



Online Self-Injury Activities among Psychiatrically Hospitalized Adolescents: Prevalence, Functions, and Perceived Consequences

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Abstract

The majority of adolescents with psychiatric disorders use social media, engaging in a range of online activities that may confer both risks and benefits. Very little work, however, has examined engagement in online activities related to self-injury among these youth, such as posting about self-injury, viewing self-injury related content, or messaging about self-injury with online or offline friends. This study examined the frequency and types of online self-injury activities in which adolescents engage, perceived functions that these activities serve, and associated risk for self-injurious thoughts and behaviors (SITBs). Participants were 589 psychiatrically-hospitalized adolescents ($M_{age} = 14.88$), who completed self-report measures assessing online self-injury activities, perceived functions and consequences of these activities, and SITBs. Results indicated that 43.3% of the sample had engaged in online self-injury activities, that the majority (74.8%) used social networking sites (e.g., Snapchat, Instagram) to do so, and that these activities were significantly more common among sexual and gender minority youth. Adolescents who talked about self-injury with friends met online were more likely to report a history of suicide attempt(s). A latent profile analysis revealed three distinct subgroups of youth based on their perceived functions of engaging in online self-injury activities. Subgroups reporting higher levels of engagement for purposes of identity exploration, self-expression, and aiding recovery were at heightened risk for negative perceived consequences of these activities and reported greater suicidal ideation severity. Findings offer new insights for identifying youth who may be at heightened risk for SITBs in the context of social media use.

Keywords Adolescents · Self-injury · Suicide · Social media · Online

Introduction

Social media plays a central role in the lives of most adolescents. Nearly 97% of youth ages 13–17 use some form of social media (Anderson and Jiang 2018), broadly defined as any digital tool that allows for social interaction (Moreno and Kota 2013), including social networking sites, messaging apps, and video sharing sites. The diverse landscape of social media tools gives rise to a number of possible online activities, some of which may confer benefits for youth, including opportunities for self-expression, creativity, and social support (Anderson and Jiang 2018; Rideout and Robb 2018). However, a number of risks are present as well, including possibilities for cybervictimization, social comparison, and exposure to risky or inappropriate content (John et al. 2018; Nesi and Prinstein 2015; Rideout and Robb 2018). Although youth with mental health concerns may stand to benefit from opportunities for social support

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and psychoeducation online, they may also be especially vulnerable to potential risks associated with social media. For example, a range of possible activities related to self-injurious thoughts and behaviors (SITBs) may be readily available online, such as posting about self-injury, viewing self-injury related content, or messaging about self-injury with online or offline friends. However, very little work has explored patterns of engagement in these activities and their associated risks, particularly among youth with acute mental health concerns. Research is needed to examine the types of online self-injury activities in which adolescents engage, as well as the range of functions these activities may serve for youth with psychiatric symptoms.

Self-injurious behaviors, or deliberate acts of self-harm performed with or without suicidal intent, represent a significant public health concern among young people. Prevalence rates, based on a systematic review, estimate that 16% of adolescents have engaged in deliberate self-harm (Muehlenkamp et al. 2012). Rates of suicide, self-injury, and depressive symptoms in youth have risen substantially over the past decade, coinciding with the widespread adoption of social media (Twenge et al. 2018). Although the question remains whether social media has contributed to rising rates of depression and SITBs, it is critical to identify specific online behaviors that may exacerbate or ameliorate symptoms. Further, it is necessary to examine individual characteristics of youth who are at particularly high risk for negative effects of social media, such as those related to self-injury.

Interpersonal Theories of Suicide Risk

The potential risks and benefits of adolescents' engagement in online self-injury activities may be understood within the context of interpersonally-focused theories of suicidal behavior. In particular, the Interpersonal Theory of Suicide (Joiner 2005; Van Orden et al. 2010) posits that feelings of perceived burdensomeness and thwarted belongingness contribute to suicidal ideation, and that these factors, in combination with an acquired capability for suicide, increase risk for suicidal behavior. On the one hand, engagement in online self-injury activities may serve to reduce thwarted belongingness, as online social support and media-based psychoeducation may protect against loneliness and isolation (De Choudhury and Kiciman 2017; Niederkrotenthaler et al. 2014). Indeed, prior systematic reviews of online activities related to deliberate self-harm (Dyson et al. 2016) and nonsuicidal self-injury (NSSI; Lewis and Seko 2016) highlight social benefits such as developing community, receiving messages and advice encouraging recovery, and engaging in emotional self-disclosure. On the other hand, exposure to images, videos, and other content related to self-injury may decrease fear of death through repeated exposure,

resulting in greater acquired capability for suicide (Smith et al. 2010). In line with this hypothesis, preliminary evidence suggests that exposure to such content may increase suicide risk (Arendt et al. 2019).

Interpersonal factors influencing suicide risk may be especially relevant for adolescents, given their increased reliance on peer feedback and heightened biological sensitivity to social information and rewards during this developmental period (Foulkes and Blakemore 2016). In line with social cognitive theories (Bandura 2001), which suggest that individuals' behavior is informed and influenced through observation of others' behavior, adolescents have been shown to be at heightened risk for suicide following exposure to news or information about other youths' suicidal behavior (Hawton et al. 2020). In addition, a large body of literature has highlighted the role of both media and peer factors in adolescent self-injury and suicide (King and Merchant 2008; Niederkrotenthaler and Stack 2017). For example, media depictions of suicide have been found to influence youth suicide risk (Gould et al. 2003). Moreover, peer contagion effects, through both selection and socialization, play an important role in SITBs through reinforcement and normalization of self-injurious behavior (Heilbron and Prinstein 2008; Insel and Gould 2008). Thus, exposure to online self-injury content may not only increase acquired capability for suicide, but may also trigger urges to self-injure and lead to the reinforcement and normalization of SITBs (Dyson et al. 2016; Lewis and Seko 2016).

