DRUG AND ALCOHOL USE BY HOMICIDE VICTIMS IN TRINIDAD AND TOBAGO, 2001-2007

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Abstract

Purpose: This paper examines toxicology results from homicide victims in Trinidad and Tobago to explore patterns in pre-mortem drug and alcohol use.

Methods: Toxicology test results were obtained for 1,780 homicide victims. Toxicology data from the coroner's office were linked with police data on homicide incidents to examine patterns in drug use and homicide.

Results: Trinidad and Tobago homicide victims tested positive for cannabis at a significantly higher rate (32%) than the average rate among other drug toxicology studies. Victims tested positive for alcohol (29%), cocaine (7%), and opioids (1.5%) at rates that were either comparable with or lower than those of homicide victims examined in other studies. The proportion of victims testing positive for cannabis grew significantly from 2001-2007; the proportions for alcohol and other drugs were fairly stable over time. Toxicology results also varied by homicide motive, weapon type, and the demographic characteristics of the victim.

Conclusions: Toxicology data are a useful source for understanding patterns in drug use and homicide. Though such data have limitations, when combined with other types of data, they can often provide unique insights about a community's drug and violence problems.

Keywords: homicide, drugs, alcohol, toxicology, Caribbean

Introduction

The relationship between licit and illicit drug use and violence is complex and dynamic [1-3]. There are multiple pathways through which drugs might facilitate violence. For instance, drug use might induce aggressive or violent reactions in the user. Research shows that certain drugs are more likely than others to generate a psychopharmacological effect, including alcohol, barbiturates, phencyclidine (PCP), amphetamines, and other stimulants, including cocaine and crack cocaine [4]. Many studies have focused on licit and illicit drug use as a contributor to violent *offending* [5-13], but fewer studies have examined the psychopharmacological influence of drug use on increasing risk for violent *victimization* [14-15]. Drug users might also carry out violent acts to acquire money (or drugs) for drug use [2, 16- 24]. Given the well-known overlap between offending and victimization [25], drug use is likely to increase the risk of violent victimization, particularly when drug users target other offenders or when persistent users engage in numerous drug purchases in dangerous open-air markets [9]. Participation in drug distribution networks is also associated with victimization risk. Violence is a primary tool of the illicit drug trade for settling disputes and grievances since there is no legal means of adjudicating disputes that occur in illegal markets [24, 26]. Although drug sellers are the more typical victims of this type of violence, research suggests that many drug sellers are also users [9]. In summary, there are multiple pathways connecting drug use to violent victimization.

This study draws on toxicology and homicide data collected as part of an effort to diagnose the causes of a serious violent crime outbreak in Trinidad and Tobago, a small two-island developing Caribbean nation that is home to approximately 1.3 million people. Toxicology findings from Trinidad and Tobago were used as part of a larger suite of data collection initiatives meant to illuminate the nature of drug use and violent crime. To our knowledge this is the only study that presents toxicology findings from a small-island, developing nation, and one of the few studies from the Latin American and Caribbean region [27].

Widening the scope of research in this area to include countries outside of North America, Europe and Australia will expand the international comparison base for toxicology findings. For instance, in a recent systematic quantitative review (or "meta-analysis") of drug toxicology studies among homicide victims, only 3 of the 19 studies identified by the authors were conducted outside of the United States, and those were from just four countries: Canada, Denmark, Norway, and Sweden [28]. Similarly, in a recent meta-analysis of alcohol toxicology findings

among homicide victims, only 16 of 61 studies were conducted outside of the United States, including Australia (4), South Africa (3), Denmark (2), Finland (2), Sweden (2), Canada (1), Norway (1), and Turkey (1) [29].

This study also combines toxicology data from the crime laboratory with police data on homicide incidents, including data on victim and incident characteristics. We examine toxicology findings by age, sex, and race of the victim since understanding demographic correlates is a key step in clarifying the epidemiology of violent victimization. We also examine toxicology findings by homicide motive and weapon type. Understanding variations in toxicology test results by homicide incident characteristics can be useful for informing the design of violence prevention, intervention, and enforcement efforts.

Material and Methods

We obtained electronic copies of every toxicology report from January 2001 to November 17, 2007 directly from the Forensic Science Centre (FSC) of Trinidad and Tobago. During this same time period, the police recorded 1,900 homicides. We were able to locate toxicology data from the crime laboratory on 1,780 cases, or about 93.7% of all suspected homicide cases. The toxicology reports provide the results of toxicological testing of one or more victim samples of blood, urine, stomach contents, and/or organ tissues. In some cases, two separate reports were available for a victim, reflecting different samples that were submitted at different times and/or by different police officers. When these situations occurred, we combined the results and used the earliest "Case Reported Date" if that date closely matched the homicide date. Further, the data for 2007 only included homicides until mid-November given the timing of our data collection.

Qualifications

Drug samples were first screened using an enzyme immunoassay instrument and then confirmed using a Gas Chromatograph Mass Spectrometer. Toxicology testing processes did not change during the period covered by this study. Each individual toxicology report contained information indicating the presence or absence of alcohol, whether the alcohol level reached the legal definition of intoxication (defined as 0.08% BAC or above in Trinidad and Tobago), and the presence or absence of various psychoactive drugs. The standard toxicology testing process typically included tests for alcohol (ethyl); cannabis (as indicated by the presence of Δ-9-tetrahydrocannabinol or THC); cocaine (as indicated by the presence of either cocaine itself, or benzoylecgonine, one of cocaine's major

metabolites); and opioids (as indicated by the presence of morphine, the principal metabolite of heroin).[1] As such, our analyses focused on four psychoactive drugs in Trinidad and Tobago: alcohol, cannabis, cocaine, and opioids. Recent research and other external indicators suggest that other drugs may be abused in Trinidad and Tobago, and those drugs may contribute to violence and violent victimization [30-31], but we were unable to consider other drugs in this study. Nevertheless, the majority of evidence suggests that these are the four most frequently used and abused drugs in Trinidad and Tobago.

