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STUDIES

Understanding impulsivity scientifically: Some of the variables that affect the steepness of delay discounting and may affect suicide



Comprendre l'impulsivité scientifiquement : certaines variables qui influencent le « delay discounting » et potentiellement le suicide

P.M. Miller (Professor)

Salem State University, Psychology, 352 Lafayette Street, 01970 Salem, MA, United States

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Summary An important aspect of what is called impulsivity is making choices quickly. Often, when individuals choose an outcome that occurs earlier in time, they may at the same time be excluding a more valuable outcome that occurs somewhat later. Individuals who are overly impulsive often end up making choices that harm them in a variety of ways. This paper will first contrast two different ways of measuring impulsivity, one based on a model of impulsivity as a trait and the second based on a set of measures used in studies of what is called delay discounting. The study reviews research on delay discounting, summarizing evidence on how outcomes such as problematic substance use, gambling, and others are significantly related the tendency of individuals to choose an earlier but less valuable outcome. Because delay-discounting measures are more directly related to current behaviors, they may be better predictors than trait-based models. Implications of including such models in predictions of suicidal thoughts and behavior, and a few examples of research on that are discussed. While such research is still in its infancy, the few studies that exist suggest that this may be a productive addition to this area of research.

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E-mail address: patricemariemiller@comcast.net

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MOTS CLÉS

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Résumé Un aspect important de l'impulsivité consiste à faire des choix rapidement. Souvent, lorsque les individus choisissent l'option menant à un résultat qui se produit plus tôt, ils peuvent en même temps exclure un choix ayant un résultat plus profitable mais qui se produit un peu plus tard. Les personnes excessivement impulsives finissent souvent par faire des choix qui leur nuisent de diverses manières. Cet article va tout d'abord mettre en contraste deux manières différentes de mesurer l'impulsivité, l'une basée sur un modèle de l'impulsivité en tant qu'attribut et la seconde sur un ensemble de mesures utilisées dans les études sur ce que l'on appelle le « *delay discounting* » (délais de gratification). L'étude passe en revue les recherches sur le « *delay discounting* » et offre un sommaire des preuves démontrant la manière par laquelle les conséquences telles que la consommation problématique de substances, le jeu et autres problèmes sont significativement liés à la tendance des individus à choisir une option ayant un résultat plus rapide mais moins bénéfique. Comme les mesures de « *delay discounting* » sont plus directement liées aux comportements actuels, elles peuvent être de meilleurs indicateurs que les modèles basés sur les attributs. Les implications de l'inclusion de tels modèles dans les prévisions de pensées et de comportements suicidaires ainsi que quelques exemples de recherches sur ce sujet sont discutés. Bien que de telles recherches soient encore nouvelles, les quelques études existantes suggèrent qu'il pourrait s'agir d'une addition productive à ce domaine de recherche.

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Choosing an immediate or close-in-time outcome that is less valuable, instead of a more delayed but more valuable outcome is a major aspect of what we call impulsivity [1,2]. Behaving in an impulsive fashion has been shown to often result in negative outcomes. A well-known example is seen in the behavior of a young person who chooses to attend a party with friends on the night before a test, rather than spending the time studying. In this paper we will concentrate on a delay discounting account of impulsivity, describing important aspects of the delay-discounting model of impulsivity. After reviewing that information, we will discuss implications of using this model for predicting suicidal thoughts and behaviors.

Ethical considerations

When discussing the treatment and prevention of mental illness, as well as the possible consequences of mental illness, including suicide, it is important to begin with a discussion of ethical guidelines for clinicians and others. The discussion at this point will be a general one. Previous work on ethical guidelines concerning mental health treatment in general is voluminous. Here, we will touch on some approaches that specifically discuss the relationship of ethics to treating suicidal patients. Rosenbluth et al. [3] argued that, when dealing with suicidal patients, it is important to balance ethical principles, such as beneficence toward the patient or respect for patient autonomy with clinical issues. So, while maximizing beneficence would be important for many or most patients who are acutely suicidal, for other patients, particularly some who are resisting suicidal impulses, it may

be more helpful to work on increasing their sense of autonomy.

