Chapter 21

What addicts can teach us about addiction: A natural history approach

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1 Introduction: goals and approach

Our long-term goal is to change the conversation about addiction, replacing "Beyond a reasonable doubt … addiction is a disease of the brain," (NIDA 2010) to "*Addicts retain the capacity to quit drugs. How do we get them to quit sooner or prevent addiction in the first place*?" Our short-term goal is to present the research that establishes this view of addiction. The studies show that addiction to illegal drugs typically ends after a few years, usually without the benefit of interventions, and that the correlates of remission include many of the factors that influence everyday choices, such as economic pressures, family pressures, the desire to be a better person, and the desire to lead a more meaningful life. No disease or psychiatric disorder has this profile. As these findings become better known, we expect that they will persuade researchers, clinicians, the public, and addicts themselves that addiction does not entail compulsive drug use. Indeed, research presented in this chapter reveals that most addicts already know this, or, put more accurately, they behave as if they know this. They quit drugs, the conditions that persuade them to do so are not necessarily extraordinary and, in the case of illegal drugs, they typically quit drugs at clinically significant levels by about age 30. This is what all the major epidemiological surveys have shown, including those sponsored by the agencies that continue to claim that addiction is a chronic disease (e.g. the National Institute on Drug Abuse: NIDA). The results reviewed in this chapter are among the most reliable in behavioral science. If given the attention they deserve, they promise to change received opinion regarding the nature of addiction—which, in turn, promises to change addiction.

This chapter is based on research that describes how addicts behave, including epidemiological studies, treatment interventions, experiments, and historical accounts of the effects of changes in drug availability. Although the findings sensibly reinforce one another, they are not well known. NIDA directors and spokespersons, journalists, and the many addiction researchers who frame their articles and grant proposals with the boilerplate (and incorrect claim) that "addiction is a chronic, relapsing disease" have routinely failed to focus on or

even mention the findings emphasized in this chapter. Put another way, widely held ideas about addiction are at odds with what research says about addiction, particularly research on the manner in which addiction changes over time and the factors that influence these changes.

2 How to tell whether addiction is a disease

2.1 Expert opinion

When addiction specialists say that addiction is a disease, they mean that drug use has become involuntary. In support of this perspective, the American Psychiatric Association's handbook of diagnostic criteria for mental disorders (DSM-IV 1994) states that "drug dependence" (the technical term for addiction) is "compulsive" drug use, which the dictionary would translate as "an irresistible urge" to use drugs that "goes against one's conscious will" to not use drugs. Miller and Chappel, psychiatrists who specialize in addiction, write that the "*sine qua non*" of the disease interpretation of addiction is "loss of control" over drug use (1991). In the journal *Science*, Alan Leshner, a previous director of NIDA and now head of the American Association for the Advancement of Science, states that addicts start off as "voluntary" drug users, but then drugs change their brains, turning them into involuntary "compulsive" drug seekers (1997). In the British medical journal, the *Lancet*, O'Brien and McLellan (1996), frequently cited addiction experts, draw similar conclusions. They find that "At some point after continued repetition of voluntary drug taking, the drug 'user' loses the voluntary ability to control its use. At this point the drug 'misuser' becomes 'drug addicted' and there is a compulsive, often overwhelming *involuntary* aspect to continued drug use" (p. 237).

According to the experts cited above, major medical organizations, and government research agencies, the term "addiction" is equivalent to "involuntary drug use." However, these accounts fail to define "involuntary" in measurable terms that are independent of drug use. What is needed are formulas for defining voluntary and compulsive and then a check if the formulas apply to drug use in those who meet the criteria for addiction.

2.2 Popular opinion

Every winter, offices across America display signs that read, "Stop the spread of flu. Wash your hands." This becomes relevant to addiction when we imagine a possible sign that is not posted: "Stop the spread of flu. Don't sneeze." Elimination of sneezing would likely reduce the spread of flu viruses as effectively as handwashing, but no public notice makes this point. This difference reflects the widely shared intuition that hand washing can be influenced by exhortations, bribes (e.g. from parents), admonitions of others, and cultural values such as "cleanliness," whereas sneezing cannot. There is little or no record of "anti-sneezing" policies, which in turn, reflects the understanding that the tools of social policy will have little or no direct influence on sneezing. Put more generally, widely shared intuitions about behavior distinguish between activities that can be

readily influenced by their consequences and those that are relatively immune to their consequences.

2.3 How researchers distinguish between voluntary and involuntary behavior

Informal public norms regarding voluntary behavior have a scientific analog. Researchers interested in basic behavioral processes routinely distinguish between elicited behaviors and learned instrumental behaviors. Reflexes and other automatic responses are triggered by stimuli, as when the male stickleback attacks objects with "red bellies" in mating season. This is the subject matter of ethology. In contrast, learned responses take shape in ever-evolving, dynamic feedback loops that involve reward and/or punishment. This is the subject matter of psychology and economics.

Consequence-driven behavior is voluntary in several senses. It emerges "spontaneously" (without an obvious external prod) and then evolves. Planning plays a role, as when individuals enact self-control measures such as removing temptations in order to achieve some long-term end (Ainslie 1975). It overlaps with the activities that in the courts are considered matters of free will and individual responsibility. In contrast, reflexes have explicit proximal causes, are not as easily avoided by self-control measures, and are not under the jurisdiction of the legal system. Thus, a fundamental feature of behavior is the degree to which it is influenced by its consequences, which is to say, its "voluntariness." For simple creatures, such as the much-studied drosophila fly, the list of possible consequences is relatively short and likely does not go far beyond those things that it can sense. For humans, the number of possible consequences is vast, ranging from the concrete (e.g. food) to the intangible (e.g. ethical values). Humans routinely risk everything for what they believe others imagine about themselves. We can, then, test whether drug use in addicts is voluntary by assessing the degree to which it responds to its costs and benefits–where costs and benefits may be concrete or abstract. Do addicts use drugs regardless of the costs and benefits, as implied by the claim that they are compulsive users who cannot say no? Or do addicts cut back on their drug use, or maybe even quit, as the costs of drug use increase and the benefits decrease?

3 Characteristics of voluntary behavior relevant to addiction

Implicit in this approach to testing whether addicts are involuntary drug users is (1) that choice is not free will, (2) that voluntariness is a continuous dimension, (3) that choice is not necessarily optimal or rational, as is often assumed in economics and psychology, and (4) that choice has a biological basis.

3.1 Not free will

The degree to which consequences influence behavior distinguishes voluntary and involuntary behavior. Thus, the issue is not free will but a distinction between causal relations.

