Rethinking Drug-Attributable Crime Beyond DAFs: Toward a New Conceptual Framework and a Dashboard Approach

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Abstract:
In trying to estimate the total amount of crime attributed to drug use or markets, researchers have focused on refining estimates of a single drug attribution fraction (or DAF). Although this is important, even a perfect DAF still only provides one piece of the puzzle, because it ignores elements of the drugs–crime relationship that are not part of DAF estimates. This article examines the conceptual problems of trying to estimate a single DAF and use it to quantify all drug-attributable crime. It proposes a fundamental rethinking that incorporates DAFs within a broader set of measures addressing the drug–crime relationship. One practical manifestation of that reconceptualization can take the form of a dashboard, which may be a more useful way to communicate to policymakers the multiple impacts of drug use and markets on crime.

I. Introduction

Among policymakers, there is demand for a (large and apparently precise) estimate quantifying how many crimes can be blamed on drugs. Unfortunately, it is very difficult to develop such estimates, although it is not for want of trying. Various researchers in the United States and abroad have tried to arrive at such an estimate (e.g., Pernanen et al., 2002; ONDCP, 2004; Brochu et al., 2002; MacDonald et al., 2005; Collins and Lapsley, 2008; Rehm et al., 2007; NDIC, 2011), but they have run up against three challenges: (1) data limitations that preclude the ability to reliably measure the main variables of interest (drug use/involvement and crime); (2) the lack of true experiments that made it difficult to infer causality; and (3) conceptual challenges.

The first two have elicited an energetic technical literature, although the conceptual challenges are fundamental, arguably rendering the pursuit of methodological "silver bullets" quixotic. For this reason, this paper focuses on these conceptual issues. We first review where the concept of attribution came from and how it has been applied to the drugs-crime relationship as a prelude to identifying conceptual problems with attempting to measure this complex relationship with a single attribution fraction (DAF). We then propose a framework to deal with those conceptual problems that relies not on a single number, but on a set of complementary indicators—including an improved DAF—that together tell how drug users and suppliers influence crime in a given area at a given point of time. We then propose a way of presenting this information for policymakers who seek better understanding of these relationships. The suggested approach is a "dashboard," which while familiar to those in business management, is a new approach in this context.

II. Background on the Concept of Attributable Risk

The concept of attributable risk comes from the health field, particularly epidemiology, where it is rooted in the idea of population risk factors. A population risk factor is based on the notion of comparing two populations—one exposed to a risk factor and one not—and then assessing the *excess amount* of a health problem observed in the first population that is the result of its exposure to that particular risk factor.

For example, we can determine the amount of lung cancer attributable to cigarette smoking or the amount of HIV/AIDS attributable to injection drug use. For these examples there is a known medical pathway through which the risk factor (smoking, injection drug use) can lead to the health problem/condition (lung cancer, HIV/AIDS). Just how much a risk factor leads to a particular health outcome varies. Liver cirrhosis and lung cancer are very strongly associated with specific health behaviors (drinking and smoking, respectively), while heart attacks are less strongly associated with any particular health behavior. While a given risk factor will not influence every individual exactly the same, due to environmental interactions, genetics, and other factors, the attribution risk indicates how much the disease incidence would be reduced on average if the risk factor were removed from the population.

A population attribution factor essentially captures the following: If risk factor A were non-existent (e.g., there was no smoking), how much of a reduction would there be in health outcome B (e.g., lung cancer)? The question is hypothetical because, in many cases, the risk factor will not completely disappear. Still, it helps inform which risk factors are the most important to focus on.

Several aspects of measuring attribution deserve closer attention. First, health attribution fractions are developed for risk factors for which there is a clear mechanism linking the risk factor and health outcome, and often that mechanism is universal across populations and places because it is based on human physiology.

A second issue is that attribution fractions, when properly measured, hold other factors (competing risks) constant. Epidemiologists typically follow cohorts of individuals over time, some exposed to risk factors and others not. They then assess the differential likelihood of disease based on exposure and intensity of the risk factor, the individual's environment, general health, genetics, and other relevant factors. The ability to fully control for the influence of competing risk and protective factors is important for properly identifying the real causal attribution of the particular risk factor.

Finally, for many health problems, population-level health outcomes are the simple sum of individual health outcomes. For example, the number of people in a community with lung cancer, liver cirrhosis, or heart failure does not strongly influence the likelihood of anyone else getting the disease. Under these circumstances, identifying risk attribution is relatively simple. Thus, the marginal effect of eliminating a certain amount of a risk factor on the health outcome is more or less the same as the average effect for the population.

Contagious conditions are clearly exceptions; for HIV/AIDS or the flu, social interactions influence the spread of the disease. Thus, the population risk is no longer simply an additive function of the individual risk; instead, it is a nonlinear function of the level of disease in the population. For these conditions, the marginal effect of reducing a risk factor is no longer the same as the average effect, and calculating the impact of reducing a risk factor depends critically on what stage the disease has reached in the population.

III. How DAFs Have Been Applied to Drugs and Crime

For five decades, researchers and policymakers have sought to understand and show the relative economic burden various diseases impose on society in terms of health care resources and lost productivity. The exercise began with Rice (1967), who was one of the first to attempt to document the *direct costs* of diagnosing, preventing, treating, and rehabilitating people with certain medical disorders and the *indirect costs* in terms of these people's lost earnings, productivity, and household production. The approach—the Cost of Illness (COI) framework—was made more explicit through a series of conventions leading to published guidelines by Hodgson and Meiners (1982) that

describe which costs to consider and how to account for them. These methods continued to evolve (e.g. Single et al., 1995) but still maintain the COI framework and perspective.

