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The functions of deliberate self-injury: A review of the evidence

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Abstract

Deliberate self-injury is defined as the intentional, direct injuring of body tissue without suicidal intent. The present article reviews the empirical research on the functions of self-injury. This literature includes self-reports of reasons for self-injuring, descriptions of the phenomenology of self-injury, and laboratory studies examining the effects of self-injury proxies on affect and physiological arousal. Results from 18 studies provide converging evidence for an affect-regulation function. Research indicates that: (a) acute negative affect precedes self-injury, (b) decreased negative affect and relief are present after self-injury, (c) self-injury is most often performed with intent to alleviate negative affect, and (d) negative affect and arousal are reduced by the performance of self-injury proxies in laboratory settings. Studies also provide strong support for a self-punishment function, and modest evidence for anti-dissociation, interpersonal-influence, anti-suicide, sensation-seeking, and interpersonal boundaries functions. The conceptual and empirical relationships among the different functions remain unclear. Future research should address the measurement, co-variation, clinical correlates, and treatment implications of different functions.
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Keywords: Self-injury; Self-injurious behavior; Deliberate self-harm; Suicidal behavior; Self-mutilative behavior; Reinforcement; Phenomenology

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1. Introduction

Deliberate self-injury (to be referred to as *self-injury* for the remainder of the paper) can be defined as the intentional and direct injuring of one's body tissue without suicidal intent (Herpertz, 1995; Muehlenkamp, 2005). Other names have also been used to refer to this behavior, including *moderate self-mutilation* by Favazza and Rosenthal (1993), *deliberate self-harm* by Pattison and Kahan (1983), *self-wounding* by Tantam and Whittaker (1992), and *parasuicide* by Ogundipe (1999). Self-injury is differentiated from stereotypic self-injurious behaviors seen in individuals with mental retardation, and from severe forms of self-mutilation such as limb amputation seen in psychotic individuals. Skin-cutting appears to be the most common type of self-injury, but other forms include burning, scratching, banging or hitting body parts, and interfering with wound healing (Briere & Gil, 1998; Favazza & Conterio, 1989; Herpertz, 1995; Langbehn & Pfohl, 1993).

The phenomenon of self-injury has concerned mental health professionals for decades. In their seminal paper, Graff and Mallin (1967) recognized self-injury as a mainstream psychiatric problem, stating that "[nonsuicidal] wrist-slashers have become the new chronic patients in mental hospitals, replacing the schizophrenics" (p. 36). Efforts to characterize the scope and nature of the problem increased in the 1970s (Carr, 1977; Lester, 1972), and by the early 1980s some were calling for self-injury to comprise its own diagnostic entity (Pattison & Kahan, 1983).

Research on self-injury has increased in recent years, and much is now known about the prevalence and risk factors for self-injury in various populations (Skegg, 2005; Gratz, 2003). However, we continue to lack a sufficient understanding of the functions of self-injury. This understanding would inform treatment, and provide a meaningful context for research on the etiology, classification, prevention, and treatment of self-injury. The goal of the present paper is to consolidate and advance knowledge about the functions of self-injury. Towards this end, I first summarize the research on the psychosocial characteristics, descriptive psychopathology, and treatment of self-injury. I then present a detailed review of the empirical literature on the functions of self-injury. I conclude by describing research endeavors that would further clarify the functions of self-injury and their implications for clinical practice.

2. Psychosocial characteristics, descriptive psychopathology, and treatment

According to the psychiatric nosology (APA, 2000), self-injury is a symptom of borderline personality disorder. Although research has documented a strong relationship between self-injury and this disorder (Klonsky, Oltmanns, & Turkheimer, 2003; Simeon et al., 1992; Stanley, Gameroff, Michalsen, & Mann, 2001; van der Kolk, Perry, & Herman, 1991; Zlotnick, Mattia, & Zimmerman, 1999), patients with other diagnoses may also self-injure, including those with major depression, anxiety disorders, substance abuse, eating disorders, posttraumatic stress disorder, schizophrenia, and several personality disorders (Haw, Hawton, Houston, & Townsend, 2001; Herpertz, Sass, & Favazza, 1997; Klonsky et al., 2003; Zlotnick et al., 1999). Self-injury occurs in non-clinical populations as well. Studies have reported a history of self-injury in 4% of the United States population (Briere & Gil, 1998), 4% of military recruits (Klonsky et al., 2003), and 14% or more of college students (Favazza, DeRosear, & Conterio, 1989; Gratz, 2001; Whitlock, Eckenrode, & Silverman, 2006). Some studies have found that more women than men self-injure (e.g., Zlotnick et al., 1999), whereas others have not found gender differences (e.g., Briere & Gil, 1998; Stanley et al., 2001). Several studies have reported an inverse correlation between *lifetime* rate of self-injury and participants' age (Briere & Gil, 1998;

Soloff, Lis, Kelly, Cornelius, & Ulrich, 1994; Zlotnick et al., 1999), suggesting that self-injury has become more common in recent years.

Self-injury usually first appears between ages 14 and 24 (Favazza & Conterio, 1989; Herpertz, 1995). Research suggests that the most common form of self-injury is skin-cutting, occurring in between 70 and 97% of individuals who self-injure, followed by banging or hitting (21%–44%) and burning (15%–35%) (Briere & Gil, 1998; Favazza and Conterio; Herpertz; Langbehn & Pfohl, 1993; Nijman et al., 1999; Wilkins & Coid, 1991). Many individuals who self-injure use more than one method (Favazza and Conterio; Gratz, 2001; Herpertz). Estimates for the average number of lifetime instances of self-injury are variable, ranging from 3.4 (Soloff et al., 1994) to 50 (Favazza and Conterio).