3.2 The voluntary/involuntary continuum

According to the dictionary, tics are brief, repetitive, spasmodic, involuntary movements involving voluntary muscles. However, careful observation reveals that those who tic chronically have some degree of voluntary control as a function of the situation. Oliver Sacks (1995) introduces his readers to a physician who suffered from Tourette's syndrome yet reliably was tic free when doing surgery or flying his private plane. The documentary *Twitch and Shout* (Chiten et al. 1994) features a chanteuse who does not tic when she is on stage. Nevertheless, it would be unreasonable as well as inhumane to punish someone with Tourette's for ticing: one cannot always hold the stage or the surgery amphitheater.

A quite different but perhaps more familiar example makes the same point. When and what we eat is voluntary. But this is true only in the short run. Well-established records show that as deprivation increases, eating becomes less voluntary. To be sure there is an occasional successful hunger striker, but this is an unrealistic standard for voluntary action. To be useful, we need feasible criteria for judging whether consequences significantly influence behavior. While on stage many Touretters might not tic, and at the point of a gun, we are confident that most, if not all, addicts would abstain. But these are neither feasible nor reasonable examples for classifying drug use in addicts. Rather, we ask if less than extraordinary pressures, consequences, repercussions and non-drug alternatives convince addicts to become controlled drug users or to quit using drugs altogether.

3.3 Choice is not necessarily rational

In economics and psychology, it is often assumed that individuals make choices so as to maximize the consequences of their actions. For instance, textbook chapters on consumer choice begin with the assumption that individuals choose the optimal market basket of goods, taking into account price, budget, and diminishing marginal utility (e.g. Baumol and Blinder 1994). In contrast, the idea that voluntary behavior refers to activities that vary systematically with their consequences presumes nothing about rationality. Actions primarily controlled by the most immediate consequences (e.g. over the next few minutes) are likely to seem irrational from a perspective that includes the future as well as the present and the welfare of others. Moreover, as discussed elsewhere (Heyman 2009), the local frame of reference is usually more salient than the future so that, in experiments, subjects typically make choices as predicted by the local frame of reference, thereby "irrationally" reducing their overall benefits (Herrnstein et al. 1993). Consequently, we are not asking if the persistence of drug use in addicts is rational, but whether it is susceptible to its consequences.

3.4 Drug-induced brain changes are not prima facie evidence of disease

Drugs change the brain. Leshner and his successors at NIDA assume that this is sufficient evidence that addiction is a disease state. Leshner (1997) writes: "drugs change the brain, this is what makes addiction a brain disease." Nora Volkow, the current Director of NIDA, adds that because drugs can affect the orbito-frontal cortex, addiction is a disease (Volkow and Fowler 2000). However, drugs do not have privileged status when it comes to affecting

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the brain. Everything that influences behavior does so by way of the brain. Similarly our preferences have a genetic basis—even political preferences (Waller et al. 1990). For anyone who takes evolution seriously, how could it be otherwise? The proper question is not whether drugs change the brain, but whether they change the brain so that drug use is no longer voluntary. This is a behavioral question that can only be answered by studying the natural history of drug use. To determine whether drug addicts are compulsive drug users, we need to know what influences drug use in those who meet agreed-upon criteria for addiction. If the factors are similar to those that affect voluntary actions, then drug use in addicts remains voluntary, albeit irrational and self-destructive. Conversely, if the factors that affect voluntary action have little influence on drug use in addicts, as is the case for diseases, then it may be reasonable to identify addiction as a disease.

4 The criteria for identifying addicts: the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders*

The American Psychiatric Association's nosological handbook (1994), entitled the *Diagnostic and Statistical Manual of Mental Disorders* (DSM), has become the gold standard for identifying psychiatric disorders for clinicians, researchers, and the courts in the United States. The manual substitutes the term "substance dependence" for "addiction." It begins its description of Substance Dependence in the following words:

> The essential feature of Substance Dependence is a cluster of cognitive, behavioral, and physiological symptoms indicating that the individual continues use of the substance despite significant substance-related problems. There is a pattern of repeated self-administration that usually results in tolerance, withdrawal, and compulsive drug-taking behavior.
>
> (APA 1994, p. 176)

Following this passage is a list of seven observable, measurable signs related to drug use, such as tolerance, withdrawal, using more drug than initially intended, or failing to stop using after vowing to do so. If three or more of these symptoms are present in the previous 12 months then the drug user is considered drug-dependent. These classification rules have proven reliable and useful. Different raters agree as to who is an addict (e.g. Helzer et al. 1987; Spitzer et al. 1979), and research based on these criteria yields orderly distinctions. Drug users who meet the criteria for addiction reliably differ from drug users who do not meet the criteria (Anthony and Helzer 1991). Thus, it is reasonable to use the APA criteria for distinguishing addicts from non-addicts. Indeed there is no better set of guidelines to follow. (There are several editions of the DSM. We cite the 1994 version, as its approach was used by most of the researchers cited in this chapter.)

4.1 Is addiction a chronic disorder?

The claim that addicts are involuntary drug users has two parts. First, that addiction is a chronic disorder, requiring lifelong treatment. This is because there is no known cure. Second, that addicts use drugs against their will. We examine chronicity first.

4.2 Remission in the general population

Addiction researchers have typically recruited their subjects from treatment centers. However, a well-known principle in medical research is that studies based on treatment populations are susceptible to systematic biases. For a given illness, those who are in treatment are more likely to suffer from additional illnesses than those who have the same illness but are not in treatment (Berkson 1946). The additional illnesses are linked to poorer outcomes so that treatment studies tend to yield a darker picture of the illness of primary interest. For addiction, this is particularly important since the additional disorders typically are ones that affect how long someone continues to use drugs. Moreover, most addicts do not seek treatment (Anthony and Helzer 1991; Stinson et al. 2005). Thus, to understand addiction's natural history it is essential to ensure that subjects in treatment are not overrepresented. American epidemiologists solved this problem by organizing large study samples that numbered in the thousands and mimicked the demographic characteristics of the American public, using such criteria as gender, age, and ethnicity (Robins and Regier 1991). The results have proved reliable and interesting.