Results

Alcohol was detected in 29.4% of the homicide victims from 2001 to 2007. Trinidad and Tobago uses an 80 mg/dl threshold (0.08% BAC) for legal intoxication. Using that threshold, 9.8% of homicide victims met the local standard for intoxication. Cannabis was detected in 32% of the victims, cocaine in 7% of the victims, and opioids in 1.5% of the victims. Figure 1 illustrates the alcohol and alcohol intoxication toxicology results from 2001 to 2007 and Figure 2 provides the same results for cannabis, cocaine, and opioids. With the exception of cannabis, changes in the percentages of homicide victims testing positive for any of these substances were generally small. However, the percentage of homicide victims testing positive for cannabis increased each year from 2003 to 2007 and increased 48% overall from 2001 to 2007 (testing procedures remained the same during this period, thus we do not attribute this finding to a change in detection rates). During this same period, homicides in the country increased 158%, from 151 homicides in 2001 to 389 homicides in 2007.

—INSERT FIGURES 1 & 2 ABOUT HERE—

Comparison with Other Studies

Two recent meta-analytic studies provided quantitative summaries of existing research from multiple countries on toxicology findings among homicide victims. While these studies do not represent a random sample of homicide victims worldwide, they do provide a useful source of comparison for thinking about toxicology findings from any given location. The first meta-analysis examined 61 original studies published between 1953 and 2007

[1] The testing procedures called for analysts to carry out a separate test for heroin any time the initial test for opioids was positive (heroin is detected by the presence of 6-Monoacetylmorphine in urine). However, since the data we obtained did not contain separate results for heroin, we are only able to report results for opioids more generally. Therefore we are unable to distinguish between illicit use of opioids (like heroin) and potentially legal uses of opioids (like morphine) that may have occurred in a medical setting.

that examined post-mortem alcohol toxicology data from homicide victims [29]. Based on more than 78,000 homicide victims, the findings showed that 48% of victims tested positive for alcohol and 33-35% of victims were intoxicated (depending on the threshold used to determine intoxication). These results were consistent with an earlier meta-analysis [32] from a smaller number of studies which found that 47.1% of homicide victims tested positive for alcohol. The second meta-analysis examined 19 original studies containing toxicology tests for three illegal drugs in homicide victims: cannabis, cocaine, and opioids [28]. Based on more than 29,000 homicide victims, the findings showed that 6% of the homicide victims tested positive for cannabis, 5% tested positive for opioids, and 11% tested positive for cocaine and its derivatives. These two recent meta-analyses synthesized a large and diverse body of research on toxicology results from homicide victims and can serve as a useful point of comparison for local toxicology results (as long as the limitations of this approach are carefully considered). Figure 3 illustrates the frequency with which drugs were detected in Trinidad and Tobago homicide victims over the seven-year timeframe and compares the results with findings from these two meta-analyses of toxicology findings from homicide victims [28-29].

—INSERT FIGURE 3 ABOUT HERE—

Trinidad and Tobago homicide victims from 2001 to 2007 tested positive for alcohol (29.4%) at lower than average rates compared with homicide victims from other toxicology studies (48%) [29]. Further, only 8.1% of the Trinidad and Tobago homicide victims met the BAC $\geq$ 100 mg/dl threshold for intoxication, compared to 35% in other studies. Trinidad and Tobago uses an 80 mg/dl threshold (0.08% BAC) for legal intoxication, but even using that figure results in just 9.8% of homicide victims meeting the local standard for intoxication, compared with 33% in other studies. On initial inspection, it appears that proportionally fewer homicide victims in Trinidad and Tobago test positive for alcohol, or were intoxicated, at the time of death compared with homicide victims from other countries included in a recent meta-analytic review of existing research.

Homicide victims in Trinidad and Tobago tested positive for cannabis at significantly higher rates than homicide victims included in the drug meta-analysis (32% versus an average of 6% in eight other studies with 95% confidence interval of 2% to 17%). On the other hand, Trinidad and Tobago homicide victims tested positive for cocaine (7%) at a slightly lower rate than among victims from other parts of the world (11% across 16 studies with a 95% confidence interval of 6% to 19%), although the difference was not statistically significant. Finally, Trinidad

and Tobago homicide victims tested positive for opioids (1.5%) at significantly lower rates than victims from other areas of the world (a mean of 5% across twelve other studies with a 95% confidence interval of 3% to 7%).[2]

Toxicology and Demographic Characteristics

A long tradition of research has found strong demographic differences in both drug use and violent victimization [33, 34]. Trinidad and Tobago is home to the following ethnic groups: Indian (South Asian) 40%, African 37.5%, mixed 20.5%, and other 1.2%. The gender ratio for citizens in the 15-64 age range is 1.11 males per female. Finally, the age group distributions are as follows; *0-14 years* - 19.5%, *15-64 years* - 71.6%; *65 years and over* - 8.9% [36].

