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Economic Models in the Context of Heroin Substitution Programs

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Abstract

Despite widespread disapproval of harm reduction strategies, and heroin substitution programs in particular, evidence from the Vancouver and Swiss trials both indicate that these public health measures are positively correlated with a decrease in the incidence of drug use and high treatment retention rates, as well as a reduction in crime and an increase in employment rates.

This paper examines the predictions of two widely accepted economic theories in the context of these harm reduction programs: the rational choice theory and the behavioural economic theory and explains how neither economic model can account for the empirical findings of the heroin substitution trials on its own. Rather, the observed trends are more thoroughly explained through a consideration of both rational choice theory and behavioural economic theory.

While predictions of the rational choice theory are consistent with empirical findings that peripheral societal costs associated with illicit drug use generally decrease in response to heroin substitution programs, it fails to account for other trends associated with illicit drug use. Behavioural economics thus helps to explain the other empirical data that have emerged from studies of heroin substitution programs. Therefore, a complete economics theory of addiction requires some acknowledgement that both of these theories of economics are valid and operate together. Finally, as heroin substitution takes place among persons already addicted to illicit drugs, one limitation of this analysis is its inability to be directly applied to the issue of legalization.

Introduction

In October 2005, the Toronto Drug Strategy Advisory Committee released a report delineating the need to expand harm reduction strategies including the provision of heroin substitution programs (City of Toronto, 2005). Unsurprisingly, many Toronto residents and business owners were outraged (Wente, 2005). However, the reality at the time was that the rate of infectious disease was rising among intravenous drug users, and a recent study had placed the prevalence of illicit opiate use in the Canadian population at approximately 0.29-0.43% (Fischer & Rehm, 1997).

It was based on these statistics that Vancouver opted to follow Switzerland's lead in February 2005, becoming the first North American city to implement clinical heroin prescription trials (Johal, 2005). The implementation of such programs is, and continues to be, highly controversial. Many individuals expressed concern that these programs would ultimately lead to an increase in the incidence of drug use among the general Canadian population. The empirical results from the Swiss and Vancouver trials both indicate, however, that these programs have had the opposite expected effect to date.

This paper examines two widely accepted economic theories, rational choice theory and behavioural economic theory, in the context of harm reduction programs, and explains how neither economic model can account for the empirical findings of the heroin substitution trials on its own. This discussion will also consider the implications of the findings for strategic policy development targeted at reducing opiate-related correlates. Finally, a discussion of the limitations of these existing models in light of empirical results from the Swiss and Vancouver trials will be undertaken.

Rational Choice Theory and Addiction

The rational choice theory put forth by Gary Becker holds as its core principle the rationality of human decision makers. Most emphatically, it posits that barring mental illness or some other form of incapacity, decision-makers actively weigh

the costs and benefits of alternatives when making a choice, including a weighing, *inter alia*, of the financial, social, and health costs against its countervailing benefits.

Prior to proceeding to an analysis of heroin substitution programs through the lens of the rational choice model, one must ask whether addiction or addictive behaviour even fits into the class of potential behaviours that can be undertaken rationally. Can illicit drug use ever be considered rational? Aren't drug use and addiction irrational by definition? Becker and Murphy (1988, p. 675) attempted to tackle this precise question: they asked, "Addictions would seem to be the antithesis of rational behaviour. Does an alcoholic or heroin user maximize or weigh the future?" They attempted to answer this question by analyzing the time preferences of addicts as compared to non-addicts. In their analysis, rationalization was treated subjectively; an addict's choice to undertake, or continue drug use was assessed as potentially rational so long as the addict had arrived at the decision through a consideration or balancing of the pros and cons of such a choice. According to Becker and Murphy (1988, p. 675), "addictions, even strong ones, are usually rational in the sense of involving forward-looking maximization with stable preferences." In Becker and Murphy's analysis, addictions can be rational in the sense that they can involve a maximization of benefits, whatever they may be, to a particular addict. Becker and Murphy (1988, p. 682) state that: "present-oriented individuals are potentially more addicted to harmful goods than future-oriented individuals. The reason is that an increase in past consumption leads to a smaller rise in full price when the future is more heavily discounted." In other words, those persons with a tendency towards delayed gratification are less likely to undertake use of illicit addictive drugs than those with a preference for short-term gain. Thus, despite associated future costs, addicts live in the present and prefer the shorter-term gains associated with drug use. However, this alone does not necessarily mean that immediate-gain-preferring addicts have not engaged in some form of cost-benefit analysis prior to ultimately arriving at the conclusion that illicit drug use is the choice that best embodies their subjective utility maximization.