4.3 Stationary remission rates according to cumulative remission functions

Figure 21.1 summarizes the remission rates for dependence on an illicit drug for three of the four major, psychiatric epidemiological studies based on the DSM. On the X-axis are the studies and years of data collection (Conway et al. 2006; Kessler et al. 2005a, 2005b; Stinson et al. 2005; Warner et al. 1995). On the Y-axis is the percentage of those who met

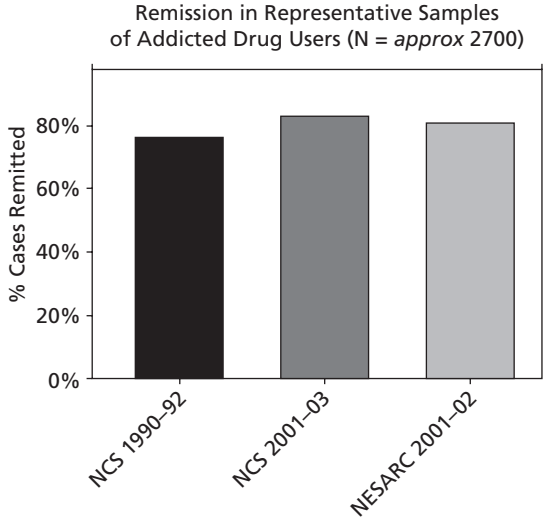

Figure 21.1 Percentage of those with a lifetime diagnosis of dependence on an illicit drug who did not meet the criteria for dependence for at least a year prior to the diagnostic interview in the three major US psychiatric surveys that distinguished between drug dependence and drug abuse. The dates indicate the period in which the research was conducted

the lifetime criteria for dependence on an illicit drug, but at the interview and the preceding 12-month period did not. That is, they had been in remission for at least a year. The graph shows that this was the case for most lifetime addicts. Between 76 percent and 83 percent were in remission. According to the interviews and diagnostic criteria, they once met the criteria for addiction but, for at least a year prior to the interview, they no longer did so. The average age of the participants in these studies was about 41 years old, and the average age of those who met the criteria for lifetime dependence on drugs was about 37 years. Since dependence typically begins in early adulthood (Kessler et al. 2005a), the age trends suggest that more than half of those who were ever dependent on an illicit drug remitted by age 30.

4.4 Did remission vary as a function of type of drug?

Since the results in Figure 21.1 are at odds with current opinion, it is reasonable to suppose that the findings are misleading. For instance, the national epidemiological studies included marijuana users, so it is possible that the high remission rates reflect a drug that many consider not addictive. Figure 21.2 tests this idea. It shows the results for the two epidemiological studies that provided information on specific illicit drugs. On the X-axis is type of drug. On the Y-axis is percentage in remission. For this analysis, it seemed reasonable to include the first major national community survey, the Epidemiological Catchment Area study. (We omitted the ECA survey results from the first graph because it collapsed abuse and dependence into a single category, and claims regarding "compulsivity" are reserved

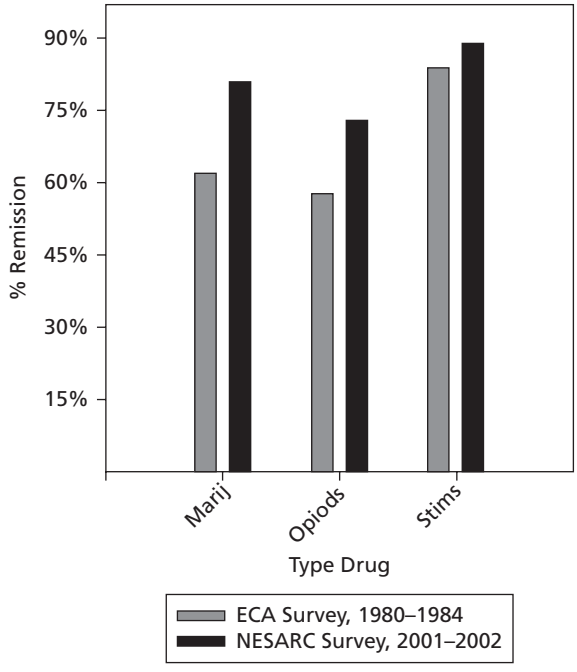

Figure 21.2 Percentage of those in remission as a function of type of drug dependence. The ECA survey did not distinguish between dependence and abuse

for dependence. However, marijuana abuse and marijuana dependence are difficult to differentiate, so it not unreasonable to include the ECA when the focus is marijuana.)

Remission did not vary greatly as a function of drug type, and marijuana users were not the most likely to remit. However, remission did vary by study. For every drug, remission rates were higher in the NESARC survey. This may reflect how the two studies grouped their subjects. Remission rates are often lower for abuse than for dependence (e.g. Vaillant 2003), despite the fact that abuse is, by definition, the less severe conditions. Thus, remission rates for the ECA should be lower since they conflated abuse and dependence.

5 Possible methodological problems in the study of remission

5.1 Are the remission rates stable?

Marijuana users do not explain the high remission rates. Possibly, then, the results are misleading because those who had remitted relapsed in the future, as expected according to the phrase that "addiction is a chronic, relapsing disease." We tested this possibility graphically.

If remission in Figures 21.1 and 21.2 is temporary, then a graph of the cumulative frequency of remission as a function of time will level off well below 50 percent and/or show some complex, fluctuating pattern. In contrast, if remission is stable, then according to Figures 21.1 and 21.2, the cumulative frequency of remission should increase as a function of time, settling in at an asymptote of 75 percent or higher. We plotted these predictions in two ways: first as a conventional cumulative frequency plot, showing the overall percentage of those in remission as a function of time; second as a linearized version of the same data but expressed in terms of those still addicted—a "survival plot."

Figure 21.3 shows remission as a function of time since the onset of dependence. The data are from the Excel data file compiled by NESARC researchers and provided by the authors (Lopez-Quintero et al. 2011). On the X-axis is time since the onset of dependence. On the Y-axis is the percentage of those who have been in remission for a year or more. This is the conventional, most straightforward way of presenting remission results. It shows that remission was stable.

The fitted equations are negative exponentials. The multiplier that precedes the parentheses estimates the asymptotic rate of remission (so that it should not be greater than 1.0), and the exponent for the constant term *e* is the yearly rate of remission. For example, the equation describing cocaine remission says that each year 17 percent of those still dependent on cocaine remitted, whereas the equation for alcohol says that 5 percent of those still dependent on alcohol remitted each year. The equations fit the data well, with one exception. For cigarettes, the best fitting asymptote was greater than 1.0, which is not sensible. However, it is apparent that this was because the rate of quitting markedly increased among those who had smoked for fifty years.

