's Autism and Developmental Disabilities Monitoring Network (ADDM) (CDC, 2014). ASD are a class of disorders that include Autistic Disorder, Asperger Syndrome, Rhett Syndrome and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS) (CDC, 2012). ASDs include a broad spectrum of the disorders, but typically manifest as impairments in 3 separate developmental areas of a child; the social, language (communication), and behavioral areas (Abrahams and Geschwind, 2008). Symptoms can include: Inattention to other people, avoiding eye contact, trouble communicating emotion, aversion to touching, echolalia, repetition of behaviors, and unusual reactions to stimuli (CDC, 2014). While these are some hallmark symptoms, impairments can present differently in each separate case. ASDs also appear to affect all races, ethnicities, and socioeconomic statuses equally, however males are almost five times as likely to develop an ASD (CDC, 2014). Currently, there is no cure for Autism, however early intervention and treatment has been shown to reduce symptoms, and improve quality of life (Eapen et al., 2013).

Juvenile Justice Involvement in ASD Population

Previous studies have shown that rates of mental and behavioral health issues are prevalent among those in the juvenile justice system (Garland et al., 2001) (Bullis and Yovanoff, 2005). The prevalence can exceed 50%, and may be an underestimation (Garland et al., 2001). This high proportion of individuals with disabilities implies that a large number of those individuals may be on the autism spectrum. This is further evidenced by research showing that individuals with an ID/ASD comprise 12%

of individuals in a sample of 5 service systems (mental health, serious emotional disturbance, child welfare, juvenile justice, and alcohol/drug services) (Brookman-Frazee et al., 2009). However, most research has been limited to hospital settings and is not a reliable estimate of general prison contact (Cashin and Newman 2009). While there is available research examining the interplay of psychiatric disorders and behavioral disorders, (e.g. Attention Deficit and Hyperactivity Disorder [ADHD] and Asperger Syndrome) with the justice system, there is minimal literature investigating the prevalence of individuals with Autism Spectrum Disorders (ASD) in the justice system (Browning & Caulfield, 2011) (Soltis, et al., 2013). With the rate of ASD having a bias towards males, gender differences are of a particular interest in this study because being male is also a risk factor for juvenile justice encounter (Shader, 2001). While overall there has been a decrease in juvenile justice rates since the mid 1990's, a significant proportion of those in the juvenile justice population have a psychiatric, behavioral, and/or developmental disorder (Garland, et al., 2001). A recent study has shown that people in the juvenile justice system exhibit higher levels of symptoms/behaviors consistent with ASD as compared to the general population (Geluk, et al., 2012). ASDs have also recently been linked to serial killers and mass murderers in an exploratory study examining case histories of past offenders (Allely et al., 2014). While this study found a significant proportion of the individuals studies with a probable autism diagnosis (28%) no clinical assessment was completed, and most sources used were not peer reviewed. In contrast to the previous studies' implications, a Danish case control study found that people with autism were less likely to exhibit criminal behavior, and be convicted of a crime (Mouridsen et al., 2008).

Asperger syndrome has occasionally been exclusively studied separately from autism spectrum disorders. A study performed in Sweden examined risk factors for violence among individuals with an ASD, and found that individuals who are male as well as those diagnosed with Asperger syndrome are more likely to be violent offenders (Langstrom et al., 2009). Qualitative case studies and literature reviews have hypothesized that while the rate of criminal activity may not be different in those with

Asperger syndrome, the manifestations of their symptoms were almost always involved in their justice system contact (Browning and Caulfield, 2011)(Schwartz-Watts, 2005).

If these findings have validity, then it can be assumed that individuals with ASD may exhibit more behaviors that will increase their likelihood of coming into contact with the juvenile justice system as compared to individuals without ASD. By describing juvenile justice contact in the ASD population, and comparing that to the general population, a clearer picture into the relationship between ASD and the juvenile justice system will be gained.

Study Aims

This study has 4 concrete aims to describe the relationship between ASD and juvenile justice encounters. The first, to compare the rates of juvenile justice encounters (defined as initial disposition counts) between youth with ASD and the general population. The second, to describe the demographic risk factors for juvenile justice system encounters in the ASD population. The third, to compare the rates of juvenile justice encounters over time in the ASD population, and determine if that change is different in comparison to the general population. And fourth, to describe the types of offenses committed among youth with ASD and examine how that distribution differs from offenses seen throughout the juvenile justice system.

Methods

Study Design

The study design is a two point time series secondary data analysis study. It is concerned with examining the differences and characteristics of two populations (ASD and general populations) from two separate years (2005 and 2011). The aim is to describe contact with the juvenile justice system using initial deposition data. Initial dispositions are the first meeting between the judge and the

defendant, where it is decided if the assessed charges will be acted upon. "A *disposition* is defined as an outcome of a written allegation received by the juvenile probation department" (JCJC, 2013). It is an appropriate assessment of contact with the justice system, as there was some previous event with law enforcement to cause the progression to a disposition hearing. There is a caveat to disposition counts. The *Juvenile Delinquency Data Analysis Tool* specifies that a disposition may contain one or more offenses, and that it is arbitrarily assigned the day of the hearing. However, all initial dispositions are assumed to be treated this way, and therefore there is little reason to suspect that the ASD disposition data are fundamentally different from the state general population records.

ASD Population

Individual level data on the ASD population were acquired through data requests from the ASERT (Autism Services, Education, Resources, and Training) Collaborative, a grant funded by the Pennsylvania Department of Public Welfare (DPW)'s Bureau of Autism Services (BAS). The study sample is comprised of children and young adults residing in the Commonwealth of Pennsylvania in two selected calendar years (2005 and 2011) who have an ASD diagnosis, and are covered by Medicaid. Individuals with ASD were identified via ICD-9 codes in Medicaid claims. The data were then linked to juvenile justice records by the Office of Juvenile Justice and Delinquency Prevention, de-identified, and then returned. Returned data included demographic information as well as initial disposition data. Initial preliminary analyses of the data showed ages that were outside the range of juvenile justice encounters (ages 3 and 24) and thus were excluded from the analysis. Our final inclusion criteria included Individuals who were on Medicaid rolls with an ASD diagnosis in 2005 and 2011, and were between the ages of 10-21. All races, ethnicities, and genders were included.

General Population

General population data were gathered using two separate publicly available resources. For the initial disposition data, the amount of initial dispositions was acquired using *The Pennsylvania Juvenile Delinquency Data Analysis Tool*, sponsored by the Juvenile Court Judges' Commission (JCJC), funded by the Office of Juvenile Justice and Delinquency Prevention. This tool allows specific characteristics to be selected, and will then supply group level disposition data on the individuals.

General population denominator data were acquired using *Public Use Microdata Samples* (PUMS), a subset of the American Community Survey (ACS) samples. This information is provided in individual level and household level form yearly and is sponsored by the Census Bureau. These data are representative of 1% of the American population, and is estimated using a weighted formula. PUMS are formed using geographic areas containing least 100,000 people, and span across the US and Puerto Rico. Data sets were collected for years 2005 and 2011, and were categorized into the specified analysis variables.