Kelly et al. [4] present an extensive discussion of ethical considerations related to suicide and suicide prevention, basing their arguments on philosophical as well as scientific work. In this paper, they also discuss the two ends of a possible continuum, which is that on the one hand all people should be prevented from committing suicide at all costs (the beneficence view), versus the idea that, given some conditions, people may be allowed to choose to kill themselves (autonomy). They make two points that are important to consider with respect to the current paper. One, is that a truly autonomous decision is only possible if the individual has the mental capacity to make such a decision. They then present considerable evidence that many individuals who attempt suicide have a higher likelihood of being "mentally ill, ambivalent, [or] making a cry for help, or a combination of all three." In conclusion, their view is that it is worth intervening due to factors such as these.

Different methodologies for measuring impulsivity

Two sets of literature with different methodologies have studied the relationship of impulsivity to negative outcomes. In one set of literature, impulsivity is most often measured as an inferred trait using self-report measures. Using this kind of methodology, for example, trait impulsivity has been related to various aspects of problematic substance use [5–7], as well as gambling disorders and bulimia nervosa [8]. Adolescent problem behavior has also been related to

their “future orientation”, a trait-related self-assessment also related to impulsivity [9].

Impulsivity measured as a trait has also been related by numerous investigators to suicidal thoughts and behavior. Mann et al. [10], for example, proposed a diathesis-stress model for suicidal behavior. In this proposed model, a stressor or stressors may exacerbate an already existing psychiatric disorder. The stressors included such factors as impulsivity, aggression, pessimism as well as family genetics and aspects of early experience. McGirr et al. [11] using psychological autopsies of a wide age range of individuals who died by suicide, found that impulsivity and aggression were particularly influential in predicting suicides among younger individuals. Turecki et al. [12] in a review of a number of studies relating impulsivity to suicidal risk concluded that impulsive-aggressive personality traits predict suicidal behaviors primarily in young people. At the same time, for some individuals, suicide risk is not associated with a history of impulsive-aggressive behaviors.

In general, traits are considered as being inherent or endogenous characteristics and also to be more long term in nature. As has also been discussed by others [11–13] such traits or characteristics are not, by themselves, very good predictors of suicide risk since the majority of people who are assessed as having such traits do not in fact even think about committing suicide.

It may be, therefore, that measures that are more directly related to current behavioral patterns may be better predictors. The second set of measures related to impulsivity are more directly related to behavioral patterns than to underlying traits. In this second set of literature, impulsivity is measured behaviorally using a set of related experimental paradigms or paper and pencil assessments. These situations either experimentally trade off different values delivered over differing amounts of time, or ask adolescent or adult people questions about obtaining different values at different times. In general, as suggested above, choosing the less valuable but closer in time outcome is considered as being more impulsive. In a very wide-ranging set of literature on humans, such impulsive choice making has been related to adolescent risk-taking [14], smoking and addiction to other drugs [15,16], gambling [17], among other primarily negative outcomes. This view of impulsivity can be considered as more situational. That is, how much someone behaves impulsively has been related to both the values of the consequences that are being delivered and also to the time frame in which they are delivered, among other factors. We will next discuss this in more detail.

What is “delay discounting” and how is it measured?

The main point of delay discounting is that immediate consequences and states dominate over future considerations of both outcomes and states. Speaking in slightly more technical terms, discounting is the process by which outcomes that are valued, such as reinforcement, lose their value or effectiveness as the valued event occurs further in time from a choice. In experimental situations, the delay is sometimes measured from the time of a choice to the delivery of a

consequence. The measure of delay in such a case can be called preferred value. In other situations [18–20] stimuli with different values are presented, and participants’ perceived values of these stimuli are obtained. These measures have been shown to produce equivalent results [18].

One important characteristic of discounting is that discounting functions that are graphed over a range of outcome values and across time tend to show a hyperbolic curve. This curve shows the tendency of reinforcement to lose its perceived or preferred value very quickly over short time periods, but more slowly over longer ones. A comparison of such a hyperbolic curve to an exponential curve shown in Fig. 1. As can be seen, the exponential curve descends rapidly, suggesting that the most rational response is to choose a more immediate valued consequence. The hyperbolic curve suggests that under certain circumstances individuals will choose more delayed outcomes. What circumstances lead to choosing consequences that are delivered later vary, but one important factor is how valuable that consequence is when compared to the immediately available consequence.

