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Drug Abuse, Crime Costs, and the Economic Benefits of Treatment[1]

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Several studies have examined the social consequences and costs of criminal activity. The most popular approach for estimating the costs of crime focuses on easily measurable factors such as incarceration costs, victims' out-of-pocket expenses, medical costs, and lost earnings. However, the intangible losses incurred by victims of crime have rarely been considered. These losses include pain and suffering, as well as loss of the enjoyment of living. Based on recent developments by Cohen and colleagues, we adopt a more comprehensive method for estimating the dollar value of avoided criminal activity, taking into account these intangible losses. We demonstrate the feasibility of this method by estimating the pre- and posttreatment costs of criminal activity for a sample of 2420 drug abusers. The estimated crime-related costs incurred during the period prior to treatment admission and the period after treatment discharge are significantly higher when calculated using the proposed method compared to methods that only consider tangible costs. Furthermore, a simple benefit–cost comparison of criminal activity outcomes indicates that drug abuse treatment has the potential to return net benefits to society through crime reduction. Although the treatment outcomes are not based on an experimental design, this study presents quantitative evidence that including victims' intangible losses can substantially raise the estimated dollar benefits of avoided criminal activity due to drug abuse interventions.

KEY WORDS: crime cost; drug abuse; economic benefits.

1. INTRODUCTION

Despite considerable national efforts to reduce the prevalence of substance abuse, the overall rate of illicit drug use in the United States has remained high, and the percentage of violent hard-core drug users is particularly distressing (Office of National Drug Control Policy, 1994a). National

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surveys have shown that the overall rate of illicit drug use has declined slightly in recent years, but heavy drug use is still common in urban areas and among teenagers. According to the 1993 National Household Survey on Drug Abuse (U.S. Department of Health and Human Services, 1994), more than 77 million Americans over the age of 12 have used illicit drugs. Drug abuse imposes high costs on society in the form of increased medical resources for treatment and rehabilitation, crime and law enforcement, psychological suffering by abusers and their families, and reduced or lost productivity (Rice *et al.*, 1990).

The connection between criminal activity and drug use is extensive and complex. Almost 40% of crack and cocaine users report that they committed crimes to obtain money to buy drugs (Boyum and Kleiman, 1995). Even more alarming, between 50 and 80% of individuals who were arrested for nondrug crimes tested positive for drugs at the time of their arrest (Freeman, 1996). Several studies have examined the various social costs related to drug abuse (e.g., Arthur D. Little Company, 1974; Cruze *et al.*, 1981; Harwood *et al.*, 1984; Rice *et al.*, 1990; French and Martin, 1996), focusing mainly on incarceration, police protection, property loss, medical expenses, and other tangible costs. However, previous studies have not considered the pain and suffering inflicted on crime victims and their families, as well as other intangible losses suffered by victims. This omission creates a gap in the literature that increases the difficulty of making fully informed policy decisions about the merits of anticrime programs. If these intangible losses are considered, crime-related costs of drug abuse could potentially overshadow other costs related to drug abuse. In the study by Rice *et al.* (1990), crime-related costs of drug abuse (excluding victims' pain and suffering) still accounted for almost three-quarters of the total estimated social cost.

The shortage of research on the crime-related costs of drug abuse is particularly unfortunate because some concern has been expressed recently that drug abuse interventions may not improve social welfare enough to warrant their high costs (Liappas *et al.*, 1988; Apsler, 1991). For example, researchers at RAND (Rydell and Everingham, 1994; Everingham and Rydell, 1994) estimated that about $13 billion is being spent annually in the United States on four cocaine-control programs: source-country control, interdiction, domestic enforcement, and treatment of heavy users. Domestic enforcement (i.e., drug and asset seizures, arrests, and imprisonment) accounted for the vast majority of these expenses at 73% of the total. However, a cost-effectiveness analysis of these programs revealed that domestic enforcement was the least costly of the three supply-control programs per 1% reduction in current annual cocaine consumption. In addition, domestic enforcement programs required more than seven times the expenditures of treatment programs to achieve the same reduction in cocaine consumption.

Rydell and Everingham (1994) examined the societal cost of crime due to cocaine use, but their techniques are based on early methods developed by Harwood *et al.* (1984), revised by Rice *et al.* (1990). Designing and testing improved methods to quantify the dollar value of avoided crime would greatly aid future benefit–cost analyses of drug-related programs. This study proposes and demonstrates such a method for estimating the dollar benefit of avoided crime due to drug abuse interventions. Following the techniques first reported by Cohen (1988) and recently amended by Miller *et al.* (1993, 1995), the proposed cost estimation method could improve the ability of policy makers to compare the dollar costs and benefits of these intervention programs. The findings from our empirical analysis indicate that drug abuse treatment may reduce social costs much more than previously believed. When loss of life and the pain and suffering of crime victims are taken into account, the findings from an economic evaluation of drug abuse intervention programs are more precise.

In this paper, we first briefly discuss the various dimensions of the costs of crime, which include the costs to crime victims; the costs of law enforcement, legal adjudication, incarceration, and property damage; and the economic resources associated with committing crimes. The most amorphous of these categories is the costs to crime victims. We briefly review five possible methods of estimating victim costs: the cost-of-illness approach, the numerical crime ranking method, the property-value method, the quality-of-life approach, and the jury-compensation method. These methods are not mutually exclusive because different approaches can be used to measure different types of costs to victims. Therefore, we explain why we believe that a combination of the cost-of-illness and the jury-compensation approaches is the superior strategy for estimating the cost of crime.

Next we present actual estimates for the social cost of each type of crime using this proposed method. Based on these crime-specific cost estimates, we then examine the potential crime-related benefits of drug abuse treatment. The drug abuse treatment data were derived from the Treatment Outcome Prospective Study (TOPS), which included 11,750 participants at 41 drug abuse treatment programs across the country, making it one of the largest treatment outcome studies ever conducted [see Chapter 2 of Hubbard *et al.* (1989), for a lengthy description of the TOPS research design and sample].

Finally, we discuss the weaknesses of the proposed method and the assumptions necessary to perform the calculations. Relaxing these assumptions permits a sensitivity analysis of the estimates. Although sensitivity analysis leads to some quantitative variation in our results, drug abuse treatment still appears to be substantially more beneficial to society if estimates of crime-related benefits include the value of lost life and crime victims' pain and suffering.

2. ESTIMATING THE COSTS OF CRIME

Crime imposes costs on society in a number of ways, all of which must be properly quantified to accurately measure the full social cost. For simplicity, we divide costs into four main categories (Hodgson and Meiners, 1979; Harwood *et al.*, 1984; Rice *et al.*, 1990):

(1) *Victim costs.* These costs include the medical care, lost wages, reduced productivity, and property damage incurred by crime victims, as well as the pain and suffering they endure as a result of crime. The personal loss of life suffered by a homicide victim should also be included. In the case of stolen property, unless it is damaged or destroyed, it is typically not counted as a social loss because it is transferred to another member of society, namely, the criminal (Becker, 1968; McChesney, 1993). Although this assumption is certainly debatable, property loss would only amount to a small percentage of the total cost of crime.

(2) *Costs of crime protection and law enforcement.* These costs include police protection costs, the costs of running the criminal justice system, private legal costs, costs of drug trafficking (for drug-related crime), and correctional costs (including incarceration). We label these criminal justice system (CJS) costs.

(3) *Crime career/productivity losses.* This category refers to the value of lost productivity of law-abiding citizens who turn to crime rather than pursue a lawful career that could directly benefit society.

(4) *Other external costs.* The effects of crime touch many segments of society. As crime escalates across a community, residents who were not personally victimized are beset by fear and psychological distress about becoming victims. In addition to this emotional toll, individuals may participate in more overt activities, such as purchasing locks, weapons, security alarms, and other devices [see Clotfelter and Seeley (1979) for a detailed examination of the private costs of crime including purchased goods and services and protective behavior]. Casual observation of the proliferation of these devices in today's society point to the importance of avoidance behaviors in the overall cost of crime.