Scholars have tried to produce parallel estimates for costs associated with using alcohol and illicit drugs, with crime added as an additional cost consideration. Although Cruze et al. (1981) is widely cited as the first to develop attribution fractions for crime, Barton (1976) earlier argued that all income-generating crimes committed by daily users of heroin could be causally attributed to supporting their expensive drug use. Cruze et al. (1981) broadened this concept to include not only the income-generating crime committed by daily heroin users, but also 20 percent of the income-generating crime committed by other drug users (including non-daily heroin users and all users of other drugs). The 20 percent figure was ad hoc and justified in comparison to similar constructs identified for alcohol.

This framework was broadened by Harwood et al. (1984), who added an assumption that 10 percent of all violent crimes could be causally attributed to illicit drugs. This 10 percent estimate was also somewhat arbitrary because empirical support for the idea that violent crime was caused by drug use or drug markets came mostly from abundant anecdotal evidence concerning violent cocaine markets. Rice et al. (1991) also adopted these latest attribution fractions.

Harwood et al. (1998) made an important methodological modification by replacing the heroin-centered attribution fractions with fractions based on inmates' self-reporting that they committed a crime for drugs or drug money. *This methodological modification limited their consideration of attribution mainly to the economic-compulsive theory of crime*. An important exception was homicide, for which they used detailed homicide data collected by the U.S. Federal Bureau of Investigation (U.S. Department of Justice, 1994b) to try to capture systemic crime. From their review of these documents, Harwood et al. (1998) attributed 15.8 percent of homicides to drugs. These DAF assumptions were maintained in the last two updates sponsored by ONDCP (ONDCP 2001, 2004).

Researchers in Canada, the United Kingdom, and Australia have produced similar national estimates of the economic burden of illicit drugs (Pernanen et al., 2002; Brochu et al., 2002; MacDonald et al., 2005; Collins and Lapsley, 2008; Rehm et al., 2007). In each study, sections are dedicated to estimates of the amount of crime caused by drug use and/or drug markets (Makkai and MacGregor, 2003; Perez-Gomez, 2004). These efforts largely rely on a similar approach to that used in the United States.

In the most recent study—for the National Drug Intelligence Center (or NDIC)—drug-induced offenses included all crimes self-reported as being committed to get money to buy drugs ("instrumental offenses") and 10 percent of all other crime committed while under the influence ("related offenses") (NDIC, 2011). This 10 percent figure was completely arbitrary, as the NDIC document makes clear: "There appear to be no research-based findings that might justify our selection of a probability here, and so we choose to err conservatively by assuming that the proportion of related offenses that are drug induced is 0.10. This is an area where additional research effort is warranted."

(NDIC, 2011 p. 8) The portion of the inmates meeting these definitions was estimated as the population fraction for each type of offense.

Relying on inmate self-reports has a number of limitations that have been discussed elsewhere (see Reuter 1999; Kleiman, 1999; Cohen, 1999). One is that *these attribution fractions do not accurately account for the true causal associations between drug use and crime*. First, current attribution fractions are based on self-reports of use, intoxication, or perceived involvement (from law enforcement) rather than on clear, objective measures of the role drugs (or alcohol) played. Second, it ignores crimes that are committed but not captured in administrative records (e.g., victimization that goes unreported or crimes that go undetected). Third, it misses systemic violence not captured by the two questions asked. This last point is especially troubling, given that much drug-related violence, particularly during the 1980s, is systemic (Goldstein et al., 1989; Reuter et al., 1990; Spunt et al., 1990, 1995; Brownstein et al., 1992; Goldstein, Brownstein, and Ryan, 1992).

A second limitation is that the approach assumes *the proportion of committed offenses attributable to drugs matches the corresponding proportion revealed by offenders who are now incarcerated* (Cohen, 1999). There are many steps from the commission of a crime to incarceration, including arrest, prosecution, conviction, and sentencing. Only a subset of offenders move from one step of the process to the next, and that subset is *not* random. Additionally, sampling from *all current inmates* over-samples those with long sentences relative to those who are just beginning incarceration. While there have been attempts to moderate this bias by using arrestee populations (e.g., Collins and Lapsley, 2008; MacDonald et al., 2005), they do not completely remove the potential bias because individuals who get caught may be systematically different from those who do not.

These criticisms, as well as others raised in the literature, tend to revolve around the improper or inadequate identification of causal connections between drugs and crime because of limited data and/or weak identification strategies. The applicability of the risk attribution construct itself has not received enough attention.

IV. What Conceptual Issues Work Against Applying Attribution Fractions to Drugs?

Because the connection between drugs and crime is probabilistic, importing the risk attribution concept from epidemiology is inherently appealing. Unfortunately, little else about the drugs–crime connection matches the circumstances that typically hold in classic epidemiological applications. Specifically, four conceptual issues work against applying attribution fractions to drugs:

The Drugs–Crime Relationship Is Not Linear

As noted above, when estimating how many cases of lung cancer smoking causes, one does not have to consider interactions between different cancer patients, because cancer

is not contagious. This means the population-level outcome is simply the sum of the outcomes for the individuals. Formally, we would say the principle of linear supposition holds.