The Role of Social Media in Online Self-Injury Activities

Social media may represent a confluence of peer and media influences on self-injury, as it provides new opportunities for adolescents to engage with other youth who self-injure and increases the breadth and depth of adolescents' exposure to the wider media landscape. Indeed, theoretical work on social media has noted the potential for these platforms to amplify both helpful and harmful interpersonal influences due to their constant accessibility, public audiences, and potential for anonymity (Nesi et al. 2018). Examining how these effects are related to online self-injury activities on social media sites is crucial. The majority of prior studies have examined online self-injury activities as they occur in discussion forums and chatrooms designed specifically for individuals who self-injure, and studies have only recently begun to explore individuals' online self-injury activities on modern social networking sites, such as Instagram (Arendt 2019; Brown et al. 2018; Carlyle et al. 2018). Yet the social media landscape is now larger and more diverse than ever. This creates a plethora of new online self-injury activities in which youth can engage, with possibilities for sharing and viewing multiple types of self-injury content (e.g., videos,

messages, posts, photos) with various audiences (i.e., in person and online ‘friends’) across numerous platforms (e.g., social networking sites, apps). As the possibilities for online self-injury activities expand, it becomes even more critical to identify specific types of activities that may put youth at greater risk for SITBs.

Online Activities among Sexual and Gender Minority Youth

The Differential Susceptibility Model of Media Effects highlights the importance of examining the specific media behaviors in which youth engage, as well as individual differences that may make certain youth more vulnerable, or resilient, to media effects (Valkenburg and Peter 2013). In the context of online self-injury activities, it is critical to examine whether certain youth may be especially susceptible to negative and/or positive effects. Youth identifying as sexual and/or gender minorities (SGM) may be more likely to experience both risks and benefits of online self-injury activities. Prior work suggests that SGM youth are at heightened risk for SITBs, compared to non-sexual minority and cisgender youth (Johns et al. 2019; Peters et al. 2020). SGM youth are also more likely to have online friends whom they have never met in person (Ybarra et al. 2015), and for SGM youth with histories of self-injury, it is possible that engagement with these online-only friends may involve discussions of SITBs. Notably, sexual minority youth have been found to be more likely to seek support for self-injury online (Frost and Casey 2016). Thus, more work is needed examining whether SGM youth differ from non-SGM youth in their online self-injury activities, and whether this may have implications for SITB risk.

Online Self-Injury Activities and SITBs

Prior systematic reviews of the literature on online activities related to deliberate self-harm (Dyson et al. 2016) and NSSI (Lewis and Seko 2016) highlight a range of possible risks and benefits of these activities. However, the majority of studies in this area have used qualitative methods and most involve direct observation and thematic coding of online self-injury content (Dyson et al. 2016; Lewis and Seko 2016). Only a small number of studies have directly surveyed youth regarding motivations for engaging in these activities, and even fewer studies have examined associations among specific online self-injury activities, motivations, and SITBs. This limited research is problematic, given initial evidence that individuals who engage in online self-injury activities are a clinically high-risk group. Recent studies suggest that exposure to online content related to self-injury is associated with greater likelihood of self-injurious behaviors. In a cross-sectional study of over 400 young adults,

those who self-reported online exposure to risky behavior were more likely to report self-harm and other offline risky behaviors (i.e., drug use, excessive alcohol use, disordered eating; Branley and Covey 2017). A longitudinal study of over 700 young adults also found that exposure to self-harm content on Instagram was associated with increases in self-harming behavior, suicidal ideation, suicide risk, and hopelessness one month later (Arendt et al. 2019).

Furthermore, recent evidence indicates that young people who use the Internet to communicate about suicide or search for suicide-related information may be at higher risk for suicide than those who do not (Bell et al. 2018; Mok et al. 2016; Niederkrotenthaler et al. 2017). Among suicidal young adults, those who had engaged in suicide-related social media use were more socially anxious (Bell et al. 2018; Mok et al. 2016), more depressed (Niederkrotenthaler et al. 2017), and at higher risk for suicide (Bell et al. 2018; Mok et al. 2016; Niederkrotenthaler et al. 2017) than those individuals who had not. In addition, in a sample of over 600 college students with a history of self-injury, those who sought help from peers online for self-injury reported greater distress, suicidality, and more frequent self-injury than those who did not (Frost and Casey 2016).

Despite this important initial work, significant gaps in the literature remain. Quantitative studies with large samples of adolescents are needed to explore the prevalence and associated risks of online self-injury activities. Studies focusing on youth with psychiatric concerns and those who identify as SGM are also important, given these youth are at high risk for future SITBs and may be more susceptible to potential negative effects of social media. Furthermore, there are likely a multitude of reasons why adolescents engage in activities related to self-injury on social media. Among those youth who do engage in online self-injury activities, identifying potential subgroups based on their associated motivations may provide valuable information regarding individual risk profiles. It may be that youth who endorse certain patterns of perceived functions (e.g., supporting a self-injury based personal identity, regulating negative emotions) versus others (e.g., seeking support and recovery encouragement) may differ in their SITB risk. Identifying these potential subgroups is important to inform targeted assessment, prevention, and intervention efforts.