Treating patients who self-injure presents a number of challenges for therapists. Self-injury may cause psychological distress to the patient and his or her loved ones, and can result in physical damage that requires medical treatment or even leads to death. In addition, patients who self-injure may be hospitalized against their will, even though some mental professionals fear this intervention may damage the therapeutic relationship and may not be helpful for these patients (Huband & Tantam, 1999).

Research on Dialectical Behavior Therapy (DBT) for patients who self-injure has been encouraging. DBT is an intensive treatment involving individual and group modalities developed by Marsha Linehan (1993). When compared to treatment as usual in the community, DBT appears to produce better improvements in frequency of self-injury, hospitalizations, and many other outcome variables (Linehan, 2000; Robins & Chapman, 2004). However, few studies have compared DBT to more rigorous control conditions involving manualized treatments or treatment by experts (Robins & Chapman, 2004; but see Linehan et al., 2006), and many patients treated with DBT continue to self-injure even if less frequently. Understanding the functions of self-injury, or in other words, the variables that motivate and reinforce the behavior, could greatly improve prevention and treatment.

3. Empirical research on the functions of self-injury

The primary aim of this article is to review the empirical research on the functions of self-injury. Below I describe the inclusion criteria, functional theories examined, methods utilized to examine functions, and findings from the empirical literature.

3.1. Inclusion criteria

Studies reporting data that directly address the functions of self-injury (i.e., motivating and reinforcing variables) were included in the present review. Examples include studies that assess motivations or reasons for self-injury, as well as studies that examine variables temporally associated with self-injury, such as affect-states or events that precede, accompany, or follow self-injury, and which may be conceptualized as providing motivation or reinforcement. Studies on psychosocial and clinical correlates of self-injury are summarized at the beginning of this article and are not included in the empirical review of self-injury functions. In addition, studies that analyze behaviors without ruling out suicidal intent were excluded. Literature searches and examinations of the references sections of relevant papers yielded 18 empirical studies on the functions of self-injury that met the inclusion criteria.

3.2. Functions examined

Aggregating results on the functions of self-injury is a difficult task because different studies examined different functions and used different terms and items to reference and define these functions. On the basis of a close reading of the empirical literature, I identified seven functions that were repeatedly examined. These functions are listed and described in Table 1. I attempted to use labels and descriptions for these seven functions that accurately reflect how they have been described and operationally defined in the empirical literature, although I acknowledge there may be additional ways to organize, define, and label the functions that have been studied. I refer to the seven functions as affect-regulation, anti-dissociation, anti-suicide, interpersonal boundaries, interpersonal-influence, self-punishment, and sensation-seeking. The central theme of each model is presented below. It is important to note that these functional models are not mutually exclusive since different functions may co-occur and overlap conceptually.

Table 1
Functions of deliberate self-injury examined in the empirical literature

Function	Description of function
Affect-regulation	To alleviate acute negative affect or aversive affective arousal
Anti-dissociation [a]	To end the experience of depersonalization or dissociation
Anti-suicide	To replace, compromise with, or avoid the impulse to commit suicide
Interpersonal boundaries	To assert one's autonomy or a distinction between self and other
Interpersonal-influence	To seek help from or manipulate others
Self-punishment	To derogate or express anger towards oneself
Sensation-seeking	To generate exhilaration or excitement

[a] "Feeling generation" is another term for the anti-dissociation model of self-injury. When individuals dissociate they may feel unreal, outside their body, or nothing. The physical sensations produced by self-injury may help individuals feel something and thus end episodes of dissociation, depersonalization, or derealization.

The *affect-regulation* model of self-injury[1] suggests that self-injury is a strategy to alleviate acute negative affect or affective arousal (Favazza, 1992; Gratz, 2003; Haines, Williams, Brain, & Wilson, 1995). Linehan (1993) theorizes that early invalidating environments may teach poor strategies for coping with emotional distress. Individuals from these environments and/or with biological dispositions for emotional instability are less able to manage their affect and are therefore prone to use self-injury as a maladaptive affect-regulation strategy. How self-injuring may diminish negative affect is unknown, although both psychological (Brown, Comtois, & Linehan, 2002; Suyemoto, 1998) and biological (Russ, Roth, Kakuma, Harrison, & Hull, 1994) mechanisms have been proposed.

The *anti-dissociation* model characterizes self-injury as a response to periods of dissociation or depersonalization. Gunderson (1984) suggests that individuals who self-injure experience prolonged dissociative episodes when loved ones are absent. Episodes of dissociation or depersonalization may also occur as a result of the intense emotions that self-injurers feel. Causing physical injury to oneself may shock the system – perhaps through the sight of blood (Simpson, 1975) or the physical sensation (Gunderson, 1984) – and thereby interrupt a dissociative episode, and lead one to regain a sense of self. *Feeling generation* is another term used to characterize this function. Individuals who dissociate may describe feeling unreal or nothing at all, and self-injury may be a way to generate emotional and physical sensations that allow individuals to feel real or alive again.

The *anti-suicide* model views self-injury as a coping mechanism for resisting urges to attempt suicide. From this perspective, self-injury may be thought of as a means of expressing suicidal thoughts without risking death, and serves as a replacement for or compromise with the desire to commit suicide (Suyemoto, 1998). For example, Himber (1994) described a patient who felt she became suicidal after long periods of time without cutting, and that cutting prevented suicidal ideation.

The *interpersonal-influence* model stipulates that self-injury is used to influence or manipulate people in the self-injurer's environment (Chowanec, Josephson, Coleman, & Davis, 1991; Podovall, 1969). Self-injury is conceptualized as a cry for help, a means of avoiding abandonment, or an attempt to be taken more seriously or otherwise effect people's behavior (Allen, 1995). For example, an individual might self-injure to elicit affection from a significant other or loved one, or to elicit reinforcing responses from authority figures or peers in correctional, clinical, or school settings. One who self-injures for these reasons may or may not be aware of the reinforcement provided by others' reactions to the self-injury.