Data Analysis

Data were collapsed into 5 categories for analysis; Gender, county, age, race, and ethnicity. While gender needed no special classification, county was categorized into three separate designations, urban, suburban, and rural. A slight problem concerning the county designation arose when comparing the PUMS and ASD county data. ASD county information was classified based off of a county designation of urban, rural, or suburban, and were classified as such. As mentioned previously, PUMS data contains geographic areas that inhabit at least 100,000 people. There was some overlap from suburban to rural county boundaries, but they were minimal and not taken into account in this analysis. Age was categorized into 4 separate age ranges, 10-12, 13-15, 16-17, 18+, and based off of the distribution of offenders. Race was collapsed into three categories, White, Black, and Other, as there were low counts

of races besides White and Black. Gender and ethnicity (Hispanic, non-Hispanic) were unchanged. In the PUMS data, those of Black race and Hispanic ethnicity, were not represented by weights. With that population contributing minimal magnitude to the total numbers, they were excluded from the analysis.

Statistical analyses included determining unadjusted and adjusted rate estimation and group-level poisson rate regression. After the initial crude rates were attained, poisson regressions were used to create adjusted rates. Poisson regressions were also performed to determine if there are demographic risk factors for the ASD population, and these risk factors were compared to the general population. However, due to overdispersion in the model, new models were creating using the negative binomial approach. This decreased the dispersion and provided a better fit to the models, and thus was used for all subsequent analyses. To determine power and detectable rate ratios, an Arcsign formula was used outlined in Statistical Methods in Cancer Research to ascertain the minimum detectable Rate Ratio that is statistically significant, contrasting the 2011 ASD vs general population (Breslow & Day, 1987). This sample has 80% power to detect a Rate Ratio of 1.22. Using the same standards, the sample had 80% power to detect a Rate Ratio of 1.17 when contrasting the ASD 2005 Population and the ASD 2011 Population. All data management and statistical analyses was completed using Microsoft Office Excel® and SAS® software, Version 9.2 of the SAS System for Windows (Copyright, SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA.).

To determine the distribution difference of charges between the ASD and general populations, charges were classified into three distinct categories. The first is “Offense against Person” entails any offenses that involved causing harm or harassment to other individuals, ranging from assault charges to stalking and harassment. The second “Property” consists of any charges that resulted in damage against property including arson, trespassing, and vandalism. The third, “Other” consists of all other charges

grouped together, such as driving offenses, and non-payment of fines. Categorization was performed on an individual level basis for the ASD group, and on a group level basis for the general population. Once the three category counts were created, they were stratified by the demographic variables, proportions of total charges in each variable were created, and the distribution was compared.

Results

Table 1 shows the distribution of the ASD and general population group demographic

Table 1. Demographic Characteristics of ASD and General Populations Stratified by Group and Year

	Populations in the Years 2005 and 2011							
	2005 ASD		2005 GP		2011 ASD		2011 GP	
	N	%	N	%	N	%	N	%
Population	6,616		1,908,039		16,974		2,070,077	
Gender								
Male	5,330	80.6%	972,999	51.0%	13,619	80.2%	1,069,342	51.7%
Female	1,286	19.4%	935,040	49.0%	3355	19.8%	1,000,735	48.3%
County								
Urban	1369	20.7%	414,379	21.7%	3407	20.1%	431,111	20.8%
Suburban	3118	47.1%	897,756	47.1%	8360	49.3%	997,978	48.2%
Rural	2129	32.2%	595,904	31.2%	5207	30.7%	640,988	31.0%
Age Range								
10-12	2726	41.2%	479,530	25.1%	6624	39.0%	463,327	22.4%
13-15	2081	31.5%	513,277	26.9%	5103	30.1%	486,617	23.5%
16-17	936	14.1%	346,979	18.2%	2344	13.8%	340,108	16.4%
>17	873	13.2%	568,253	29.8%	2903	17.1%	780,025	37.7%
Race								
Black	773	11.7%	239,605	12.6%	1812	10.7%	273,800	13.2%
White	5437	82.2%	1539257	80.7%	13,509	79.6%	1590212	76.8%
Other	406	6.1%	129,177	6.8%	1653	9.7%	206,065	10.0%
Ethnicity								
Non-Hispanic	6368	96.3%	1,807,090	94.7%	16047	94.5%	1899404	91.8%
Hispanic	248	3.7%	100,949	5.3%	927	5.5%	170673	8.2%

Note: ASD-Autism Spectrum Disorder, GP- General Population

characteristics. In terms of gender, the distributions match what we would expect to see in these populations. The ASD population has approxiamtely an 80% male composition, which matches current findings from the ADDM (CDC, 2014). County distribution is uniform across all groups, with the majority of individuals located in suburban counties. Another diffence was located in the age group distributions, as the ASD groups tended to have a higher proportion of individuals in the 10-12 age range. In both the ASD and the general population groups, an increase over time in the >17 age group was also observed, but moreso in the general population, a 7.9% increase compared to a 3.9% in the ASD group. Race was uniform in the populations, with the majority identifying as White or Black. Ethincity also varied little between the groups, with most individuals identifiying as non-Hispanic, athough there was an increase over time in both populations in the proportion identifying as Hispanic.

Calculating the crude rate of contact, the ASD group saw an increased in risk when compared to the general population, an RR of 6.37 (95% CI 6.25-6.50), calculated using a ratio of incidence densities formula (Szklo and Nieto 2012). Figure 1 shows the specific rates of observation years 2005 and 2011 for each group. Table 2 shows the unadjusted and adjusted models predicting contact with the juvenile justice system. In the unadjusted negative binomial model, the ASD group are 4.86 times as likely to come into contact with the juvenile justice system when compared to the general population. After adjusting for other variables, the risk increases to 6.13 times as likely. Using models which controlled for each predictor separately in conjuction with group type, it was found that age had the biggest influence on increase in risk for

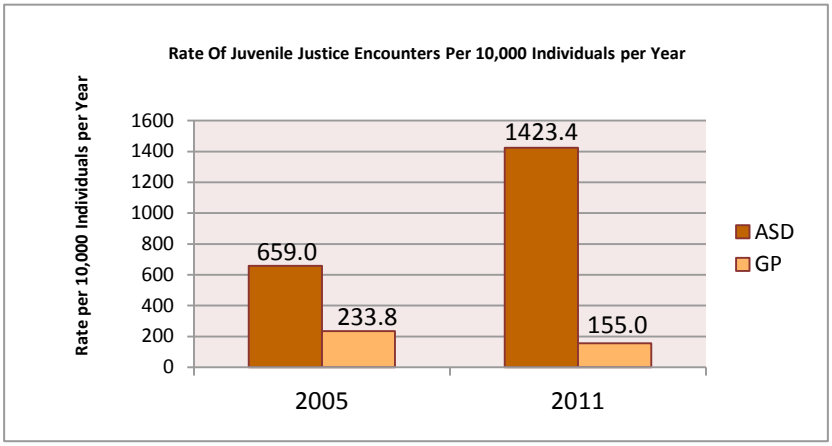

Figure 1. Crude rate of contact with the juvenile justice system over time comparing the ASD and general population groups. ASD saw an increase in contact while the general population saw a decrease. Note: ASD= Autism Spectrum Disorder Group, GP= General Population Group.

offending. In the adjusted model, age had increased risk as individuals age when comparing older age groups to ages 10-12. The highest risk was found in age group 16-17 with a RR of 9.92. Females were found to have substantially lower risk to offend when compared to males, a highly protective RR of 0.37. It was also found that those in suburban counties were found to be at higher risk of offending than those in urban and rural environments.