Such linearity does not hold for crime, which is a social behavior in a way that cancer is not. The amount of crime expressed by one person depends on the amount of crime expressed by others. There are interpersonal or local effects (e.g., peer pressure, retaliation, etc.), but also macro considerations. Schelling (1978) famously showed that an individual's incentives for being corrupt depend on the prevalence of corruption in the surrounding population, and Kleiman (1993) showed how "enforcement swamping" can reduce offenders' risks when many others are already offending.

Hence, the relationship is not one of simple proportionality. Over certain ranges, crime might increase more than or less than proportionally. Lack of proportionality means the *average effect* can differ from the *marginal effect*. DAFs, by comparing the status quo to a drug-free world, measure the *average effect*. But there is no policy that could create a drug-free world. Actual policy choices would increase or decrease drug volumes by some incremental amount, say 10 or 20 percent. So for practical purposes, policymakers ought to be interested in *marginal effects*.

A further complication is that one person's drug use can cause a *non-user* to commit crime. For example, many assaults include violence by more than one party; one person's intoxication can escalate an argument or invite retaliation from non-users. This undermines the premise that crimes attributable to drug use can be measured as the difference between the number of crimes committed by drug users and the number committed by non-users. Unlike with conventional epidemiological applications, one cannot make comparable adjustments in the case of drugs and crime because the transmission mechanisms are multiple, diffuse, and indirect.

Indirect Causal Pathways Are Important

When researchers estimate attribution fractions, they do not mechanically compare everyone exposed to a condition to everyone else. They first control for other variables. Take smoking, for example. Smokers in the United States are in much worse health than non-smokers. Although much of that difference can be blamed on smoking, it is also true that smoking is increasingly concentrated in the poorer and less-educated segments of American society (Escobedo and Peddicord, 1996; Flint and Novotny, 1997; Jarvis and Wardle, 1999; Gilman et al., 2003), and poverty and low educational status *independently* predict poor health outcomes (Pritchett and Summers, 1993; DeWalt et al., 2004). Researchers control for these variables and that makes good sense—as long as smoking does not cause poverty or lead someone to drop out of school. If it did, then the resulting attribution factor could *understate* how much ill health smoking caused.

Unfortunately for DAFs, the indirect effects of drugs on crime are numerous and collectively constitute an important part of the commonsense understanding of how drugs cause crime. This problem is fundamental to the notion of attribution fractions. If someone were to compare offense rates for drug users and non-users, they would

certainly control for income, because the rich commit fewer income-generating street crimes than the poor do. But controlling for income would erase a crucial mechanism by which drugs cause crime, namely that dependence can undermine income. Similarly, they would control for prior arrests, but if those prior arrests were due to prolonged drug use, then a key mechanism through which drug use impacts crime would be omitted.

Indirect Effects Are Mediated Through "Stocks"

Researchers and policymakers must account for both direct (or proximal) and indirect (distal) pathways, but DAFs have traditionally focused on the proximal effects. For example, NDIC's (2011) DAFs mainly considered *economic-compulsive and psychopharmacological* crimes by drug users, such as when a drug user robs someone to get money for drugs, as well as drug offenses (arrests for manufacturing/trafficking/sales and possession) and, following the convention of Harwood et al. (1984, 1998), a narrow aspect of systemic crimes. This overlooks the lagged (distal) and indirect effects of drugs on crimes, such as when a heroin user who is not currently using turns to crime for basic necessities because past heroin use rendered that person unemployable.

These indirect pathways can be thought as being mediated through a series of "stocks". Five types of stocks bear mention. First, there is a *consumption stock*, which reflects all the physiological and psychological changes that occur within an individual who has used drugs. Brain-imaging research funded by the National Institute of Drug Abuse (NIDA) identify some long-lasting effects of drug use on the human brain; the neural pathways are not affected only when the drug itself is present within the body but also persist after a history of use. An example is stimulant-induced psychoses, which can occur after individuals stop using the stimulant. If such psychoses contribute to an assault, then drug use can cause psychopharmacological crimes even when the user is not intoxicated.

Human capital refers to the accumulation of education, knowledge, and experience that makes a person more productive at a given task. To the extent that drug use reduces the attention that an individual gives to learning or the individual's willingness to stay in school, it can have long-term negative effects on his/her opportunities and, thus, the economic gains of legitimate employment vis-à-vis those from crime. Similarly, gaps in employment caused by drug use (including being in prison or because of losing a job because of a drug charge) can interfere with a person's ability to get legitimate employment years after s/he stops using.

Relational capital refers to the relationships with friends, family members, or co-workers. Drug use can reduce relational capital through strains placed on relationships with those who were close to an individual before s/he began to use drugs. Strains might occur because these people do not approve of the individual's drug use, thus leading the individual to feel that s/he needs to regularly lie to them. Alternatively, these friends and family members may feel the burden of the drug user's "flakiness," as drugs become an increasing focus at the expense of important activities with family, friends, or co-workers. As drug users begin to disassociate themselves from non-using peers and family members, they seek friendship and acceptance from people like them—people who are

willing to break certain laws they view as unimportant or irrelevant. Such associations can, in turn, increase the individual's own willingness to engage in crime.