Many of the costs listed above are directly measurable because they are observable. For example, short-term medical expenses, lost wages of victims, property damage, protection and policing costs, and, to some extent, lost productivity can be estimated through victimization surveys and criminal justice records (McPheters, 1979; Jones, 1979). These costs are labeled "direct costs" by some (Harwood *et al.*, 1984; Rice *et al.*, 1990), but we prefer to call them "tangible costs."

Most studies on the cost of drug-related crime, such as those by Harwood *et al.* (1984) and Rice *et al.* (1990), have focused only on the tangible costs.[5] Several tangible costs, such as victims' long-term medical expenses, the cost of crime prevention programs and averting behaviors are difficult to measure and are generally overlooked. Furthermore, many "intangible costs" can be measured only indirectly, such as crime victims' pain and suffering, the loss of life suffered by homicide victims, and potential victims' fear of crime. For a discussion of these issues, see Gray (1979) and French *et al.* (1991).

The intangible costs to victims of crime are difficult to measure because individual well-being or utility is a theoretical concept that does not easily lend itself to income or monetary equivalents (Varian, 1990). Losses in utility must be indirectly translated into monetary values by using the concept of either victim compensation or victim willingness to pay.

In the victim-compensation approach, the cost of a crime is measured by how much money would be necessary to compensate the crime victim. This award should ideally cover all losses incurred by the victim, including his/her pain and suffering. The alternative approach is to measure the dollar amount a potential victim is willing to pay to reduce the risk that a particular crime would occur in the future. By measuring this risk reduction and dollar payment, one can calculate the cost of the crime to the potential victim. A variation of this approach is to link a particular crime to the injury or death that results and ask how much an individual is willing to pay to avoid that injury or death. Most methods for estimating the victim cost of crime are based on either the victim-compensation or the willingness-to-pay concept.[6] Five of these methods are briefly outlined and discussed below.

2.1. Cost-of-Illness Method

The cost-of-illness method is the most direct application of the victim-compensation concept. This method includes only "tangible costs" to victims, such as short-term medical expenses, lost wages, lost productivity, and loss due to property damage. The calculations are typically based on household surveys like the National Crime Victimization Survey (NCVS).

[5]A critique of their methodology is presented by Heien and Pittman (1989) and Anderson (1992).

[6]The victim-compensation concept is more commonly referred to in the literature as the "willingness to accept" or the "willingness to accept compensation" concept. Willingness to pay and willingness to accept are different but related concepts; for a discussion see Mishan (1959) or Lankford (1988). Theoretically, the two can at times lead to large differences in the estimated monetary equivalent of a loss (Hanemann, 1991). In estimating the victim cost of crime, neither concept appears to be more "correct," though this is a matter of some debate.

Costs are calculated individually for various types of crime such as assault, automobile theft, and burglary. Used extensively in previous studies to estimate the cost of drug-related crime (Harwood *et al.*, 1984; Rice *et al.*, 1990) and in other applications (Cooper and Rice, 1976; Paringer and Berk, 1977; Lave and Seskin, 1977; Hodgson and Kopstein, 1984), the cost-of-illness method has several conceptual problems that are discussed at length by Kenkel (1994).

The obvious advantage of this method is that it relies on readily available data. Unfortunately, household survey data generally include only short-term economic losses suffered by victims. For instance, the NCVS asks respondents to report information on crime incidents that occurred only in the previous 6 months. In addition, many survey respondents could be unaware of their full medical costs, which are often paid by insurance companies. A recent paper by Miller *et al.* (1995) attempts to overcome this limitation by largely ignoring medical costs in the NCVS for hospitalized injuries. Instead, they use actual hospital discharge data coupled with information on the type and severity of injury to arrive at medical cost estimates. This technique is one potential way to overcome some of the limitations of survey data.

But the most significant disadvantage of the cost-of-illness approach is that it ignores intangible losses suffered by crime victims. No attempt is made to measure victims' pain and suffering. Furthermore, the loss of life from homicide is measured in terms of lost productivity, ignoring the intrinsic value of life. As a result, the cost-of-illness method tends to substantially underestimate the true social cost of crime.

2.2. Numerical Crime-Ranking Method

The numerical crime-ranking method attempts to estimate the cost of victims' pain and suffering by asking survey respondents to attach numerical rankings to each type of crime (Roth, 1978; Schrager and Short, 1980; Evans, 1981; Phillips and Votey, 1981; Byers, 1993). Subject to several assumptions, the numerical rankings can then be converted to monetary values through a crime valuation scale to estimate the total cost of crime.

One drawback of the numerical crime-ranking approach is its subjectivity—it is unclear whether respondents can objectively rank the severity of crimes in a systematic way. Much depends on the crime-ranking techniques used, and unfortunately, the more reliable techniques also tend to be more expensive. Another disadvantage of this method is the difficulty in converting respondents' numerical crime rankings to monetary values. Among the studies listed in the first paragraph of this section, only Phillips and Votey (1981) actually carry out this conversion. The rest of the studies do not go

beyond asking respondents for rankings. A promising research area is the use of contingent valuation techniques to directly elicit respondents' valuations of crime compensation or their willingness to pay to reduce crime risk. The latter would, of course, be an application of the willingness-to-pay concept rather than the victim-compensation concept. Several researchers believe that contingent valuation estimates are more accurate when respondents are asked questions about their willingness to pay rather than about their willingness to accept compensation. Overall, the numerical crime-ranking method is potentially useful for measuring the cost of crime, but more research is needed in this area. Critics of the method include Miethe (1982), Cullen (1985), and Carlson and Williams (1993).

2.3. Property-Value Method

Unlike the first two approaches, the property-value approach is based on the willingness-to-pay concept rather than on the victim-compensation principle. After controlling for other factors (e.g., size of the dwelling, amenities, age of the structure) through statistical techniques, analysts use the partial differential in property values due to neighborhood crime rates to calculate the dollar amount residents in the safer neighborhoods are willing to pay for a lower level of crime. The cost of crime to these residents can be estimated from this value (Thaler, 1978; Gray and Joelson, 1979; Rizzo, 1979; Hellman and Fox, 1984; Little, 1988; Buck *et al.*, 1991, 1993).

The main advantage of the property-value method is that it includes, at least conceptually, the intangible costs of crime to potential victims. These intangible costs are revealed through individuals' utility-maximizing behavior in their choice of where to live. The most serious drawback of this method is that data limitations and measurement issues may make it difficult to separate the cost of individual types of crimes from the total cost of crime to potential victims. Crime-specific cost estimates are needed for our purposes because drug abusers tend to commit some types of crime more often, and others less often, than criminals in general.

2.4. Quality-of-Life Approach

The quality-of-life approach also uses the willingness-to-pay principle but in a different framework compared to the property-value approach. The amount of a crime victim's pain and suffering can be estimated by first ranking the severity of the physical and psychological injuries (Miller *et al.*, 1993; Rosser and Kind, 1978). These rankings are translated into monetary values by comparing the loss in quality of life due to the injury with the

value of an index state such as perfect health or a statistical life (Viscusi, 1983; Tolley *et al.*, 1994). For example, consider a slipped-disc injury that causes an individual to lose 30 productive days per year. This injury might be ranked at a loss equal to one-twelfth of the value of a remaining life, which can be measured by estimating the individual's willingness to pay to reduce the risk of death. But if a doctor rates the individual as being 10% disabled, one could estimate the cost of the injury as one-tenth of the value of a remaining life. The calculation can also be done using the concept of quality-adjusted life years (French and Mauskopf, 1992; French *et al.*, 1996; Nichols and Zeckhauser, 1975). A third way of measuring the cost is to conduct surveys of individuals' rankings of injuries as discussed earlier. Rice *et al.* (1989) discuss these issues in greater detail.