The *interpersonal boundaries* model holds that self-injury is a way to affirm the boundaries of the self (Carroll, Schaffer, Spensley, & Abramowitz, 1980; Podovall, 1969; Suyemoto, 1998). Proponents of this model tend to draw upon object-relations theory. Self-injurers are thought to lack a normal sense of self due to insecure maternal attachments and a subsequent inability to individuate from the mother (Friedman, Glasser, Laufer, Laufer, & Wohl, 1972). Marking the skin, which separates individuals from the environment and other people, is thought to affirm a distinction between oneself and others, and assert one's identity or autonomy.

The *self-punishment* model suggests that self-injury is an expression of anger or derogation towards oneself. Linehan (1993) hypothesizes that self-injurers have learned from their environments to punish or invalidate

[1] Terms such as affect-regulation, emotion regulation, and mood regulation are used by different psychologists in different ways. These concepts have become popular and efforts to reach consensus about terminology and definitions are ongoing (e.g., Larsen, 2000); discussion of this larger issue is beyond the scope of this paper.

themselves. Many have reported that self-directed anger and self-derogation are prominent characteristics of those who self-injure (Bennun, 1983; Herpertz et al., 1997; Klonsky et al., 2003; Soloff et al., 1994). Self-injury may therefore be experienced as familiar and ego-syntonic, and become a way of self-soothing when faced with emotional distress.

The *sensation-seeking* model regards self-injury as a means for generating excitement or exhilaration in a manner similar to sky-diving or bungee jumping. This model has received less attention in the theoretical literature, perhaps because it is not readily apparent in clinical populations. Nevertheless, this function has been examined repeatedly in the empirical literature (Nixon, Cloutier, & Aggarwal, 2002; Osuch, Noll, & Putnam, 1999; Shearer, 1994).

3.3. Methodological considerations

Three methodological approaches have been used to examine the functions described above: self-report of reasons for self-injuring, self-report of phenomenology, and laboratory studies. Self-report of reasons refers to studies in which self-injurers indicate their reasons or motivations for self-injuring. For the purposes of the present review, the terms motivations and reasons are used interchangeably and no conceptual distinction is made between them. In these studies, participants are asked to identify their reasons for self-injuring from a list of potential reasons, or in some cases report their reasons in response to open-ended questions. While participants' opinions about their motivations for self-injury can offer valuable insight into its functions, this approach has important limitations. Verbal reports of mental processes are often invalid (Nisbett & Wilson, 1977). Self-injurers may not know why they self-injure or have difficulty verbalizing reasons and offer explanations that are not accurate. Others may fabricate explanations if they are embarrassed by their true reasons.

Self-report of phenomenology refers to studies that ask participants about the experience of self-injuring. Participants may be asked to describe emotions or events that precede, accompany, or follow a self-injury episode. Answers to these questions can help illuminate the variables that prompt and reinforce self-injury. This approach has the advantage of reducing demand characteristics because participants are not overtly asked to give reasons for, or justify, a socially unacceptable behavior. Participants may therefore be less likely to withhold, alter, or fabricate information. Nevertheless, self-reports of phenomenology, like self-reports of reasons, are limited by people's tendency to misunderstand or mischaracterize their mental processes (Nisbett & Wilson, 1977).

Laboratory studies offer an alternative to self-report designs. These studies assess the effects of proxies for self-injury and have been used to evaluate the affect-regulation function. For example, self-injurers are asked to visualize cutting or to perform a painful task while affect and affective arousal are assessed with self-report and physiological measures. Demonstrating decreases in negative affect and arousal when participants perform a self-injury proxy, but not control tasks, would provide evidence that self-injuring reduces negative affect. Laboratory studies are not susceptible to the same limitations as traditional self-report studies. In these studies, self-report of affect-states is immediate rather than retrospective, and there is the opportunity to use physiological measures of affective arousal such as skin conductance and heart rate that are less susceptible to conscious manipulation. An important limitation of this approach is that proxies for self-injury may have poor external validity. Practical and ethical issues preclude the laboratory study of actual self-injury. In addition, laboratory paradigms are not well suited for investigating some functions.

Table 2 summarizes the methods and findings of the 18 studies on the functions of self-injury included in the present review. Each study used either one or two of the three methods described above. Nine used only self-report of reasons, four only self-report of phenomenology, two used self-report of reasons and phenomenology, and three were laboratory studies of proxies for self-injury. Discussion of these studies will be organized by methodological approach.

3.4. Findings from studies examining self-reports of reasons

Eleven studies examined self-reported reasons for self-injury (see Table 2). In all 11 studies, reasons suggesting an affect-regulation function were heavily endorsed. For example, in a sample of 75 women with borderline personality disorder, 96% of participants endorsed reasons indicative of emotion relief such as "to stop bad feelings" and "to relieve anxiety or terror" (Brown et al., 2002). Similarly, in another a study of women with borderline personality disorder, the reason "to reduce anxiety and despair that I feel I can't otherwise control" received the second highest mean rating among 17 possible reasons (Shearer, 1994).