An example of one kind of procedure used with humans can be found in Rachlin et al. [21]. There are two reasons to present this study, which was one of the original ones, here. First, it is important for readers of this paper to consider the way that delay discounting may be assessed. Second, it is important to know that many current studies continue to use very similar procedures. In this study, they asked participants to consider a series of hypothetical choices, starting with the choice between receiving \$1000.00 now versus receiving \$1000.00 in a month. With that choice, participants would likely choose the immediate amount. The researchers then decreased the size of the immediate amount in predetermined increments until the participant reached a point at which they would switch to choosing the delayed outcome. Using this kind of procedure, plus several minor different variants of it, an increasing number of studies of delay discounting and its applications to human and animal behavior have been published in the last 20 to 30 years.

What is clear also from literature on hyperbolic discounting is that individuals’ own discounting curves will show variation in terms of how long that individual (as compared to others) will wait for a somewhat more valued consequence or simply choose the more immediate outcome. These individual differences are how “impulsivity” is captured using this methodology. This way of studying impulsivity seems particularly well suited to capturing trade-offs between shorter term, more rewarding behaviors and longer term behaviors that are less rewarding in the moment. This is shown next, in the results of a study of smokers versus non-smokers by Bickel et al. [15]. Both groups of participants were first asked to rate a hypothetical trade-off involving money (similar to the task described above). Would they prefer to receive \$1000.00 that was delayed, or would they prefer to receive a reduced amount of money that would be available immediately. Both the amounts for the lesser sum of money and the time delays that individuals would have to wait were varied. The smokers only were also asked how many cartons or partial cartons of cigarettes they would prefer without a delay versus how many they would prefer on a delayed basis. Their results, shown here in Fig. 2, show

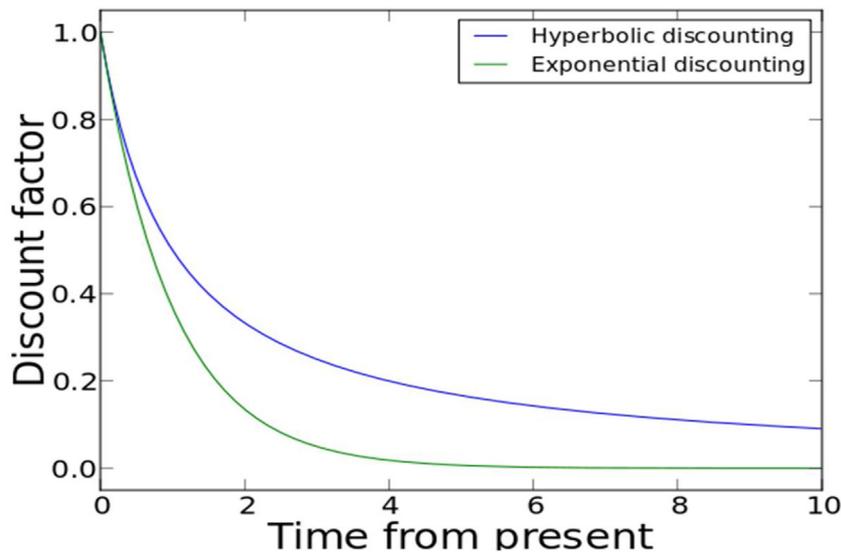


Figure 1. Comparison of hyperbolic (top) and exponential (bottom) discounting curves. Hyperbolic discounting curves show an initial rapid decrease in value, but as time increases value decreases more slowly.
Comparaison des courbes de discounting : hyperbolique (haut) et exponentielle (bas).