Perhaps the most attractive feature about this approach is that, unlike the property-value method, it is generally easier to arrive at a victim cost estimate for each individual type of crime. The estimates for the cost of each injury, however, are quite subjective. As seen above, these estimates can be derived in a number of ways, and no clear consensus exists about which way is best.

2.5. Jury-Compensation Method

The jury-compensation method is based on the victim-compensation concept but borrows elements of the willingness-to-pay principle. (As explained later, the victim-compensation concept is unsuitable for measuring the cost of a homicide.) It is credited mainly to Mark Cohen, who was the first to use jury-compensation data to measure the cost of crime (e.g., Cohen, 1988; Miller *et al.* 1993, 1995).[7] Again, the cost of pain and suffering from a particular crime is measured by estimating the cost of injuries to the victim. But this approach deviates from those discussed earlier by dividing the cost of an injury into an observable component (i.e., medical expenses, lost wages, and other economic losses) and an unobservable component (i.e., pain and suffering). The observable component can be directly measured by interviewing the victim or by obtaining medical records, but the pain-and-suffering component must be indirectly estimated. The pain-and-suffering estimate can be derived by equating it with the pain-and-suffering damages awarded to plaintiffs in civil cases who are seeking compensation for similar injuries. More recently, Miller *et al.* (1995) used actual jury awards from victims of crimes to estimate pain and suffering damages. If it is assumed that juries will award injured individuals more than their measurable economic losses,

[7]See also Technology and Economics, Inc. (1980), which used the jury-compensation method to estimate the cost of consumer product injuries.

then the difference will constitute a pain-and-suffering award for the individual. With this method, researchers can obtain estimates for both the tangible and intangible victim costs of each type of crime by examining the combination of injuries involved.

The jury-compensation approach relies on the hypothesis that for each type of injury, a stable relationship exists between a plaintiff's observable economic expenses, or "specials" (i.e., medical expenses plus lost wages), and the corresponding jury award. In fact, simple regression procedures, using actual jury compensation data, enable one to form predictions of jury awards for pain and suffering based on "specials." One readily available source of such data is Jury Verdict Research, Inc. (JVR). This source, used by Cohen, is a private company that collects data on civil court cases from around the country, covering about 90,000 of the estimated 150,000 civil cases that take place annually. [For other estimates, see Danzon and Lillard (1983) and Viscusi (1986).] Criminal cases include no explicit jury awards for pain and suffering, but potential awards can be estimated from victims' injuries and "specials." For a crime resulting in a homicide, the loss to society is estimated as the full value of a statistical life (Viscusi, 1983), similar to the quality-of-life approach.

As with other methods, certain criticisms can be levied against the jury-compensation method. First, it is not clear that a particular type of physical injury (for example, a concussion) suffered by a crime victim is truly similar to the same type of injury suffered by a plaintiff in a civil case. A crime victim may experience greater pain and suffering from such an injury, although there is no evidence to support this.[8] Furthermore, JVR's research shows that even among civil cases, some types of cases (notably those involving medical malpractice and product liability) tend to result in higher pain-and-suffering awards than others. In practice, the best strategy is to conduct a sensitivity analysis and compute several different sets of pain-and-suffering estimates for a crime-related injury, each based on data from a separate category of civil cases. [Cohen (1988) used only one set of complete civil case data in this seminal study.]

Estimating crime victims' pain and suffering due to psychological injuries and, to a lesser extent, psychological distress is especially difficult. Information is difficult to find on the incidence of psychological injuries or the amount of related medical expenses. In addition, there are obvious difficulties in comparing crime victims' psychological injuries and distress with those of victims in civil cases. Cohen *et al.* (1993) estimate the incidence of psychological injuries for various types of crimes from a survey of 391 women

[8]Of course, this limitation would not be present if actual jury data for crime victims were always available.

(Kilpatrick *et al.*, 1987). Recent work by Cohen and Miller (1995) provides better data on crime victims' psychological injuries and related expenses, but our understanding of the true incidence and extent of such injuries is still limited. However, it seems reasonable to assume that all victims of violent crimes such as aggravated assault and robbery suffer some degree of psychological distress. Better data and some simplifying assumptions are necessary to estimate the resulting pain and suffering in dollar terms.

As a final criticism, only part of a jury award in a civil case ultimately goes to the injured plaintiff; the rest is used to cover attorney's fees and other litigation-related expenses. If juries take these expenses into account when compensating victims, the jury-compensation approach, which measures pain and suffering by examining the difference between the jury award and "specials," leads to an overestimate of the intangible cost of crime.[9] ("Specials" do not, by definition, include legal expenses.) As with all methods, confidence in the empirical approach is much higher if the drawbacks are recognized and a sensitivity analysis is conducted. Stated differently, policy recommendations should be based on a range of estimates and not on a single point estimate.

3. PROPOSED METHOD FOR ESTIMATING THE COSTS OF CRIME

As discussed previously, the costs to victims of crime can be categorized as either tangible or intangible costs. The cost-of-illness approach is the obvious method for estimating the tangible costs of crime, but it does not address intangible costs. For comparison purposes and to allow for aggregation with intangible costs, we used the cost-of-illness method to estimate the average tangible costs per crime incident in 1992 dollars. As part of TOPS, self-reports on criminal activity were obtained for the following crimes: aggravated assault, robbery, burglary, theft, auto theft, forgery and embezzlement, fencing, gambling, pimping and prostitution, and drug law violation. These estimates of tangible costs are presented in Table I and discussed in the next section.

[9]While the inclusion of legal costs in jury awards may lead to an overestimate of the pain-and-suffering component, the neglect of income taxes in the lost wages calculations could lead to an underestimate of this component. As noted by Cohen in a personal correspondence, assume that the jury award is equal to A, lost wages are equal to W, and the tax rate is r. We would estimate the pain-and-suffering component of the jury award to be $(A-W)$. However, the wage loss is really only equal to $(1-r)W$ after accounting for taxes, and the pain-and-suffering component is equal to $(A-W)+rW$.

Table I. Tangible Costs for Different Types of Crimes in 1992 Dollars[a]

Type of crime	Crime victim costs ($)	Criminal justice system costs ($)	Crime-career costs ($)	Total tangible costs ($)
Aggravated assault	5,631[b]	3,252	778	9,661
Robbery	2,027[c]	3,377	1,059	6,463
Burglary	165[d]	917	222	1,304
Theft	106[d]	578	45	729
Auto theft	354[d]	672	113	1,138
Forgery	0	439	111	550
Fencing	0	85	14	100
Gambling	0	6	0	6
Prostitution	0	43	0	43
Drug law violation	0	18	3	21

Note: Formulae used for the calculations were based on Harwood *et al.* (1984). Also, the social cost of each homicide was assumed to be equal only to the victims' lost productivity, or $750,977. *Sources*: Hubbard *et al.* (1984). Office of National Drug Control Budget Summary (1994b). Rice (1994). U.S. Department of Justice, Bureau of Justice Statistics (1991, 1992a, b, 1993a–d, 1994a, b). U.S. Department of Justice, FBI (1993). French and Zarkin (1992).

[a] For a more detailed description of the data sources and calculations, see Rajkumar and French (1994).

[b] Total crime-victim costs for aggravated assault is the sum of medical expenses, lost wages, and the value of property damage ($305), and the risk-of-homicide cost ($5326).

[c] Total crime-victim costs for robbery is the sum of medical expenses, lost wages, and the value of property damage ($300), and the risk-of-homicide cost ($1727).

[d] Total crime-victim costs includes medical expenses, lost wages, and the value of property damage, but does not include a risk-of-homicide cost.