The Current Study

The current study explores patterns of online self-injury activities in a large, diverse sample of adolescents who were psychiatrically hospitalized due to risk of harm to self or others. We examine the proportion of youth ever having engaged in four online activities: viewing self-injury content, sharing self-injury content, talking about self-injury with peers known only online, and talking about self-injury

(using technology) with peers known offline. We also examine the digital tools used to engage in these activities, and associated risks of suicidal ideation (SI), suicide attempts, and NSSI. Finally, to identify those youth who may be at highest risk based on their online self-injury activities, we classify subgroups of adolescents based on the perceived functions that these activities serve for them. We examine whether these subgroups differ in demographics, the type of online activities in which they engage, their perceived consequences of these activities, and their clinical risk profiles, including SI, attempts, and NSSI.

Methods

Participants

Participants in the current study were 589 psychiatrically hospitalized adolescents ages 11–18 ($M = 14.88$, $SD = 1.83$). A total of 55.7% identified as female, 35.1% as male, 4.3% as transgender, 3.7% in another way (e.g., gender nonconforming, other, not sure), and 1.2% declined to state. In regard to sexuality, 48.6% identified as heterosexual or straight, 25.7% as bisexual or pansexual, 10.6% in another way (e.g., asexual, other, not sure), 6.5% as gay or lesbian, and 8.7% declined to state. Participants were 68.0% White, 14.0% Black, 1.0% Asian, 0.9% Native Hawaiian/Pacific Islander, 0.7% American Indian/Alaskan Native, 15.0% other races, and 0.3% declined to state; 24.7% of the sample was Hispanic/Latinx. The hospital Institutional Review Board (IRB) approved this research. The measures administered and analyzed as part of this study were part of a standardized admission process for all adolescents admitted to the inpatient unit. This assessment battery was used to provide information on clinical presentations and enhance unit programming. Assessment results were entered in patient charts. This study consists of a retrospective chart review; the IRB approved a waiver of informed consent.

General clinical characteristics. The modal length of stay on the inpatient unit was 9 days. Approximately 53% of teens are insured by Medicaid. Chart data indicate that the vast majority (88%) of adolescents admitted to the unit met criteria for DSM-5 current Major Depressive Episode. Adolescents also present with a wide range of other internalizing and externalizing psychiatric disorders, with the most common diagnoses being Oppositional Defiant Disorder (43%), Generalized Anxiety Disorder (37%), Attention Deficit/Hyperactivity Disorder (34.5%), Conduct Disorder (28%), Post Traumatic Stress Disorder (19%), and Substance Use Disorder (17%). These clinical characteristics are representative of the full inpatient unit and include information about patients not represented in the final study sample.

Measures

Suicidal Ideation. The Suicide Ideation Questionnaire – Junior (SIQ-Jr; Reynolds and Mazza 1999) is a 15-item self-report measure employed to assess severity of suicidal ideation over the past 30 days. Items are rated on a seven-point Likert scale, from 0 (*I've never had this thought*) to 6 (*Almost every day*). Items are summed, with higher scores reflecting greater severity of SI. The SIQ-Jr has good psychometric properties (Reynolds and Mazza 1999), and evidence suggests it prospectively predicts suicidal ideation among psychiatrically hospitalized adolescents (King et al. 1997). In this sample, internal consistency was excellent ($\alpha = 0.96$).

Suicide Attempt. A single self-report item was adapted from the Self-Injurious Thoughts and Behaviors Interview (SITBI; Nock et al. 2007) to assess lifetime history of suicide attempts. Participants were asked to respond *yes* or *no* to the question, “*Have you ever made an actual suicide attempt, where you were trying to kill yourself, even just a little?*” Responses were coded 0 for *no* and 1 for *yes*.

Nonsuicidal Self-Injury (NSSI). To assess lifetime history of engagement in NSSI, a single self-report item was adapted from the SITBI (Nock et al. 2007), asking “*Have you ever in your life done anything to purposefully hurt yourself without trying to die (for example, cutting or burning your skin)?*” Responses were coded 0 for *no* and 1 for *yes*.

Online Self-Injury Activities. A questionnaire assessing the presence of a range of self-injury related social media experiences, as well as the functions and consequences of these experiences, was developed to improve clinical care on the inpatient unit (see Online Supplement 1 for the full measure). The information collected was used to inform topics covered in group therapy, and to guide individual therapy as part of the standard intake process. The measure was developed through review of prior literature on potential benefits and consequences of online self-injury activities (e.g., Dyson et al. 2016; Lewis and Seko 2016), and a process of iterative feedback in consultation with senior investigators, research staff, and clinicians with expertise in working with clinically acute adolescents. Participants were asked whether they engaged in four online activities: (1) viewing content related to self-injury, (2) sharing content related to self-injury, (3) talking (using technology) to others known offline (i.e., in “real life”) about self-injury, and (4) talking (using technology) to others known only online (i.e., never met in person) about self-injury. Responses were coded as either 0 = *Never did this* or 1 = *Did this at least once in lifetime*. Only participants who responded positively to at least one of these items were asked the questions described below.