Becker and Murphy (1988, p.683) further elaborate on this point by providing a possible explanation for why these rational preferences for present consumption can be considered rational. They explain that as the addict becomes more heavily involved in drug use, they correspondingly become increasingly likely to prefer short-term gains over long-term gains. According to them, "The consumers… become more and more myopic as time preference for the present gets larger…. It is then 'rational' to ignore the future effects of a change in current consumption."

One plausible explanation for this present-oriented preference is that the long-term gain that the addict perceives they will obtain from refraining from drug use decreases as the addict becomes increasingly dependant on the drug, as their health deteriorates, and their life expectancy dwindles. As Becker and Murphy (1988, p. 684) have stated, "If lives are finite, the inverse of the number of years of life remaining is an approximation to the rate of 'time preference' for people who do not discount the future...". In fact, continued drug use can be perceived as the more rational choice as the addict ages, contracts an infectious disease, or loses social support needed to attempt cessation of drug use, for any benefit could be potentially gained from the cessation of illicit drug use, when adjusted for the lower probability of being attained, from an addict's point of view, also becomes less worthwhile.

To deal with illicit drug abuse or addictions, Becker and Murphy's economic model favours punitive interventions that raise costs to the individual over maintenance programs that reduce costs, albeit to promote treatment. Heroin substitution programs and other harm reduction strategies are generally thought to reduce the costs associated with illicit drug use by the reduction or altogether elimination of the purchase price, or more indirectly, through a reduction of the health risks associated in engaging in the illicit act, while keeping the social or other perceived benefits constant.

In contrast, increased law enforcement and more punitive laws increase the likelihood of arrest and detention. This substan-

tially raises costs to drug addicts, both personally and even for the cost of the product. According to the logic of rational choice theory, this will reduce consumption. According to Becker and Murphy (1988, p. 687), "…banned goods become more expensive when the ban is supported by punishments to consumers and producers… the long-run demand for illegal heroin and other illegal addictive drugs tends to be much reduced by severe punishments that greatly raise their cost." Thus, rational choice theory seems to result in the prediction that there will be an increase in criminal or illicit drug use behaviour in response to the implementation of heroin substitution programs.

But does an increase in the frequency and severity of criminal sanctions truly result in a decrease in illicit drug use? While a social actor may make a full and active cost-benefit analysis prior to *initial* use of illicit drugs, once a person is addicted to a drug, there is a new cluster of perceived costs and benefits that must be factored in. This includes the potential loss of new criminal associates, the emotional and physical pain of drug withdrawal, and the risk of overdose. Thus, the cost-benefit analysis of the addict becomes more cluttered and complicated. To obfuscate things further, the "successful" addict will spend most of their waking hours readily sedated by their drug of choice. As a result, a "rational" or near-perfect analysis of whether to continue drug use is expected to become increasingly difficult and unlikely as the addict becomes more dependant on the drug, less psychologically capable of engaging in a cost-benefit analysis of alternate choices, and the perceived benefits of continued drug use disproportionately increase.