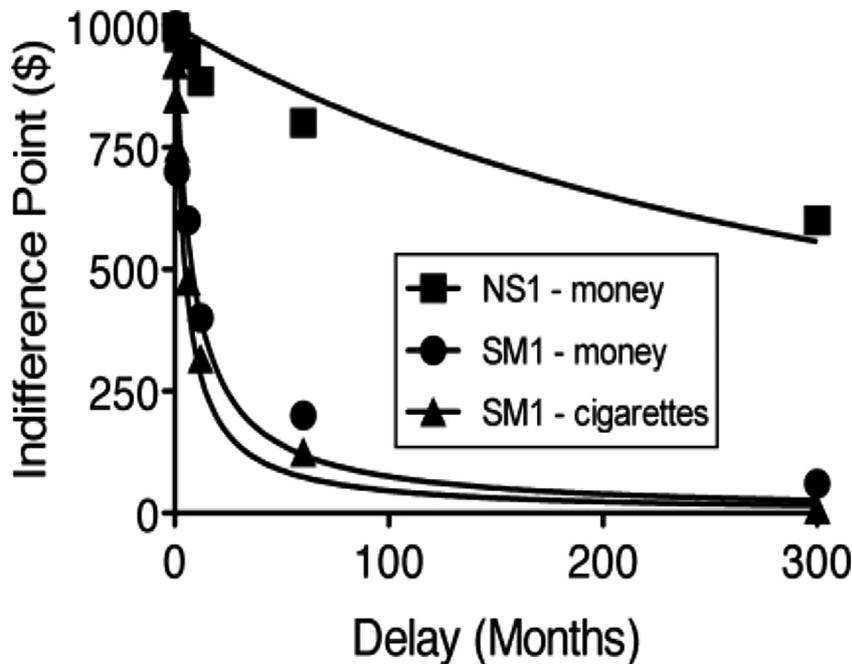


Figure 2. Indifference points as a function of delay. This figure shows indifference points as a function of delay for two individuals, one a nonsmoking participant (NS1) and the other a smoking participant (SM1) for hypothetical money (NS1 & SM1) and hypothetical cigarettes (SM1) [Figure reprinted from Bickel et al., 1999].
Les points d'indifférence en fonction du delay.

very typical delay discounting curves. The results are from only 2 participants, one a non-smoking participant (NS1) and one for a smoking participant (SM1). These results illustrate both individual differences between the two participants and group differences between smokers and non-smokers. There are three findings of this study. Two of them are shown in Fig. 2. The most striking finding is that not only did the smoking individual more steeply discount both cigarettes and money (as seen by the fact that the bottom two curves go down very much more quickly), but also it is important to

notice the extent of the difference. The smoking participant in this case showed a tendency to choose smaller amounts delivered sooner and also appeared to not be willing to wait, at all, for a more delayed outcome. The second finding shown in the figure is that the discounting of cigarettes is steeper than that of money for this individual smoker, although not greatly so. Not shown in the figure is the finding that current smokers in the study in general tended to discount monetary outcomes more than both those who never smoked and also more than ex-smokers. According to

Odum [2], these findings are similar across studies of many different substance use disorders.

Hyperbolic discounting is mathematically described using the formula shown next. Many of the studies that present discounting applications do not examine this formula in detail. Because there are some important implications of aspects of this formula, its different aspects will be discussed further here. The formula, shown next, is from Mazur [22]:

$$V = A / (1 + kD)$$

V measures of the value of the consequence, or the extent to which it is either preferred or perceived by the organism being studied. Clearly, as implied by the above equation, V will be determined by the terms on the right side of the equation. So, it is a function of: A , or the amount or importance of the delayed consequence, D , or the delay of this consequence, and k , which is a parameter that governs the rate or degree of discounting of the consequence. Relative to the discussion, above about individual differences, k , is the parameter that captures this.

This paper has already discussed the importance of the value of the consequence, explaining in general terms that this value is based on its perceived amount relative to other consequences, and of its delay relative to other consequences. In the next section, we will discuss k , and why it is important to consider.

The importance of k in accounting for discounting difference

A recent summary of a large number of delay discounting studies has made the point that what is being valued and discounted makes a difference in the value of k [2]. Larger values of k mean more rapid discounting. More rapid discounting means making choices for the more immediate consequence rather than the one that is more delayed. That means that k is directly related to impulsivity, as defined here.

While k is generally referred to in the field as a parameter, we have proposed [20] that it will be more productive for the field if we consider that the value of k is actually a function of a number of variables, or to put that symbolically, $k = f(x_1, x_2 \dots x_k)$. Doing so will allow for a more systematic account of a number of the variables that will affect how rapidly organisms discount. We will briefly discuss a few examples of some of the possible variables that effect discounting rate, or k , next.

First, drive variables have been shown to effect k to a large extent. This is true in two ways: (a) how strong is the drive itself; and (b) how long does it take the drive to satiate. For example, one drive that is very strong is the need to inhale oxygen and expel carbon dioxide through breathing. People may normally only be able to hold their breath for about a minute. On the other hand, one can live without drinking water for perhaps 2 days, and without eating for three weeks to a month. Another way that drives influence discounting is that they satiate at different rates. Injecting a drug, such as morphine, the drug may take effect in just a

few seconds. It takes about 20 minutes for eating to satiate the hunger drive. Clearly, any consequence that is related to a very strong drive or to a drive that satiates very quickly will lead to more rapid discounting.