In addition to stocks on the individual level, drug use can affect those other than the user. Friends and family members are often directly affected by drug users, which we refer to as *family and friendship capital*. A child living with a severely drug-dependent parent can have long-lasting scars caused by neglect, malnutrition, and/or a sense of abandonment. This can include placement in foster care; children in foster care are at significantly higher risk of engaging in crime in the future than children who grow up in stable two- or even one-parent households. In assessing the role of drugs on crime, few evaluations attempt to include the crime committed by the children of drug-abusing parents, but this pathway is indeed quite real.

Reductions of *neighborhood and societal-level capital* caused by drug use can also promote crime. An example would be if high rates of drug use support a flagrant, open-air drug market whose presence drives away legitimate businesses, resulting in a neighborhood susceptible to criminal activity that is intensified by empty storefronts and few local economic opportunities. The "broken windows theory" suggests that the sense of disorder can be directly criminogenic (Wilson and Kelling, 1982). Inasmuch as law enforcement depends on citizen cooperation, drug markets can undermine the effectiveness of crime control more generally (e.g., leaving witnesses too fearful to testify, exacerbating racial tensions, or undermining citizens' general confidence in the police).

Interactions between Drugs

Different drugs have are associated with different crimes in different ways. Incorporating this heterogeneity into DAFs is complicated by polysubstance use, as many users are on more than one drug at a time. This presents a challenge to estimating a DAF, but presents a conceptual challenge as well. DAFs make unstated assumptions about substitution and complementarity by asking us to imagine a world in which no illegal drugs are available but in which everything else is the same. But it is not reasonable to assume that alcohol use would be identical in such a parallel universe. And if the disappearance of drugs would affect alcohol use, then it would also affect alcohol-related crime.[1] Yet it is not possible to adjust for this either practically (we have no idea what the overall long-run cross-price elasticity of demand is) or politically (policymakers do not want a DAF that nets out this hypothetical interaction with alcohol).

This problem has no parallel for typical health-oriented attribution factors. Scientists estimating the smoking attribution factor for lung cancer do not worry that in the absence

[1]It is not clear whether this parallel universe would have more or less alcohol and, thus, more or less alcohol-related crime. Suppose there would have been more alcohol use because, on net, illegal drugs have substituted to a degree for the use of alcohol. Then, the inmate-survey based approach will tend to overestimate the amount of crime that is causally attributable to drugs because it fails to recognize that the use of drugs is effectively causing a reduction in alcohol use and, thus, in alcohol-related crime. If, however, drugs and alcohol are not complements, similar logic leads to the opposite bias.

of tobacco people would smoke asbestos instead because they have some underlying demand for lung cancer.

Substitution and/or complementarity can also pose issues on the supply side. If drug sellers were not selling drugs, would they be robbers instead? Conversely, if the police were not so busy catching drug sellers, would they do a better job of deterring robbers? The answer is not clear, but there is no reason to believe that all such indirect effects would cancel each other out.

The Mechanisms Linking Drugs to Crime Are Not Universal

There is no universal law that defines how much crime and violence a given amount of drug use (and associated drug selling) causes. The cultural and policy context mediate the amount of crime created, as Watters et al. (1985) observed long ago. For example, the volume of drugs being produced in, and trafficked through, Mexico is not so different in 2013 from what it was in 2006, yet the number of drug-related homicides has grown roughly tenfold. So, two identical studies—each done extremely well—could produce DAFs that differ by a factor of ten, just because one was done seven years before the other.

There can also be cross-sectional and intertemporal variation. Homicides per unit of drug use are higher in countries with lots of guns, like Colombia and the United States, than they are in places with fewer guns, like Australia or Western Europe. Likewise, one explanation for the decline in lethal drug-related violence is that many flagrant street-corner retail markets have been replaced by arranged sales and/or sales made within a social network, which are not conducive to violence. Thus, the decline in such violence may be linked to changes in how drug markets operate (the context or environment) and not to changes in drug use. This means that equal changes in drug use in Australia and the United States, or in the United States today versus the United States in the 1980s, will not cause equal changes in crime.

DAFs are Intervention Dependent

Various interventions could reduce tobacco smoking by 10%, including raising taxes, subsidizing cessation treatments, and increasing funding for prevention. To a first order approximation, all would produce roughly comparable reductions in lung cancer, at least in the long run. The same cannot be said of alternative ways of reducing drug use.

A demand-side intervention (e.g., a prevention program) that reduces illicit drug use by 10 percent will not have the same effect on crime as a supply-side intervention that raises the price enough to reduce illicit drug use by the same amount. The prevention policy will decrease drug use and spending by the same proportion, while the supply-side strategy creates higher prices, so spending—and spending related crime—falls by less than drug use.

Because drug policies can influence the amount of crime caused by drug use and drug distribution as much as they can affect the volume of drugs distributed and used, it is very

difficult statistically to properly measure the drug attribution that is solely the result of drug use and distribution, *independent of the drug policy context*. Embedded in a given data set employed for identification of a DAF is a specific policy setting (state or city), a specific time period, and a population with varying levels of capital stocks.

Drug policy itself is an important part of the overall societal context that affects the DAF. Of course, this interconnectedness is not unique to drugs–crime DAFs. The number of smoking-attributable deaths from lung cancer is influenced by the availability of health insurance coverage and sophisticated medical treatments, which are both aspects of health policy. Likewise, policy can affect alcohol-attributable premature deaths associated with drunk driving by reducing the amount of drinking or by raising the safety standards of cars.