While heroin substitution programs can be seen to lower the perceived cost of engaging in illicit drug use when an individual is already addicted, heroin substitution programs cannot really be said to factor into the cost-analysis undertaken prior to initial drug use, for if the first time drug user contemplated drug addiction as a *probability* rather than a possibility, he or she would likely not be doing the drug in the first place, as the perceived long-term cost would outweigh any perceived

benefit. According to Adams and Ulen (2009, p. 24), "[other] costs of addictive substances are deferred: not only the health consequences of long-term use but the risk that use will lead to addiction and all the costs that entails." Thus, while heroin substitution programs may act to confound other measures aimed at helping addicts cease drug use, they cannot be said to promote initial drug use, and thus cannot be expected to increase the number of new users. Interestingly, while the possibility of an increase in the incidence rate of heroin use is cited as a concern among Canadians, the evidence shows that heroin prescription is not associated with such an increase. Since the Swiss heroin prescription trials were implemented in 1994, Nordt and Stohler have actually documented a surprising decrease in the incidence of heroin use from 850 to 150 new users during the 12-year course of the study (Nordt & Stohler, 2006, p. 1830).

Furthermore, the very nature of illicit drug use leads the addict to undertake activities to finance their habit. As Adams and Ulen (2009, p. 24) have noted, "addicts are often unable to hold lawful jobs and therefore commit significant amounts of property crime to finance their addiction". This, in turn, raises the social cost of addiction to much higher levels than the cost of addiction, *per se*. Various governmental and independent scientific research reports indicate that heroin substitution programs are immensely beneficial both to society and the addict. According to studies and statistics published by the Canadian government, heroin substitution (also referred to as "heroin maintenance"), greatly improves the social welfare of addicts, improves various aspects of their physical and mental health, while simultaneously reducing the costs incurred by society as a result of delinquency, property damage and theft, incarceration and health interventions (Uchtenhagen, n.d.;; Haasen et al., 2007, p. 55). Studies have shown that the annual cost of an untreated user to Canadian taxpayers is approximately $45,000 (Wall, Rehm, & Fischer, 2001). By comparison, the cost to keep a user in a heroin substitution program is approximately $22,000 per year (Kahan, Srivastava, & Shen, 2006, p. 705-706). These figures are consistent with public health principles that

hold that prevention is generally more cost-effective than is treatment (Thorpe, 2005, p. 1436). Thus, from a cost-benefit perspective, harm reduction strategies such as heroin substitution programs seem to present the most optimal method of addressing the societal impact of illicit opiate use.

While the aforementioned costs are generally borne by society and are therefore likely to be perceived as externalities to the common drug user, illicit drug use and its alternative, heroin substitution, nevertheless present parallel costs and benefits to the addict as well. For instance, while illicit drug use involves criminal activity and the associated risks of criminal liability, as well as impure drug formulations, heroin prescription presents a controlled safe alternative to the criminal and hostile environment of the streets. Heroin substitution programs generally include access to an affiliated safe injection facility or includes the monitoring of drug use to prevent drug overdoses and unsafe drug use practices such as improper injection techniques and needle-sharing behaviour, all of which can have far-reaching health consequences (Marlatt, 2002, p. 3). Furthermore, heroin prescription poses no financial cost to the heroin addict, and presents virtually no risk of criminal liability. As heroin prescription involves reduced risks, the "rational addict" would find the latter to be the more beneficial alternative. Therefore, on the basis of the rational choice theory alone, two predictions can be made: (1) heroin prescription programs will maintain a high retention rate, and (2) property crimes typically used to finance drug use will decrease with the implementation of heroin prescription programs.

The findings of the Swiss trial are very much consistent with these predictions: first, the Swiss trials boasted a treatment retention rate of approximately 70% after its first year of implementation (Drucker, 2001, p. 1385). In addition, since the inception of the Swiss trial in 1994, social productivity has significantly increased (Merrill, 2002, p. 361); criminal offences have dropped 60%, income from illicit sources has dropped from 69% to 10%, and stable employment has increased from 14% to 32% (Davies, 1999). Interestingly, the results from the

Swiss trial vis-à-vis peripheral societal impact (e.g. employment, crime rate, etc.) are largely consistent with the predictions of the rational choice theory of economics. However, the results of the Swiss trial indicate a decrease in the incidence of illicit drug use, which is diametrically opposed to predictions of the rational choice theory. This is where behavioural economics' model of human behaviour provides great insight.