Websites/Apps Used. Participants were asked “Which of the following websites or apps did you use to do these activities (i.e., talking about, sharing, or looking at posts/photos related to injuring oneself)?” They were asked to check all response options that applied including: (1) social networking site (e.g., Snapchat, Instagram, Twitter, Facebook), (2) video sharing site (e.g., YouTube), (3) chat or discussion forum/website specifically for people who injure themselves, (4) text messaging or messaging apps (e.g., WhatsApp), and/or (5) other websites or apps.

Functions. Participants rated 9 items on a Likert scale from 0 (*strongly disagree*) to 4 (*strongly agree*) assessing the extent to which they identified with a range of functions of their own self-injury related online experiences. Specifically, we examined seven functions with one or two items per function. (1) *Negative affect regulation*: “I am more likely to do these activities when I am feeling a negative emotion (e.g., upset, sad, angry)”, “I am more likely to do these online activities when having thoughts of injuring myself”, (2) *Boredom reduction*: “I am more likely to do these activities when I am feeling neutral or bored”, (3) *Positive affect enhancement*: “I am more likely to do these online activities when I am feeling a positive emotion (e.g., happy, excited)”. (4) *Reduced isolation*: “I do these online activities in order to feel less isolated or alone”. (5) *Self-expression*: “I do these online activities to “vent” or express how I feel”. (6) *Recovery*: “I do these online activities to help me try and get better”. (7) *Identity exploration*: “Doing these online activities helps me feel like I’m part of a group of other people like me”, and “Doing these online activities allows me to express who I really am”. Means ranged from 1.39 ($SD=1.28$) to 2.17 ($SD=1.30$), Skewness from -0.39 to 0.45, and Kurtosis from -1.27 to -0.79 (see Table S1).

Perceived consequences. Participants were administered a total of ten items, rated on a Likert scale from 0 (*strongly disagree*) to 4 (*strongly agree*) assessing the extent to which they experienced negative consequences of self-injury related online experiences. All items were analyzed individually. Participants indicated, using single items, whether online self-injury activities led to the (1) *normalization* of self-injury (“Doing these activities makes me think that injuring myself is something I could do in my situation”), the experience of (2) *thwarted recovery* (“Doing these activities makes me think that I am unlikely to ever stop having thoughts of injuring myself”), (3) *behavioral triggering* (“Doing these activities makes me more likely to act on thoughts of injuring myself”), (4) *social comparison* (“Doing these activities causes me to compare my experience of self-injury with others’ experiences of self-injury”) and (5) *discovery of new methods* (“Doing these activities has introduced me to new methods for injuring myself”). These perceived consequences items had a range of 0 to 4, means ranged from 1.17 ($SD=1.24$) to 1.40 ($SD=1.18$),

Skewness from 0.22 to 0.76, and Kurtosis from -0.53 to -1.18 (see Table S1). Five administered items were excluded from analyses: four items were excluded because they asked about consequences of specific online activities that were not relevant to all participants (e.g., “I have been harassed or teased online *after posting about injuring myself*”; “When I am having thoughts of hurting myself, *viewing photographs or videos about injuring oneself* helps reduce this urge”). One item was excluded because it was redundant with an item already analyzed (i.e., “Doing these online activities makes me *less* likely to act on thoughts of injuring myself”).

Analytic Approach

First, we conducted descriptive statistics within the full sample to determine the proportion of participants who had ever engaged in the four online self-injury activities (i.e., viewing self-injury content, sharing self-injury content, talking to “real life” friends about self-injury, and talking to online friends about self-injury) and compared these proportions across participants of different genders and sexual identities. We also explored which websites and apps were most commonly used to engage in these activities. Next, we conducted bivariate logistic and linear regression analyses in SPSS 22.0 to simultaneously examine associations between each of the four online self-injury activities and SITBs (i.e., suicidal ideation, history of NSSI, and history of one or more suicide attempts), controlling for gender, sexuality, age, race, and ethnicity. All regression analyses were also repeated with the other SITBs included as covariates (i.e., for the model predicting suicide attempt history, we controlled for NSSI and SI; for the SI model, we controlled for NSSI and suicide attempt history; and for the NSSI model, we controlled for SI and suicide attempt history).

The sample was then limited only to those who had engaged in at least one of the four online self-injury activities ($n=254$), as these were the only participants who completed follow up measures assessing the functions of these activities. We conducted latent profile analysis (LPA) using Mplus 8.2 (Muthén and Muthén 1998–2018) within this subsample to identify profiles based on adolescents’ self-reported functions of engaging in these activities. Seven standardized indicators representing various functions of online self-injury activities were employed to estimate classes, with full information maximum likelihood used to handle missing data. Two items were excluded from analyses, as each was redundant with another item: specifically, one of the items assessing negative affect regulation (i.e., engaging in activities when having thoughts of self-injury) was redundant with the other ($r=0.77$), and the item assessing positive affect enhancement was redundant with the boredom reduction item ($r=0.64$). Classes were compared

empirically by examining the Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC), sample-size adjusted BIC (aBIC), and the parametric bootstrap likelihood ratio test (BLRT) (Nylund et al. 2007). The optimal model was determined empirically based on the BIC, which is considered to be the most reliable information criteria and is thus recommended to weight most strongly (Nylund et al. 2007). Interpretability of each class solution was also considered when selecting the optimal number of classes.