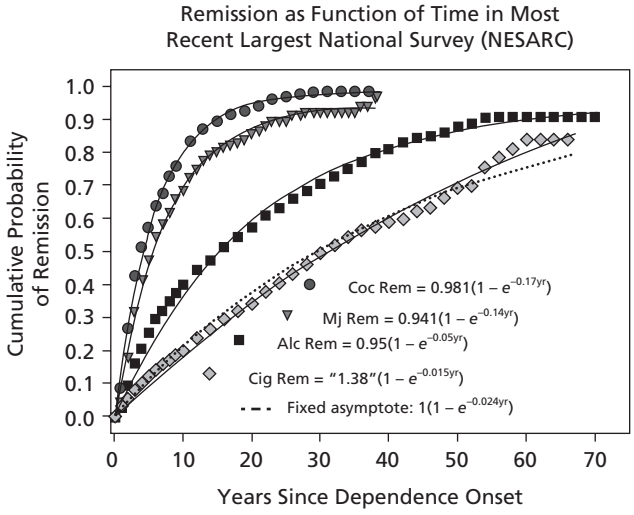

Figure 21.3 Cumulative probability of remission as a function of the time since the onset of dependence in National Epidemiological Survey on Alcohol and Related Conditions. The graph is based on two diagnostic interviews (see text)

5.2 Exponential cumulative remission functions: discussion

These results are orderly but surprising. First, the asymptotes are 90 percent or higher, meaning that most of those who were dependent have remitted or will do so. Second, each drug had its own characteristic rate of remission, a result that has no established theoretical basis. For instance, there is no biological or behavioral theory that says the expected duration of alcoholism is about 3.4 times longer than for cocaine addiction. Third, as illustrated by this last example, remission rates were considerably higher for the two illegal drugs. If legal status reflects the supposed addictiveness or dangerousness of a drug, these results are contrary to what should occur. However, the results are in perfect accord with the premise that drug availability plays a critical role in the persistence of addiction. Fourth, the equations fit the data almost perfectly even though they are based on the assumption that the likelihood of remitting is constant and independent of the duration of dependence. These characteristics hold for the decay of radioactive particles and assembly line errors, but surely the trajectories for remission from addiction must be more complex—either increasing or decreasing as a function of time since the onset of dependence.

The unlikely results prompted a reanalysis of the remission results. We sought guidance from researchers with experience fitting "decay" data with exponential functions. Radioactive isotopes have a characteristic decay rate that follows an exponential distribution. Different isotopes have different decay rates, and a given sample of radioactive material may contain more than one species of radioactive material. According to texts on radioactive decay, physicists deal with the heterogeneity by plotting decay as a survival function in logarithmic coordinates, rather than plotting the cumulated decay in linear

coordinates. If there is but one isotope that decays at a constant rate, the survival graph will follow a linear trajectory. However, if there are two or more isotopes with different decay rates or an isotope that spawns "daughter" isotopes with different decay rates, the data points will deviate systematically from linearity. Put in terms of addiction, a single linear function will describe the relationship between time since the onset of addiction and those still addicted or, alternatively, more than one function will describe this relationship, and it may not be linear.

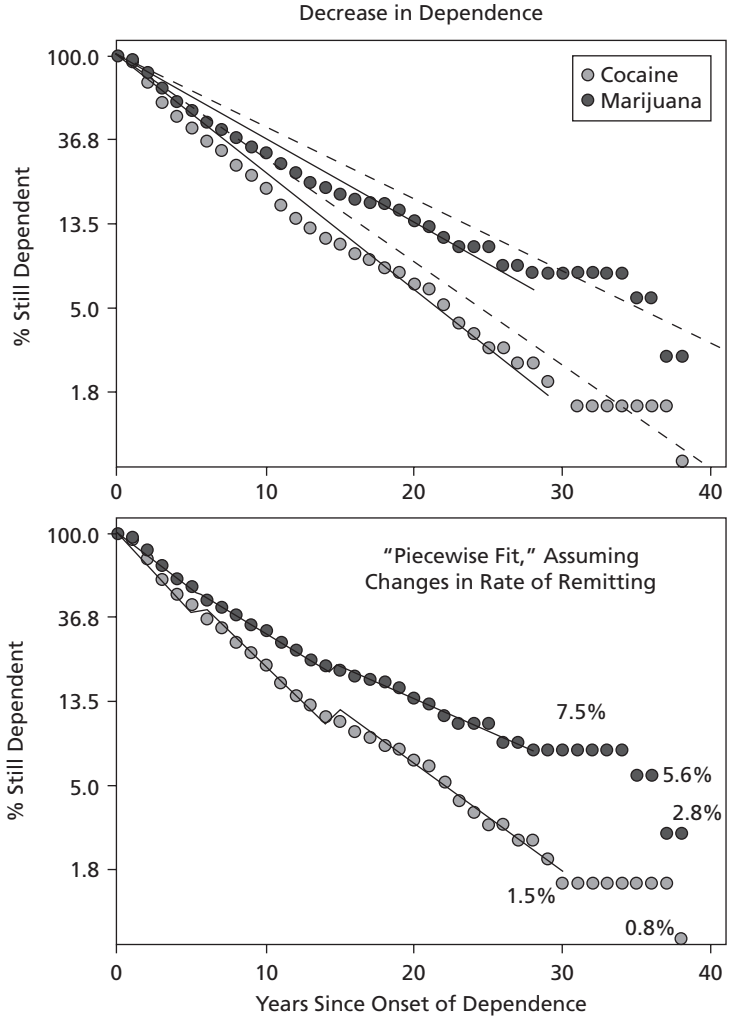

Figure 21.4 Percentage of those who are still dependent on cocaine and marijuana as a function of time since the onset of dependence. The y-axis is logarithmic, resulting in a linear relationship between the variables. The data are the same as in Figure 21.3, but here are plotted as a survival function.

5.3 Linearized cocaine and marijuana remission rates reveal non-stationarity

Figure 21.4 shows the percentage of individuals who are still dependent as a function of years since the onset of dependence on either marijuana or cocaine. These are the same data that appeared in Figure 21.3, except that the Y-axis is logarithmic and the equation is expressed as a survival function: those still addicted = $ae^{-\lambda t}$ (or in logarithms: log a $-\lambda$t, so that a is the zero intercept and $-\lambda$ is the slope). In the top panel, the solid lines are the best fitting linear models assuming a constant rate of remitting for up to 30 years since the onset of dependence. This encompasses 92.5 percent of those dependent on marijuana and 98.5 percent of those dependent on cocaine. The dashed lines were fit to all the subjects, including those who did not remit by 37 years. For both approaches, there are systematic deviations from the assumption that the rate of remission remained constant for all addicts.

The bottom panel shows a piecewise fit (by eye), which allows for multiple remission rates. Table 21.1 lists the rate parameters (λs) for a given span of years and the percentage of addicts who remitted within that span of years. Remission rates decreased as years of dependence increased. The changes are small in absolute terms but not trivial in relative terms. For instance, according to the best fitting straight lines, the rate of remitting from cocaine was 17 percent per year for those who remitted within 6 years of the onset of dependence (60 percent of lifetime cocaine dependent informants) but 12 percent per year for those who remitted after 14.5 years of dependence (9 percent of informants). In addition, 2.8 percent of those dependent on marijuana and 0.8 percent of those dependent on cocaine did not remit within the 37-year period for which the researchers had records.