Behavioural Economics and Addiction

While rational choice theory maintains that decision-makers accurately assess the probabilities of individual alternatives available to them and make choices that maximize subjective utility, many findings in the study of behavioural economics erode the rational choice principle. Behavioural economics' recognition of various confounding factors supports the proposition that many decisions made by human actors are made irrationally (Adams & Ulen, 2009). Behavioural economics theory holds that human actors make systematic mistakes in the process of making decisions. Those most significant to the discussion of addiction are (1) imperfect assessment of the risks, (2) lack of knowledge of the law, and (3) the illusion of control.

Imperfect Assessment of Risks

How risks are accounted for among addicts (or whether they are taken into account at all) is an important consideration in determining the functionality of the rational choice theory. In general, studies have shown that individuals have a tendency to underestimate high probability events and overestimate low-probability events (Viscusi, 1990, p. 1253). As scientists have noted, much of this observed phenomenon is due to greater knowledge or information about an event; i.e., risks of a particular event or incident are most often overestimated if they "have received widespread publicity" (Combs & Slovic, 1979, p. 1981). This provides a plausible explanation for why smoking cessation is more of a perceived risk among middle-aged individuals than it is among teenagers. The relative increase in perceived risk among middle-aged individuals can be at-

tributed to age-specific associations and relationships, as these increase the probability that middle-aged persons will know or have known a person with lung cancer than would a teenager, thus increasing the relative perceived risk of morbidity among the former group. It therefore comes as no surprise to find that the majority of new smokers "lack the experience to appreciate how their future selves will perceive the risks from smoking or how they will value the tradeoff between health and the need to smoke" (Slovic, Finucane, Peters, & MacGregor, 2002, p. 329-342); a lack of exposure to anti-smoking publicity and/or affected persons is expected to lead to an absence of information required to adequately ascertain the risks associated with smoking and addiction. This finding presents a strong refutation of rational choice theory's proposition that all decisions are made through an informed rational process, and instead supports the finding that beginning smokers spend very little energy contemplating the risks of smoking (Slovic et al., 2002), or alternatively, that when risks and benefits are considered, the information available is often imperfect or incomplete. A lack of information about the risks of a drug clearly poses a problem for the purposes of drug risk assessment, since without the ability to conduct a proper risk assessment, the perceived benefits of an activity can almost always be expected to outweigh its perceived risks.

Another possible explanation for the peculiar or seemingly irrational behaviour of addicts arises due to the fact that illicit drug use constitutes a criminal act. The very fact that an addict's substance of choice is an illicit one illustrates that they are less risk-aversive than a law-abiding citizen by virtue of their decision to engage in a risky activity.

As Oldfather (2007, p. 249-262) puts it:

> …even if one takes behavioural biases to be true of the average member of the population, we know that criminals differ from the average in many ways; so, absent experiments focused on criminals, we cannot assume the applicability of the behavioural literature to this unusual subpopulation.

This view is consistent with that of Robinson and Darley (2004, p. 173-205), who posit that criminals do not rationally assess the costs and benefits of committing criminal acts, are impulsive, and have "discount rates that favour immediate consumption." Therefore, while rational behaviour may be ascribable to members of the general public, the very high criminal risks involved with drug use may, from an objective standpoint, preclude illicit drug users from being deemed part of the "rational" population. The major behavioural deviations from the average that the addict exhibits may be indicative of an inability to assess risks in any meaningful or objectively useful way.

Ignorance of the Law

Yet another confounding factor in the assessment of risks is the absence of legal knowledge possessed by most members of the general population, and drug addicts in particular. Injection drug use is known to have many socioeconomic correlates, including a lack of education, lack of employment, poverty, childhood sexual abuse and neglect, and racism (Government of Saskatchewan, 2008). These factors all inevitably make awareness of, and access to, the law more difficult than it would otherwise be. Many scholars have noted this trend in the literature. Among them, Robinson and Darley (2004) have stated that "[p]otential offenders commonly do not know the legal rules, either directly or indirectly, even those rules that have been explicitly formulated to produce behavioural effect". The existence of this lack of knowledge about what the laws require leads to the inevitable conclusion that the criminalization of drug use and the implementation of harsher sanctions for drug crimes would be unlikely to produce any effect on drug use trends. It is unreasonable to expect that individuals will follow the law when they are unaware of what it requires of them. The closure of heroin substitution programs is not therefore expected to result in a decrease in drug use as rational choice suggests. As ignorance of the law is relatively commonplace, particularly among drug users and addicts (Thorpe, 2005, 1436), it is unlikely that harsher legal sanctions