Of the four remaining methods discussed earlier, only the jury-compensation method can use readily available data to generate the most objective crime-specific estimates for intangible costs. Thus, we suggest a blended method that combines the cost-of-illness approach and the jury-compensation approach to estimate both the tangible and intangible costs of crime. We implemented this proposed method to derive new estimates of the cost of different crimes, making certain modifications to the jury compensation approach as used by Cohen (1988), to address some of the concerns listed above (Section 2.5). We applied these crime cost estimates to data on drug abusers who participated in TOPS treatment programs. Assuming that a relationship can be established between drug abuse treatment and crime reduction, the differential between the pretreatment cost of crime and the posttreatment cost of crime is an indication of the dollar benefit of drug abuse treatment in the area of crime reduction. We show that the estimated dollar benefit derived using our proposed method is considerably higher than earlier estimates that only considered tangible costs.

In estimating intangible costs, we considered only aggravated assault[10] and robbery, the "crimes of violence." Some of the other crimes reported by TOPS' clients could also have involved physical injury or death, but we were unable to estimate these relationships. As explained later, one should ideally estimate pain and suffering from psychological injuries or psychological distress for nonviolent crimes, but the relevant data are difficult to obtain.[11] Because the proposed cost estimation method requires several data sets and assumptions, performing a sensitivity analysis is important. Therefore, cost estimates are obtained using different assumptions about the data and the calculations. A range of estimates is presented for the differential between the pretreatment and the posttreatment costs of crime.

3.1. Tangible Costs of Crime

Table I presents our estimates of the average tangible costs of crime, per crime incident, in 1992 dollars. We normalized all monetary data to 1992 dollars to correct for inflation in actual dollars from different years, because most recent public information was available for that year, and the estimates can be compared to other studies around this period (e.g., Miller *et al.*, 1993, 1995). Calculations are based on the formulas reported by Harwood *et al.* (1984) and Rice *et al.* (1990), both of which used the cost-of-illness method (Hodgson and Meiners, 1979). The main sources of data are reports from the Bureau of Justice Statistics (U.S. Department of Justice, 1991, 1992a, b, 1993a, b, d, 1994a, b), the Federal Bureau of Investigation (FBI) (U.S. Department of Justice, FBI, 1993), raw data from the National Crime Victimization Survey (NCVS) (U.S. Department of Justice, 1993c), and TOPS interview data (Hubbard *et al.*, 1984). Notable weaknesses in the estimation procedure for tangible costs are that the NCVS includes only short-term medical costs, and data are not collected for persons under 12 years of age.

As shown in Table I, costs were estimated for each individual type of crime and are divided into three categories: crime victim costs, criminal justice system (CJS) costs, and crime-career costs. Predatory crimes such as aggravated assault and robbery have the highest total tangible cost per victimization at $9,661 and $6,463, due in part to the high victim costs.

[10]An aggravated assault is defined as an attack or attempted attack with a weapon, regardless of whether an injury occurs, or an attack without a weapon when serious injury results. In this paper, rape is included under assault, as it is in TOPS.

[11]Miller *et al.* (1995) have overcome some of the weaknesses of the NCVS by augmenting the medical cost data with actual hospital discharge data by type of injury.

Property crimes such as auto theft also have a relatively high cost per victimization. Crimes with the lowest cost per victimization include gambling and prostitution because it is assumed that they do not involve victim or crime-career costs.

Crime victims' tangible costs include medical expenses, lost wages, and any loss due to property damage (U.S. Department of Justice, 1993c, 1994b). However, another important element of crime cost is the possibility that the crime could result in homicide; this is called the risk-of-homicide cost of a crime. Homicide is included for this study under the particular crime leading to its occurrence, as listed in the Uniform Crime Reports (U.S. Department of Justice, FBI, 1993). For example, the Uniform Crime Reports count the 2254 murders in 1992 that are known to be linked with robbery as acts of robbery. Unfortunately, data collected in the TOPS interviews do not include the number of homicides committed by the clients.

To estimate the risk-of-homicide cost of each type of crime, we consider both the probability that a particular crime could result in a homicide, as well as the cost to society of each homicide. Using the cost-of-illness approach, the cost of each homicide to society is calculated using data on the average future lifetime earnings and value of housekeeping services in the United States (Rice, 1994) and the percentage of homicide victims in each age and gender group (U.S. Department of Justice, FBI, 1993). Combining these data allows us to derive an estimate for the mean productivity cost to society of a homicide of $750,977 in 1992 dollars.

Regarding criminal justice system costs, we adopted the methodology of Harwood *et al.* (1984), which included costs of police protection; general justice system expenditures (e.g., processing arrest cases); incarceration costs for federal, state, and local prisons; and drug control. Using arrest data from the Uniform Crime Reports (U.S. Department of Justice, FBI, 1993) and NCVS data on the incidence of offenses (U.S. Department of Justice, 1993c, 1994b), we estimated the percentage of offenses leading to arrest for each type of crime. For crimes not covered by the NCVS (i.e., forgery, fencing, gambling, prostitution, and drug offenses), this information was taken from TOPS interview data (Hubbard *et al.*, 1984). Then, using figures for total annual expenditures on police protection and other justice system expenditures (U.S. Department of Justice, 1992a, 1993a), we were able to estimate the average expenditure per crime incident for each type of crime. [An implicit assumption made by Harwood *et al.* (1984) is that crimes affect police protection costs and other justice system costs through the number of arrests they cause.] We adopted a similar procedure for incarceration costs. For example, data on numbers of prisoners held for different types of crimes (U.S. Department of Justice, 1991, 1993b, d), together with figures for total expenditures on federal, state, and local incarceration (U.S. Department of Justice, 1992a, 1993a), were used to estimate average expenditures

on incarceration per crime incident, for each type of crime.[12] The estimated expenditure on drug control was taken from a report by the Office of National Drug Control Policy (1994b).

The last category in Table I, crime-career costs, can be difficult to measure. In a survey of drug dealers in Washington, DC, Reuter *et al.* (1990) found that these individuals "earned" about $2000 per month net of expenses from drug-dealing activities. Compared to their modest legal earnings potential, the illegitimate earnings of drug dealers would make it financially worthwhile for them to spend 1 year in jail for every 2 years that they sold drugs (Freeman, 1996). As demonstrated by Lott (1992), criminals' potential legal earnings if they do not choose a criminal career are likely to be lower than the national average. However, criminals may contribute to underground economic activity and earn illegal income that could be more beneficial to society than their legal incomes might suggest (O'Connor, 1971; Johnson *et al.*, 1985).

Using data on individuals convicted of drug offenses, Lott (1992) found that lost postconviction income accounts for between 35 and 96% of the total pecuniary penalty borne by the average criminal. Analysis of the TOPS data indicate that a reduction in crime by drug abusers does not lead to a significant increase in legal earnings (Harwood *et al.*, 1988). Based on these findings and the subjectivity of the TOPS data, the only type of crime-career costs included in this study is lost productivity due to incarceration of prisoners. In this respect, we differ from Harwood *et al.* (1984) and Rice *et al.* (1990). We assume that the annual productivity loss per prisoner is $7603 (1992 dollars), the mean annual legal earnings of TOPS clients in all modalities (French and Zarkin, 1992).