5.4 Linearized cigarette and alcohol remission rates

Figure 21.5 shows the percentage of those still dependent on alcohol and cigarettes as a function of time since the onset of dependence. The pattern is somewhat different than for marijuana and cocaine. First, a higher percentage of those dependent on alcohol and cigarettes did not remit, even though they had more than 50 years to do so. Second, for alcoholics the rate of remission changed little. Third, as noted earlier and in contrast to marijuana and cocaine, the remission rate for smoking increased after 50 years of dependence on cigarettes, which was the case for 25 percent of dependent smokers. Logic demands that the increase in remission rate after many years of smoking must be due to a within-individual changes, rather than different rates of remission for different individuals. For instance, if the remission rate at the onset of smoking were as high as it was after 54 years of smoking then the percentage of those still smoking after 30.5 years would be 13 percent rather the observed 50 percent. Presumably, the health consequences of smoking become more persuasive as smokers age.

5.5 Are the high remission rates due to missing addicts?

Figure 21.2 showed that the high remission rates did not reflect a bias for selecting subjects who used marijuana, and Figures 21.3, 21.4, and 21.5, showed that remission was not

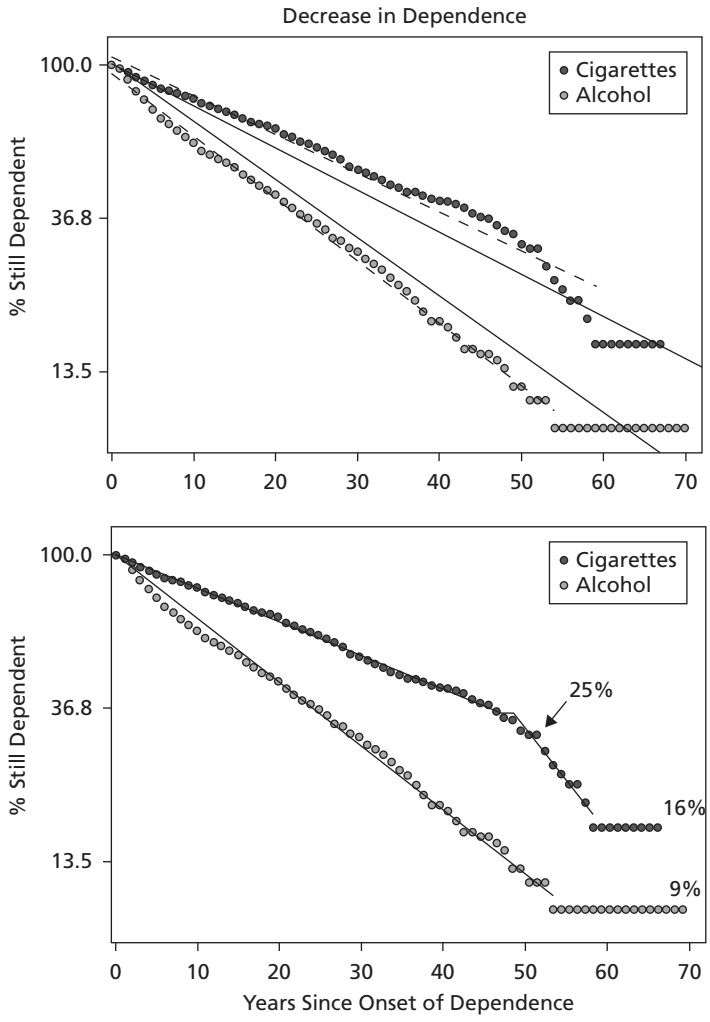

Figure 21.5 Percentage of those who are still dependent on cigarettes and alcohol as a function of time since the onset of dependence. See Figure 21.4 legend and text for details.

temporary. Nevertheless, the high remission rates could be misleading. If the researchers failed to count a significant number of addicts, particularly those who did not remit, then the findings would be biased in favor of remission. As it is reasonable to suppose that the most severely addicted would be least likely to cooperate with researchers, this is a plausible hypothesis—but missing addicts are hard to count. However, we can calculate how many addicts would have to be missing to significantly change the results presented so far. To push remission much below 50 percent in the US today, it is necessary to assume about 20 million missing addicts. This seems unlikely. (See Heyman 2013 for details of this calculation.)

Table 21.1 Remission rate parameter for a given period of dependence and percentage of those dependent

Cocaine			Marijuana			Alcohol			Tobacco		
Yrs	Rem Rate	percent	Yrs	Rem Rate	percent	Yrs	Rem Rate	percent	Yrs	Rem Rate	percent
0–5.5	–0.172	60	0 –5.5	–0.127	51	0–54	–0.042	91	0 –49	–0.022	67
5.5–14.5	–0.151	29	5.5–14.5	–0.102	29	—	—	—	49–59	–0.066	17
14.5 – 30	–0.124	9	14.5– 28.0	–0.076	13	—	—	—	—	—	—

5.6 Do epidemiological surveys yield valid self-reported drug use histories?

The survey results, like much of research in psychiatry, are based on self-report. This raises the possibility that the participants either exaggerated earlier drug use and/or underestimated current drug use, thereby elevating remission rates. Stated more generally, do participants tell researchers the truth?

Researchers have dealt with this issue by comparing metabolic tests of drug use with what drug users say about their recent drug use. The basic findings are that self-reports match the metabolic results when drug users have no apparent fear of negative consequences, whereas the reports are palpably false when censure or worse is possible (Darke 1998; Land and Kushner 1990; Weatherby et al. 1994). The national surveys adopted methods that are similar to those that produce good fits between biological and verbal measures. In support of this point, self-reported drug use histories predict demographic characteristics (Anthony and Helzer 1991; Kessler et al. 1994; Robins 1993) and even laboratory, experimental measures, such as working memory and IQ. For example, in a recent study, self-reported drug histories predicted working memory scores in span tests even though one was a personal history and the other was performance in an on-the-spot experimental procedure (Heyman et al. 2014). It is impossible to concoct this correlation. Thus, it seems unlikely that the high remission rates are an artifact of inaccurate drug histories.

5.7 Remission rates are orderly, but when someone remits is unpredictable

It seems reasonable to suppose that the transition from dependence to non-dependence is often complex, entailing many steps, not all of which proceed in the same direction. Yet simple equations captured the temporal features of these transitions, accounting for more than 95 percent of the variance in the data. On the other hand, according to the logic of the fitted exponential functions, exactly when a particular individual remits is unpredictable, albeit on average constant. Thus, the results reflect both orderliness and unpredictability.

The analysis, though, is incomplete. The equations and graphs apply to populations. We have not analyzed the processes that lead individuals to change. How those processes relate to the results presented here is not understood. Possibly, there are addicts who become increasingly likely to stop using drugs and those who become increasingly likely to keep using drugs, but the population graphs fail to show this because the two tendencies cancel each other out. And, of course, some drug users may go through periods in which they are more or less likely to continue using drugs. This sort of complexity is highly plausible, but has not been studied. However, we need not wait for a successful theory of individual change to identify the correlates of remission. These are reasonably well documented, and they provide important information on the nature of addiction.