will have any effect on behaviour whatsoever. Rather, it suggests that public health measures such as heroin substitution programs and other harm reduction strategies may be better suited to tackle the special problem of drug use. Harm reduction strategies generally facilitate or support access to primary health care and positive social associations and psychological support, but above all, they foster greater awareness of the risks of illicit drug use and provide education about, and access to, the legal system (Thorpe, 2005, 1436). As such, public health measures may be in a better position to target the knowledge gap that exists among addicts, and may serve to bridge the gaps in human rationality.

Illusion of Control

Another confounding factor in the study of "rational addiction" is the addict's own perception of control not only over the addiction, but also over the risks associated with use. As Adams and Ulen (2009, p. 20) have noted, individuals often suffer from an 'illusion of control' whereby they overestimate their ability to control risks and distinguish to a greater extent than is reasonable between controllable and uncontrollable risks.

While their comment was made in reference to human decision-makers in general, one can easily see how this is particularly true of a choice as emotionally laden as initial drug use of any kind. Individuals have a tendency to rationalize and overemphasize benefits relative to risks when faced with a choice that has the potential of reinforcing previously held beliefs (Adams & Ulen, 2009, p. 4). Thus, an individual facing the choice of first time drug use and the benefit of social acceptance will likely rationalize that the risks involved are much less than they actually are. The risks and benefits of a potential act are constructed subsequent to the decision, skewing the authenticity of the cost-benefit analysis. Therefore, the illusion of control is ultimately an impediment to rational utility maximization, regardless of whether rationalization is considered a subjective or objective endeavour.

Studies in neurobiology have found that individuals' choices

may be in large part shaped by chemical processes rather than "voluntary" or rational processes (Hyman, 2007, p. 8-11). Hyman (2007, p. 8-11) writes that studies from the cognitive and social sciences are beginning to "call into question folk psychology views on the voluntary control of behavior, that is, for the most part, we regulate our actions based on conscious 'reasons'". He continues: "Challenges to folk psychology views of the voluntary control of behavior may be highlighted most vividly… by conditions such as addiction, in which the core symptoms reflect a failure of… *cognitive control*."[italics in original article].

The work of Hyman and other neurobiologists (see Miller & Cohen, 2001; Montague et al., 2004, p. 760-767; Miller & D'Esposito, 2005, p. 535-538) demonstrate that in light of the biochemical processes underlying cognitive processes, decision-making may be less rational than Becker's rational choice theory suggests – particularly among those for whom drugs are no longer a choice, but a habit, and for whom physiological dependency has set in.

Alternatively, if rationalization does occur at later stages of drug addiction, the physiological and psychological costs of withdrawal are overemphasized in relation to the longer-term benefits of drug cessation. Further, criminal aspects of drug addiction or prolonged drug use render the decision to cease illicit drug use less rational and less a product of free conscious will, and more a product or influence of previous choices. As Jolls, Sunstein and Thaler (1998, p. 1472) have remarked, "[t]he decision to enter a life of crime is not one that is made repeatedly with many opportunities to learn. Once a teenager has dropped out of high school to become a drug dealer, it is difficult to switch to dentistry." Over time, drug addiction can be seen to reduce an individual's choices drastically to the point where drug cessation not only becomes increasingly difficult but the subjectively perceived costs of drug cessation to the addict begin to outweigh the perceived benefits as the probability of long-term recovery and of attaining educational, professional and social growth opportunities, decrease. Thus, the

"rational" choice to cease drug use eventually becomes a type of rational oxymoron in the eyes of the addict.