We examined differences among classes in terms of engagement in each of the four online self-injury activities, perceived consequences of engaging in these activities, SITBs, and demographic variables (age, gender identity, and sexual orientation). Comparisons were conducted with chi-square tests using Lanza's method (Lanza et al. 2013) for inclusion of distal outcomes (i.e., online self-injury activities, perceived consequences, and SITBs) within the latent class model (Asparouhov and Muthén 2014). This model-based approach uses Bayes theorem to derive the joint distribution of the latent class and distal variables, and was estimated using the DCAT (for categorical variables) and DCON (for continuous variables) specifications for auxiliary variables in MPlus 8.0. If omnibus differences in distal outcomes across classes emerged, we examined pairwise comparisons between classes on mean parameters (for continuous variables) or probabilities (for categorical variables).

Results

Descriptive Statistics and Regression Analyses

Of the total sample of 589 adolescents, 254 (43.3%) reported having ever engaged in any online activities related to self-injury. The most common activity (31.8% of participants) was using technology to talk about self-injury with people known in “real life” (i.e., not exclusively online), followed by viewing content online (i.e., others' posts, messages, and videos) related to self-injury (26.5% of participants). Using technology to talk about self-injury with people known only online (16.8% of participants) and sharing or posting one's own content related to self-injury (14.5% of participants) were relatively less common. In general, gender minority adolescents (i.e., those who do not identify as male or female) were most likely to have engaged in online self-injury activities, followed by female adolescents, and then male adolescents (see Table 1). In addition, sexual minority youth were more likely than non-sexual minority youth to have engaged in all online self-injury activities.

The 254 adolescents who had engaged in online activities related to self-injury used a variety of apps and websites to do so (see Table 2). The majority of adolescents ($n = 190$, 74.8%) used a social networking site like Snapchat or Instagram. About one-third of youth used text messaging or messaging apps ($n = 86$, 33.9%). Less commonly, adolescents engaged in online

Table 1 Engagement in online self-injury activities, with comparisons by gender and sexuality

	Full Sample (N = 589) <i>n</i> (%)	Male (<i>n</i> = 206) <i>n</i> (%)	Female (<i>n</i> = 327) <i>n</i> (%)	Gender Minority (<i>n</i> = 54) <i>n</i> (%)	χ^2	Non-Sexual Minority (<i>n</i> = 285) <i>n</i> (%)	Sexual Minority (<i>n</i> = 300) <i>n</i> (%)	χ^2
Shared content related to self-injury	85 (14.5)	20 (9.8) ^a	49 (15.0) ^a	16 (30.2) ^b	14.28**	31 (10.9)	54 (18.0)	5.97*
Viewed content related to self-injury	156 (26.5)	38 (18.4) ^a	98 (30.0) ^b	20 (37.0) ^b	11.94**	60 (21.1)	96 (31.8)	8.66**
Talked about self-injury with people known only online	99 (16.8)	23 (11.2) ^a	53 (16.2) ^a	23 (42.6) ^b	30.37***	35 (12.3)	64 (21.2)	8.31**
Talked about self-injury with people known in person	187 (31.8)	40 (19.5) ^a	120 (36.7) ^b	26 (48.1) ^b	24.57***	78 (27.5)	108 (35.8)	4.65*
Any online self-injury activity	254 (43.3)	58 (28.3) ^a	160 (48.9) ^b	35 (66.0) ^c	34.20***	106 (37.3)	147 (48.8)	7.89**

Superscript letters denote column proportions differ from each other at the $p < .05$ level. Note that 2 participants were missing data on gender and sexuality, 2 were missing data on the item assessing sharing content related to self-injury, and 1 was missing data on the item assessing talking about self-injury with people known in person. Given small group sizes, youth who did not identify as male or female were combined into a single “gender minority” group, for comparison across gender groups. Those who did not identify as heterosexual/straight were combined into a single “sexual minority” group. Comparisons were repeated excluding those who declined to state their gender or sexual identity, and the pattern of results remained the same. Total $N = 589$

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 2 Websites and apps used to engage in online self-injury activities

	<i>n</i>	%
Social networking site (e.g., Snapchat, Instagram, Twitter, Facebook)	190	74.8
Video sharing site (e.g., YouTube)	46	18.1
Chat or discussion forum/website specifically for people who injure themselves	25	9.8
Text messaging or messaging apps (e.g., WhatsApp)	86	33.9
Other websites or apps	23	9.1

Sample is limited to the 254 adolescents who reported engaging in any online self-injury activities (i.e., talking about, sharing, or looking at posts/photos related injuring oneself)

self-injury activities using video sharing sites like YouTube (*n* = 46, 18.1%) or websites specifically for people who injure themselves (*n* = 25, 9.8%).

Controlling for demographic variables (gender, sexuality, age, race, and ethnicity) and for all online self-injury activities, two activities were significantly associated with increased suicidal ideation severity: viewing content related to self-injury and using technology to talk to “real life” friends about self-injury (Table 3). In addition, sharing content related to self-injury, viewing content related to self-injury, and using technology to talk about self-injury with “real life” friends were significantly associated with history of NSSI. Finally, talking about self-injury with people known only online was significantly associated with a history of one or more suicide attempts. Those identifying as female and gender minorities were significantly more likely to

report all SITBs; sexual minority status was significantly associated with NSSI only. White participants, compared to non-White participants, were also more likely to report a history of NSSI. In addition, as described in the data analysis section, all models were re-run controlling for the two other SITBs examined. The pattern of results remained the same in all three analyses.