Examining race, people idenfitiying as Black were 2.29 times as likely to come into contact with the justice system, and people of Other minority groups were found to be at less of a risk when compared to Whites. Being of Hispanic ethnicity was associated with a 47% increase in risk of contact. In this model there seemed to be no difference in contact risk when comparing 2005 and 2011 overall.

Table 2. Contact Rates with the Juvenile Justice System: ASD and General Populations

	Unadjusted Model		Adjusted Model	
	RR (95%CI)	p-value	RR (95%CI)	p-value
Group				
General Population	1.00	-	1.00	-
ASD	4.86 (3.47-6.79)	<.0001	6.13 (4.46-8.42)	<.0001
Gender				
Male	-	-	1.00	-
Female	-	-	0.37 (0.29-0.49)	<.0001
County				
Urban	-	-	1.00	-
Suburban	-	-	1.41 (1.02-1.94)	0.0335
Rural	-	-	1.19 (0.86-1.65)	0.2821
Age Range				
10-12	-	-	1.00	-
13-15	-	-	7.59 (5.29-10.88)	<.0001
16-17	-	-	9.92 (6.94-13.71)	<.0001
>17	-	-	1.95 (1.26-3.02)	0.0028
Race				
White	-	-	1.00	-
Black	-	-	2.29 (1.51-3.46)	<.0001
Other	-	-	0.33 (0.23-0.47)	<.0001
Ethnicity				
Non-Hispanic	-	-	1.00	-
Hispanic	-	-	1.47 (1.03-2.10)	0.0320
Year				
2005	-	-	1.00	-
2011	-	-	1.00 (0.76-1.32)	0.9835

Note: ASD-Autism Spectrum Disorder, GP- General Population, RR- Rate Ratio, ref-reference group. All adjusted model RR's adjusted for group type, gender, county, age range, race, ethnicity, and year

Table 3 shows results of models analyzing change in risk for the ASD group between 2005 and 2011. In the unadjusted model, RR values increased from 1.58 (95% CI .97-2.59) to 10.75 (95% CI 6.87-16.84) from 2005 to

2011. After adjusting for other demographic variables, the risk increased from 2.30 (95% CI 1.50-3.53) to 13.37 (95% CI 9.05-19.75) becoming statisically significant in 2005.

Table 3. Risk of Offending Over Time in the ASD Population

	Unadjusted Model		Adjusted Model	
	RR (95%CI)	p-value	RR (95%CI)	p-value
ASD				
2005*	1.58 (0.97-2.59)	0.0661	2.30 (1.50-3.53)	0.0001
2011**	10.75 (6.87-16.84)	<0.0001	13.37 (9.05-19.75)	<0.0001

Note: ASD-Autism Spectrum Disorder, GP- General Population, RR- Rate Ratio, ref-reference group. Predictors: *Group Type, Year, Interaction Group and Year, **Group Type, Year, Interaction Group and Year, Gender, County, Age Range, Race, Ethnicity

Table 4 shows the distribution of charge types by demographic variables. When examining county type and charges, the general population had relatively similar distributions between the 3 charge categories in both observation years. The ASD groups showed little difference in urban counties between the two years, but both suburban and rural counties saw a shift to larger proportions of crimes in the Other and Property charge categories. Gender comparisons showed a possible imprecise shift in the ASD female proportions, due to low representation in the population. Male ASD charges saw a shift toward larger Other and Property charges from 2005 to 2011, similar to what was seen in the County distribution. The general population saw no change in proportions between the two observation years in regards to Gender. Charges regarding age groups in the general population saw similar distributions throughout both years with a trend showing with an increase an age, an increase in proportion of Other charges, and a decrease in Offense against Person charges. Race shows a nearly identical distribution in both observation years in the general population. The ASD population show an increase in Other and Property charges between 2005 and 2011 in all race groups. Black race has a slightly higher proportion of Other charges compared to White, where White maintains a higher proportion of Property charges. Those of non-Hispanic ethnicity in the ASD population had a larger proportion of Other and Property charges over time, where those of Hispanic ethnicity had a similar distribution in both years. In all demographic areas, the ASD population always maintained a higher level of Offense against Person charges, but gernally saw a

decrease in that porportion over time. The general population consistently had approximately the same distribution in both years.

Table 4. Distribution of Charge Types by Demographic Variables for ASD and General Populations in Years 2005 and 2011

	ASD 2005			ASD 2011			GP 2005			GP 2011		
	Person	Property	Other	Person	Property	Other	Person	Property	Other	Person	Property	Other
Gender												
Male	66.3%	15.5%	18.2%	46.1%	31.6%	22.2%	23.7%	28.6%	47.7%	26.2%	27.3%	46.5%
Female	63.6%	24.2%	12.1%	67.4%	17.4%	15.2%	29.2%	14.6%	51.3%	31.4%	18.5%	50.1%
County												
Urban	58.0%	18.7%	23.3%	55.8%	16.1%	28.2%	29.5%	27.7%	42.8%	31.7%	24.5%	43.9%
Suburban	77.7%	12.3%	10.0%	44.6%	32.3%	23.1%	23.0%	26.5%	50.5%	25.5%	25.5%	49.1%
Rural	68.1%	18.7%	13.2%	49.8%	34.4%	15.8%	22.1%	26.8%	51.1%	25.0%	26.0%	49.0%
Age Range												
10-12	73.6%	15.1%	11.3%	67.0%	20.2%	12.8%	38.6%	29.9%	31.5%	40.4%	26.3%	33.3%
13-15	62.6%	18.9%	18.4%	58.4%	23.4%	18.2%	29.6%	28.7%	41.7%	32.1%	26.4%	41.4%
16-17	65.5%	18.0%	16.5%	42.3%	37.0%	20.7%	20.1%	24.4%	55.5%	23.1%	23.8%	53.1%
>17	70.7%	8.6%	20.7%	42.1%	29.5%	28.4%	10.9%	20.4%	68.7%	15.9%	25.5%	58.6%
Race												
White	66.3%	18.3%	15.3%	47.0%	33.4%	19.6%	21.9%	27.7%	50.4%	24.4%	25.5%	50.1%
Black	63.3%	14.8%	21.9%	47.4%	24.7%	27.9%	29.8%	24.7%	45.5%	32.1%	24.8%	43.1%
Other	83.3%	0.0%	16.7%	77.4%	4.8%	17.9%	23.0%	23.5%	53.5%	25.6%	22.1%	52.3%
Ethnicity												
Non-Hispanic	66.9%	16.2%	16.9%	47.0%	31.7%	21.3%	24.9%	26.6%	48.5%	27.4%	25.1%	47.5%
Hispanic	45.0%	30.0%	25.0%	63.0%	10.9%	26.1%	25.2%	24.5%	50.3%	28.7%	24.6%	46.7%

Note: ASD-Autism Spectrum Disorder, GP- General Population. Person- Offense Against Person Charge, Property- Offense Against Property Charge, Other- Other Charges

Discussion

Overall, it appears individuals on Medicaid with an ASD diagnosis in Pennsylvania may be at a significantly higher risk to come into contact with the juvenile justice system, when compared to the general population. The unadjusted crude rate of 6.27 using the ratio of incidence density formula is

highly suggestive of an increased risk. Examining the negative binomial model's unadjusted crude rate of 4.86, a difference in risk of some magnitude is observed. Whether this is due to the assumptions of the model, a log transformation of the denominator, or the exclusion of those of Black and Hispanic race/ethincity, is under further analysis. Regardless, both rates show an elevated risk for the ASD population. After adjusting for the other variables, the risk for contact increased to 6.13. By performing further analyses, it was found that the main demographic characteristic responsible for this increase in risk, was age. This evidence is supported in multiple ways. In the adjusted model, age constitutes the highest RR's by far in comparison to the other demographic variables, showing that individuals in the age ranges of 13-15 and 16-17 had an elevated risk for contact. A second support comes from the demographic distribution shown in Table 1. The ASD group shows a much higher proportion of individuals in the age range of 10-12, when compared to the general population. After adjusting for age in the models, the RR increases. This is most likely due to those in the 10-12 age range being at lower risk, and the high proportion in the ASD group lowering the risk in the unadjusted model.