6 What prompts remission from addiction?

It is customary to say that addiction is in remission, rather than resolved. However, "in a state of resolution" may be a more accurate descriptor of the endpoint for most addicts. The quantitative analyses say that the asymptotic "resolution" rate for those addicted to illicit drugs is not less than 94 percent and for legal drugs the asymptotic resolution rate is not less than 90 percent. But what are the circumstances surrounding remission? If drug use in addicts is impervious to the factors that affect choice, then quitting drugs should usually involve extraordinary events, such as medical interventions, forced detoxifications, and draconian judicial measures. Conversely, if drug use in addicts remains voluntary then the circumstances surrounding remission may consist mostly of the economic, familial, and moral concerns that influence non-drug, day-to-day challenges. A related question is whether the factors that predict remission from addiction also predict remission from the chronic diseases to which addiction is often compared, such as diabetes, heart disease, and cancer. To answer these questions, we first outline the logical implications of the high addiction remission rates and then summarize what the literature on addiction says about the correlates of remission.

6.1 Logical implications of high remission rates in addicts who are not in treatment

There is wide agreement that most addicts do not make use of clinical services (Anthony and Helzer 1991; Stinson et al. 2005). Since most addicts remit, quitting drugs must typically take place without benefit of professional interventions. What brings about change? Absent interventions, the logical answer is that the pressures of everyday life reduce drug use in addicts.

In-depth interviews with addicts (e.g. Waldorf et al. 1991) and memoirs (e.g. Burroughs 1959; Rettig et al. 1977) yield the following correlates of why those who meet the APA criteria for drug dependence stop or greatly reduce drug use as they age: financial pressures, legal pressures, family pressures, hardships associated with pursuing illegal and/

or stigmatized activities, drug tolerance, witnessing an overdose, wanting to be a better parent, the desire to make parents proud rather than embarrassed, involvement in a self-help group, an awakened spirituality, a new romantic relationship, the breakup of a romantic relationship, and so on. The material and emotional costs and benefits of everyday life, including existential and value laden self-reflections, are the correlates of remission from addiction. When ex-addicts talk about quitting, their comments are replete with references to values as well as instrumental concerns: "I wanted my parents to be proud of me," "I didn't want to embarrass my children," "I was not raised to be bad parent," "I was not put on earth to be an addict," "I could no longer afford my drug habit," "my life had gotten out of control," "I was sick of the hassles." In many cases, addicts quit abruptly, a process known as "cold turkey." There is no disease that has this profile. The narratives associated with diabetes or cancer or even schizophrenia include no references to the therapeutic efficacy of embarrassment or pride, and the time course of recovery for these diseases is never all at once. No-one has stopped being a diabetic "cold turkey."

Research that used more objective methods for gathering data supports the memoirs and interviews and adds the important point that the correlates of addiction distinguish it from other psychiatric disorders as well as from diseases.

7 Natural experiments in the history of addiction

The history of addiction includes several abrupt, society-wide changes in policy and information relevant to drugs. These events share several key features with experiments. There is a marked change in conditions relevant to drug use (e.g. the legal status of opiates), and a public record of changes in drug use. However, in contrast to an experiment, we do not have to guess as to how the results might apply outside of the laboratory. For addiction, this distinction is important because drug effects and drug use vary as a function of context, particularly drug availability, expectations, and societal trends. Several sources provide detailed and entertaining accounts of these events (e.g. Courtwright 1982; Musto 1973). Below, we briefly list them. (See Heyman 2009, 2015 for more detailed summaries.)

7.1 Opiates

In 1914 President Wilson signed off on legislation that criminalized the nonmedical use of opiates and cocaine—referred to as the "Harrison Narcotics Tax Act." Heretofore, pharmacies openly sold "medications" containing opiates and cocaine, and those without access to a nearby pharmacy could order addictive drugs by mail from Sears Roebuck and Company. The legislation set the stage for drug prohibition, the emergence of heroin as the opiate of choice, a shift from sniffing heroin to injecting it, and the emergence of the urban, minority, street addict, along with a thriving street addict culture and economy.

Kolb and DuMez ([1924] 1981, p. 1191), the first to chronicle the effects of the Harrison Act, write:

> Addiction is becoming more and more a vicious practice of unstable people who by their nature have abnormal cravings which impel them to take much larger doses than those which were taken by the average person who so often innocently fell victim to narcotics some years ago. Normal people now do not become addicted or are, as a rule, quickly cured leaving as addicts an abnormal type with a large appetite and little means to satisfy it.

7.2 Alcohol Prohibition 1920–1933

In the United States, Prohibition is widely perceived as a failed, counter-productive social experiment. Nevertheless, Prohibition reduced drinking in alcoholics, particularly in its early years. This is reflected best in the decrease in cirrhosis of the liver. Cirrhosis is a stoppable but not reversible disease that results primarily from heavy drinking. Prohibition increased the costs of alcohol as measured by dollars, risk of arrest, and effort. These increases were accompanied by a marked decrease in the incidence of cirrhosis of the liver in Canada (Seeley 1960) and the United States (Miron and Zwiebel 1991). Since alcoholism is the most common pathway to cirrhosis, this means that increasing the costs of alcohol decreased alcoholism.

7.3 Surgeon General's 1964 report on smoking

In 1964 the Office of the US Surgeon General published a 357-page report on the health risks of smoking (USDHHS 1964) that summarized hundreds of studies on the medical consequences of smoking and stopping smoking. The take-home message was that smoking increases the likelihood of diseases that shorten life, and quitting smoking can reverse much of the damage. The science was overwhelming. Virtually all scientists and physicians agreed that smoking was unhealthy. However, individuals differ in how seriously they regard scientific opinion. Given the assumption that college increases the likelihood of valuing scientific research, the correlation between smoking and education should increase following the 1964 report. As predicted, those with more education have been much more likely to quit smoking. To our knowledge the frequencies and correlates of diseases are not so tightly correlated with how their characteristics are presented to the public.

7.4 What natural experiments teach us about addiction and disease

The natural experiments are informative. They show that social practices, cultural trends, economics, and even new information can persuade addicts not to take drugs. Of course, not every addict is persuaded at the same moment, but neither is every voter persuaded by a given political message. In the context of whether it makes sense to classify addiction as a disease, the issue is whether judicial actions and public opinion campaigns reduce disease symptoms. We have no record of legislation altering the frequency of cancerous moles or diabetic thirst, and it seems hard to imagine these effects in the future. On the other hand, these are the very measures that have dramatic effects on the frequencies of addiction. But the

distinction is one of degree. Healthy living interventions have had some success persuading those with Type 2 diabetes to exercise and lose weight which, in turn improves insulin sensitivity, a key symptom of diabetes (Sigal et al. 2006). However, exercise-related decreases in diabetes symptoms have a more gradual time course than do documented historical changes in addiction rates, and the magnitude of behaviorally induced changes in diabetes symptoms are considerably smaller than the policy-related decreases in dependence on drugs. For instance, we do not see 90 percent of diabetes cases going into remission as a function of age, even though diabetes victims are more likely to be in treatment than drug addicts.