We next merged the crime laboratory's toxicology data with the police service's homicide incident data. The analyses using the merged data set are based on a subset of data from 2001 to 2005 (N=1,074) because police processes for recording homicide data changed in early 2006. Our analysis identified some variations across demographic subgroups, although most of the comparisons were not statistically significant (see Table 1). More Africans tested positive for cannabis (33%) than East Indians (17%) or others (13%; $\chi^2 = 22.8$; $p < .000$). East Indian victims who tested positive for alcohol had significantly higher average BAC (80 mg/dl) than African victims (58 mg/dl; $t = -1.93$; $p < .05$). Male victims (32%) were significantly more likely to test positive for cannabis than female victims (10%; $\chi^2 = 25.0$; $p < .001$). Further, the average age for intoxicated victims (36.7 years old) was significantly higher than the average age for victims who were not intoxicated (32.8; $t = -2.5$; $p < .05$); the average age for those testing positive for cocaine (37.7) was significantly higher than those who tested negative (32.8; $t = -2.8$; $p < .01$); and the average age for victims testing positive for cannabis (28.9) was significantly lower than for those who did not (34.9; $t = 6.3$; $p < .001$). Finally, age and blood alcohol content were weakly and positively correlated ($r = .144$; $p < .01$).

—INSERT TABLE 1 ABOUT HERE—

[2] This comparative analysis is limited by whatever causal mechanisms are responsible for leading forensic scientists from certain jurisdictions to publish articles containing toxicology findings from homicide victims. If the locations reporting such findings are random, then the findings are more meaningful. If there is some sort of unseen selection effect influencing which jurisdictions publish toxicology findings, then the findings may be less robust. Moreover, since the studies included in these meta-analyses provided varying levels of detail about testing procedures, definitions, and thresholds, any such comparisons may contain measurement error.

Toxicology and Homicide Incident Characteristics

The Trinidad and Tobago Police Service (TTPS) assigned each homicide from 2001-2005 to a motive category. Merging the toxicology data with the homicide data enabled us to compare toxicology test results across homicide motives (see Figure 4) and examine variations in weapon use. For reasons beyond our control, we only consider three motive categories: domestic, robbery, and other.[3] Although the "other" category in this case is heterogeneous, research suggests that most of the homicides in this category are "street" homicides having to do with gangs and/or the market in illicit commodities like drugs and guns [37].

—INSERT FIGURE 4 ABOUT HERE—

Virtually the same percentage of victims within each motive category tested positive for alcohol (domestic = 34%; robbery = 32%; other = 34%). Eleven percent of the victims of other motives were legally intoxicated, compared with 6% of robbery-related homicide victims and 7.5% of domestic homicide victims, but these differences were not statistically significant. On the other hand, significantly more victims of other motives (45%) tested positive for one or more drugs, compared with 20% of robbery-related victims and 15% of domestic homicide victims ($\chi^2 = 41.2$; Phi/Cramer's V = .250; $p < .000$). This finding is consistent with expectations, since street homicides are more likely to involve illicit drugs.[4]

Test result comparisons for specific drugs are not shown in Figure 2. However, significantly more victims of other motives (37%) tested positive for cannabis compared to 14% of robbery-related and 9% of domestic victims ($\chi^2 = 40.2$; Phi/Cramer's V = .247; $p < .000$). This pattern continued for the cocaine results where 9% of the victims of other motives tested positive compared to just two percent each for robbery-related and domestic victims (χ^2 =

[3] The TTPS generally assigned homicides to one of the following eight motive categories: robbery, domestic, gang-related, drug-related, altercation, revenge, other, or unknown. Research on homicide motives in Trinidad and Tobago suggests that the two most reliable and valid classifications are robbery-related and domestic homicides, because it is typically easier for detectives to recognize when a homicide was connected to a robbery or a domestic dispute. On the other hand, homicides that were motivated by gangs, drugs, revenge, or altercations are often difficult to distinguish from one another. Consistent with other research on homicides in Trinidad and Tobago, we collapsed homicide motives into three categories: robbery, domestic, and all others. About forty percent of the homicides were missing motive data at the time of the data collection, often because motive is assigned later during the investigation. As a result, we only analyzed homicides that included an assigned motive during the time when the data collection process was occurring (n=661).

[4] Our use of the term "street" homicide is not meant to describe *where* the event took place; it is meant to encapsulate homicides that are associated with gangs and/or illicit drug and gun markets. These homicides are often difficult to classify because they involve a mix of motives. For instance, if a gang member has an altercation with a drug dealer who is infringing on his territory and kills the dealer, should it be classified as gang-related, drug-related, revenge, or an altercation? Previous research in Trinidad and Tobago has shown that these individual homicide motive categories are not reliable, therefore we collapse them here [37].

10.0; Phi/Cramer's V = .123; $p < .007$). Finally, just one percent of the victims of other motives and two percent of robbery-related and domestic victims tested positive for opioids. Considering overall alcohol and drug involvement, victims of other motives were significantly more likely to test positive for alcohol and/or drugs (66%) than victims of robbery-related (47%) or domestic homicides (40%; $\chi^2 = 28.1$; Phi/Cramer's V = .206; $p < .000$).

With respect to weapons, the majority of all homicides were committed with firearms (63%), followed by sharp instruments (22%), blunt objects (4.5%), body force/strangulation (3%), other weapons (fire, drowning, etc. - ~1%) or unknown (7%). Street homicides and robbery-based homicides were significantly more likely to involve firearms, while domestic homicides were most likely to be committed with sharp instruments. Victims of homicides committed with blunt or sharp objects were significantly more likely to test positive for alcohol and/or be intoxicated, while the victims of gunshot wounds were significantly more likely to test positive for cannabis.