Latent Profile Analysis

An LPA was conducted with all participants who endorsed having used social media to view or share self-injury related content (*n* = 254), and five classes were estimated. As can be seen in Table 4, all information criteria indices became smaller as the number of classes increased. The BLRT indicated significance for all class solutions, and therefore did not aid in class selection. The optimal model determined empirically was the four-class model. However, upon inspecting classes and weighting interpretability, it was determined that a three-class solution was superior to a four-class solution. Indeed, the four-class solution subdivided one of the classes in the three-class solution; this subdivision created somewhat redundant classes and was less interpretable. Thus, when considering empirical comparison and when weighing interpretability, a three-class solution was chosen (see Fig. 1 for class profiles).

Class 1. The first class may be regarded as a “Low Function Endorsement Class” (*n* = 84, 33.2% of the sample). This class reported moderate to low engagement in online self-injury activities for affect regulation and boredom

Table 3 Linear and bivariate logistic regression models predicting self-injurious ideation and behaviors from online self-injury activities

	Suicidal Ideation (SIQ)	History of NSSI	History of Suicide Attempt
	<i>B</i> (95% <i>CI</i>)	<i>OR</i> (95% <i>CI</i>)	<i>OR</i> (95% <i>CI</i>)
Covariates			
Age	0.27 (-0.83, 1.38)	1.04 (0.94, 1.16)	1.05 (0.95, 1.15)
Female	12.92 (8.30, 17.53)***	4.92 (3.19, 7.58)***	2.69 (1.81, 3.98)***
Gender Minority	19.18 (10.96, 27.40)***	3.37 (1.52, 7.47)**	3.22 (1.45, 6.64)**
Sexual Minority	3.62 (-0.80, 8.03)	1.56 (1.03, 2.39)*	1.09 (0.75, 1.57)
White	2.33 (-3.25, 7.91)	1.92 (1.23, 3.27)*	0.97 (0.60, 1.57)
Black	-1.72 (-8.85, 5.40)	0.78 (0.40, 1.52)	1.09 (0.60, 1.99)
Hispanic	-4.82 (-9.78, 0.13)	1.01 (0.63, 1.60)	1.03 (0.67, 1.56)
Online Self-Injury Activities			
Shared content related to self-injury	2.98 (-3.65, 9.61)	2.49 (1.17, 5.31)*	0.79 (0.44, 1.41)
Viewed content related to self-injury	7.10 (1.56, 12.64)*	1.76 (1.00, 3.09)	1.24 (0.77, 2.01)
Talked about self-injury with people known only online	4.61 (-1.94, 11.16)	0.87 (0.44, 1.72)	2.04 (1.14, 3.67)*
Talked about self-injury with people known in person	7.73 (2.47, 12.98)**	2.63 (1.54, 4.48)***	1.25 (0.79, 1.96)

NSSI nonsuicidal self-injury. For linear regression predicting suicidal ideation, total $R^2=0.19$, $F(582)=17.07$, $p<.001$. Reference groups for categorical demographic variables were: boys, non-sexual minority youth, other races (i.e., non-White, non-Black), and non-Hispanic. Total *N* for all models = 582. Number of participants who endorsed a history of NSSI was 345 (58.7%); number of participants who endorsed a history of suicide attempt(s) was 311 (52.9%). SIQ: $M(SD)=34.59(27.2)$, Skewness = 0.22, Kurtosis = -1.33, Range 0–90. Note that each model was re-run controlling for the other two SITBs examined, and the pattern of results remained the same

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 4 Model fit statistics for latent class models estimated up to 5 classes

Class	LL	AIC	BIC	aBIC	BLRT	Entropy
2	-2507.26	4587.05	4664.78	4595.05	0.000	0.848
3	-2271.52	4438.50	4544.51	4449.40	0.000	0.851
4	-2189.25	4379.09	4513.36	4392.90	0.000	0.898
5	-2147.35	4304.21	4466.75	4320.92	0.000	0.971

LL Log Likelihood, AIC Akaike Information Criteria, BIC Bayesian Information Criterion, aBIC sample size adjusted BIC, BLRT Bootstrap Likelihood Ratio Test. Note that for the 5-class solution, the number of random starts was increased to 200 to allow for model convergence (replication of the best loglikelihood value); convergence difficulties are sometimes an indication that the data do not support this number of classes. One participant was missing data on all 7 items, and thus the total sample size for latent profile analyses was $n = 253$

reduction purposes (0.50 – 0.62 SD below in the mean). They also reported well below average identification with all other functions of self-injury activities, including isolation reduction (0.93 SD below the mean), self-expression (0.83 SD below the mean), recovery (0.98 SD below the mean), and identity exploration (0.86 – 0.92 SD below the mean).

Class 2. The second class ($n = 127$, 50.2% of the sample) reported average likelihood of engagement in online self-injury activities for purposes of affect regulation and boredom reduction (0.11 – 0.22 SD above the mean). They also reported average to moderately above average levels of endorsement of isolation reduction (0.31 SD above the mean), self-expression (0.23 SD above the mean), recovery (0.21 SD above the mean), and identity exploration (0.08 – 0.09 SD above the mean) functions. This class may be regarded as a “Moderate Function Endorsement Class.”