8 Years of school reduces years of heavy drug use

The degree to which the negative consequences of drug use curtail future drug use depends, in part, on access to non-drug alternatives. Recently, some addiction specialists have begun to refer to non-drug activities as "recovery capital" or "human capital," where recovery/human capital is loosely defined as "acquired useful abilities that can produce wealth." Education is a key component of human capital. This suggests that if non-drug alternatives are central to quitting drugs, years of education should predict lower rates of dependence and, for those who become dependent, higher remission rates. A recent study tested these predictions (Heyman et al. 2014).

The subjects were opiate addicts in treatment at Boston methadone clinics and volunteers, many of whom had been or were heavy drug users. The methadone clinic patients met the criteria for drug dependence. The non-clinic subjects were not evaluated according to DSM criteria, but many had drug histories that matched the clinic subjects. The study measures included years of heavy illicit drug use (three times/week or more), IQ, impulsivity, working memory, psychiatric symptoms, and years of school. The study's goal was to identify the variables that predicted the transition from any drug use to heavy use, and persistence of heavy use once in place.

IQ, impulsivity, and years of school were highly correlated with illicit drug use (in the expected ways) when there was no control for other factors. However, in a double-hurdle multiple regression analysis that controlled for correlated variables only years of school continued to predict the transition to dependence and years of illicit heavy use. Impulsivity remained a significant predictor for heavy drinking and regular smoking. Put another way, IQ and impulsivity predicted years of school, and years of school predicted illicit drug use. Figure 21.6 illustrates these relations.

On the Y-axis is the number of occasions of opiate and stimulant use for high and low risk drug users, where high-risk was defined as low IQ and high impulsivity. The graph shows that high-risk drug users who attained 14 years or more of schooling were less likely to continue to use stimulants and opiates than low-risk individuals with fewer than 14 years of school. Years of school (and/or its correlates) protected high-risk drug users from further drug use. This is significant in regard to efforts to reduce the costs of addiction and for the understanding of addiction. For instance, it seems highly unlikely that years of school trump the influence of obesity in diabetes.

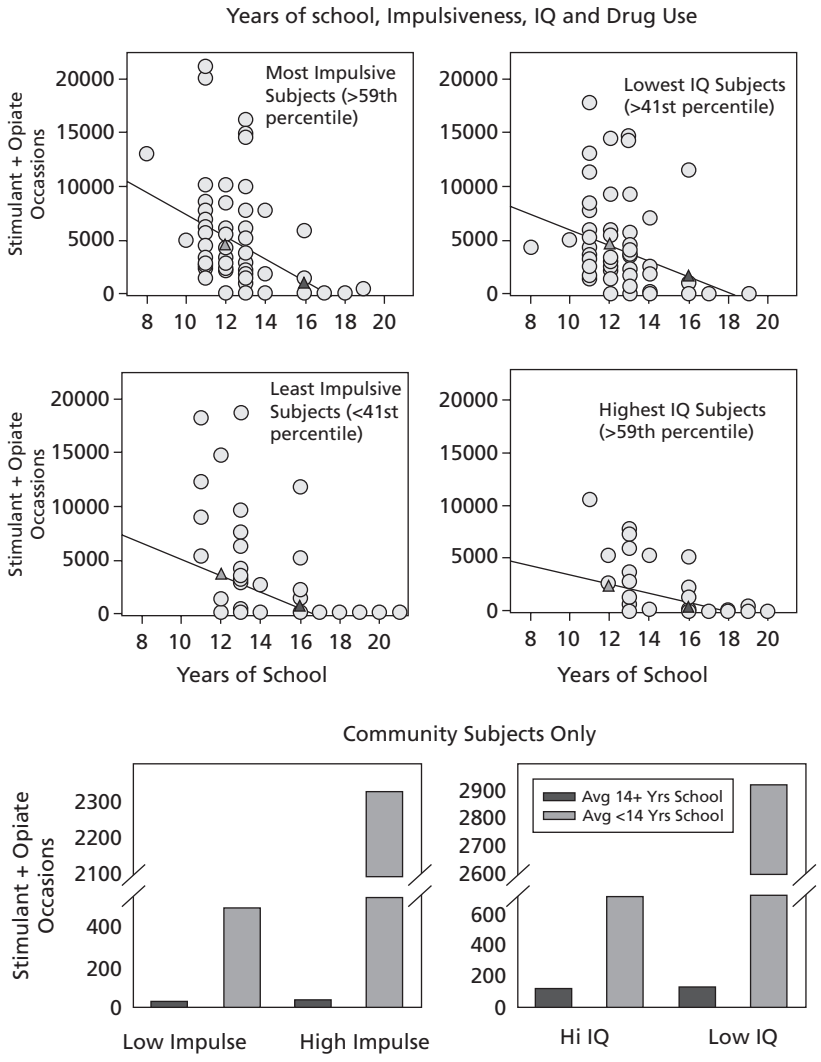

Figure 21.6 The relationship between the frequency of stimulant and opiate use and years of school for the most and least at-risk subjects as measured by the Barratt Impulsiveness Scale and IQ. The top four panels show the results for clinic and community subjects. The filled triangles indicate the averages for subjects with fewer than 14 years of school (gray) and 14 or more years of school (black). The bottom panel shows the correlation between school and drug use for just the community subjects.

9 Interventions based on the view that drug use in addicts is voluntary

The historical correlations between changes in the consequences of drug use and changes in drug use in addicts have laboratory parallels. In controlled experiments with animals and humans, including addicts, drug consumption is sensitive to its price and to the availability

of competing non-drug activities. For example, Cohen and her colleagues (1971) conducted an interesting study of binge drinking that pitted a priming dose of alcohol against money for not drinking. The subjects were late-stage gamma alcoholics, the most serious that Cohen could find. For every alcoholic, there was a priming dose that initiated a binge. However, for every binge-inducing priming dose, there was a monetary incentive that would bring the binge to a halt. Behaviorally-oriented clinicians tested whether these findings could be applied to addicts seeking treatment. The answer was not obvious. The experiments took place in environments that reduced the value of drug use (e.g. drug-using friends were absent), and the subjects knew that they could resume drug use when the experiment was over. Nevertheless, interventions that include contingencies have proven more effective than those that do not. In the clinic, vouchers for abstinence improve outcomes for addicts seeking help to quit cocaine (Higgins et al. 2000). In the workplace, drug-testing programs that carry the threat of job loss yield an 80 percent to 100 percent decrease in drug use (e.g. Coombs 1997; see Heyman 2009 for review of outcomes for workplace drug-testing programs). In the justice system, the Project HOPE contingency program reduced drug use in criminal offenders who were on parole by 72 percent (Hawken and Kleiman 2009).