However, how much crime is jointly determined both by participants (users and distributors) and policy is hard to dismiss in the case of illegal drugs. Caulkins et al. (1999) used some heroic assumptions to guess that five-sixths of cocaine-related crime was economic-compulsive or systemic and, thus, driven more by cocaine dollars than by cocaine intoxication. Yet spending on cocaine is very much a function of cocaine price, which is affected directly by supply control policies and programs (Caulkins and Reuter, 1998).

Thus, the DAFs are really all conditional on drug policy being what it is today. The implication of this additional insight is that any particular DAF constructed from a scientific study or review is context-dependent. Empirical methods, including propensity score methods, instrumental variable techniques, and regression discontinuity approaches, attempt to overcome the fact that people cannot be randomly assigned to different conditions, but to some degree these studies are always bounded by time and place (and the policies in effect and being enforced at that time and place). Thus, the estimates generated from these studies, rather than capturing a universal relationship, always reflect the social, physical, and temporal environments in which the population studied is being evaluated.

Moreover, the relationship also changes over time. Drug use has an epidemic character, with periods of rapid initiation among youth and young adults giving way to endemic stages characterized by an aging population of dependent users. Today cocaine is in the late stage of that cycle, with most use associated with people who are well past the high offending ages. Hence, the same decline in consumption today (say a 5 percent decline in use) would not necessarily have the same impact on crime as a 5 percent decline in use at the height of the epidemic, when the median user was younger. These are the sorts of social and environmental factors that reinforce the non-universal nature of the relationship just described.

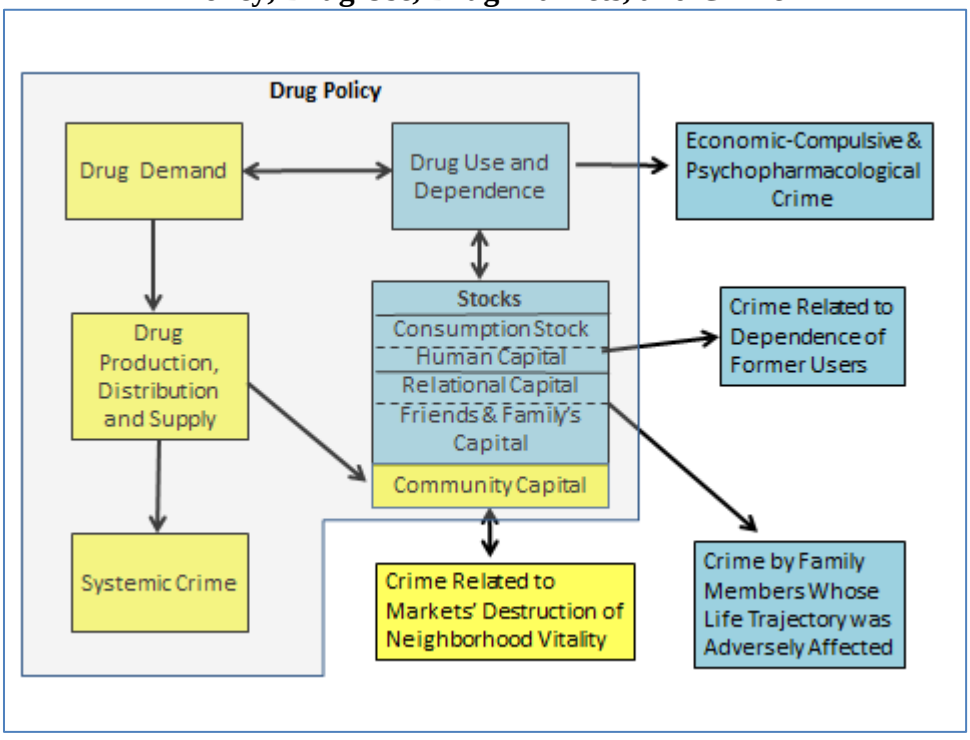
Additionally, any DAF that is constructed is also relationship dependent. Different studies using populations with different capital stocks (e.g., youth versus adults) or different policy environments (e.g., stringent versus lax drug enforcement) could legitimately estimate a very different marginal effect of drug use on crime. For example,

while Stuart et al. (2008) found that the use of stimulants (typically cocaine) on a given day was associated with intimate partner violence later that day in a sample of individuals arrested for intimate partner violence, Jaffe et al. (2009) found no association between crack cocaine use and intimate partner violence among participants recruited through an HIV program. While both studies examined the link between the same drug and the same crime, the effect was different in different populations, and perhaps the difference in the capital stocks explains the difference in results. Thus, it is not surprising that the estimated marginal effects vary from study to study.

A Framework to Address These Multiple Concerns

A true conception of drug-related crimes would need to take these multiple concerns into account, reflecting the effects of drug use, drug supply, and drug policy, and the potential mediators of individual and community-level stocks. A simplified model incorporating these multiple aspects is in Figure 1.