3.2. Intangible Costs of Crime

We estimated the intangible costs of crime using the jury-compensation method as originally suggested by Cohen (1988) and subsequently utilized

[12]While we believe that this valuation method is fairly comprehensive, it certainly does not include *all* criminal justice system costs. First, our estimates include corrections expenditures on institutions (incarceration costs) only. They do not include the remainder of corrections expenditures (spending on probation and parole, for example) because of the difficulty in apportioning these expenditures to different types of crime. Total national expenditures on these other types of corrections were $3.1 billion in 1990 (1992 dollars). Second, our CJS costs estimate does not include private protection costs, again because apportioning expenditures on private protection to different types of crimes is difficult. Following Harwood *et al.* (1984) and assuming that total private protection costs are 56.4% of the total police protection costs, we estimate that private protection expenditures in 1990 were $19 billion (1992 dollars). More recently, Freeman (1996) estimates that about 0.6% of the annual gross domestic product (GDP) in the United States is spent on private crime prevention, ranging from security guards to burglar alarms.

by Miller *et al.* (1993, 1995). This approach imputes the cost of pain and suffering for each type of crime-related injury using data on jury awards in civil cases where the medical expenses and lost wages (i.e., "specials") are known. Unfortunately, the NCVS, the most complete source of data collected from crime victims, includes only short-term losses suffered by victims. Using these data to calculate "specials" results in misleadingly low estimates of pain and suffering. Hence, we used the Civilian Health and Medical Program for the Uniformed Services of the Department of Defense (CHAMPUS) data, which were also used by Cohen (1988). These data, which cover long-term and short-term losses, were collected from 74 hospital emergency rooms in the United States.[13]

As a simple example, CHAMPUS data indicate that the average hospital outpatient and inpatient expenses, including long-term costs, for treatment of a concussion are $614 and $3852, respectively.[14] According to JVR's regressions, a concussion victim with $614 or $3852 in medical expenses would receive a pain-and-suffering award of $3433 or $16,027, respectively (Jury Verdict Research, 1994). Because only 27.5% of seriously injured crime victims are seen on an inpatient basis (U.S. Department of Justice, 1994b), the weighted average pain-and-suffering estimate overall is $6896. Lost wages must also be considered for certain types of injuries when estimating pain and suffering, but not for a concussion.

Unlike Cohen (1988) and Miller *et al.* (1993), we did not include victims' psychological injuries in our calculations because data in this area are difficult to obtain and several assumptions are necessary (see Section 2.5 above). For example, Cohen and Miller (1995) used a survey of 168 mental health care professionals to estimate the tangible costs of crime victims' psychological injuries. This research is a promising start to studying the costs of psychological injury among crime victims, but Cohen and Miller acknowledge that the results are preliminary and the sample size is small. Furthermore, the link between a victim's expenses for mental health care and the corresponding intangible costs is still uncertain.[15]

[13]These data were provided by the U.S. Consumer Product Safety Commission (1994), which uses them in its injury cost model (Technology and Economics, Inc., 1980). Average "specials" were estimated for each type of injury. With an accurate estimate of "specials," we could obtain an accurate estimate of the pain and suffering associated with each type of injury through regression results carried out by JVR (1994).

[14]These data actually provide separate cost figures for males and females. We took a weighted average of these two figures, based on the percentage of male victims (60%) and female victims (40%) of violent crime.

[15]The annual cost of counseling or treatment received per victim in 1991, based on the sample of mental health care professionals interviewed by Cohen and Miller (1995), was $2390 for assault (simple as well as aggravated) and $1266 for robbery, both in 1991 dollars.

More recently, Miller *et al* (1995) were able to include implicitly the cost of psychological injury beyond the cost of pain and suffering because they had access to jury awards for crime victims who sued perpetrators or third parties. With actual jury data from crime victims, there is no need to add a psychological injury term apart from the pain and suffering component because psychological damages are already included in the jury award.

Given data limitations and availability, we adopt a conservative approach for the current study and do not include victims' psychological injuries when forming our pain-and-suffering estimates. We did, however, consider that victims are likely to suffer psychological distress from fear even if they are not physically or psychologically injured. The costs of psychological distress with and without an assailant weapon are $5813 and $2871, respectively, based on awards in a sample of cases from the Louisiana appellate courts (Cohen, 1988). Although these estimates were based on a sample of only 10 cases, the figures appear similar to or lower than JVR's estimates of pain-and-suffering awards for emotional distress. The latter estimates differ according to the cause of the distress, but the smallest is $5280 for distress caused by invasion of privacy and trespassing. Distress caused by the threat of or attempt at physical harm brings $28,800 in compensation, according to JVR.

We generated a pain-and-suffering estimate for each type of physical injury and for psychological distress associated with predatory crimes. Then, using NCVS data on the frequency of occurrence of various kinds of physical injuries for assault and robbery (U.S. Department of Justice, 1993c), we estimated pain-and-suffering values for these two crimes. As an example, according to NCVS data, about 5% of robbery victims experience a concussion, and the average pain-and-suffering estimate for a concussion is $6896 (as explained above). Thus, on average, the weighted "contribution" of a possible concussion to the pain and suffering of a robbery victim is equal to 5% of $6896, or $345. Similarly, the weighted "contribution" to a robbery of each possible type of physical injury, as well as psychological distress (with and without an assailant weapon), was computed. All "contributions" were added to derive the $4944 average pain-and-suffering estimate for a robbery (see Table II).

We did not estimate pain and suffering values for other crimes because nonviolent (nonpredatory) crimes rarely result in physical injury and we lack available data on their psychological impact. However, nonviolent crimes could result in significant psychological injury or in fear. Unfortunately, we are not aware of any study that has estimated the extent to which psychological distress is experienced by burglary victims, for example. A small general population survey that queried respondents for contingent rankings and valuation of crime-related fear is a possible avenue for further

Table II. Crime Victim Costs for Aggravated Assault and Robbery in 1992 Dollars

Type of crime	Tangible cost excluding risk of homicide ($)	Pain and suffering cost ($)	Corrected risk-of-homicide cost ($)	Total victim cost ($)
Aggravated assault	305	8,753	37,655	46,713
Robbery	300	4,944	12,211	17,454

Note. Sources: Hubbard *et al.* (1984). Jury Verdict Research, Inc. (1994). Office of National Drug Control Budget Summary (1994b). Rice (1994). U.S. Consumer Product Safety Commission (1994). U.S. Department of Justice, Bureau of Justice Statistics (1991, 1992a, b, 1993a–d, 1994a, b). U.S. Department of Justice, FBI (1993). French and Zarkin (1992).

research in this area (e.g., Portney, 1994; Tolley *et al.*, 1994). The pain-and-suffering estimates for aggravated assault and robbery are presented in Table II. Bear in mind that these figures probably underestimate total intangible losses because we did not include psychological injury and because our estimates for the cost of psychological distress are conservative.

In deriving the tangible costs of crime presented earlier, the value of a lost life due to homicide was based on the value of lost productivity ($750,977). However, this value includes only tangible or measurable losses. The total loss to homicide victims, their families, and society is typically much higher. Unfortunately, data on jury compensation cannot be used to estimate this loss because a jury cannot directly compensate a dead individual. One can, of course, examine the amount of compensation received by the individual's family in cases of wrongful death. However, compensating the family is not the same as compensating the individual. In fact, awards in cases of wrongful death are typically low. According to JVR, the death of a 25-year-old, married childless man, before adjusting for medical expenses, brings $480,000 in compensation. A better estimate is obtained from the willingness-to-pay literature on the value of a statistical life. Numerous studies have obtained value-of-life estimates by looking at individuals' willingness to pay to reduce the risk of death as evidenced through wage rate differentials for dangerous jobs. Viscusi (1993) finds that most estimates range from $3.19 million to $7.44 million (in 1992 dollars), with a midpoint of $5.31 million (see also Fisher *et al.*, 1989; Miller, 1990).

The risk-of-homicide cost for each violent crime was re-estimated for calculating intangible costs, using a value of $5.31 million as the loss to society from each homicide and removing the $750,977 value that we used in the tangible cost calculations presented in Table I. This value-of-statistical-life estimate can easily be adjusted downward in the model to account for the fact that the typical homicide victim may have different risk preferences and career prospects than the average person (these calculations are

Table III. Total Cost of Individual Crimes in 1992 Dollars

Type of crime	Tangible costs only ($)	Tangible and intangible costs[a] ($)
Aggravated assault	9,661	50,743
Robbery	6,463	21,890
Burglary	1,304	1,304
Theft	729	729
Auto theft	1,138	1,138
Forgery	550	550
Fencing	100	100
Gambling	6	6
Prostitution	43	43
Drug law violation	21	21

Note. Sources: Hubbard *et al.* (1984). Jury Verdict Research, Inc. (1994). Office of National Drug Control Budget Summary (1994b). Rice (1994). U.S. Consumer Product Safety Commission (1994). U.S. Department of Justice, Bureau of Justice Statistics (1991, 1992a, b, 1993a–d, 1994a, b). U.S. Department of Justice, FBI (1993). French and Zarkin (1992).