Table 2
Methods and results from 18 empirical studies on the functions of deliberate self-injury

Study	*n* of self-injurers	Average age	% Female	Sample type [a]	Methods [b]	Functions studied and supported [c]
Briere and Gil (1998)	93	35	96	In- and outpatient	R, P	AD, **AR**, IB, II, **SP**
Brain et al. (1998)	35	Not given	57	Outpatient	L	**AR**
Brown et al. (2002)	75	30	100	Outpatient BPD	R	**AD**, **AR**, **II**, **SP**
Coid (1993)	67	29	100	Forensic BPD	P	**AR**
Favazza and Conterio (1989)	240	28	100	Non-clinical	R	**AD**, **AR**, SP
Haines et al. (1995)	15	21	0	Forensic	L	**AR**
Herpertz (1995)	54	27	87	Inpatient	R	AD, **AR**, II, SP
Jones et al. (1979)	39	18–20	56	General and psychiatric hospital	P	**AR**, II
Kemperman et al. (1997)	38	30	100	Inpatient BPD	P	AD, **AR**
Kumar et al. (2004)	50	15	62	Inpatients	R	**AR**, SP, II, SS
Nixon et al. (2002)	42	16	86	In- and outpatient	R	**AR**, AS, II, **SP**, SS
Laye-Gindhu and Schonert-Reichl (2005)	64	15	75	Non-clinical	R,P	AD, **AR**, AS, II, **SP**, SS
Nock and Prinstein (2004)	108	15	70	Inpatient	R	AD, **AR**, II, SP
Osuch et al. (1999)	75	37	85	Inpatient	R	**AR**, SP, II, SS
Penn et al. (2003)	23	16	28	Forensic	R	**AD**, **AR**, **SP**
Russ et al. (1992)	22	24	100	Inpatient BPD	L	**AR**
Shearer (1994)	41	Not given	100	Inpatient BPD	R	AD, **AR**, AS, IB, II, **SP**, SS
Wilkins and Coid (1991)	74	25	100	Forensic	P	**AR**, AD

[a] BPD indicates that all participants had been diagnosed with borderline personality disorder.
[b] This column indicates the methods used to study functions. R = self-report of reasons; P = self-report of phenomenology; L = laboratory study of a proxy for self-injury.
[c] AR = affect-regulation, AD = anti-dissociation, AS = anti-suicide, IB = interpersonal boundaries, II = interpersonal-influence, SP = self-punishment, and SS = sensation-seeking. The presence of an abbreviation for a function indicates that the function was examined by a particular study. If a function received strong empirical support in a particular study (e.g., that items relevant to a particular function were endorsed by more than half the sample or more often than items related to other functions), its abbreviation is underlined and bolded. If a function received modest empirical support in a particular study (e.g., items relevant to a particular function were endorsed by between 5 and 49% of the sample, or that it is possible but not certain that the items endorsed support a particular function), its abbreviation is underlined. If a function was examined but not supported by a particular study, its abbreviation is neither underlined nor bolded.

Reasons consistent with an affect-regulation function are also prominent in non-borderline samples. Seventy-six percent of a heterogeneous group of psychiatric inpatients selected "tension release" as a reason for self-injury, the only reason endorsed by the majority of the sample (Herpertz, 1995). In another inpatient sample, reasons related to affect-regulation (e.g., "to decrease feelings of rage") received substantially higher ratings than reasons related to other functions (Osuch et al., 1999). Likewise, in a mixed sample of psychiatric inpatient and outpatient self-injurers, 80% endorsed the reason "distraction from painful feelings," 77% "manage stress," 77% "release pent-up feelings," and 75% "reduction of tension" (Briere & Gil, 1998). In the only study of self-injury reasons in a non-clinical adult sample, the three reasons identified most often were all related to affect-regulation: "to control their mind when it is racing" (endorsed by 72% of the sample), "to feel relaxed" (65%), and "to feel less depressed" (58%) (Favazza & Conterio, 1989).

In adolescent samples, affect-regulation reasons are also endorsed by a majority of participants. For example, in Penn, Esposito, Schaeffer, Fritz, and Spirito (2003), 23 incarcerated adolescents with a history of self-injury were administered the Functional Assessment of Self-Mutilation (FASM; Lloyd, Keeley, & Hope, 1997, as cited in Penn et al.), a self-report measure of 22 reasons for self-injury. The most common reason was "to stop bad feelings," selected by 65% of participants. Nock and Prinstein (2004) administered the FASM to 89 adolescent psychiatric inpatients who had self-injured within the past year. Once again, the reason most often chosen was "to stop bad feelings," although the majority was smaller in this case (53% of the sample). Similar results were found in a community sample of adolescent self-injurers, where 80% indicated they self-injured because "I felt very unhappy or depressed" and 45% endorsed the reason "it helped me to release tension or stress and relax" (Laye-Gindhu & Schonert-Reichl, 2005). Thus reasons related to affect-regulation were endorsed by a majority of participants in both adult and adolescent samples, although these reasons might be slightly less common in adolescents than adults.

Self-reported reasons related to a self-punishment function were investigated in 11 studies. This function received strong support in six of the studies. For example, in a sample of women with borderline personality disorder, the item "to punish myself for being 'bad'" received the highest mean rating of 17 possible reasons (Shearer, 1994). In another study of women with borderline personality disorder, 63% endorsed "self-punishment" as a reason for self-injury (Brown et al., 2002). Likewise, 83% of self-injurers in a mixed sample of psychiatric patients selected "self-punishment" as a reason (Briere and Gil, 1998). Self-punishment reasons were also common in adolescent self-injurers. Half of adolescents receiving psychiatric treatment endorsed the reason "punish self for being bad/bad thoughts" (Nixon et al., 2002). Self-punishment reasons were particularly apparent in a community sample of adolescent self-injurers, where 70% endorsed the reason "I did not like myself," 64% selected "I felt like a failure," and 63% endorsed "I was angry at myself" (Laye-Gindhu & Schonert-Reichl, 2005).