Another factor that may be increasing the risk post-adjustment is gender. Typically, males are at a higher risk to offend and with the ASD population comprising 80% males, an increase in risk would be assumed. During the adjustment procedures, a major increase in risk was not observed when gender was controlled for. This suggests that gender may not have an effect on risk. An increase in risk over time for the ASD population is supported by the findings between the unadjusted and adjusted models found in Table 3. In the unadjusted model, the risk for year 2005 was 1.58, was not significant, with an increase in risk to 10.75 in 2011, shifting to significance. This suggests and increase in risk, but is further supported by the adjusted model. The risk for both years increased, and became significant. This change from non-significance to significance supports an increase in risk in year 2011 from year 2005. Age is also the most likely demographic variable most responsible for this shift in risk in these models.

The charge distribution between the populations is varied. Overall, the ASD population has a higher proportion of Offense against Person crimes across the demographic variables. Throughout all demographics, the general population had similar distributions of the charges in both years 2005 and 2011. As age was the most explanatory demographic variable in the regression models, a close examination of the distribution of charges stratified by age group in the ASD population shows a noteworthy trend. In year 2005, there was no discernible pattern as the ages increased from 10-17+. However, in 2011, there was a trend that is mirrored in the general population. As time increases from 2005 to 2011, so do the proportion of Other and Property charges in comparison to Offense against Person charges. Similarly, as the individuals increased in age, the proportion of Other and Property charges increase in both the ASD and general populations. As the sample size of charges increased in 2011 for the ASD group, the pattern seemed to begin to match what we see in the general population. The ASD population still maintains a higher proportion of Offense against Person charges, but still exhibits a similar distribution to the general population. This could possibly be due to the opportunity to commit offenses. Individuals with ASD may not have the oppurtunity to commit crimes of the Property or Other offenses, due to the circumstances in which they live. Further analysis and data acquisiton is necessary to address this issue.

In conclusion, age appears to be the biggest predictor regarding the likelihood of offending. After age 13, risk for contact increases dramatically. Also, ASD population may be at a higher risk of offending overall when compared to the general population. The risk for offending in the ASD population has increased between 2005 and 2011, and the majority of those offenses are classified as Offense against Person charges. The proportional distribution of charges in the ASD group may be shifting toward what we see in the general population, though further analysis is needed to confirm this association.

This study has several strengths. First, it is a novel look at a population level relationship between ASD and juvenile justice system involvement. No previous study has performed an analysis such as this, as they have been typically restricted to hospitalized or prison populations. This study also collected valuable insight into what an individual with ASD might experience when coming into contact with the juvenile justice system. This information can be used to inform policy programming and possible intervention strategies. Two observation years also allowed an analysis of a limited temporal relationship.

There were also some limitations to this study. First, errors in the PUMS denominator data collection were not accounted for. There are error estimates associated with the weights, and these error terms were not included in the confidence interval estimates for the risk ratios. Therefore, these confidence intervals are most likely larger than they currently are. Also, comparing group level general population data to this ASD specific data isn't a direct comparison of two distinct groups, as the ASD population account for some of the general population rates.

There also may be some selection bias when it comes to this sample population. The ASD group was pulled from those who had a Medicaid claim with an ICD-9 ASD diagnosis. Some factors that contribute to those individuals being on Medicaid (eg. poverty) may be contributing to an increase in risk, and may not be representative of individuals with ASD in Pennsylvania. This situation is complicated further due to the PH-95 "loophole" in Medical Assistance law, which allows individuals to qualify for Medicaid based on disability status regardless of income. This may be adding more individuals with ASD from affluent socio-economic status to this Medicaid population, possibly making them more like the general population, and adding validity. However it is difficult to examine this relationship with the information we have to determine the extent of this issue.

Future directions include interacting with stakeholders in the juvenile justice system to determine areas where interventions or policy programming could be implemented. Also for further analysis to determine the risk for the ASD population, comparison Medicaid groups need to be formed in order to collect data on their interactions with the juvenile justice system. An MR/ID Medicaid group as well as a random selection of non-disabled individuals will allow for a more complete and direct comparison across groups, and will form a clearer picture of the ASD and justice interaction. Further analysis of charges is also needed, to determine if the risk for having charges classified as Offense against Person are more likely in the ASD population. Current analysis only allowed for an examination of the proportions of the charges, and therefore was not controlled for demographic characteristics.

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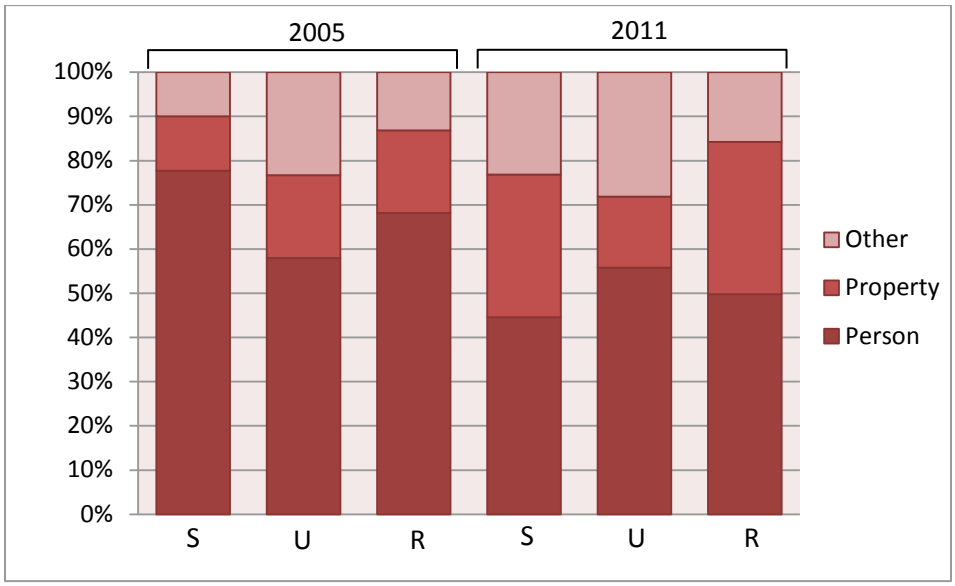
Appendix I