[a]Intangible costs were only calculated for aggravated assault and robbery.

presented later in Table VII). The new estimates for the risk-of-homicide cost of aggravated assault ($37,655) and robbery ($12,211) are listed in Table II. As explained in Section 3.1, the risk-of-homicide cost of a crime is equal to the probability that it could result in a homicide multiplied by the average value of premature mortality, which for Table II is $5.31 million. The total intangible cost estimates for assault and robbery include both pain and suffering and the corrected risk-of-homicide costs. The total victim costs (including tangible and intangible costs) for assault and robbery are reported in the last column of Table II. Not surprisingly, the estimates in Table II indicate that the corrected risk-of-homicide cost is the dominant factor in the total victim cost of violent crimes.[16] Aggravated assault results in a total victim cost of $46,713 and robbery leads to a total victim cost of $17,454.

Summing the total tangible costs reported in Table I (excluding the risk of homicide to crime victims) and the pain-and-suffering costs and corrected risk-of-homicide costs reported in Table II provides an estimate for the total cost (including tangible and intangible costs) of that crime. Our estimates

[16]As noted by an anonymous reviewer, the corrected risk-of-homicide costs are 81% of the total victim costs from aggravated assault and 70% of the total victim costs from robbery. However, the dominance of the corrected risk-of-homicide costs in victim costs does not drive the qualitative findings from the benefit–cost analysis because the original risk-of-homicide cost (see Table I) was also dominant at 95% of the total victim costs of aggravated assault and 85% of the total victim costs from robbery.

of total costs for each crime are presented in Table III. For nonpredatory crimes such as drug law violations, the total cost estimate in Table III (i.e., $21) is identical to the tangible cost estimate in Table I because we assume that this type of crime does not involve intangible losses. However, comparing the estimates in Tables I and III reveals that intangible costs for aggravated assault and robbery are much larger than the cost-of-illness estimates based only on tangible costs. For example, the tangible costs to society of each aggravated assault amount to $9661, but our estimate of total cost, including intangible costs, is $50,743—more than five times as large as the cost-of-illness estimate. Tangible costs for each robbery are $6463, and total costs including intangible losses are more than three times higher, at $21,890. Thus, the cost-of-illness method, which addresses only tangible costs, may substantially underestimate the full cost to society of each violent crime incident.

4. VALUING THE CRIME-RELATED BENEFITS OF DRUG ABUSE TREATMENT

As noted earlier, we use drug abuse treatment data from TOPS to demonstrate our estimation methods with actual treatment clients. Treatment programs were recruited for TOPS in the late 1970s and client interviews began in 1979. Treatment intake interviews were conducted through 1981 and follow-up interviews were conducted for several years thereafter. TOPS is one of the premiere treatment process and outcome studies, but it was not designed as a randomized controlled trial. Researchers can use TOPS data to examine relationships between treatment variables (e.g., length of stay, treatment planning) and treatment outcomes (e.g., drug use, crime, employment). But, the prospective or epidemiological design of TOPS makes it difficult to separate the treatment effect from selection effects and other unobserved client characteristics that may influence outcomes (Cook and Campbell, 1979; LaLonde, 1986). Thus, TOPS should not be used to draw conclusions about the causality between treatment per se and corresponding outcomes. As noted by Hubbard and colleagues (1989), drug abuse treatment is a complex process with interactions between the program, the client, and the environment, which complicate the estimation of treatment effectiveness.

Many researchers have used TOPS data to study treatment characteristics and effectiveness (e.g., Harwood *et al.*, 1988; French *et al.*, 1993; Collins *et al.*, 1988; Condelli and Dunteman, 1993a, b). TOPS data provide a useful application of our method for valuing the potential crime-related benefits of drug abuse treatment. All clients were interviewed at admission to treatment, and subsamples were selected for follow-up interviews at 3,

12, and 24 months after discharge from treatment.[17] A small sample of clients were reinterviewed at 3 to 5 years following admission to treatment, but the response rates are low and data reliability have not been examined. Our analysis for this paper is based on the 12-month follow-up sample of clients, the largest follow-up and most frequently analyzed cohort in TOPS. The admission and 12-month follow-up data have been examined for reliability and validity (Hubbard *et al.*, 1984).

We chose TOPS to illustrate the proposed crime cost estimation methodology for several reasons. First, the study is widely known and cited in the drug abuse treatment literature. Although key changes have occurred in society (e.g., escalation of the AIDS epidemic) and the drug-using culture (e.g., the popularity of crack cocaine) since the early 1980s, TOPS remains a useful resource for measuring treatment effectiveness. Second, pure randomized controlled trials of drug abuse treatment are difficult to implement for ethical and methodological reasons. Some efforts are currently under way in this area, but no research findings are available. The design limitations of TOPS are not critical for this study because we use TOPS data to demonstrate the feasibility and policy significance of the proposed cost method rather than definitively estimating the impact of treatment per se. The policy implications of this cost estimation approach will become even more significant as new and better data become available from randomized control trials of treatment interventions. Third, criminal activity information was a major focus in TOPS. These sensitive data are difficult to obtain for any study and the TOPS researchers invested substantial resources to create a nonthreatening and confidential setting for respondents (Collins *et al.*, 1982, 1983; Hubbard *et al.*, 1982). Finally, Harwood *et al.* (1988) is an often-cited analysis of the criminal activity costs for treatment clients before and after treatment in TOPS programs. Our purpose here is to show that the tangible cost estimate presented by Harwood and colleagues may significantly underestimate the full crime-related benefits of TOPS treatment.

As mentioned, TOPS' clients reported criminal activity episodes in the following categories: aggravated assault, robbery, burglary, theft, auto theft, forgery and embezzlement, fencing, gambling, pimping and prostitution, and drug law violation. The TOPS data cover the 12 months preceding treatment admission and the 12-month period after treatment termination. The respondents were asked whether they were involved in criminal activities in each time period and, if so, how many times they committed a particular crime. Harwood *et al.* (1988) analyzed criminal activity information for the preadmission and follow-up periods; the summary findings from this study are presented in Table IV.

[17]Because methadone treatment is a long-term outpatient process for most clients, the follow-up interviews correspond to the 12-month period following treatment admission rather than the 12-month period following treatment termination.

Table IV. Criminal Activity During the Year Before and the Year After Treatment for 2420 Drug Abusers in TOPS Programs

	Year before treatment			Year after treatment		
Type of crime	Non respondents	Respondents admitting to at least one act	Total criminal acts	Non respondents	Respondents admitting to at least one act	Total criminal acts
Aggravated assault	283	216	678	78	168	659
Robbery	310	178	2,124	83	120	740
Burglary	320	296	3,096	88	227	3,554
Theft	387	486	13,544	111	325	9,302
Auto theft	300	98	505	79	91	1,165
Forgery	315	230	3,977	93	136	2,902
Fencing	346	302	8,098	98	218	5,880
Gambling	377	255	23,244	119	215	14,116
Prostitution	329	159	16,935	100	123	15,776
Drug law violation	537	547	84,315	146	406	54,715
All items	184	—	—	67	—	—
Any of above	—	1,161	156,576	—	917	108,809

Note. Source: Harwood *et al.* (1988).