In summary, 393 of 661 (59%) of the victims for which we had motive data tested positive for alcohol, one or more drugs, or a combination of both. There were no significant differences across motive categories with respect to alcohol use and intoxication. Victims of other motives (which included altercations, drug-related, revenge, or gang-related) were more likely to have been shot and more likely to test positive for drugs than victims of domestic and robbery-related homicides. From 45% to 72% of the victims, regardless of motive, tested positive for alcohol, one or more drugs, or both. Again, street homicides tend to take place in environments characterized by greater drug use and availability and often involve firearms.

Discussion

While there are limits to the inferences that can be derived from analyses of toxicology data, these types of findings were useful for helping to illuminate some aspects of the drug and violence problems in Trinidad and Tobago. First, toxicology results for alcohol, cocaine, and opioids reveal that Trinidad and Tobago homicide victims are on par with or lower than the average rates reported in other toxicology studies [28-29, 32]. The cocaine toxicology rate is also particularly noteworthy considering the relative geographic proximity of Trinidad and Tobago to cocaine source countries, including Colombia, Bolivia and Peru. Moreover, evidence suggests that Trinidad and Tobago may serve as a transshipment country for South American drugs bound for North America or Europe [38]. Other evidence also supports the inference that cocaine is not a widely abused drug in Trinidad and Tobago, including two national youth surveys [31, 39] and interviews we conducted with drug investigation officers and

other security officials working on drug-related issues. There is an important lesson here – drug availability and drug preference are not always consistent. Second, homicide victims in Trinidad and Tobago had lower rates of alcohol and alcohol intoxication than victims from other studies. These findings are somewhat surprising given research on the links between alcohol consumption and minor crimes in the country [40-41].

Third, Trinidad and Tobago homicide victims tested positive for cannabis at substantially higher rates (32%) when compared to victims in other studies, for whom the average rate was only 6%. Just one of the eight studies included in a recent meta-analysis reported cannabis toxicology results that were higher (just slightly) than those in Trinidad and Tobago [28]. Several explanations might account for this finding. Marijuana is the most widely used illicit drug in Trinidad and Tobago, although the 2002 annual prevalence abuse rates were among the lowest (at 3.7%) within the Caribbean countries [42].[5] However, two recent school surveys also suggest that about one in eight secondary students had tried marijuana in their lifetime and that approximately 2.7% to 4.5% reported using marijuana in the past 30 days [39, 43]. As such, more recent evidence suggests that marijuana is being used by youths who are entering high offending and victimization age ranges. Although other sources of data on drug use are not consistently available, anecdotal evidence suggests a widespread social acceptance of alcohol and marijuana in some Caribbean countries, among both in-school and out-of-school youth. Out-of-school teenagers are the most at risk for substance abuse and involvement in drug dealing [44]. Given the relatively impoverished population in the neighborhoods where most homicides take place, it is also likely that many marijuana users purchase small amounts of marijuana at frequent intervals.[6] Frequent drug purchases in illicit markets will likely increase the likelihood of violent victimization, particularly among youths (as buyers and sellers), because the risk of victimization multiplies by the number of transactions. Further, if either the buyer or seller is intoxicated or under the influence of alcohol or other illicit drugs, risk of victimization might increase further.

Fourth, this study also documented demographic differences in toxicology test results. In summary, younger, African male homicide victims were more likely to test positive for cannabis. Older victims were more

[5] This estimate comes from the World Drug Report, produced by the United Nations Office on Drugs and Crime [42]. The data sources used to estimate national drug abuse rates in this report have a wide range of reliability and validity. If we take this estimate at face value, it suggests that homicide victims use marijuana to a significantly greater extent than the general population (32% versus 3.7%). Unfortunately, it is difficult to know how much place to faith in the estimate of marijuana use in the general population.

[6] Interviews with detectives and observations during ride-alongs with police confirmed that this is the most common purchasing process.

likely to test positive for alcohol and alcohol intoxication, and East Indian victims were likely to be more intoxicated than victims of other races. Finally, cocaine use was higher among older homicide victims. Considered collectively, it appears that Trinidad and Tobago youth who become victims of homicide are more involved in cannabis use than other drugs of abuse.

Fifth, this study also provides evidence that homicide victims who were killed within the context of "other" homicide motives – what we call *street violence* (including gang-related, drug-related, altercation, revenge, and retaliation homicides) – more often tested positive for drugs than victims of domestic and robbery-related homicides. These patterns are probably not limited to Trinidad and Tobago since the links between drug use, drug markets, and violence have been documented worldwide. Changes in drug market activity have been linked to changes in aggregate homicide rates as well as homicide rates among racial subgroups [45-46]. Diagnosing violent crime problems means disentangling the precise nature of drug-violence relationships and understanding how those relationships change over time.