Class 3. The third class ($n = 42$, 16.6% of the sample) included participants who endorsed engaging in online self-injury activities for affect regulation and boredom reduction at slightly above average levels (0.51 – 0.61 SD above the mean). They identified with isolation reduction (0.85 SD above the mean) and self-expression (0.88 SD above the mean) functions at levels moderately above the mean. However, this group is noteworthy for very high endorsement of functions of online self-injury activities related to recovery (1.24 SD above the mean) and, even more so, identity exploration (1.37 – 1.45 SD above the mean). Thus, this group may be regarded as the “Identity and Recovery Functions Endorsement Class.”

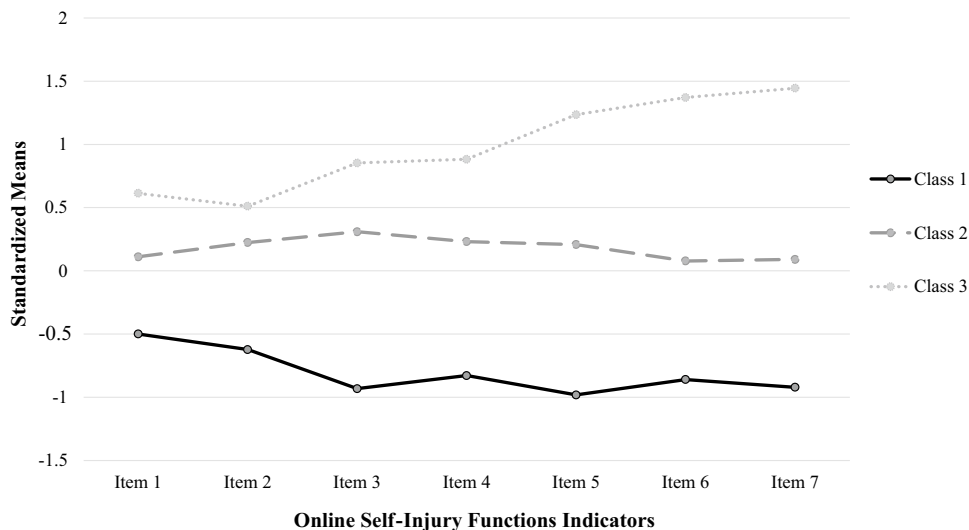


Fig. 1 Class profiles for the final 3-class model (total $n = 253$). Indicators represent the following self-reported functions of online self-injury activities: *Negative Affect Regulation: Item 1:* I am more likely to do these activities when I am feeling a negative emotion (e.g., upset, sad, angry). *Boredom Reduction: Item 2:* I am more likely to do these activities when I am feeling neutral or bored. *Reduced Isolation:*

Item 3: I do these activities in order to feel less isolated or alone. *Self-Expression: Item 4:* I do these activities to “vent” or express how I feel. *Recovery: Item 5:* I do these activities to help me try and get better. *Identity Exploration: Item 6:* Doing these activities helps me feel like I’m part of a group of other people like me and *Item 7:* Doing these activities allows me to express who I really am

Comparisons Across Classes: Social Media Activities, Perceived Outcomes, and SITBs

When considering the likelihood of engagement in specific social media activities, youth in Class 3, as compared to Class 1, were more likely to report having talked about self-injury with others met online and to have viewed others' content related to self-injury online (see Table 5). In addition, compared to youth in Class 1, those in Classes 2 and 3 were more likely to report having shared content (e.g., posts, messages, comments, photos, videos) related to self-injury online. No significant class differences emerged regarding participants' likelihood of using technology to talk about self-injury with "real life" friends.

In terms of perceived consequences, compared to Class 1, youth in Classes 2 and 3 indicated higher levels of agreement with statements indicating that these online self-injury activities led to negative consequences. In particular, participants in Classes 2 and 3 were significantly more likely to report that engaging in these activities led to the normalization of self-injury, feelings of thwarted recovery, self-injury related social comparison, and triggering of self-injurious behaviors. Classes 2 and 3 were also significantly more

likely to report that engaging in these activities resulted in them discovering new methods of self-injury.

Classes were also compared in regard to participants' lifetime history of SITBs. Youth in Class 3 were significantly more likely to have a history of NSSI compared to those in Class 1. Compared to those in Class 1, youth in Classes 2 and 3 reported higher suicidal ideation severity. However, no differences emerged between classes in terms of likelihood of one or more prior suicide attempts. In addition, no differences emerged between classes by age, gender identity, or sexual orientation.