Empirical Results and Limitations of the Current Models

While rational choice theory is a useful framework in setting up an analysis of the ways in which free actors make decisions by taking into account the costs and benefits of alternative choices, the foregoing analysis demonstrates that rational choice theory, does not and cannot on its own, account for the statistical findings of the Swiss trial. As behavioural economics theory provides, human beings are prone to committing systematic errors as a result of incomplete information, ignorance of the law, and the illusion of control over risks. These human errors partially account for some of the empirical evidence that has emerged from the heroin substitution programs.

Rational choice theory and behavioural economic theory, together, seem to support the inference that a program which provides a primary point of contact between decision-makers (addicts in this case) and experts with specific and relevant knowledge (medical professionals) and the means to conveying information effectively while simultaneously removing the individual from negative influences such as other drug addicts or criminal associates, leads to a better outcome through education and the ultimate completion of knowledge gaps. Therefore, heroin substitution programs are expected to produce a more significant impact on illicit drug use than would criminal sanctions, due to their direct impact on the knowledge possessed by addicts.

In conclusion, a kind of hybrid model which acknowledges that all human decision makers, barring mental disease or incapacity, engage in some extent of the weighing of pros and cons of any decision, as the rational choice theory suggests, but also accepts behavioural economics' proposition that human beings make systematic errors in the process of making choices is likely to be the most useful framework for evaluating and understanding heroin substitution programs and other harm reduction strategies. This hybrid model would be something like a

"rational imperfect choice" theory in that it would recognize that human beings engage in rationalization and evaluation of alternative choices to the best of their abilities while inevitably facing erroneous or incomplete information. The "rational imperfect choice" model is expected to best account for the observed trends from the heroin prescription trials, and is expected to be useful in evaluating and generating projections of trends in the context of other harm reduction strategies.

Limitations

An analysis of economic theories in the context of heroin substitution programs possesses certain limitations by virtue of the fact that heroin substitution or prescription programs fall short of legalizing heroin altogether. This is an important distinction for one main reason: while heroin substitution or prescription renders heroin legally available to persons already addicted to heroin, legalizing it would make the drug available to the public at large. Because heroin substitution is limited in its reach, it is expected to reduce the perceived costs of heroin use only among those who are already addicted to the drug. It cannot be expected to have an effect on the decision-making processes of members of the general Canadian population who remain legally restricted and would still face criminal liability and sanctions were they to decide to purchase heroin. Thus, the conclusions of this analysis remain restricted to the context of heroin substitution programs, and therefore cannot necessarily be extended beyond the scope of this analysis.

Conclusion

Despite widespread disapproval of harm reduction strategies and heroin substitution programs in particular, evidence from the Vancouver and Swiss trials indicate that these public health measures are correlated with a decrease in the incidence of drug use, reductions in crime rates, high treatment retention rates and increases in employment rates. These findings cannot be explained using projections from the rational choice theory alone. The observed trends are more thoroughly explained

through a consideration of both rational choice theory and behavioural economic theory.

While predictions of the rational choice theory are consistent with empirical findings that peripheral societal costs associated with illicit drug use generally decrease in response to heroin substitution programs, it fails to account for other trends associated with illicit drug use. Behavioural economics thus helps to explain the other empirical data that have emerged from studies to heroin substitution programs, primarily through the identification of such factors as lack of information, ignorance of the law, and the illusion of control over the risks of drug use. Therefore, a complete economics theory of addiction and programs aimed at addressing this problem specifically, requires some acknowledgement that both of these theories of economics are valid and operate together.

Finally, as heroin substitution takes place among persons already addicted to illicit drugs, one limitation of this analysis is its inability to be directly applied to the issue of legalization.

References

Becker, G., & Murphy, K. (1988). Theory of rational addiction. *J of Political Economy 96*(4), 675.

City of Toronto. (2005). The Toronto Drug Strategy: A Comprehensive Approach to Alcohol and Other Drugs in the City of Toronto. *City of Toronto.* Retrieved from http://www.toronto.ca/health/drugstrategy/.

Combs, B., & Slovic, P. (1979). Newspaper Coverage of Causes of Death. *Journalism Q, 56*,837.

Davies, L. (1999). Background materials and press release concerning heroin prescription motion introduced by Libby Davies, MP. *Canadian Foundation for Drug Policy.* Retrieved from http://www. cfdp.ca/herback.htm.