Figure 1. A Simplified Model of the Relationship between Policy, Drug Use, Drug Markets, and Crime



Different studies examine different relationships within that model. Econometric studies typically focus on identifying the marginal effect of current drug use on current crime, notably the relationships between drug use and dependence and economic-compulsive & pharmacological crime and drug supply and systemic crime. DeSimone (2001), for example, using cocaine price as an instrument for cocaine use, found that an increase in cocaine use was associated with an increase in six of the seven index crimes. Epidemiologists and criminologists have focused on the role of early drug use on capital stocks and how that influences the concurrent relationship between drug use and crime.

For example Ford (2005) applied a structural equation model to three waves of data from the 1979 National Longitudinal Survey of Youth to find that early marijuana use and other illicit drug use were associated with later delinquency and that the disruption of family bonds was a mediating pathway. Likewise Green et al. (2010), using propensity score matching for African-Americans in Chicago entering first grade in 1966, found that heavy marijuana use in adolescents was associated with crime through education as the main mediating pathway.

In light of these issues, it is not surprising that a range of estimates emerge from each of the literatures attempting to identify the relationship between drugs and crime. The diversity of estimates should not be construed as "measurement error" surrounding a single precise-but-as-of-yet-unknown universal constant. Rather, every DAF is really conditional on a variety of contextual factors, including policy and epidemic stage. Hence, it is not meaningful to try to obtain an average effect by taking the simple average of the disparate estimates obtained in the literature. They are, in fact, measuring quite distinct things, and averaging ignores the very different dimensions of the problem they try to enlighten.

Currently constructed DAFs, which rely on responses to just two questions from all offenders arrested and/or incarcerated in a given time period, cannot accurately reflect the total amount of crime truly attributable to drug use or drug markets. In fact, previously estimated DAFs miss critical mechanisms through which drug use might influence crime.

V. Dashboards—A Way Forward

For some, the sole reason for DAFs is to make the point that the amount of drug-related crime is large. For them, a single overarching DAF may be sufficient. But there is much more we know and can say about the drugs–crime connection besides "it's big." For example, the evidence of a causal relationship is well-established for cocaine and various crime types but not for marijuana (Pacula et al., 2013). So, an alternate way to answer the question of "How much crime is drug-related?" is not with a single number, but with a small set of complementary indicators. Even businesses, which are known for pursuing a singular objective (maximizing profits), typically examine a variety of key indicators of performance, including sales growth, risk adjusted return on capital, inventory turnover, and unit production costs. The complexity of the drugs–crime relationship suggests the need for a broader set of indicators for describing drug-related crime as well.

How does one do this? Following a strategy from business management, one might try to construct a "dashboard" of core indicators based on the particular policy maker's needs and what science suggests are key drivers of change in the drug-crime relationship.

The goal is not to include every imaginable indicator; doing so would overwhelm the user of these numbers. The principle would be to think about considerations such as, what mechanisms are important to track for policy makers/ law enforcement personnel to meet their goals? Do indicators currently exist for tracking those mechanisms? Should only

indicators representing causal relationships be included, or would it also be useful to include measures reflecting correlation that could be better understood with additional science?

Table 1 provides examples of indicators from the literature and our own understanding of these mechanisms. The traditional measure of the amount of crime committed while under the influence of a drug or committed for need of money to buy drugs is included to capture some of the relationship between crime and current use. However, these need not be limited to inmate survey data. As the inmate surveys are not collected annually, information from them can become dated and knowledge of changing dynamics may be lost. Inmate surveys also provide estimates only at the national level, leaving state to state variation unexplored. Similar measures, perhaps from arrestees who are part of the Arrestee Drug Abuse Monitoring Program (ADAM) or some other program in which more frequent data collection occurs, can represent local, state, and/or national geographic areas (e.g. RAP sheet data) can supplement or replace indicators from inmate survey data.

Table 1. Potential Indicators Capturing Dimensions of the Drugs-Crime Relationship

Specific Pathway	Possible Indicators
Current Drug Use → Current Crime	• Crime committed under the influence • Committing crime because of the need for money for drugs • Drugged driving • Victims under the influence
Policy → Current Use → Current Crime	• Drug possession arrests • Drug sales arrests
Current Use → Consumption or Human Capital Stock → Future Crime	• Crimes committed by former drug dependents • Proportion of arrestees/inmates ever in drug treatment • Crimes committed by former drug offenders
Policy → Community Stock → Current Crime & Drug Use	• Lab seizures (policy) • Lab explosions (environment) • Proportion of weapons seized from drug offenders • Proportion of assets seized from drug offenders • Vacancy rate/property values in active drug market neighborhoods

Other causal pathways require different indicators. For example, drug sales and drug possession arrests are crimes because they are defined as such. While we would not expect large changes in this policy, changes such as the decriminalization of possession

could lead to differential rates of both drug possession arrests and drugged driving arrests. (If use goes up because of the reduced criminality of drug use, drugged driving could go up while drug possession arrests go down.) Similarly, lab seizures are a function of policy, but it is a policy that can also influence the environment in which drugs are being traded, at least in the short run.

Other measures, such as lab explosions, the proportion of weapons seized from drug offenders, and vacancy rates/property values in neighborhoods with active drug markets, can help measure the effect drug use might have on the local environment over time and then how this might translate into future crime down the road (e.g., deteriorated neighborhoods often become targets for gangs or other criminal activity).