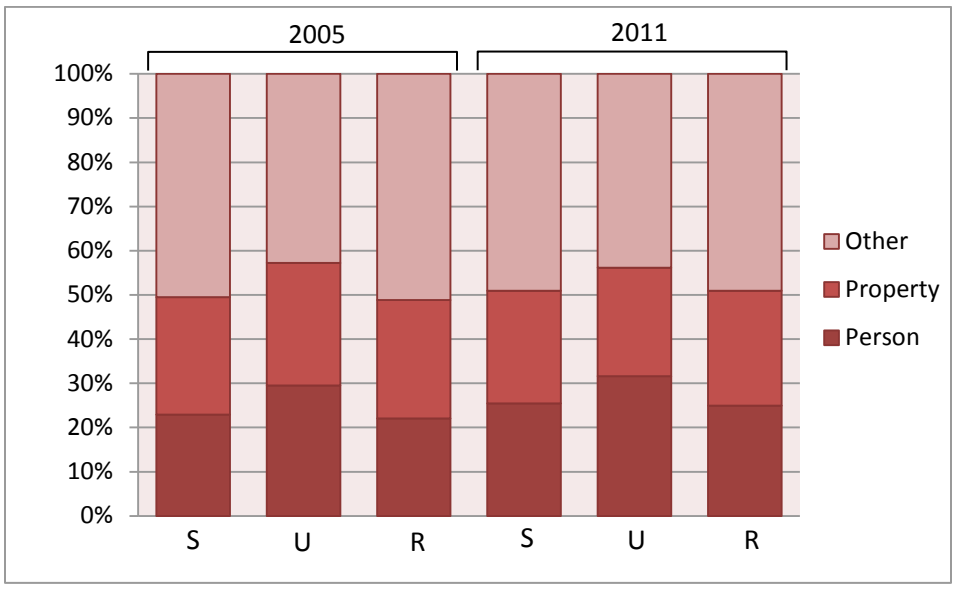
Distribution of Charges

County: S=Suburban, U=Urban, R=Rural

ASD Group

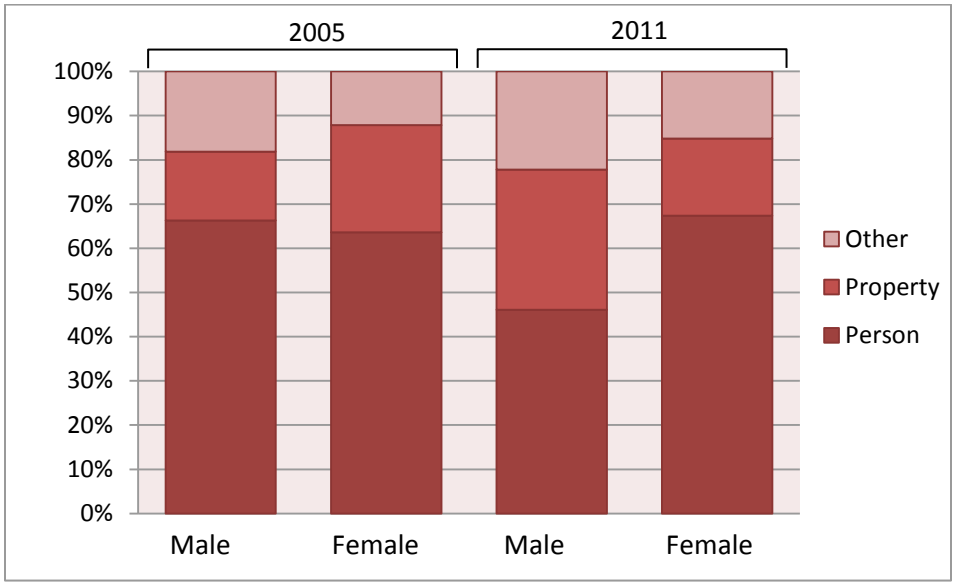


General Population

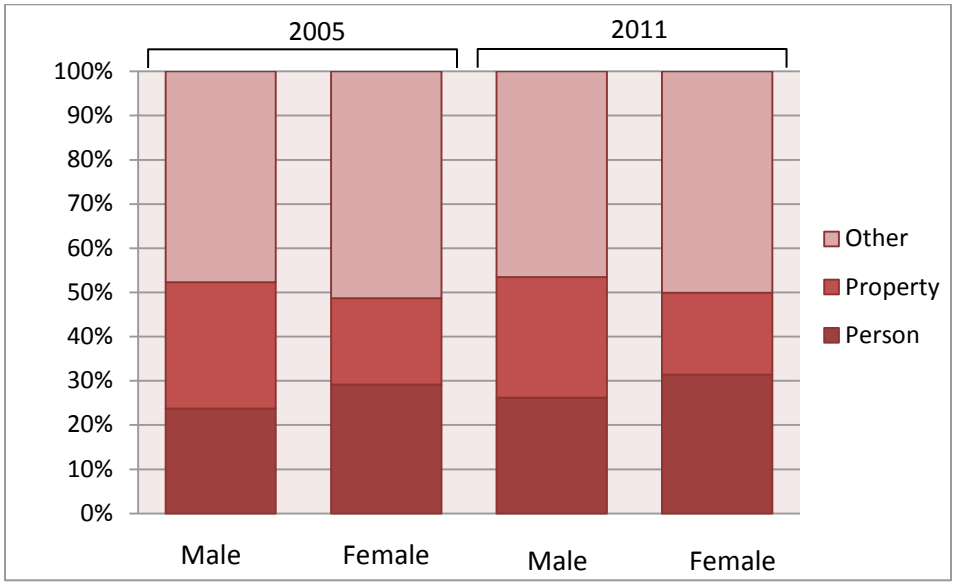


Gender

ASD Population

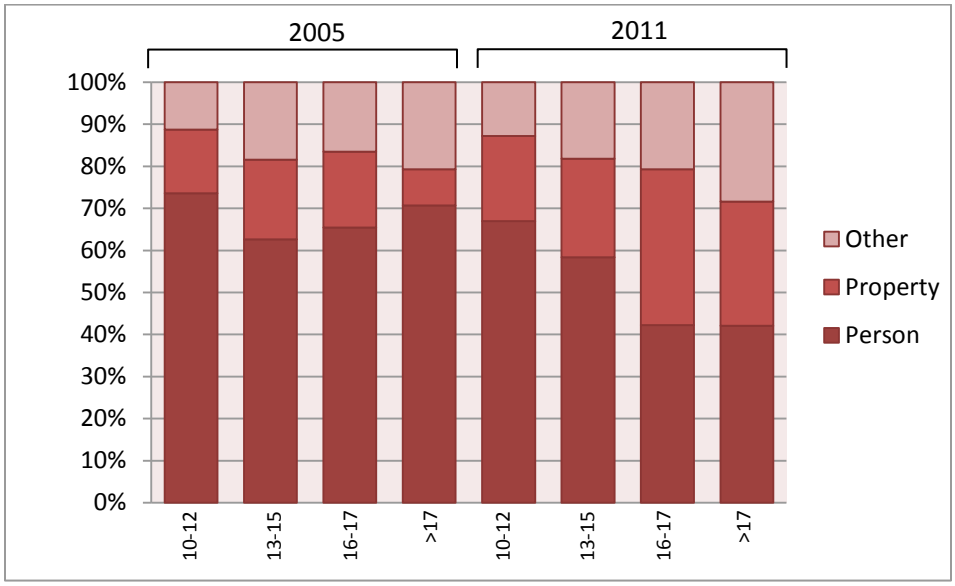


General Population

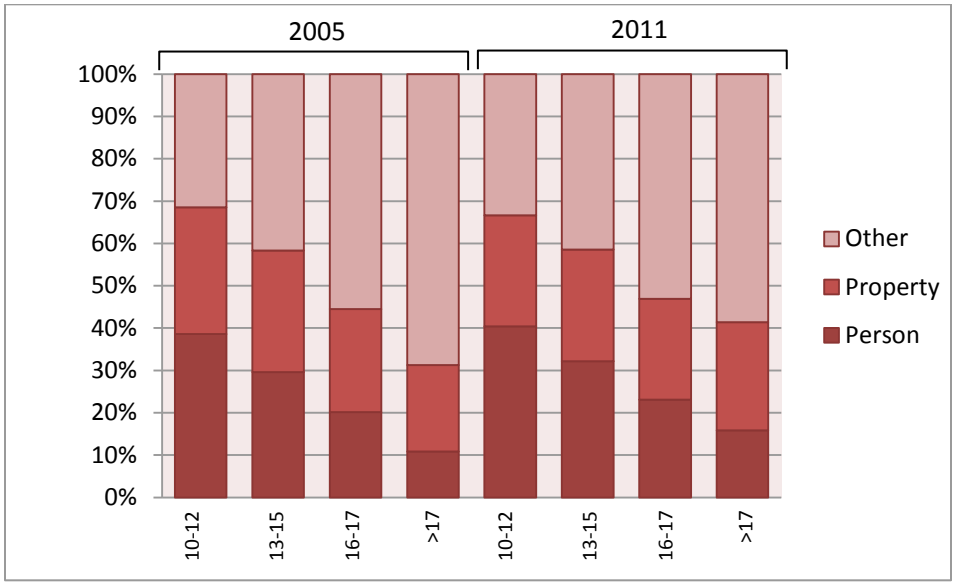


Age

ASD Population

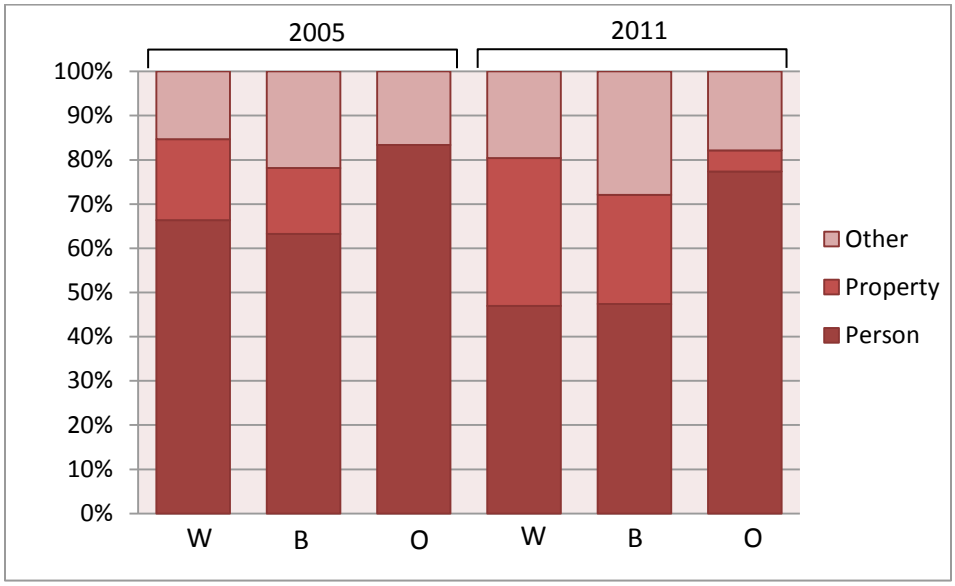


General Population

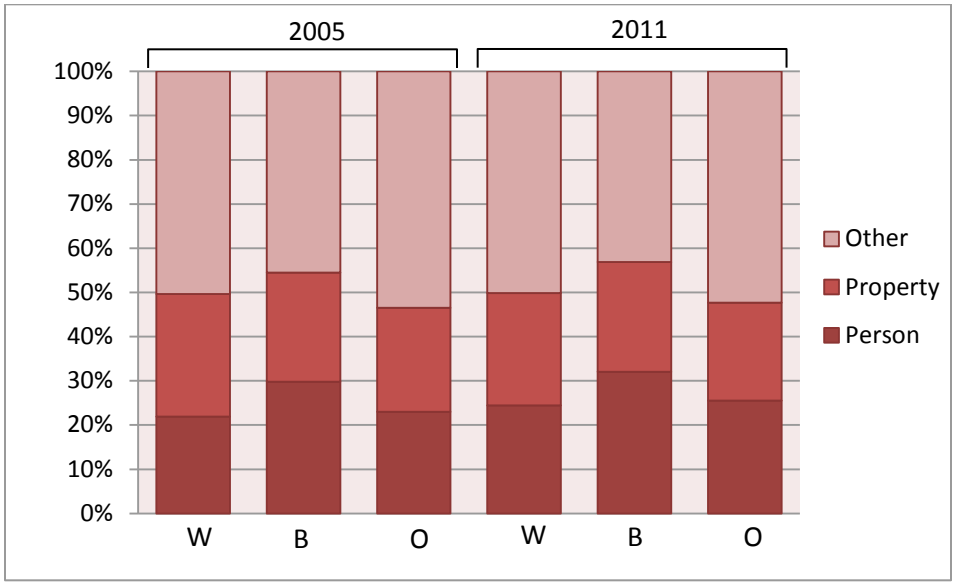


Race

ASD Population

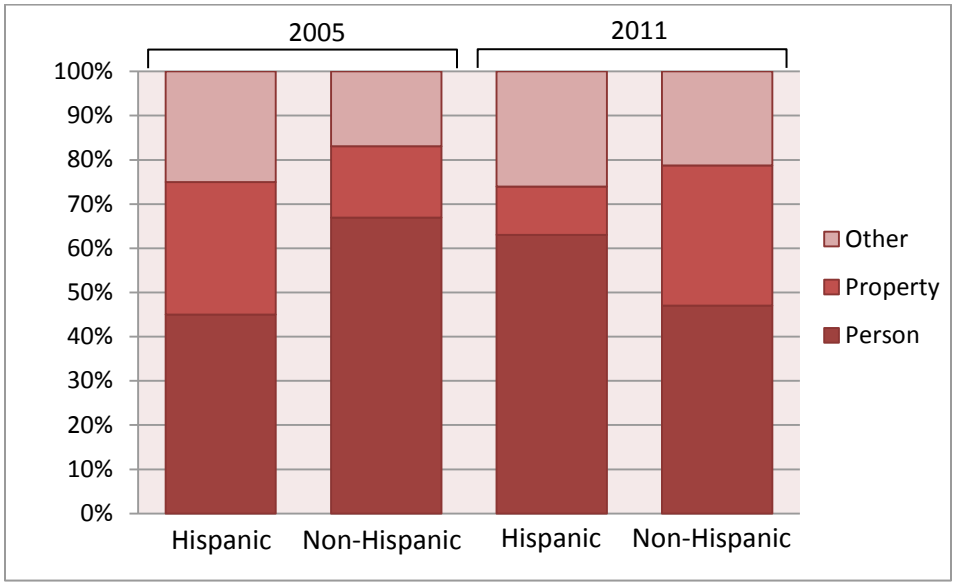


General Population



Ethnicity

ASD Population



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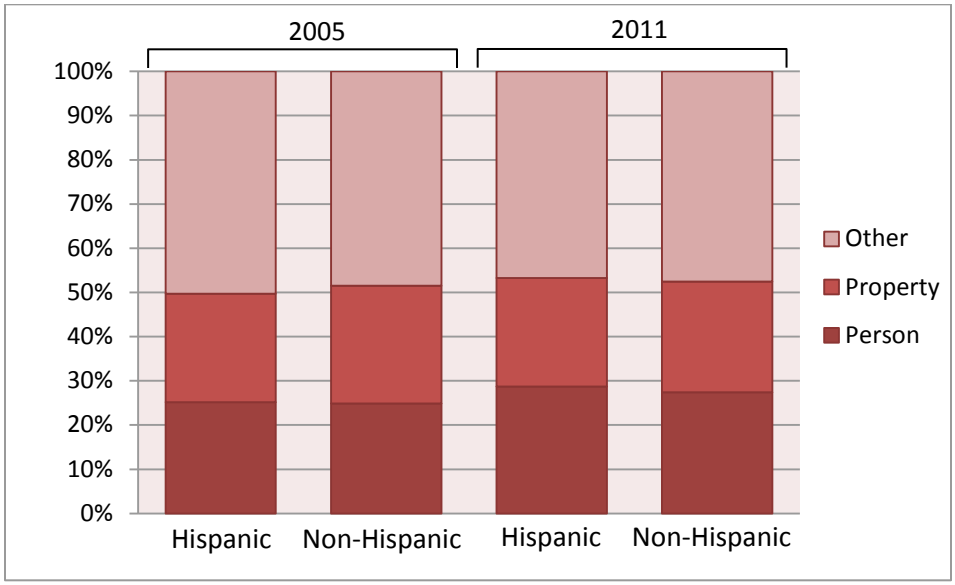

Appendix II

SAS Regression Output

Overdispersion in Poisson Model

Model Information	
Data Set	WORK.NEWSET
Distribution	Poisson
Link Function	Log
Dependent Variable	num
Offset Variable	newdenom

Number of Observations Read	480
Number of Observations Used	467
Missing Values	13

Class Level Information		
Class	**Levels**	**Values**
groupnum	2	0 1
genderp	2	0 1
countyp	3	0 1 2
agep	4	0 1 2 3
racep	3	0 1 2
ethnicp	2	0 1
year	2	0 1

Criteria For Assessing Goodness Of Fit			
Criterion	**DF**	**Value**	**Value/DF**
Deviance	455	15084.9306	33.1537
Scaled Deviance	455	455.0000	1.0000
Pearson Chi-Square	455	29668.9666	65.2065
Scaled Pearson X2	455	894.8917	1.9668
Log Likelihood		13935.6926	
Full Log Likelihood		-8417.9291	
AIC (smaller is better)		16859.8581	
AICC (smaller is better)		16860.5454	
BIC (smaller is better)		16909.6141	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-5.3819	0.0959	-5.5698	-5.1940	3151.88	<.0001
groupnum	0	1	1.7446	0.1106	1.5278	1.9614	248.70	<.0001
groupnum	1	0	0.0000	0.0000	0.0000	0.0000	.	.
genderp	0	1	-1.0160	0.0478	-1.1096	-0.9224	452.32	<.0001
genderp	1	0	0.0000	0.0000	0.0000	0.0000	.	.