Drucker, E. (2001). Injectable heroin substitution treatment for opioid dependency. *The Lancet 358*, 1385.

Fischer, B., & Rehm, J. (1997). The case for a heroin substitution

treatment trial in Canada. *Can J Public Health 88*(6), 367.

Fischhoff, B., Lichtenstein, S., Slovic, P., Derby, S.L., & Keeney, R.L. (1981). *Acceptable Risk*. Cambridge: Cambridge University Press.

Government of Saskatchewan. (December 31, 2008). A review of needle exchange programs in Saskatchewan – Final Report. *Government of Saskatchewan*. Retrieved from www.health.gov.sk.ca/needle-exchange-exec-summary.

Haasen, C., Verthein, U., Degkwitz, P., Berger, J., Krausz, M., & Naber, D. (2007). Heroin-assisted treatment for opioid dependence: randomized controlled trial. *Br J Psychiatry, 191,* 55.

Hyman, S. (2007). The neurobiology of addiction: Implications for voluntary control of behavior. *The American Journal of Bioethics 7*(1), 8-11.

Johal, A. (23 March 2005). North America's first heroin prescription program introduced in Canada. *World Press online: World Press* http://www.worldpress.org/Americas/2054.cfm.

Jolls, C., Sunstein, C., & Thaler, R. (1998). A behavioral approach to law and economics. *Stanford Law Review, 50,* 1472.

Kahan, M., Srivastava, A., & Shen, K. (2006). Why we object to NAOMI: Heroin maintenance in Canada. *Canadian Family Physician, 52*, 705-706.

Marlatt. G.A. (2002). *Harm Reduction: Pragmatic Strategies for Managing High-Risk Behaviors*. New York: Guilford Press.

McAdams, R., & Ulen, T. (2008). Behavioral criminal law and economics. In N. Garoupa, (Ed.) *Criminal Law and Economics, IX The Encyclopedia of Law and Economics* (forthcoming: 2009), p. 24.

Merrill, J. (2002). Policy Progress for Physician Treatment of Opiate Addiction. *J of Gen Intern Med 17*, 361.

Miller, E., & Cohen, J. (2001). An integrative theory of pre-frontal cortex function. *Ann R of Neurosci, 24*, 167.

Miller, E. & D'Esposito, M. (2005). Searching for 'the top' in top-down control. *Neuron, 8,* 535-538.

Montague, P.R., Hyman, S.E., & Cohen, J.D. (2004). Computational

roles for dopamine in behavioral control. *Nature, 431*, 760-767.

Nordt, C., & Stohler, R. (2006). Incidence of heroin use in Zurich, Switzerland: a treatment case register analysis. *The Lancet, 367*, 1830.

Oldfather, C.M. (2007). Heuristics, biases, & criminal defendants. *Marquette Law Review, 91*, 249-62.

Robinson, P. & Darley, J. (2004).
Does criminal law deter? A behavioral science investigation. *Oxford J. Legal Studies, 24*(2), 173-205.

Slovic, P., Finucane, M., Peters, E., & MacGregor, D. (2002). Rational actors or rational fools: Implications of the affect heuristic for behavioural economics. *The Journal of Socioeconomics, 1,* 329–342.

Thorpe, K. (2005). The rise in health care spending and what to do about It. *Health Affairs* 24(6), 1436.

Uchtenhagen, A. Heroin assisted treatment for opiate addicts – The Swiss experience. *Parliament of Canada*. Retrieved from http://www.parl.gc.ca/37/1/parlbus/commbus/senate/Com-e/ille-e/presentation-e/ucht-e.htm.

Viscusi, W.K. (1990). Do smokers underestimate risks? *J Pol. Econ 98*(6), 1253.

Wall, R., Rehm, J., & Fischer, B. (2001). The social cost of untreated opiate use. *J Urban Health 77*(4), 688-722.

Wente, M. (22 October 2005). Needling the habit; Want to reduce harm from drug use? I'll go out on a limb here: Reduce drug use. *The Globe and Mail*. Retrieved from http://www.keepingthedooropen.com.