In summary, homicide victim toxicology reports are one useful tool for learning more about patterns in drug use and violent victimization. However, toxicology data have some inherent limitations that are important to keep in mind. First, they do not provide information on offender drug use, so only half the potential contribution to violence is considered using this data source. Second, toxicology data typically provide only a narrow range of information useful for understanding the nature of homicides. Linking toxicology results from the crime laboratory with police data on homicide incidents can provide some additional clarity by adding information on victim, offender, and offense characteristics. However, in nations that have difficulty in solving homicide cases (like Trinidad and Tobago), the identity of offenders is often unknown and therefore police data are unlikely to contain much information about offenders [47]. Third, postmortem toxicology testing is inherently challenging. The reliability and validity of toxicology tests can be compromised by delays or other problems in evidence submission and processing and inadequate preservation of samples. These problems can result in sample deterioration and ethanol evaporation [48]. Finally, toxicology findings often lack an effective comparison group. Comparing these data to drug and alcohol usage rates for other categories of offenders, non-offenders, and non-victims is important for drawing proper inferences. In spite of their limitations, toxicology findings have value for those interested in learning more about patterns and trends in drug use and violence in specific communities. Using toxicology test results provides a scientifically defensible measure of drug use among homicide victims. Investing in a similar

process for homicide offenders (e.g., urinalysis tests combined with self reports of intoxication at the time of the violent encounter) would enrich our understanding of the role of drug use in lethal violence encounters. Moreover, combining multiple sources of data for use in a larger diagnostic framework can often provide insights about a community's drug and violence problems. Toxicology data should be included among the many data sources used within such a framework.

Key Points

(1) Toxicology results for alcohol, cocaine, and opioid use among Trinidad and Tobago homicide victims are similar to or lower than the average rates reported in other toxicology studies, yet cannabis use was substantially higher.

(2) The proportion of victims testing positive for cannabis grew significantly from 2001-2007, while the proportions for alcohol and other drugs were fairly stable over time.

(3) Notable demographic differences in toxicology findings were observed.

(4) Victims of *street violence* tested positive for cocaine, cannabis, and opioids more often than victims of domestic and robbery-related homicides.

(5) Though they have some inherent limitations, homicide victim toxicology reports are a useful tool for learning more about patterns in drug use and violent victimization.

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References

[1] Kuhns JB. The dynamic nature of the drug use/serious violence relationship: a multi-causal approach. *Violence Vict.* 2005;20(4):433-54.

[2] Goldstein PJ. Drugs and violent crime. In: Weiner N, Wolfgang ME, editors. Pathways to criminal violence. Newbury Park, CA: Sage Publications; 1989. pp. 16-48.

[3] Parker RN, Auerhahn K. Alcohol, drugs, and violence. *Annu. Rev. Sociol.* 1998;24:291-311.

[4] Boles SM, Miotto K. Substance abuse and violence: a review of the literature. *Aggress and Violent Behav.* 2003;8(2):155-174.

[5] Farrington DH. Longitudinal analyses of criminal violence. In: Wolfgang ME, Weiner NA. editors. Criminal violence. Beverly Hills, CA: Sage Publications; 1982. pp. 171-200.

[6] Chaiken MR, Chaiken JM. Offender types and public policy. In: Weiner NA, Zahn MA, Sagi RJ, Merton RK, editors. Violence: patterns, causes and public policy. New York, NY: Harcourt Brace Jovanovich Publishers; 1990a. pp. 351-366.

[7] Chaiken, JM, Chaiken, MR. Drugs and predatory crime. In: Tonry M, Wilson JP, editors. Drugs and crime. Chicago, IL: University of Chicago Press; 1990. pp. 203-239.

[8] Nurco DN, Hanlon TE, Kinlock TW. Recent research on the relationship between illicit drug use and crime. *Behav Sci. Law.* 1991;9(3):221-42.

[9] Fagan J, Chin K. Violence as regulation and social control in the distribution of crack. In: de la Rosa M, Lambert EY, Gropper B, editors. Drugs and violence: causes, correlates and consequences. Rockville, MD: U.S. Department of Health and Human Services, National Institute on Drug Abuse; 1990. pp. 8-43.

[10] Fagan J. Intoxication and aggression. In: Tonry M, Wilson JQ, editors. Crime and justice vol. 13. Chicago, IL: University of Chicago Press;1990. pp. 241-320.

[11] Fishbein DH. The psychobiology of female aggression. *Crim Justice Behav.* 1992;19(2):99-126.

[12] Fishbein DH. Differential susceptibility to co-morbid drug abuse and violence. *J. Drug Issues* 1998;28(4):859-890.

[13] Thornberry TP, Huizinga D, Loeber R. The prevention of serious delinquency and violence: implications from the program of research on the causes and correlates of delinquency. In: Howell JC, Krisberg B,

Hawkins JD, Wilson JJ, editors. Sourcebook on serious, violent and chronic juvenile offenders. Thousand Oaks, CA: Sage Publications; 1995. pp. 213-237.

[14] Weiner MD, Sussman S, Sun P, Dent C. Explaining the link between violence perpetration, victimization, and drug use. *Addict Behav.* 2005;30(6):1261-1266.

[15] Zahn MA, Bencivengo M. Violent death: a comparison between drug users and non-drug users. *Addict Dis.* 1974;1(3):283-296.

[16] Goldstein PJ, Brownstein HH, Ryan PJ, Bellucci PA. Crack and homicide in New York City, 1988: A conceptually based event analysis. *Contemp Drug Probl.* 1989;16(4):651-687.

[17] Nurco DN, Hanlon TE, Kinlock TW, Duszynski KR. Differential criminal patterns of narcotics addicts over an addiction career. *Criminology.* 1988;26(3):407-423.

[18] Nurco DN, Hanlon TE, Kinlock TW, Duszynski KR. The consistency of types of criminal behavior over preaddiction and nonaddiction status periods. *Compr Psychiatry.* 1989;30(5):391-402.

[19] Wish ED, Johnson BD. The impact of substance abuse on criminal careers. In: Blumstein A, Cohen J, Roth JA, Visher CA, editors. Criminal careers and "career criminals." Washington, DC: National Academy Press; 1986. pp. 52-88.