10 Summary and discussion

10.1 Basic findings and puzzles

The empirical findings reviewed in this chapter fit neatly together. Individuals who meet the APA criteria for addiction remain voluntary drug users. The large majority cut back on drug use or quit altogether, and the factors that persuade them to do so are the determinants of choice. Modern, research-based choice theory predicts semi-stable suboptimal outcomes. Thus, it is possible to explain why addiction is self-destructive, yet significantly correlated with its consequences. Reframing addiction as the persistence of voluntary drug use has important implications for interventions, for social policy, for social relations with addicts, and for how addicts think about themselves. However, before briefly addressing some of these points, we need to mention possible misconceptions and puzzles that follow from the conclusion that addicts, the label notwithstanding, remain voluntary drug users.

1 Reframing addiction as a disorder of choice does not in itself reduce the immense and often overwhelming personal, societal, and financial costs associated with addiction. Rather, this perspective more properly restates the nature of the problem and in doing so promises more effective solutions.

2 The idea that addicts remain voluntary drug users yields an apparent paradox. By definition choice is behavior that is governed by its consequences, and addiction is self-destructive behavior whose costs outstrip its benefits on balance. If this were not the case, addiction would not be considered a disorder. Thus, if drug use does not become compulsive, addiction should not emerge or, if it does, it should persist but for a short while. Yet, addiction typically persists for years and, for some individuals, persists for a

lifetime, as shown in Figures 21.4 and 21.5. This apparent contradiction been discussed elsewhere (Heyman 2009). The resolution is that, on balance (globally), heavy drug use exacts more costs than benefits but, on a moment-to-moment basis (locally), just the opposite may be true when there are complex interdependencies between choices and consequences (Herrnstein and Prelec 1992). Thus, whether drug use produces beneficial or costly outcomes varies as a function of the manner in which choices are framed, and in many cases the local frame of reference prevails (Heyman 2009).

3 Why has the disease interpretation persisted if it is so out of step with the data on remission? This has been discussed elsewhere at some length (Heyman 2009). Here we will briefly discuss the issue as it relates to the understanding of remission.

Prior to the major epidemiological studies summarized by Figures 21.1, researchers almost always recruited subjects from clinics or hospitals, many of which doubled as treatment centers and prisons. These subjects differed from the representative community populations that inform the remission studies summarized in this chapter. The treatment addicts were typically unmarried males, with little education, poor work skills, poor social skills, and a criminal record (e.g. Duvall et al. 1963; Hunt and Odoroff 1962; Vaillant 1966). Clinic addicts were also more likely to suffer from additional psychiatric and medical ailments than addicts not in treatment (e.g. Regier et al. 1990). The typical result following treatment was relapse (e.g. Hunt et al. 1971). However, as shown in this chapter, when addicts are recruited independently of their treatment history, remission—not relapse—is most characteristic of addiction (and, as mentioned earlier, most addicts do not seek treatment).

11 What to do?

If addicts retain the capacity to make non-drug choices, then interventions should focus on ways to encourage non-drug choices. Examples of such programs already exist, as noted in section 9. However, it should be pointed out that these programs do not simply provide tangible advantages for abstinence, they also teach their clients to take better advantage of existing social relations, work, and community resources (Higgins et al. 2003). Put in terms of choice theory, choice-based treatment programs help individuals reframe their options globally. Figure 21.6 supports this point as well. It shows that years of school was correlated with lower levels of stimulant and opiate use, and that this correlation held for those who were most likely to use stimulants and opiates. Importantly, "school" included all sorts of training, including beautician school, computer programming, plumbing, and so on. Training that led to a career is what mattered, not a particular subject matter. The emphasis on choice does not rule out psychopharmacological approaches to addiction. For instance, methadone reduces the reward value of heroin. However, this approach is less direct and does not provide addicts with what they need most—higher valued non-drug choices.

11.1 Should insurance plans distinguish between addiction and diseases?

Addicts cause immense amounts of harm and, given the increasing interdependency that has accompanied technological change, these harms spread widely. For instance, under the Affordable Care Act and the Mental Health Parity and Addiction Equity Act, everyone is asked to pay the treatment costs for heroin addicts, alcoholics, and smokers. Yet the data presented in this chapter show that the natural history of addiction and diseases are quite different. Even chronic diseases that have important behavioral components, such as diabetes, differ markedly from addiction. As emphasized, no-one has ever quit diabetes "cold turkey." Thus, it is highly questionable whether it makes sense for publicly financed insurance plans to fail to distinguish between addiction and disease. The same line of reasoning suggests that individuals would make wiser, healthier choices if they directly bore both the negative and positive consequences of their behavior, rather than having the negative consequences differentially shared by others. These are difficult matters that may not have any good solutions. Indeed, it is easy to imagine that one of the reasons that the disease interpretation of addiction has persisted for so long is that it provides a convenient way to avoid difficult policy and moral questions. Finally, and related to this last point, should addiction remain in the *Diagnostic and Statistical Manual of Mental Disorders*? Its natural history is quite unlike that of the other psychiatric disorders. There is no other psychiatric disorder in the DSM whose frequency has varied so much as a function of social factors. For instance, the overall frequency of addiction varied about 15-fold for generations born before and after World War II (the advent of 1960's youth culture, see Figure 2.3, Heyman 2009), and no other disorder is as closely linked with interventions that stress faith and other nonmedical elements, such as Alcoholics Anonymous.

11.2 Catching up with what science says about addiction

Darwin and Wallace's compelling accounts of evolution by natural selection imply that voluntary behavior, like involuntary behavior, has a genetic basis and is mediated by the brain. Countless twentieth- and twenty-first-century studies and experiments reflect these important and irrefutable implications. The theory of natural selection and its empirical support should have precluded the argument that addiction is a disease because it has a biological basis. The epidemiological studies of the 1990s showed that addiction is not a chronic disorder, and their findings implied that the correlates of remission were the correlates of choice. Newer research continues to support the original epidemiological results. It is time for the discussion of addiction to take into account long-established understandings of the biology of voluntary behavior and well-established research on addiction. What we need now are policies that focus on the best way to reduce destructive yet voluntary drug use. Such policies may work best when the addict's capacity for positive change is given the credit it deserves.

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