Our dollar valuation calculations for criminal activity outcomes are contingent on a direct relationship between drug abuse treatment and crime reduction. Because TOPS is not a randomized controlled trial of treatment, the causal link between treatment exposure and criminal activity outcomes is less certain. The data in Table IV show that TOPS clients did exhibit a lower rate of criminal activity in the period after treatment discharge compared to the period prior to admission. But this differential could be influenced by other factors (e.g., client-specific variables, environmental factors) in addition to the treatment experience. For these reasons, our estimates might be considered an upper bound on the actual net benefits of crime reduction that can be attributed to treatment in a TOPS program. Random assignment to an intervention and control group would mitigate some of these confounding factors. While it is important to recognize this limitation with the TOPS data, the application of our valuation method to actual treatment data still has considerable merit.[18]

Using the crime participation figures in Table IV and the crime-cost estimates in Table III, we estimated the total cost to society of the crimes committed by the 2420 TOPS clients before and after treatment. By simple subtraction, we estimated the cost reduction due to lower criminal activity

[18]It should also be noted that both the admission and follow-up data in TOPS are self-reported by clients. While actual records are always preferable over self-reported information, other researchers have effectively used self-reported information for program evaluation (DiIulio and Piehl, 1991; Chaiken and Chaiken, 1982).

Table V. Total Cost of Crime for 2420 Drug Abusers Before and After TOPS Treatment in 1992 Dollars

Method of handling nonresponses	Tangible costs only ($ millions)			Tangible and intangible costs ($ millions)		
	Total cost before treatment	Total cost after treatment	Total cost reduction	Total cost before treatment	Total cost after treatment	Total cost reduction
Assuming zero crime participation by nonrespondents[a]	40.40	27.99	12.41	101.02	66.48	34.54
Assuming low crime participation by nonrespondents[b]	46.97	29.56	17.41	116.09	69.35	46.73
Assuming high crime participation by nonrespondents[c]	50.25	30.34	19.91	123.63	70.79	52.83

[a] Assumes that nonrespondents engage in no criminal activity.
[b] Assumes that nonrespondents engage in criminal activity at the same rate as respondents.
[c] Assumes that nonrespondents engage in criminal activity at 1.5 times the rate for respondents.

over this period, as reported in Table V. To perform these calculations, however, we had to address the issue of nonresponse for certain questions in the TOPS instrument. Initially, we assumed nonrespondents' rate of participation in crime was the same as respondents' participation rate. We designated this as "low" participation rate by nonrespondents. This enabled us to obtain two sets of estimates for cost reduction—one including only tangible costs and one including both tangible and intangible costs. Next, we repeated the procedure assuming nonrespondents did not engage in crime at all ("zero" participation rate by nonrespondents). Finally, we performed the procedure a third time, assuming that the nonrespondents' participation rate was one-and-a-half times ("high" participation rate by nonrespondents) the participation rate of respondents, a factor derived by Chaiken and Chaiken (1982), who found that nonrespondents may actually commit more crimes than respondents. In total, six sets of estimates were calculated.

Referring to Table V, when making the assumption of no crime participation by nonrespondents (i.e., zero participation), the estimated total tangible cost reduction between the period of follow-up and admission was $12.41 million ($5128 per client). Including intangible costs raises this figure to $34.54 million ($14,273 per client), a difference of $22.13 million ($9145 per client) over tangible costs. When nonrespondents' criminal activity rate was assumed to be the same as that of respondents (i.e., low participation), including intangible costs increased the estimate for cost reduction by $29.32

million (i.e., $46.73 million–$17.41 million) or $12,116 per client over tangible costs. Furthermore, by assuming high crime participation by nonrespondents, the cost reduction estimate, including tangible and intangible costs, was $32.92 million higher (i.e., $52.83 million–$19.91 million, or $13,603 per client) than the estimate based on tangible costs only. Thus, adding intangible costs raises the estimate for cost reduction over the treatment period between $9145 and $13,603 per client—more than double the corresponding cost reduction estimate based on tangible costs alone. Given the work by Chaiken and Chaiken (1982), the actual figure is likely to be toward the high end of this range.

The estimates above can be compared with the figures obtained by Harwood *et al.* (1988), who used the cost-of-illness method (including only tangible costs) to compute the cost reduction for the same sample of clients. For example, assuming zero participation by nonrespondents, Harwood and colleagues estimated the cost reduction between admission and follow-up to be $5.49 million, in 1992 dollars. The corresponding estimate in Table V ($12.41 million), assuming zero participation by nonrespondents, is higher mainly because (a) the ratio of CJS expenditures to victimizations and the ratio of corrections expenditures to prisoners have increased since 1979, the period used by Harwood *et al.* for CJS data; (b) Harwood *et al.* did not include risk-of-homicide costs in their calculations; and (c) Harwood *et al.* calculated crime-career costs differently. As to (c) specifically, they computed the increase in clients' legal earnings over the treatment period and compared this figure to the increase in earnings of nonabusers to obtain a measure of the change in crime-career costs. However, because drug abusers' legal earnings rose only slightly, crime-career costs were found to have increased over the treatment period.

The findings reported in Table V suggest that including the intangible costs of crime when evaluating drug abuse treatment programs can make a substantial difference in quantitative benefit estimates and policy recommendations. For example, including the pain and suffering of crime victims and the full loss due to homicide yields a much higher estimate of the crime-related benefits of drug abuse treatment than when these intangible costs are ignored. However, it is important to emphasize that the qualitative net benefit result using the proposed method is the same as the qualitative net benefit result from earlier studies (e.g., Harwood *et al.*, 1988).

As noted, our suggested method requires several assumptions, so we subjected the estimates reported above to a sensitivity analysis. Most of the crime reduction values in the following section are based on the assumption that nonrespondents and respondents in the TOPS data have equal crime participation rates. Also, unless stated otherwise, crime cost estimates include tangible as well as intangible costs.

5. SENSITIVITY ANALYSIS

The jury-compensation method requires several assumptions about the nature of jury compensation. Each assumption leads to a slightly different estimate of victims' pain and suffering and the cost for each type of crime. Similarly, using a different willingness-to-pay estimate for the value of a statistical life results in a different cost estimate for the risk of homicide. Therefore, obtaining a range of cost estimates based on different assumptions is necessary for informed policy recommendations.

The first exercise involves the role of legal costs in jury awards. Some experts believe that juries usually take legal costs into account when making awards for pain and suffering. According to a study by the RAND Corporation (Kakalik and Pace, 1986), legal expenses, including time lost due to litigation, consume 40% of jury awards on average. Most attorneys follow the contingent-fee system, where the plaintiff pays a fixed percentage of damages awarded, usually 33%. Legal expenses and time lost due to litigation amount to 4 and 3%, on average, respectively (Kakalik and Pace, 1986). Based on this finding, we obtained new estimates for the cost of aggravated assault and robbery. First, we assumed that juries take half of all legal costs into account, and then we assumed that they take full legal costs into account. For example, if juries take full legal costs into account, the full jury award must be reduced by 40% before further calculations are made. In all cases, the pain-and-suffering award is the difference between the full jury award and the sum of "specials" and legal costs. Thus, the more legal costs are taken into account, the less the pain-and-suffering estimate. The new estimates for crime-related cost reduction due to drug abuse treatment are presented in the first row of Table VI.

Also included in Table VI are estimates based solely on product liability cases (second row) and medical malpractice cases (third row). Juries tend to award higher damages for these cases; if crime victims experience greater pain and suffering than due civil injury victims, data from these cases might be a better proxy of crime victims' true costs. We adjusted awards upward by 17% for product liability cases and upward by 32% for medical malpractice cases (JVR, 1994). The figure of 32% for medical malpractice is based on various percentage estimates—ranging from 16 to 48%—provided by JVR for different types of malpractice cases.

Taking into account legal expenses reduces pain-and-suffering estimates and cost-reduction estimates. However, the potential dollar benefits of drug abuse treatment are still substantially higher when intangible costs are also considered. For example, using jury data covering all types of cases (instead of only medical malpractice or product liability cases) and assuming that juries take full legal costs into account, the estimate for cost reduction is

Table VI. Sensitivity Analysis of Total Crime Cost Differential Using Different Assumptions About Jury Data and Legal Costs[a]

Assumption	Legal costs not taken into account by juries ($ millions)	Legal costs taken as 20% of jury award ($ millions)[b]	Legal costs taken as 40% of jury award ($ millions)[c]
All jury data	46.73	44.86	42.98
Only product liability jury data	48.29	46.11	43.92
Only medical malpractice jury data	49.67	47.21	44.74
Estimate based on Miller *et al.* (1993)[d]	51.83	—	—

[a]For all calculations except the estimate based on Miller *et al.* (1993), nonrespondents were assumed to have a low crime participation rate and the estimated value-of-life figure was $5.31 million.