countyp	0	1	0.2737	0.0640	0.1483	0.3991	18.31	<.0001
countyp	1	1	0.3290	0.0533	0.2245	0.4334	38.12	<.0001
countyp	2	0	0.0000	0.0000	0.0000	0.0000	.	.
agep	0	1	-0.6981	0.1263	-0.9456	-0.4505	30.54	<.0001
agep	1	1	2.3501	0.0845	2.1845	2.5157	773.54	<.0001
agep	2	1	1.7691	0.0856	1.6014	1.9368	427.55	<.0001
agep	3	0	0.0000	0.0000	0.0000	0.0000	.	.
racep	0	1	-0.7114	0.1084	-0.9238	-0.4991	43.11	<.0001
racep	1	1	1.5662	0.0493	1.4695	1.6629	1008.55	<.0001
racep	2	0	0.0000	0.0000	0.0000	0.0000	.	.
ethnicp	0	1	1.0893	0.0799	0.9327	1.2458	185.92	<.0001
ethnicp	1	0	0.0000	0.0000	0.0000	0.0000	.	.
year	0	1	-0.3429	0.0416	-0.4244	-0.2614	67.94	<.0001
year	1	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	5.7579	0.0000	5.7579	5.7579		

Note The scale parameter was estimated by the square root of
: DEVIANCE/DOF.

LR Statistics For Type 3 Analysis						
Source	**Num DF**	**Den DF**	**F Value**	**Pr > F**	**Chi-Square**	**Pr > ChiSq**
groupnum	1	455	155.13	<.0001	155.13	<.0001
genderp	1	455	520.50	<.0001	520.50	<.0001
countyp	2	455	19.65	<.0001	39.30	<.0001
agep	3	455	819.66	<.0001	2458.99	<.0001
racep	2	455	504.60	<.0001	1009.20	<.0001
ethnicp	1	455	150.43	<.0001	150.43	<.0001
year	1	455	68.65	<.0001	68.65	<.0001

Negative Binomial Unadjusted

Model Information	
Data Set	WORK.NEWSET
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	num
Offset Variable	newdenom

Number of Observations Read	480
Number of Observations Used	467
Missing Values	13

Class Level Information		
Class	**Levels**	**Values**
groupnum	2	0 1

Criteria For Assessing Goodness Of Fit			
Criterion	**DF**	**Value**	**Value/DF**
Deviance	465	508.2190	1.0929
Scaled Deviance	465	508.2190	1.0929
Pearson Chi-Square	465	837.2880	1.8006
Scaled Pearson X2	465	837.2880	1.8006
Log Likelihood		468477.5778	
Full Log Likelihood		-1960.0336	