However, support for self-punishment reasons was only modest in five other studies. For example, in an inpatient sample of self-injurers, reasons related to "self-hatred and self-punishment" were endorsed by just over 10% of participants (Herpertz, 1995). In addition, in a sample of adolescent inpatient self-injurers, only 32% selected the reason "to punish yourself" (Nock & Prinstein, 2004). In two additional studies of psychiatric inpatients, one on adolescents (Kumar et al., 2004) and one on adults (Osuch et al., 1999), reasons indicative of a self-punishment functions received substantially lower ratings than reasons indicative of an affect-regulation function. Although it is unclear why self-punishment reasons are more prominent in some studies than others, recent research suggests a possible explanation. In Klonsky (2006), young adults with a history of skin-cutting rated potential reasons for self-injury as being primary, secondary, or not relevant. Although affect-regulation and self-punishment reasons were both selected by a majority of participants, affect-regulation reasons were overwhelmingly rated as primary and self-punishment reasons as secondary. The seemingly inconsistent pattern of findings in the literature may reflect that most participants identify with self-punishment reasons but fewer consider them to be principal reasons.

Reasons suggesting an anti-dissociation function were investigated in eight studies, with mixed results. In women with borderline personality disorder, reasons for self-injury related to anti-dissociation/feeling generation (e.g., "to stop feeling numb or dead," "to feel something, even if it is pain") were endorsed by 54% of the sample (Brown et al., 2002). Similar results were found in a community sample of self-injurers, in which 55% of participants selected the reason "to feel real again" (Favazza & Conterio, 1989). Likewise, 60% of a sample of incarcerated adolescent self-injurers endorsed the reason "to feel something even if it is pain" (Penn et al., 2003).

However, five other studies examining anti-dissociation reasons for self-injury found less support for this function. For example, in Herpertz (1995), only 9% of the psychiatric inpatient self-injurers endorsed the reason "termination of depersonalization." Similarly, only 7% of an inpatient sample of women with borderline personality disorder considered "to produce feelings and a sense of being real when I feel numb and 'out of touch'" to be one of their top three reasons for self-injury (Shearer, 1994). In two studies of adolescent self-injurers, reasons related to an anti-dissociation function were endorsed by approximately one third of the participants (Laye-Gindhu & Schonert-Reichl, 2005; Nock & Prinstein, 2004).

Nine studies examined reasons indicative of an interpersonal-influence function. Only one found strong evidence for this function. In Brown et al. (2002), 61% of a sample of borderline women endorsed reasons related to interpersonal-influence such as "to get other people to act differently or change". Interpersonal-influence reasons were less evident in other studies. For example, in Shearer (1994), only 17% of women with borderline personality disorder selected "to seek support and caring from others" as one of their top three reasons, and only 5% selected "to control the reactions and behavior of others" as one of their top three reasons. Similarly, 40% of self-injurers from a heterogeneous psychiatric sample selected the reason "get attention, [or] ask for help" (Briere & Gil, 1998), and 24% of self-injurers in an inpatient sample selected the reason "longing for care and attention" (Herpertz, 1995). Results were similar in adolescent populations. Just over 30% of adolescent self-injurers from a non-clinical sample endorsed the reason "I wanted other people to see how desperate I was" (Laye-Gindhu and Schonert-Reichl, 2005). In an inpatient adolescent sample the reasons "to get control of a situation" and "to try to get a reaction from someone" were endorsed by less than 15% of the participants (Nock & Prinstein, 2004).

Five studies examined reasons suggesting a sensation-seeking function. All found modest evidence for this function. For example, only 5% of women with borderline personality disorder regarded "to provide a sense of excitement or stimulation that feels exhilarating" as one of their top three reasons for self-injury (Shearer, 1994). Likewise, in a study examining six motivations for self-injury in psychiatric inpatients, sensation-seeking reasons (e.g., "to experience a

'high' that feels like a drug high") were endorsed the least often (Osuch et al., 1999). Studies of adolescents found similar results. Just over 10% of adolescent self-injurers from a non-clinical population endorsed the reason "I thought it would be fun" (Laye-Gindhu and Schonert-Reichl, 2005), and fewer than 10% of adolescent psychiatric patients selected the reason "for excitement" (Nixon et al., 2002).

Three studies examined reasons indicative of an anti-suicide function, with each study finding modest evidence for this function. In a sample of women with borderline personality disorder, the reason "to prevent me from acting on suicidal feelings" received the seventh highest mean rating among 17 reasons (Shearer, 1994). In an adolescent psychiatric sample, just under half of the participants selected the reason "stop suicidal ideation or attempts" (Nixon et al., 2002). Likewise, 41% of adolescent self-injurers from a non-clinical population endorsed the reason "it stopped me from killing myself' (Laye-Gindhu & Schonert-Reichl, 2005).

Only two studies examined reasons suggesting an interpersonal-boundaries function. Both found modest evidence for this function. Shearer (1994) found that the reason "to do something that only I have control of and no one else can control" was rated as one of the top-three reasons for self-injury by 22% of women with borderline personality disorder. Similarly, Briere and Gil (1998) reported that 26% of psychiatric patients endorsed "ownership of body" as a reason for self-injury.

Taken together, studies on self-reports of reasons for self-injury yield consistent findings. A majority of participants in the 11 studies reviewed cited the desire to alleviate negative affect or affective arousal as a reason for self-injuring. In addition, self-punishment reasons were strongly endorsed in six studies, and apparent to a lesser extent in five others. Reasons associated with anti-dissociation and interpersonal-influence were identified by participants in several studies, although usually by a minority of participants. Only five studies investigated sensation-seeking reasons, three studies anti-suicide reasons, and two interpersonal boundaries reasons, with each study producing modest evidence for these functions.