[20] Chaiken JM, Chaiken MR. Varieties of criminal behavior. Santa Monica, CA: Rand; 1982.

[21] Inciardi JA. Youth, drugs and street crime. In: Scarpitti FR, Datesman SK, editors. Drugs and the youth culture. Beverly Hills, CA: Sage Publications; 1980. pp. 175-204.

[22] Inciardi JA. War on drugs: heroin, cocaine, crime and public policy. Palo Alto, CA: Mayfield; 1986.

[23] Inciardi JA. The crack-violence connection within a population of hard-core adolescent offenders. In: de la Rosa M, Lambert EY, Gropper B, editors. Drugs and violence: causes, correlates and consequences. Rockville, MD: U.S. Department of Health and Human Services, National Institute on Drug Abuse; 1990. pp. 92-111.

[24] Grogger J. An economic model of recent trends in violence. In: Blumstein A, Wallman J, editors. The crime drop in america. New York, NY: Cambridge University Press; 2006. pp. 266-287.

[25] Lauritsen, J. Sampson R, Laub J. The link between offending and victimization among adolescents. *Criminology.* 1991;29:265–292.

[26] Taylor AP. How drug dealers settle disputes: violent and nonviolent outcomes. Monsey, NY: Criminal Justice Press; 2007.

[27] Gawryszewski VP, Kahn T, Mello Jorge MHP. Informações sobre homicídios e sua integração com o setor saúde e segurança pública. *RevSaude Publica.* 2005;39(4):627-633.

[28] Kuhns JB, Wilson DB, Maguire ER, Ainsworth SA, Clodfelter TA. A meta-analysis of marijuana, cocaine and opiate toxicology study findings among homicide victims. *Addiction.* 2009;104(7):1122-1131.

[29] Kuhns JB, Wilson DB, Clodfelter T, Maguire ER, Ainsworth S. A meta-analysis of alcohol toxicology study findings among homicide victims. *Addiction.* 2011;106(1):62-72.

[30] Caribbean Drug Information Network (CARDIN). National secondary school survey, Trinidad and Tobago. Trinidad and Tobago, West Indies: Caribbean Drug Information Network; 2002.

[31] Valdez and Torry International. Survey of chemically-dependent persons in treatment and rehabilitation centers in Trinidad and Tobago. Trinidad and Tobago, West Indies: National Alcohol and Drug Abuse Prevention Program; 2005.

[32] Smith GS, Branas CC, Miller TR. Fatal nontraffic injuries involving alcohol: a meta-analysis. *Ann. Emerg. Med.* 1999;33(6):659-668.

[33] Ho C, Kingree JB, Thompson M. Demographic differences in substance use problems among juvenile delinquents. *Am. J. Drug Alcohol Abuse.* 2007;33(5):747-754.

[34] Substance Abuse and Mental Health Services Administration. Results from the 2003 national survey on drug use and health: national findings. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2004: DHHS Publication No., SMA 04–3964, NSDUH Series H–25.

[35] Federal Bureau of Investigation. Crime in the United States, 2010. U.S. Department of Justice. 2010. http://www.fbi.gov/about-us/cjis/ucr/ucr. Accessed 17 Aug 2011.

[36] The world factbook, 2007. Central Intelligence Agency. https://www.cia.gov/library/publications/the-world-factbook/geos/td.html#People. Accessed 4 Aug 2011.

[37] Maguire ER, Willis JA, Snipes J, Gantley M. Spatial concentrations of violence in Trinidad and Tobago. *Caribb. J . of Criminol. and Public Saf.* 2008;13(1&2):48-92.

[38] Platzer M. Illicit drug markets in the Caribbean: analysis of information on drug flows through the region. In: Klein A, Day M, Harriott A, editors. Caribbean drugs: from criminalization to harm reduction. Kingston, Jamaica: Ian Randle Books; 2004. pp. 189-223.

[39] Katz CM, Fox AM. Trinidad and Tobago youth survey report. Phoenix, AZ: Center for Violence Prevention; 2007.

[40] Maharajh HD, Ali A. Crime in Trinidad and Tobago: the effect of alcohol use and unemployment. *Rev. Panam Salud Publica*. 2004;15(6):417-423.

[41] Moore S, Montane-Jaime LK, Carr LG, Ehlers CL. Variations in alcohol-metabolizing enzymes in people of East Indian and African descent from Trinidad and Tobago. *Alcohol Res Health*. 2007;30(1):28-30.

[42] United Nations Office on Drugs and Crime. World drug report 2007. New York, NY: United Nations Publications; 2007.

[43] Inter-American Drug Abuse Control Commission. Trinidad and Tobago: evaluation of progress in drug control 2005-2006. Organization of American States; 2008.

[44] The World Bank. Caribbean youth development: issues and policy directions. Washington, DC: The World Bank; 2003.

[45] Ousey GC, Lee MR. Investigating the connections between race, illicit drug markets, and lethal violence, 1984-1997. *J Res. Crime Delinq.* 2004;41(4):352-383.

[46] Ousey GC, Lee MR. Homicide trends and illicit drug markets: exploring differences across time. *Justice Q.* 2007;24(1):48-79.

[47] Maguire ER, King WR, Johnson D, Katz CM. Why homicide clearance rates decrease: evidence from the Caribbean. *Policing and Society.* 2010;20(4):373-400.