AIC (smaller is better)		3926.0671	
AICC (smaller is better)		3926.1190	
BIC (smaller is better)		3938.5061	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald 95% Confidence Limits**		**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	-3.2682	0.1131	-3.4898	-3.0466	835.57	<.0001
groupnum	0	1	1.5802	0.1712	1.2446	1.9158	85.16	<.0001
groupnum	1	0	0.0000	0.0000	0.0000	0.0000	.	.
Dispersion		1	3.0498	0.2113	2.6626	3.4934		

Note The negative binomial dispersion parameter was estimated by maximum
: likelihood.

LR Statistics For Type 3 Analysis			
Source	**DF**	**Chi-Square**	**Pr > ChiSq**
groupnum	1	74.91	<.0001

Model Information	
Data Set	WORK.NEWSET
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	num
Offset Variable	newdenom

Number of Observations Read	480
Number of Observations Used	467
Missing Values	13

Class Level Information		
Class	**Levels**	**Values**
groupnum	2	0 1

Criteria For Assessing Goodness Of Fit			
Criterion	**DF**	**Value**	**Value/DF**
Deviance	465	508.2190	1.0929
Scaled Deviance	465	508.2190	1.0929
Pearson Chi-Square	465	837.2880	1.8006
Scaled Pearson X2	465	837.2880	1.8006
Log Likelihood		468477.5778	
Full Log Likelihood		-1960.0336	
AIC (smaller is better)		3926.0671	

Criteria For Assessing Goodness Of Fit			
Criterion	**DF**	**Value**	**Value/DF**
AICC (smaller is better)		3926.1190	
BIC (smaller is better)		3938.5061	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald 95% Confidence Limits**		**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	-3.2682	0.1131	-3.4898	-3.0466	835.57	<.0001
groupnum	0	1	1.5802	0.1712	1.2446	1.9158	85.16	<.0001
groupnum	1	0	0.0000	0.0000	0.0000	0.0000	.	.
Dispersion		1	3.0498	0.2113	2.6626	3.4934		

Note The negative binomial dispersion parameter was estimated by maximum
: likelihood.