3.5. Findings from studies examining self-reports of phenomenology

Some researchers examining the functions of self-injury have avoided presenting participants with direct questions about their reasons. This approach may reduce demand characteristics because participants are not asked to provide reasons for their self-injury, which may be experienced as having to explain or justify a socially unacceptable behavior. Instead, participants are asked questions about events or emotions that precede, accompany, or follow episodes of self-injury. These questions help clarify variables that prompt and reinforce self-injury.

Six studies examined self-reports about the phenomenology of self-injury. Results from these studies, like those that analyzed self-reports of reasons, provide support for an affect-regulation function of self-injury. Specifically, findings indicate that self-injury is usually preceded by acute negative affect, and that self-injury is associated with a substantial reduction of negative affect. For example, 93% of a sample of women with borderline personality disorder reported that self-injury often occurred following feelings such as tension, depression, irritability, restlessness, racing thoughts, and anxiety, and 94% of self-injurers in this sample reported that they experience relief from these affect-states following self-injury (Coid, 1993). In another sample of self-injurers with borderline personality disorder, approximately 90% of the participants indicated that they felt less "angry" and "anxious" and more "peaceful" after self-injury as compared to before (Kemperman, Russ, & Shearin, 1997).

Similar results are apparent in non-clinical populations. In a community sample of self-injurers recruited through advertisements, the affect-states reported to be most common before self-injury were "anger at others," "hurt," and "emptiness," whereas "relief" was reported to be the most common affect-state after self-injury (Briere & Gil, 1998). Similarly, in a community sample of adolescent self-injurers, affect-states such as "angry," "depressed," "lonely," and "frustrated" were reported to be present prior to self-injury and diminish after self-injury (Laye-Gindhu & Schonert-Reichl, 2005).

Although studies on the phenomenology of self-injury primarily address an affect-regulation function, some findings also bear on other functions. For example, in a prison sample of women, 26% indicated during a clinical interview that self-injury was preceded by "depersonalization" or "derealization" (Wilkins & Coid, 1991). This result may suggest that the anti-dissociation function is relevant for these individuals. However, in another study participants reported that dissociative symptoms peaked during rather than before self-injury (Kemperman et al., 1997), which seems inconsistent with the idea that self-injury serves to reduce dissociative symptoms. In addition, one study

provides possible support for the interpersonal-influence function because interpersonal conflict was reported to be a frequent antecedent of self-injury (Jones, Congiu, Stevenson, Strauss, & Frei, 1979). However, the study did not assess whether self-injury had been used to address the interpersonal conflict. Finally, evidence from one study supported a sensation-seeking function because increases in feelings such as "happy" and "excited" were reported to be associated with self-injury (Laye-Gindhu & Schonert-Reichl, 2005).

3.6. Findings from laboratory studies

In contrast to self-report studies, laboratory studies examine the psychological and physiological influences of proxies for self-injury in controlled settings. This approach avoids the limitations of traditional self-report approaches because it allows for the measurement of affect during or shortly after performance of the self-injury proxy, and allows affective arousal to be assessed by physiological in addition to self-report measures. In addition, laboratory studies have the potential to allow for causal inferences about the psychological and physiological effects of proxies for self-injury. A trade-off is that generalizability of findings is limited by the external validity of the self-injury proxy.

In the first study to apply this approach, Haines et al. (1995) hypothesized that self-injurers administered self-injury imagery would exhibit increases in physiological arousal and negative affect during the initial stages (leading up to the self-injury act), and decreases in arousal and negative affect when the behavior and its aftermath were recalled. This pattern was not hypothesized to occur for control participants or for self-injurers imagining control events such as arguing with a significant other or accidentally cutting oneself with a kitchen knife. Participants were 38 men belonging to one of three groups: 15 prison inmates who self-injured with low suicidal intent, 11 non-self-injuring prisoners, and 11 college student controls without a history of self-injury or incarceration.

Following the self-injury imagery, participants indicated their subjective responses to the imagery by completing visual analogue scales with the following bipolar dimensions: relaxed–tense, relaxed–anxious, calm–angry, unafraid–afraid, happy–sad, normal–unreal, and relieved–uptight. In addition, as participants visualized the events they wore electrodes measuring several indices of physiological arousal, including finger blood volume (FBV), finger pulse amplitude (FPA), heart rate (HR), maximum cardiotachometer (CMAX), minimum cardiotachometer (CMIN), respiration (RESP), and skin resistance level (SRL).

Six of the seven measures of physiological arousal displayed the predicted pattern for self-injurers' responses to the self-injury script. Physiological arousal was high while participants imagined the period of time leading up to self-injury, and reduced substantially when participants imagined self-injuring and the period of time after self-injury. Subjective measures displayed a similar pattern. Self-injurers reported feeling more tense, anxious, angry, sad, and uptight before self-injury, and more relaxed, calm, happy, and relieved afterwards. This pattern differed from that observed for control events (e.g., an interpersonal argument, accident with a kitchen knife).

Brain, Haines, and Williams (1998) used similar methodology to study 35 self-injurers from two outpatient clinics, and 35 control participants who were university undergraduates with no history of self-injury. A pattern emerged that was similar to that observed in Haines et al. (1995). For the self-injurers administered the self-injury imagery, arousal was high before self-injury and decreased substantially after self-injury. This pattern was not observed when self-injurers imagined control events, and there were no significant differences between self-injurers' and control participants' physiological responses to control imagery. Results from both studies provide evidence that self-injuring reduces negative affect and arousal.