Of course, it is also valuable to consider what issues are of greatest interest to policymakers. For example, the Obama administration is very concerned about rising rates of drugged driving and has made it part of its strategic plan to reduce drugged driving over the next few years. Because drugged driving is an excellent indicator of a drug-induced crime (it is not possible to be arrested/convicted for driving under the influence if alcohol was not consumed), it is reasonable to add it to the short list of variables to include.

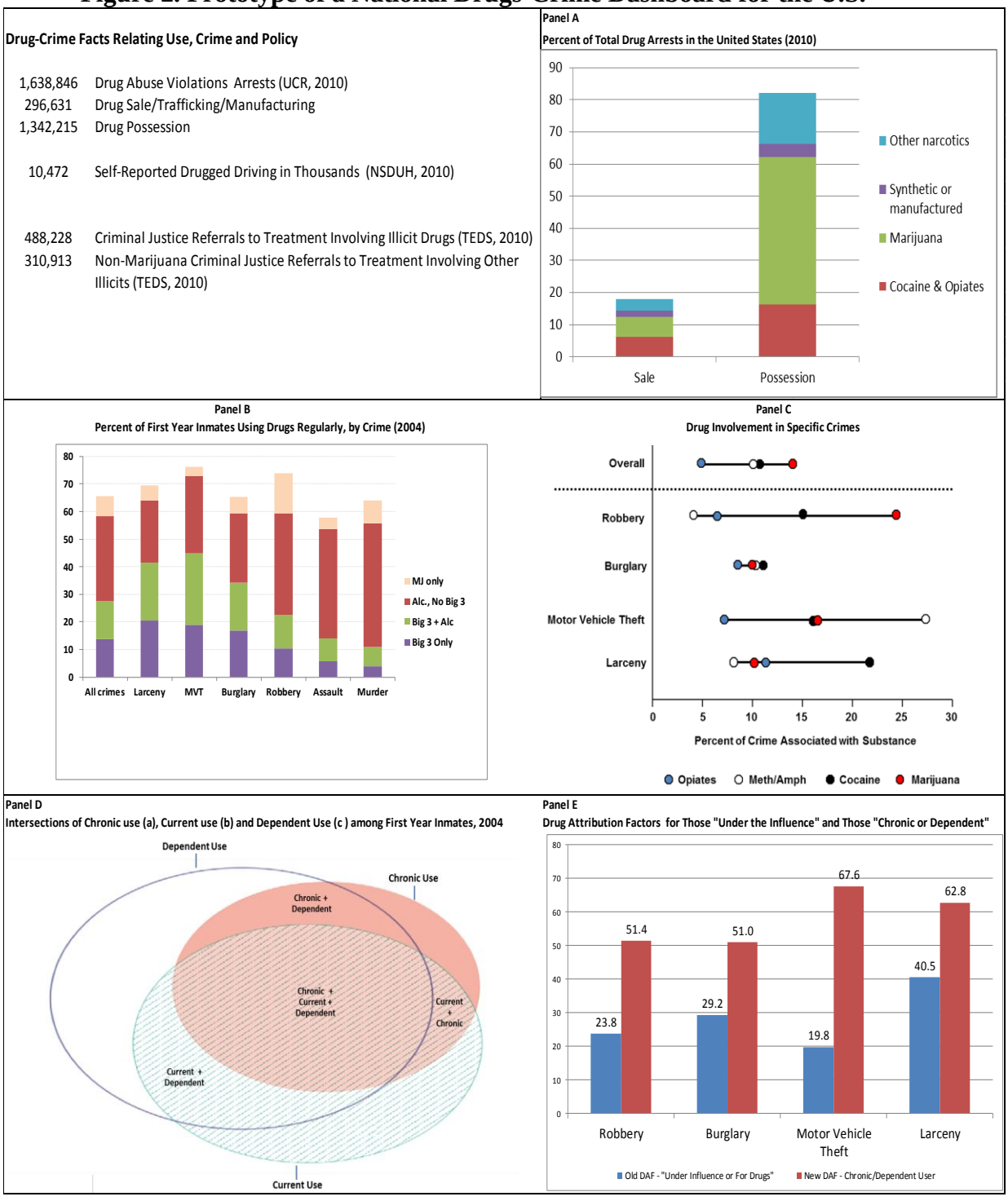
This is just a start, with the desired intent of raising interesting ideas rather than settling on specific measures for inclusion. Developing a useful dashboard requires an understanding of a specific goal and determining which of the metrics—when combined—provide the best understanding of how that goal is being reached.

In short, there is no shortage of interesting statistics from which one could develop a series of indicators about the drugs–crime problem and how much drugs are related to crime. Thus, the hardest part of developing a dashboard is deciding where to start and which statistics seem the most relevant. Some important criteria to consider include the following:

- A dashboard is only effective at communicating information if the statistics are not overwhelming.
- The statistics must reflect both the contemporaneous relationship between drugs and crime and the relationship over time.
- The statistics must help differentiate crime that is the result of drug use from crime generated by current drug policy.
- The measure must be reproduced consistently over time and measured in a way in which the presumption of causality, even if not explicitly evaluated, is reasonably inferred.

Figure 2 provides a prototype of a National Drugs-Crime Dashboard, making use of data from the 2010 Uniform Crime Reports, 2010 NSDUH, 2010 Treatment Episode Data (TEDS), and the first year cohort of inmates from the 2004 SISCF (reflecting the most recent available year).

Figure 2. Prototype of a National Drugs-Crime Dashboard for the U.S.