LR Statistics For Type 3 Analysis			
Source	**DF**	**Chi-Square**	**Pr > ChiSq**
groupnum	1	74.91	<.0001

Model Information	
Data Set	WORK.NEWSET
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	num
Offset Variable	newdenom

Number of Observations Read	480
Number of Observations Used	467
Missing Values	13

Class Level Information		
Class	**Levels**	**Values**
groupnum	2	0 1
genderp	2	0 1
countyp	3	0 1 2
agep	4	0 1 2 3
racep	3	0 1 2
ethnicp	2	0 1
year	2	0 1

Criteria For Assessing Goodness Of Fit			
Criterion	**DF**	**Value**	**Value/DF**
Deviance	455	511.9408	1.1251
Scaled Deviance	455	511.9408	1.1251
Pearson Chi-Square	455	1170.9933	2.5736
Scaled Pearson X2	455	1170.9933	2.5736
Log Likelihood		468607.3433	
Full Log Likelihood		-1830.2680	
AIC (smaller is better)		3686.5360	
AICC (smaller is better)		3687.3396	
BIC (smaller is better)		3740.4383	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald 95% Confidence Limits**		**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	-4.9625	0.2386	-5.4301	-4.4948	432.60	<.0001
groupnum	0	1	1.8126	0.1623	1.4945	2.1307	124.73	<.0001
groupnum	1	0	0.0000	0.0000	0.0000	0.0000	.	.
genderp	0	1	-0.9848	0.1353	-1.2500	-0.7197	53.01	<.0001

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald 95% Confidence Limits**		**Wald Chi-Square**	**Pr > ChiSq**
genderp	1	0	0.0000	0.0000	0.0000	0.0000	.	.
countyp	0	1	0.1775	0.1650	-0.1459	0.5010	1.16	0.2821
countyp	1	1	0.3459	0.1627	0.0270	0.6649	4.52	0.0335
countyp	2	0	0.0000	0.0000	0.0000	0.0000	.	.
agep	0	1	0.6667	0.2229	0.2298	1.1036	8.95	0.0028
agep	1	1	2.2943	0.1824	1.9367	2.6518	158.19	<.0001
agep	2	1	2.0263	0.1838	1.6661	2.3865	121.59	<.0001
agep	3	0	0.0000	0.0000	0.0000	0.0000	.	.
racep	0	1	-1.1174	0.1800	-1.4702	-0.7646	38.54	<.0001
racep	1	1	0.8286	0.2110	0.4150	1.2422	15.42	<.0001
racep	2	0	0.0000	0.0000	0.0000	0.0000	.	.
ethnicp	0	1	0.3870	0.1805	0.0333	0.7407	4.60	0.0320
ethnicp	1	0	0.0000	0.0000	0.0000	0.0000	.	.
year	0	1	0.0029	0.1409	-0.2733	0.2792	0.00	0.9835
year	1	0	0.0000	0.0000	0.0000	0.0000	.	.
Dispersion		1	1.5611	0.1267	1.3315	1.8303		

Note The negative binomial dispersion parameter was estimated by maximum
: likelihood.

LR Statistics For Type 3 Analysis			
Source	**DF**	**Chi-Square**	**Pr > ChiSq**
groupnum	1	102.69	<.0001
genderp	1	47.91	<.0001
countyp	2	4.49	0.1060
agep	3	144.78	<.0001
racep	2	111.78	<.0001
ethnicp	1	4.51	0.0337
year	1	0.00	0.9834

Negative Binomial Adjusted

Model Information	
Data Set	WORK.NEWSET
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	num
Offset Variable	newdenom

Number of Observations Read	480
Number of Observations Used	467
Missing Values	13

Class Level Information		
Class	**Levels**	**Values**
groupnum	2	0 1
genderp	2	0 1
countyp	3	0 1 2
agep	4	0 1 2 3
racep	3	0 1 2
ethnicp	2	0 1
year	2	0 1

Criteria For Assessing Goodness Of Fit			
Criterion	**DF**	**Value**	**Value/DF**
Deviance	455	511.9408	1.1251
Scaled Deviance	455	511.9408	1.1251
Pearson Chi-Square	455	1170.9933	2.5736
Scaled Pearson X2	455	1170.9933	2.5736
Log Likelihood		468607.3433	
Full Log Likelihood		-1830.2680	
AIC (smaller is better)		3686.5360	
AICC (smaller is better)		3687.3396	
BIC (smaller is better)		3740.4383	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald 95% Confidence Limits**		**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	-4.9625	0.2386	-5.4301	-4.4948	432.60	<.0001
groupnum	0	1	1.8126	0.1623	1.4945	2.1307	124.73	<.0001
groupnum	1	0	0.0000	0.0000	0.0000	0.0000	.	.
genderp	0	1	-0.9848	0.1353	-1.2500	-0.7197	53.01	<.0001
genderp	1	0	0.0000	0.0000	0.0000	0.0000	.	.
countyp	0	1	0.1775	0.1650	-0.1459	0.5010	1.16	0.2821
countyp	1	1	0.3459	0.1627	0.0270	0.6649	4.52	0.0335
countyp	2	0	0.0000	0.0000	0.0000	0.0000	.	.
agep	0	1	0.6667	0.2229	0.2298	1.1036	8.95	0.0028
agep	1	1	2.2943	0.1824	1.9367	2.6518	158.19	<.0001
agep	2	1	2.0263	0.1838	1.6661	2.3865	121.59	<.0001
agep	3	0	0.0000	0.0000	0.0000	0.0000	.	.
racep	0	1	-1.1174	0.1800	-1.4702	-0.7646	38.54	<.0001
racep	1	1	0.8286	0.2110	0.4150	1.2422	15.42	<.0001
racep	2	0	0.0000	0.0000	0.0000	0.0000	.	.
ethnicp	0	1	0.3870	0.1805	0.0333	0.7407	4.60	0.0320
ethnicp	1	0	0.0000	0.0000	0.0000	0.0000	.	.
year	0	1	0.0029	0.1409	-0.2733	0.2792	0.00	0.9835

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald 95% Confidence Limits**		**Wald Chi-Square**	**Pr > ChiSq**
year	1	0	0.0000	0.0000	0.0000	0.0000	.	.
Dispersion		1	1.5611	0.1267	1.3315	1.8303		

Note The negative binomial dispersion parameter was estimated by maximum
: likelihood.

LR Statistics For Type 3 Analysis			
Source	**DF**	**Chi-Square**	**Pr > ChiSq**
groupnum	1	102.69	<.0001
genderp	1	47.91	<.0001
countyp	2	4.49	0.1060
agep	3	144.78	<.0001
racep	2	111.78	<.0001
ethnicp	1	4.51	0.0337
year	1	0.00	0.9834