A second factor that affects the value of k is the degree of psychopathology of an individual. For example, Moody et al. [23] examined individuals with Anti-social Personality Disorder and Major Depressive Disorder. They also examined the effect of co-occurring Substance Use Disorder (SUD); this subgroup of individuals was documented as currently in treatment for SUD and abstaining from substance use. They found that all their groups had steeper discounting curves than did control individuals, however the only group that showed significantly steeper discounting than the SUD alone group was the group with SUD, Antisocial Personality and Major Depressive Disorders. While the authors note characteristics of this sample, particularly that they were primarily in treatment, that make it different from other samples (and likely lessened any effects), they also argue that the increased delay discounting seen is an important factor that may lessen the effectiveness of treatment over the long term. Other studies have also shown that Major Depressive Disorder by itself is associated with an increase in the steepness of delay discounting [24].

Other forms of psychopathology, for example, Attention Deficit and Hyperactivity Disorder (ADHD) have also been associated with both steeper delay discounting curves, higher k values, and increased numbers of poor choices, specifically in the financial arena [25], but also in other areas of life as well [26].

Another factor that affects impulsivity and therefore is likely to affect the value of k , is *stage of performance*. Here, *stage* is the name given to reliable differences in performance between individuals that are based on the difficulty of the tasks being addressed. Difficulty is defined by an equally-spaced unidimensional ordinal scale called the Order of Hierarchical Complexity [27–31]. These stage differences account for differences in performance across development in humans (e.g. from childhood through adulthood). The fact that different species of animals also successfully complete tasks that vary in difficulty means that their behaviors can also be characterized in terms of stage [32].

A fundamental assumption is that development proceeds across a large number of general sequences of behavior. These sequences exist in every domain and vary from being relatively simple to being relatively complex. A task that is of a higher Order of Complexity:

- is defined in terms of task actions from the next adjacent and lower Order of Hierarchical Complexity;
- organizes two or more adjacent less hierarchically complex actions;
- and is carried out in a non-arbitrary way.

The Orders of Complexity are shown in Table 1. Note that stage names and numbers correspond to the Order names and numbers. This model has been shown to explain differences in the difficulty of task completion within a species and across age in humans (as seen in the above-cited research, and also Giri et al. [33]). Note that behavioral stage is roughly related to age but is slightly different. It is a function of $\text{Log}_2 \text{Age}$ [33]. Stage is a preferable measure

Table 1 The Orders of Complexity.
Les ordres de complexité.

Order #	Order name	Order #	Order name
0	Computational	9	Concrete
1	Automatic	10	Abstract
2	Sensory or motor	11	Formal
3	Circular sensory motor	12	Systematic
4	Sensory-motor	13	Metasystematic
5	Nominal	14	Paradigmatic
6	Sentential	15	Crossparadigmatic
7	Preoperational	16	Meta-crossparadigmatic
8	Primary	17	Ultra meta-crossparadigmatic

Note that when an individual completes a task at a particular order of complexity they are said to be at the stage with the same name and number.

to age since due to a variety of factors, there will be variability of stages within an age group, and this variability will increase as ages increase. Age is in effect a “proxy” variable that only roughly reflects stage, and thus using stage to make predictions instead of age will result in better predictions.

One example of how age and/or behavioral-developmental stage operate can be seen in the well-known marshmallow task [34]. In the shift from the Sentential Stage 6 (often seen around age 3) to the Preoperational Stage 7 (starting around age 4), a child goes from choosing one marshmallow immediately, to waiting for two marshmallows to be delivered 5 minutes later. At the Sentential Stage 6, the child thinks about only one single sequence, as represented by a single sentence, “I want a marshmallow.” At the Preoperational Stage 7, two sentences are strung together so that the child’s thinking more often is, “If I choose now I get one marshmallow. If I wait and go without for a few minutes, I get two marshmallows.” In some videos of this situation, you can literally see children talk to themselves or hold themselves to stop from acting.

It is expected that the stage of an individual will be related to the steepness of their delay discounting curve, with older individuals showing less steep discounting. This prediction follows directly from everyone’s common knowledge that children are more impulsive than adolescents and adolescents are more impulsive than adults. Other measures of “smarts” also have been associated with size of delay-discounting and have shown this effect [35].