[48] Drummer OH. Postmortem toxicology of drugs of abuse. *Forensic Sci Int.* 2004;142:101-113.

Figure Legend

Figure 1: **Alcohol Toxicology Results by Year**
Figure 1 illustrates the alcohol and alcohol intoxication toxicology results from 2001 to 2007.

Figure 2 **Toxicology Results by Year for Other Substances**
Figure 2 illustrates cannabis, cocaine, and opioid toxicology results from 2001 to 2007.

Figure 3 **T&T Homicide Victim Toxicology Findings Compared with Meta-analysis Findings**
Figure 3 illustrates the frequency with which alcohol and drugs were detected in Trinidad and Tobago homicide victims over a seven-year period and compares the results with findings from two meta-analyses of toxicology findings from homicide victims.

Figure 4 **Percent of Homicide Victims Testing Positive for Alcohol and/or Drugs by Motive**
Figure 4 compares toxicology test results across homicide motives for 2001 to 2007.

FIGURE 1

Alcohol Toxicology Results by Year

(n=1,780)

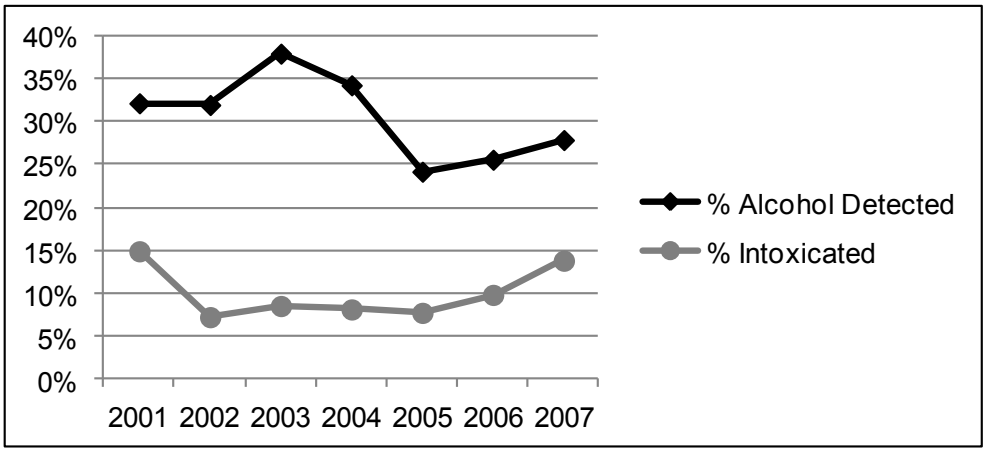

FIGURE 2

% Positive for Cannabis, Cocaine, and Opiates by Year

(n=1,780)