In a second approach to the study of self-injury in the laboratory, Russ et al. (1992) used the cold pressor test as a proxy for self-injury. The cold pressor test is often used in pain-threshold research and requires participants to immerse their hands in cold (10 °C) water for up to four minutes. The cold pressor test may simulate self-injury because it requires participants to intentionally perform an activity that causes acute physical pain, although the external validity of this task for simulating self-injury is obviously uncertain. The cold pressor test was administered to 17 borderline patients with a history of self-injury and six control participants without a psychiatric or self-injury history. The borderline self-injuring group was further split into two groups, those who reported experiencing pain during self-injury (bpd-pain; n-6) and not experiencing pain during self-injury (Bpd-no pain; $n = 11$). Immediately before and after administration of the cold pressor test, all participants completed measures of mood, including depression, anxiety,

anger, confusion, and vigor. The entire procedure was repeated three times on three consecutive days, and mood ratings were aggregated across the three administrations.

The borderline patients with self-injury histories exhibited reductions in self-reported depression, anxiety, and confusion following the cold pressor test, although results were only statistically significant for the BPD-no pain group. The BPD-no pain group also demonstrated a statistically reliable decrease in anger following the cold pressor test. Interestingly, the control group also exhibited decreases in depression, anxiety, anger, and confusion following the cold pressor test, although only results for anxiety were statistically reliable. To the extent the cold pressor test is a satisfactory proxy for self-injury, results are consistent with the affect-regulation model of self-injury, and suggest that self-injuring is associated with decreases in negative affect. It is intriguing that control participants also exhibited a trend of reduced negative affect following the cold pressor test. It may be that pain or injury can inhibit the experience of negative affect regardless of an individual's psychiatric history, but only certain types of people come to rely on self-injury as a coping mechanism.

3.7. Summary of empirical research on the functions of self-injury

Eighteen studies examining seven functions of self-injury were reviewed. Affect-regulation was the only function examined in all 18 studies. Eleven studies examined self-punishment, 10 anti-dissociation, 10 interpersonal-influence, five sensation-seeking, three anti-suicide, and two interpersonal boundaries. Even when taking into account that affect-regulation was examined most often, findings were strongest for this function. An integration of results indicates that: (a) acute negative affect precedes self-injury; (b) decreased negative affect and relief are present after self-injury; (c) most self-injurers identify the desire to alleviate negative affect as a reason for self-injuring; and (d) the performance of proxies for self-injury in the laboratory leads to reductions in negative affect and arousal. Several studies also provided strong evidence for a self-punishment function. The anti-dissociation, interpersonal-influence, sensation-seeking, anti-suicide, and interpersonal boundaries functions received modest support. Of note, the general pattern of findings regarding the seven functions tended to remain consistent, regardless of the type of sample (e.g., non-clinical vs. clinical vs. forensic, adult vs. adolescent, outpatient vs. inpatient, women vs. men).

4. Suggestions for future research

4.1. Explore conceptual and empirical relationships among functions

Although the affect-regulation function of self-injury was apparent in every study reviewed, results suggest that self-injury also serves at least six other functions. Evidence of multiple functions can be interpreted in several ways, which are not mutually exclusive: (a) different functions may distinguish different subgroups of self-injurers; (b) multiple functions for self-injury may exist concurrently within-individuals; (c) functions of self-injury may evolve over time within-individuals; and (d) different functional models may overlap conceptually and describe different aspects of the same phenomenon. Future research should assess functions at multiple time points to investigate between- and within-individual differences in functions for self-injury. In addition, studies should examine the co-variation among functions to determine which are most related and may be better conceptualized as aspects of the same functional model. Finally, although multiple functions may co-exist or overlap, some functions may be primary, in that they provide stronger reinforcement and are more likely to lead to repeated self-injury. Studies should therefore examine which functions and reinforcing variables best predict the frequency and longevity of self-injury, and therefore might be conceptualized as providing the most reinforcement for the behavior.

4.2. Measure functions comprehensively

Researchers examining co-variation or other aspects of functions should strive to measure functions comprehensively. Existing studies have typically relied on ad-hoc measures that assess only a few functions. For example, in the 11 studies examining reasons for self-injury, nine different measures of reasons were used, and the modal study examined four of the functions listed in Table 1. An ideal instrument would measure a wide variety of possible functions, contain multiple items and types of items for each function, and have psychometric properties and a

factor structure that have been examined in large and diverse samples. The development of such a measure in and of itself would be a welcome contribution to the field.

In addition, future research should utilize methodologies appropriate for evaluating interpersonal in addition to intrapersonal functions of self-injury. Methodologies used to explore the functions of self-injury have focused more on affective and physiological variables and less on social and interpersonal variables. Studies should more carefully and thoroughly assess interpersonal events that tend to precede and prompt self-injury, and obtain relevant information both from those who self-injure and family members or friends of individuals who self-injure. Informant data may be particularly useful for clarifying interpersonal functions of self-injury, although it should also be noted that many individuals conceal their self-injury from those around them.

4.3. Clarify affective-changes associated with self-injury

The changes in affect associated with self-injury should be examined in more detail. Some studies emphasize the valence of affect-states, and demonstrate that negatively valenced affect-states precede self-injury and diminish following self-injury. Other studies emphasize affective arousal, and show that arousal peaks before self-injury and drops afterwards (e.g., Haines et al., 1995). The phenomenological studies conducted so far appear to implicate affect-states with negative valence and high-arousal, such as anxiety, tension, and anger (Briere & Gil, 1998; Jones et al., 1979; Kemperman et al., 1997), as opposed to lower-arousal negative affect-states such as sad, lonely, or empty. Future research should separately examine the changes in affective valence and arousal that are associated with self-injury. In addition, analyses should identify the changes in valence and arousal that best predict frequency and longitudinal course of self-injury. This approach will help reveal the affective changes that provide reinforcement for self-injury and encourage the behavior to become habitual.