Presenting numbers together can give a better understanding of a situation than looking at particular indicators in isolation. For example, the data presented in the top left-hand corner about drug offending and Panels A and B include a disconnect between the drugs identified in sale and possession cases and those involved in non-drug offending. Cocaine and opiates, which represent only one-third of sales offenses and a quarter of possessions

offenses (Panel A), are two of the "Big 3" drugs being shown in Panel B that are involved in over half of all larceny, motor vehicle theft, and burglary offenses committed by inmates using drugs (the third "Big 3" drug, meth/amphetamines, represents a very small proportion of sales and possession offenses). Marijuana, on the other hand, is by far the most common drug identified in drug possession and sales offenses (Panel A) but is rarely the only drug consumed by inmates committing any of the property or violent crimes shown in Panel B. The implication is that, while marijuana is one of the most frequently used drugs, even among those caught offending and incarcerated, it is not necessarily driving the more serious offending.

Similarly, the data presented in Panel C, if shown alone, could be construed to suggest that marijuana in fact does play a much larger role in serious offending, as marijuana (indicated by the red dot) is the drug most frequently involved in all crimes and, in particular, robbery. By looking at the information in Panels B and C together, however, it becomes much clearer that marijuana gets used with other substances. While marijuana is reported to be involved in 25 percent of all robberies (Panel C), marijuana alone is involved in less than 15 percent of robberies (Panel B). Similarly, while 10 percent of inmates who are in jail for larceny and burglary report having been under the influence of marijuana (Panel C), only half of those consumed only marijuana. Polysubstance use is a concern even among the users of more expensive drugs, as shown in by the fact that half of all the offending attributed to cocaine, heroin and/or meth (the "Big 3") also involves alcohol (Panel B).

Panels D and E provide information regarding dependence versus use at the time of the crime. Panel D shows that a substantial proportion of crime committed by those meeting clinical definitions of dependence is ignored by a measure based on self-reported use at the time of the offense. Indeed, as is shown in Panel E, if we instead define crimes involving drugs as those crimes committed by someone who was either using a drug on a near-daily basis or has met clinical criteria for dependence rather than the traditional DAF, the proportion of property crimes involving drugs would be substantially higher, exceeding 50 percent for robbery, burglary, motor vehicle theft, and larceny.

VI. Discussion

In looking across the DAF literature and in discussing DAFs with experts in the field, it seems clear that there is the need for a fundamental rethinking of what can and cannot be measured by the traditional DAF approach. A single measure cannot accurately reflect the variety of individual and community, contemporaneous, and intertemporal mechanisms through which drug use and distribution can influence crime. But the real problem is neither the existence of the DAFs nor how they have been historically measured, but the non-existence of complementary measures that are needed to paint a more accurate and comprehensive picture of how much crime is drug-related. While DAFs do serve a role and provide some insight, it is important to recognize explicitly what aspects of drug-related crime they overlook.

In this article, we present a new conceptualization that better summarizes what the field has learned about the various mechanisms through which drugs might influence crime, one that complements the traditional framework offered by Goldstein (1985) by providing insights that might help policymakers and community leaders to think more concretely about those mechanisms, the possible metrics that can be used to capture those mechanisms, and the additional mechanisms that remain less understood or unmeasured.

The conceptualization is innovative in the emphasis it places on both the direct and indirect mechanisms through which drug use and/or drug markets can cause crime. Both types of mechanisms have been well supported in the scientific literature. Indirect mechanisms take time to play out before they are fully realized, but they are no less real in terms of their effects.

A second innovation of this conceptualization is that it recognizes drug-related crime caused by the sum of many individuals living within the same community (or a community's susceptibility to drug-related crime). The fact that neighborhoods can be economically and socially devastated by outdoor drug markets (particularly violent ones) or a high density of drug users is something that was previously ignored in other measures of drug-related crime.

A particularly relevant aspect of a community's environment is the implementation and enforcement of specific drug policies within it. For example, drug policy can affect drug prices, and the amount of crime created per person-year of dependence may be different in countries with higher or lower drug prices.

The main point is that, to fully understanding the drugs-crime relationship, we must adopt a broader conceptualization than used previously and pay explicit attention to both the direct and indirect pathways through which drug use can lead to crime. As these pathways reflect individual and community-wide factors that interact in very important ways, it is unlikely that a single metric will be sufficient for universally representing the influence of drug use on crime.

Beyond recognizing the complexity of the drugs–crime relationship and the limits of current research, the conceptual framework brings to the forefront the need to think of a broader set of indicators that can help policymakers understand not just the immediate links between drug use and crime but also their longer-term association—the dashboard concept presented here. While the use of multiple indicators is perhaps a new idea in the current application, the use of a set of indicators rather than any one indicator is quite common in business.

What sorts of metrics should be included in a drugs–crime dashboard? The research literature suggests many possibilities. The key in developing a dashboard is deciding where to start and which metrics seem the most relevant. Key criteria include making sure the resulting dashboard is effective at communicating information, captures the most relevant constructs for policymakers to understand both the contemporaneous relationship between drugs and crime and the relationship over time, can differentiate

crime that is the result of drug use from crime generated by current drug policy, and can be systematically reproduced consistently over time and measured in a way in which the presumption of causality, even if not explicitly evaluated, is reasonably inferred.

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