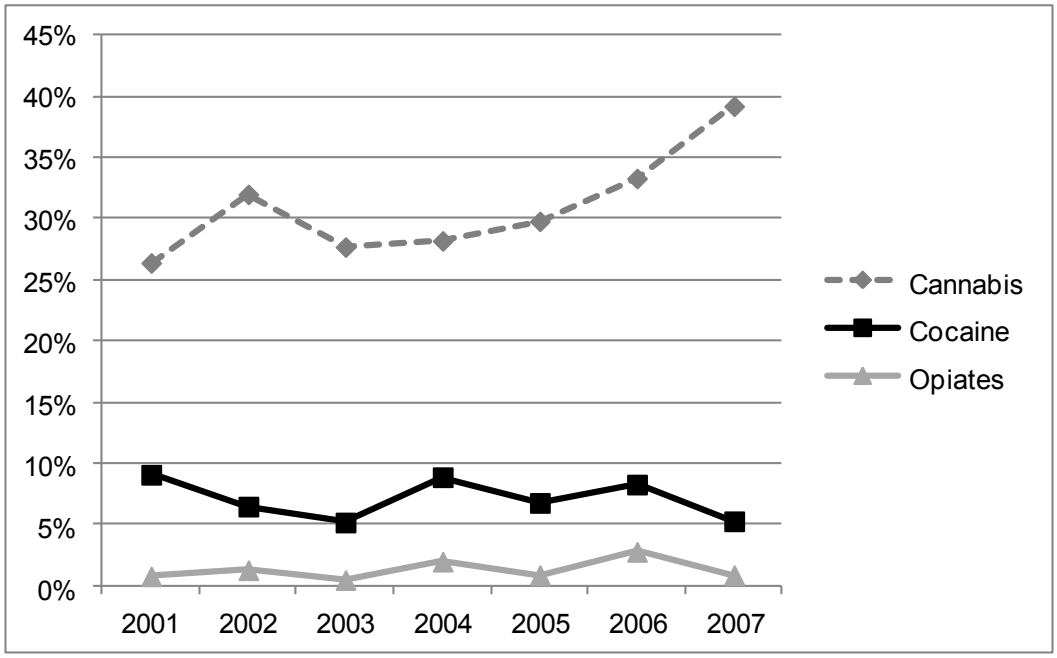

FIGURE 3

T&T Homicide Victim Toxicology Findings

Compared with Meta-analysis Findings

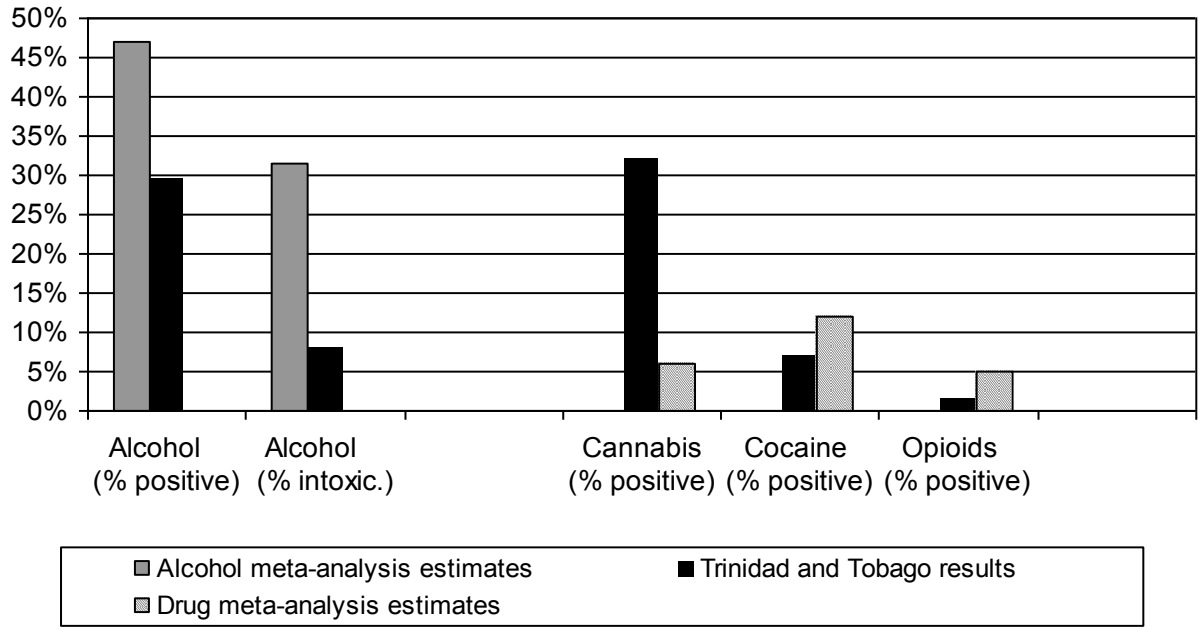

FIGURE 4

Percent of Homicide Victims Testing Positive

For Alcohol and/or Drugs by Motive

(n = 661)

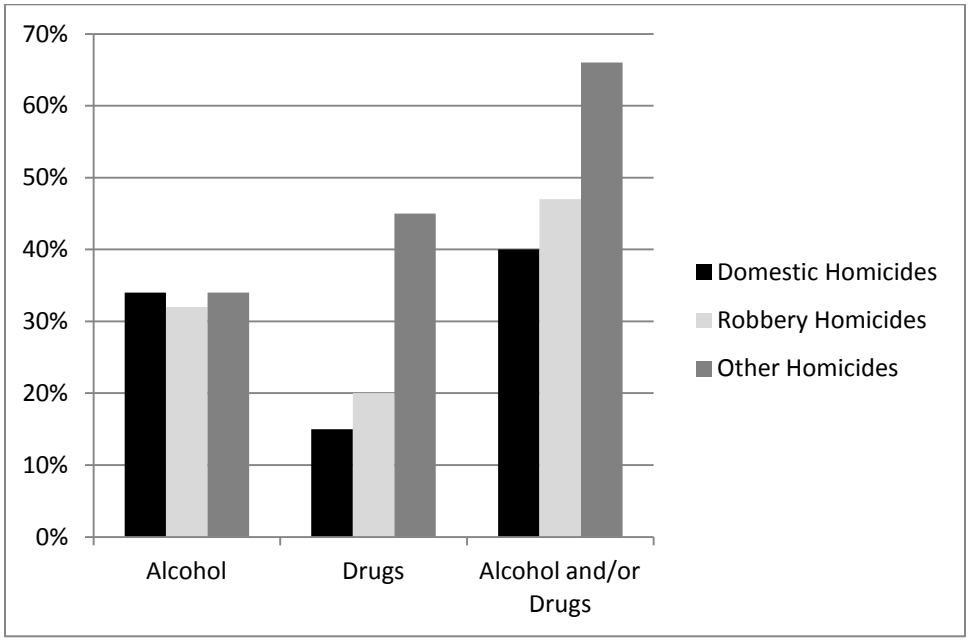

TABLE 1

Demographic Comparisons of 2001-2005 Homicide Victims Testing

Positive for Drugs (n = 1,074)

(% in parentheses)

	Positive for Alcohol	Alcohol Intoxication (80 mg/dl)	Cannabis	Cocaine	Opioids
RACE (Total N = 716					
African[a]	154 (30.1%)	34 (6.6%)	171 (33.4%)***	41 (8.0%)	2 (.4%)
East Indian	55 (40.1%)	17 (12.4%)	23 (16.8%)	7 (5.1%)	3 (2.2%)
Other	19 (28.4%)	5 (7.5%)	9 (13.4%)	5 (7.5%)	4 (6.0%)
SEX (Total N = 1,074)					
Male[b]	291 (30.8%)	54 (38.0%)	83 (8.8%)	71 (7.5%)	11 (1.2%)
Female	45 (35.2%)	88 (62.0%)	10 (7.8%)	6 (4.7%)	1 (.8%)
MEAN AGE COMPARISONS					
Positive	34.5*	36.7*	28.9***	37.7*	31.8
Negative	32.5	32.8	34.9	32.8	33.2
*p<.05	**p<.01	***p<.001			

[a] East Indians had significantly higher average BACs than Africans

[b] Males has slightly higher mean BACs than females, although the differences were not significant