[b]The estimated jury award for each injury was reduced by 20%; medical expenses and lost wages were then subtracted from the resulting value to arrive at the final pain-and-suffering estimate. The final pain-and-suffering estimate was then used to calculate intangible costs.

[c]The estimated jury award was reduced by 40% before the same procedure as footnote *b* was executed to estimate intangible costs.

[d]The cost differential estimate was formed by using $19,113 as the victim cost of an assault and $21,627 as the victim cost of a robbery.

$42.98 million when including intangible costs, but only $17.41 million for tangible costs alone. The estimates are similar when using product liability or medical malpractice awards alone.

Table VI also presents an estimate for the benefits of drug abuse treatment based on the crime-cost methodology reported by Miller *et al.* (1993). Because Cohen and colleagues were the first researchers to publish crime-cost estimates using the jury compensation approach, it would be interesting to see how their estimates affect the benefit findings for TOPS treatment. Using the crime-cost estimates reported of Miller *et al.* (1993), we calculated the average victim cost for assault ($19,113) and robbery ($21,627) in 1992 dollars. Applied to the TOPS data, the Miller *et al.* (1993) crime-cost estimates yielded a total cost reduction of $51.83 million, almost two and a half times as high as the tangible cost estimate ($17.41 million).

Finally, we obtained crime-cost estimates based on different values for a statistical life. Recall that the risk-of-homicide cost was larger than the pain-and-suffering cost for both assault and robbery. Table VII presents additional estimates for cost reduction using value-of-life figures of $750,977, $3.19 million, $5.31 million, and $7.44 million. The first value is the estimate used in the cost-of-illness approach, based only on foregone earnings. The second and fourth values are the lower and upper limits of the range in

Table VII. Sensitivity Analysis of Total Crime Cost Differential Using Different Value-of-Life Estimates[a]

Value-of-life estimate ($)	Cost reduction ($ millions)
750,977	26.42
3.19 million	37.07
5.31 million	46.73
7.44 million	56.23

[a]In all cases, when performing the calculations, nonrespondents were assumed to have a low crime participation rate. All types of jury data were used, as opposed to just product liability case data or medical malpractice case data. In addition, it was assumed that juries did not take plaintiff's legal costs into account.

which most value-of-life estimates fall, based on the willingness-to-pay studies reviewed by Viscusi (1993). The resulting estimates for cost reduction are $26.42 million, $37.07 million, $46.73 million, and $56.23 million, respectively, using these four value-of-life figures. The lower estimate, $26.42 million, is still $9.02 million higher (more than 50%) than the estimate that included only tangible costs.

As a final comparison, we performed the calculations for cost reduction under the most conservative conditions possible. Specifically, we assumed that juries take legal costs into account at 40%, we used all jury data in our calculations, we used the lowest reported value for a statistical life ($750,977), we excluded all psychological injuries and distress, and we assumed that TOPS nonrespondents committed no crimes. The estimated cost reduction under these very conservative conditions is still $16.5 million, and the risk-of-homicide cost continues to play a dominant role in the total victim costs.

Overall, our sensitivity analysis suggests that the cost-of-illness approach, which measures only tangible costs, underestimates the potential reduction in the costs of crimes committed by TOPS clients over the treatment period. The plausible range of estimates obtained in this section for cost reduction when intangible costs (using the corrected risk-of-homicide procedure) are included is $26.42 million ($10,918 per client) to $56.23 million ($23,234 per client), compared to $17.41 million ($7193 per client) if only tangible costs are computed. To obtain a point estimate for cost reduction we suggest the following assumptions:

- Juries take into account victims' medical expenses and lost wages but not their legal costs in making pain-and-suffering awards.

- All jury data, rather than only product liability or malpractice data, should be considered when estimating pain and suffering for various injuries.
- The value of a statistical life is $5.31 million, the midpoint of existing studies.
- At present, the cost of psychological injuries should not be included in the calculation of intangible costs because their incidence is difficult to estimate and data are limited.
- When analyzing TOPS data, nonrespondents' and respondents' crime participation rates should be considered equal.

Given these assumptions, the difference in the pre- and posttreatment cost of crime for 2420 drug abusers in TOPS is $46.73 million. Of course, drug abuse treatment is likely to result in other positive outcomes besides crime reduction (e.g., health status improvements, employment, reduced drug use) and the dollar value of these outcomes should be included in a full benefit–cost analysis.

6. SUMMARY AND DISCUSSION

This study proposes a method for estimating the dollar benefits of crime reduction that considers both the tangible and the intangible costs of crime. To date, the crime-related benefits of drug abuse interventions have been estimated using only tangible costs (Harwood *et al.*, 1988). In this paper, we demonstrate the proposed method by applying it to criminal activity profiles before and after a treatment episode for a sample of drug abuse treatment clients. Our figures show that including crime victims' pain and suffering and the full extent of the loss suffered by homicide victims can increase the estimated crime-related benefits of treatment and lead to more informed policy decisions.

In forming our estimates, we were deliberately more conservative than Cohen (1988) and Miller *et al.* (1993, 1995) because we did not include the cost of psychological injury. Also, we did not attempt to estimate victim's pain and suffering for crimes other than aggravated assault and robbery. As a result, our estimates for the difference between the costs of crime committed by TOPS clients before treatment and after treatment may still be lower than the actual cost savings.

As a further application of our findings, we can perform a partial benefit–cost analysis of treatment in TOPS programs, including intangible costs in the calculations. Hubbard *et al.* (1989) report that the average annual slot cost of outpatient methadone, residential, and outpatient drug-free treatment at TOPS programs was $2828, $8920, and $2908, respectively (1992

dollars). Recall that our lowest plausible estimate for the dollar benefits of avoided criminal activity between admission and the year after treatment across all treatment modalities was $26.42 million, or $10,918 per treatment client (see Table VII). Thus, in this exercise, the benefits of avoided criminal activity are greater than the average annual cost of treatment for even the most expensive treatment modality (residential) and a conservative benefit estimate. For outpatient treatment, the average cost reduction per treatment client is several times higher than the average annual cost of treatment, and most patients stay less than 1 year in treatment. Despite the limitations with this crude comparison of costs and benefits, drug abuse treatment clearly has the potential to return significant net benefits to society in the form of avoided criminal activity.

With more resources and better data, our proposed method can be improved in several ways. Naturally, the method has limited utility without reliable data on the causal link between drug abuse and crime and the crime reduction due to drug abuse interventions. Randomized controlled trials of drug abuse interventions would certainly help in this respect. In addition, data could be collected from drug abusers who do not enter treatment programs to obtain better estimates of the incidence of drug-related crime without treatment. Regarding the proposed method itself, more detailed statistical analysis using more comprehensive data on jury compensation can be performed to derive rigorous estimates of the range of pain-and-suffering awards. Additional data can be collected from crime victims to form better estimates of the long-term costs imposed and the cost of psychological injuries.

Despite these data limitations, we hope that more drug abuse intervention studies will estimate the benefits of avoided crime with the method proposed in this paper. More directly, analyses of drug abuse treatment or any type of drug abuse intervention that aims to reduce criminal activity should include intangible costs in the calculations. Quantifying intangible costs can lead to more precise results for the benefits of crime reduction compared to the estimates derived using the cost-of-illness method. As more data become available and better methods are developed for estimating intangible costs, the quality of program evaluations and policy recommendations for drug abuse interventions will also improve.

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