4.4. Establish causal link between affective changes and self-injury

Research should address whether the relationship between self-injury and subsequent changes in affect is indeed causal. Brain et al. (1998), Haines et al. (1995), and Russ et al. (1992) provide intriguing laboratory evidence that proxies for self-injury cause reductions in negative affect and arousal. Additional designs should be developed that better approximate the conditions that accompany self-injury episodes. For example, a frustrating task could be administered before a self-injury proxy to simulate the rising negative affect that typically precedes self-injury. A quicker return to affective baseline following the self-injury proxy as compared to control tasks would contribute evidence that self-injury causes reductions in negative affect and arousal. Researchers should include non-self-injurers in these paradigms as well. If self-injury proxies reduce negative affect in non-self-injurers as well as self-injurers, it would appear that self-injury diminishes the experience or presence of negative affect and arousal via a common mechanism (as opposed to a mechanism unique to self-injurers).

4.5. Explore mechanisms of affect-regulation

Research should investigate *how* self-injury reduces negative affect and arousal. There are numerous hypotheses regarding psychological and physiological mechanisms. For example, self-injury may distract people from acute negative affect in a manner similar to how distraction can be used effectively to cope with depression (Just and Alloy, 1997). A theory of affect-regulation based on distraction would have to explain why less damaging and more socially acceptable methods of distraction like exercise, cold showers, or calling a friend are not sufficient. Self-injury may also be thought of as a form of self-care. People who self-injure may be unable to soothe themselves when dealing with intense emotions (Linehan, 1993). The experience of being helpless in the face of negative emotions can be frustrating and overwhelming. Some individuals may be better able to care for physical than emotional injuries. Self-injuring, then, may provide a soothing and gratifying opportunity to competently care for oneself by examining, cleaning, bandaging, or otherwise tending to the wound.

Other theories emphasize biological effects of self-injury, such as the release of endorphins. Endorphins are endogenous opioids that are released in response to physical injury, act as natural painkillers, and induce pleasant feelings (Hawkes, 1992; Willer, Dehen, & Cambier, 1981). Some speculate that the endorphin-release following self-injury may cause the mood effects that alleviate acute negative affect (Favazza & Conterio, 1988; Richardson &

Zaleski, 1986). Notably, at least one study has failed to support an endorphins model of self-injury. The opiate antagonist naloxone did not diminish improvements in affect following the performance of a self-injury proxy, even though naloxone should block the effects of endorphins (Russ et al., 1994). Nevertheless, these and other biological explanations of self-injury should continue to be pursued because understanding the biochemistry of self-injury is essential for understanding why people self-injure.

4.6. Employ alternatives to retrospective self-report paradigms

Real-time and laboratory methods for studying self-injury should continue to be utilized and enhanced. Most studies on self-injury have relied on participants' retrospective self-reports. Although these studies provide valuable information, their validity is debatable because memories about self-injury may be inaccurate, participants may lack insight into their motivations in the first place, and some individuals may fabricate explanations they feel are more socially acceptable than their true reasons. It is therefore important to conduct studies of self-injury that are (a) not dependent on self-report and (b) not retrospective. Some of the laboratory studies described above, which utilize physiological measures of affective arousal, offer valuable alternatives to self-report studies. At the same time, the external validity of laboratory studies is limited and such approaches are best viewed as supplementary.

Ecological momentary assessment (ECA) studies are useful alternatives to retrospective studies. Participants can keep daily logs of self-injury and potentially related variables including self-injury ideation, suicidal ideation, affect-states, interpersonal events, and other problem behaviors such as binging, purging, substance use, gambling, impulsive sex, and impulsive spending. This approach would allow participants to contribute real-time descriptions of the phenomenology and functions of self-injury, and illuminate other behaviors that may serve similar functions to self-injury. Some intriguing ECA studies on self-injury and related problems are underway (Rafaeli, Howland, & Drejet, 2005).

4.7. Extend research to community samples

Researchers should continue to examine the functions of self-injury in non-clinical in addition to patient and forensic samples. Most studies included in the present review examine clinical or forensic populations, which are only subsets of the larger population of self-injurers. Since about 4% of individuals from large non-clinical populations self-injure (Briere & Gil, 1998; Klonsky et al., 2003), and rates are even higher in college students (Favazza et al., 1989; Gratz, 2001; Whitlock et al., 2006), it is likely that some people who self-injure are not in treatment and do not meet criteria for a psychiatric disorder. Limiting the scope of investigations to patient and prison populations precludes a complete understanding of self-injury and may obscure the phenomenology, functions, and treatment implications of self-injury. In addition, research in community settings such as secondary schools may lay the groundwork for the development of interventions that can be implemented at the community level.

4.8. Investigate clinical implications of different functions

Research should explore how assessing the functions of self-injury in patients can improve case conceptualization and treatment planning. Unfortunately, the clinical lore includes misconceptions about the functions of self-injury. For example, many clinicians emphasize interpersonal-influence functions (Bancroft & Hawton, 1983; Gough & Hawkins, 2000), even though the present review suggests that self-injury serves this function for a minority of self-injurers. Research on functions could be used as a basis for identifying sub-types of self-injurers with different diagnostic profiles and levels of risk for suicide and other undesirable outcomes. For example, Nock and Prinstein (2005) found that people who self-injure to alleviate acute negative affect feel more hopeless and are more likely to have attempted suicide than those who identify other reasons for self-injury. This finding (especially if replicated) suggests that clinicians should assess the functions of their patients' self-injury, and consider taking extra precautions and choosing more aggressive treatment strategies for patients who self-injure to regulate negative affect. Additional research on the diagnostic, prognostic, and treatment implications of different functions would substantially improve the ability of mental health professionals to meet the particular needs of their patients.

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