Another possible application of notions of delay discounting: suicidal behavior

In sum, when individuals have a steeper discounting curve, for whatever reason, they are making a decision more quickly. Since such decisions have been shown to be more characteristic of those who are younger, of those who have been identified as having a form of psychopathology, or of those who are addicts (to name a few conditions), we would conclude that these are all situations in which those individuals would be characterized as showing diminished mental capacity, in the terms discussed by Kelly et al. [4].

It is for this reason that suicidal thought and behavior may also be discussed in the context of delay discounting, suicide seems to be a situation in which an individual plans to take an action that is perceived as reducing immediate pain and suffering while at the same time avoiding a continuation of potentially worse or at least continuing pain in the longer term. It has a similar short term-long term trade-off as do other delay discounting situations that have been studied. People who are suicidal, or particularly those who attempt suicide, may be said from the point of view of this framework to have very steep discounting curves, similar to or even steeper than seen, for example, in cigarette smokers or other addicts.

This suggestion comes in the midst of what appears to be a crisis occurring in research that attempts to predict Suicidal Thoughts and Behaviors (STBs). Most notably, a recent meta-analysis of 50 years of research on risk factors for suicidal thoughts and behaviors [13] found that using current risk factors, prediction of STB’s was only slightly above chance level and has not improved over time. They stress that this does NOT mean that traditionally used “warning signs for STB’s” are not useful and should not be used to intervene when observed. Warning signs, which happen much closer in time to STB’s than most risk factors studied, include behaviors such as talking about killing oneself, feelings of hopelessness or being trapped, showing dramatic changes in mood, withdrawing from friends and family, to name just a few (see Rudd et al. [36] for an in-depth discussion of warning signs). As Franklin et al. [13] make clear most existing studies of risk factors have been more likely to examine the effects of one or just a few trait-like factors over relatively long periods of time (at least a year) rather than attempting to study STB’s in situations in which multiple risk factors, both longer term ones (such as existing depression) and shorter term ones (e.g. a recent loss) are examined together.

A study by Glenn et al. [37] looks in detail at some of the short term factors associated with STBs. In particular, they review literature that shows that only a small minority of individuals who at some point think about committing suicide actually go on to attempt it. According to Nock, et al. [38] 9.2% of adults have at one time seriously considered committing suicide. Of those, only 2.7% carried through

with a suicide attempt. According to Glenn and Nock, it is crucial to understand who are the individuals who progress from thinking about suicide, or even making a plan, to actually attempting suicide. Recently, Millner et al. [39] studied 30 patients who had made suicide attempts in the previous two weeks, making some progress toward answering that question. The key finding here is that while suicidal ideation often occurred years before an attempt, the time frame for the last few steps before the attempt was often very short, for most within the 12 hours before the attempt. In particular, 60% of their participants decided to actually carry out the attempt within the 5 minutes before it happened.

This recent literature suggests that examining the ideas behind delay discounting research and their relationship to STBs may make a useful contribution. A few studies have already directly examined this relationship. The results so far do not always show a consistent relationship. Bridge et al. [40] examined the extent to which adolescents' performance on a delay discounting task, along with their tendency to score highly on a scale of impulsive aggression was related to whether or not an adolescent had made a suicide attempt. They were not able to confirm such a relationship, although this may have been because their suicide attempter group and their non-suicidal group were not significantly different on either the measures of steepness of delay discounting or of impulsive aggression. Nevertheless, some other studies have found such a relationship. Dougherty et al. [41] compared adolescents who had engaged in non-suicidal self-injuries, but had not attempted suicide, and those who had engaged in both non-suicidal self-injuries and had attempted suicide. They found that this second group was not only more depressed and felt more hopeless, they also had higher self-ratings of trait impulsivity and they performed more impulsively on laboratory tests of delay discounting.

In work with adults, Liu et al. [42] compared two groups of substance using individuals on a standard delay discounting task. The group that had no suicide attempts showed a relatively typical pattern of response, preferring larger rewards that were delayed over smaller rewards delivered sooner. The group that had one or more suicide attempts showed little differentiation in their responding in the delay discounting task. This may reflect an impaired sensitivity to future rewards in substance using suicide attempters, according to the authors.

Finally, in a study with older depressed individuals (60 years old and older), Dombrovski et al. [43] compared the delay discounting responses of individuals who made suicide attempts that were either of low lethality or of high lethality. The study also included a group that had seriously contemplated suicide but had not made an attempt, a group that had no history of suicidal thoughts, and a group of non-depressed controls. In this study, a majority of those who had engaged in high lethality suicide attempts also showed a high degree of planning before their suicide attempt. It was these individuals in particular who were more likely to wait for future rewards. That is, they did not show steep discounting curves. Those who made low lethality suicide attempts, on the other hand, showed the strongest preference for immediate rewards.

Discussion and conclusions

In summary, research on delay discounting and suicide does not by itself solve the issue of how to better predict whether someone will attempt suicide. While there are not many studies of this issue as of yet, and (often of necessity) subject populations are small, delay discounting appears to be steeper in those who attempt suicide, but primarily in those who are younger when they make the attempt. More research is necessary before we can begin to understand the role that factors such as delay discounting may play.

There are likely at least two reasons why it continues to be difficult to predict suicidal thoughts and behaviors. One, already discussed, is that few of the studies have examined the kinds of factors that are present in the usually short period of time before someone actually makes an attempt (as also suggested by the work of Glenn et al. [37]). A second reason is that suicide is not one thing. Attempting suicide as an adolescent is very different from attempting it as someone who is elderly and perhaps infirm. In short, there are different kinds of suicide. Because of this, suicide should be seen as an outcome and not as a single behavior. Different outcomes will be associated with different predictors.

Nevertheless, and following the discussion of ethics by Kelly et al. [4], it would be worthwhile to examine the factors that would change k , or the steepness of discounting. There are some interesting studies that are working on this issue. For example, Brombert et al. [44] used an Episodic Future Thinking intervention to reduce impulsive behavior in healthy adolescents. This intervention consisted of asking individuals to report future events that they expected to take place at varying amounts of time in the future (including events within the next 2 to 4 weeks, and up to 5 to 7 months ahead). For each event, participants were also asked to rate each event in terms of its personal relevance, valence (positive or negative), and arousal on a 6-point scale. They then paired what they called the episodic tags (for example, my uncle is visiting in 5 to 7 months) with delays in a delay discounting procedure. They found that choice behavior was less impulsive when it was paired with these tags. According to these authors, this replicates research done with a variety of other ages in delay discounting situations. Furthermore, a number of studies have found that such interventions are useful in treating addictions and other conditions [45]. One result of this kind of Episodic Future Thinking is to increase the allocation of individuals' attention to the delayed events, relative to what it had been initially [46].

Essentially, what these studies are doing by decreasing the steepness of the discounting curve is to manipulate k . It is important for the field in general to begin to understand and better systematize the various factors that will increase or decrease k , and thereby result in discounting curves that are less steep. These techniques, especially the one used in the Episodic Future Thinking study with the adolescents, seemed to connect these individuals back to other individuals and to important events in their lives, something that individuals who are suicidal may feel particularly disconnected from. Reconnecting individuals in this way may be particularly important for those who are contemplating suicide.

A second kind of intervention stems from taking a public health/ethics perspective on suicidality, and particularly one that emphasizes cultural and social factors that contribute to suicide rates [47]. As Fitzpatrick describes, conditions such as unemployment, trauma, poverty, inequality and social isolation, among others, tend to increase the risk of suicide. Clearly, making social and cultural changes so that many fewer individuals suffer from such stressors would be important. We would add that one thing that happens to individuals who are forced to exist in the kinds of situations discussed by Fitzpatrick and other researchers in public health is that these situations force people to focus on existing in the present, rather than thinking about possibilities in the future. To the extent that this is true, then such social and cultural factors are likely to have an impact on the tendency to engage in delay discounting as well. Reintegrating such individuals into the larger community, and making the responsibility for suicide somewhat more societal as well may therefore be another important intervention for a number of reasons.

Finally, it is important to mention that some individuals who make suicide attempts are clearly aware of the possible longer term consequences (as shown in the Dombrovski et al. [43] study). These individuals did not show steep discounting curves, but they seemed to be making a decision that in any case, the earlier consequence is simply worth more to them. Intervention with such individuals may take a different form. This may be similar to what is seen in situations of assisted suicide, in which individuals are given time and support to explore their various options before going forward with a decision.

Disclosure of interest

The author declares that she has no competing interest.

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