Discussion

Very little work has examined online experiences that specifically involve self-injury, such as posting about self-injury, viewing self-injury related content, or communicating online about self-injury. Almost no studies have explored these experiences among youth with clinically severe mental illness (i.e., those who have been admitted to a psychiatric inpatient unit). This represents a critical gap in the literature, given that youth with psychiatric disorders may be more

Table 5 Online self-injury activities, perceived consequences, and SITBs across classes

	Class 1	Class 2	Class 3	χ^2
Online Self-Injury Activities	<i>Prob. (SE) / M (SE)</i>	<i>Prob. (SE) / M (SE)</i>	<i>Prob. (SE) / M (SE)</i>	
Shared content related to self-injury	0.16 (0.05) ^a	0.41 (0.09) ^b	0.47 (0.11) ^b	16.26 ^{***}
Viewed content related to self-injury	0.51 (0.06) ^a	0.63 (0.09) ^{a,b}	0.76 (0.11) ^b	7.11 [*]
Talked about self-injury with online friends	0.28 (0.05) ^a	0.42 (0.06) ^{a,b}	0.53 (0.08) ^b	7.48 [*]
Talked about self-injury with "real life" friends	0.64 (0.06)	0.78 (0.04)	0.81 (0.07)	4.93
Perceived Consequences of Online Self-Injury Activities				
Behavioral triggering	1.09 (0.12) ^a	1.65 (0.11) ^b	1.67 (0.19) ^b	13.04 ^{**}
Normalization	0.88 (0.11) ^a	1.77 (0.11) ^b	1.74 (0.19) ^b	38.87 ^{***}
Thwarted recovery	0.88 (0.11) ^a	1.60 (0.10) ^b	1.80 (0.18) ^b	30.80 ^{***}
Social comparison	0.81 (0.11) ^a	1.84 (0.11) ^b	2.24 (0.18) ^b	61.89 ^{***}
Discovery of new methods	0.56 (0.09) ^a	1.50 (0.12) ^b	1.42 (0.20) ^b	45.86 ^{***}
Self-Injurious Thoughts and Behaviors				
History of NSSI	0.72 (0.05) ^a	0.76 (0.05) ^{a,b}	0.89 (0.05) ^b	5.46 ^{****}
Suicidal Ideation	39.21 (2.75) ^a	48.42 (2.09) ^b	49.48 (3.52) ^b	8.43 [*]
History of Suicide Attempt	0.66 (0.06)	0.67 (0.04)	0.54 (0.09)	1.77
Demographics				
Age	15.33 (0.18)	15.13 (0.15)	14.69 (0.26)	0.42
Female	0.71 (0.05)	0.60 (0.05)	0.59 (0.08)	0.53
Gender Minority	0.10 (0.04)	0.14 (0.04)	0.19 (0.07)	0.53
Sexual Minority	0.53 (0.06)	0.53 (0.05)	0.62 (0.09)	0.83

Prob. = conditional probability of engagement in this behavior or belonging in this group, given latent class membership; NSSI/nonsuicidal self-injury. χ^2 represent Wald Chi-Square values for overall tests of association. A single test was conducted to compare probabilities for all three gender groups (female, male, gender minority) across three classes. Superscript letters denote column proportions differ from each other at the $p < .05$ level. Total $n = 253$. ; ** $p < .01$; *** $p < .001$; **** $p < .07$

likely to engage in, and be susceptible to, negative or risky social media experiences, but also may be poised to benefit most from supportive online interactions. Results show that there is a range in the types of online self-injury activities in which youth engage, as well as in the functions that these activities serve. Each of these factors may be critical for evaluating which youth are most at risk in regard to their online behavior, as well as who might benefit from intervention focused on improving online interactions.

Almost half of the psychiatrically hospitalized adolescents surveyed had engaged in some kind of online self-injury activity. Thus, a meaningful proportion of adolescents in this high-risk sample are engaging in these activities. The majority of adolescents reported engaging in online self-injury activities using social networking sites like Snapchat and Instagram. Very few endorsed engaging in these activities using chat websites or forums dedicated to persons who self-injure. Prior work has often focused on qualitative analysis of these forums (see Lewis and Seko 2016 for a review). Our results underscore the need to examine self-injury related activities in the online spaces most relevant to adolescents, as some studies of Instagram have begun to do (e.g., Arendt et al. 2019).

Online Self-Injury Activities among Sexual and Gender Minority Youth

Online self-injury activities were especially common in SGM adolescents. Among gender minority youth, 30.2% had shared their own content related to self-injury, and almost half (42.6%) had talked about self-injury with individuals known only online. Among sexual minority youth, nearly half (48.8%) had engaged in a least some online self-injury activities. It may be that online environments provide a low risk context for SGM adolescents to seek support from peers. Prior work suggests that SGM youth are more likely to have online-only friendships than cisgender and heterosexual youth (Ybarra et al. 2015), likely in part due to in-person social contexts that may be unsupportive or discriminatory. By engaging online, youth may reduce demands to respond immediately and minimize their exposure to potential negative response to disclosures of self-injury from in-person friends or family. Alternatively, in line with the social compensation hypothesis (Selfhout et al. 2009), it is possible that SGM adolescents who self-injure may have poorer quality friendships than those who do not self-injure, leading to fewer opportunities for in-person interactions and necessitating online interaction. These findings highlight the unique needs and possible mechanisms underlying the well-established heightened risk for SITBs in SGM populations (O'Brien et al. 2016).

Interpersonal Factors in Online Activities and SITB Risk

Talking about self-injury online with ‘real life’ friends and viewing content related to self-injury were significant predictors of suicidal ideation and history of NSSI in this sample of high-risk adolescents, even after controlling for gender, sexuality, and age. These findings are consistent with the Interpersonal Theory of Suicide, i.e., those who attempt suicide may have an acquired capability over time (Joiner 2005; Van Orden et al 2010). From a theoretical perspective, these online activities may serve as another means of gaining exposure to suicidal behaviors and reducing fear of self-harm. Indeed, recent longitudinal evidence suggests that exposure to self-injury content on social media predicts increased risk for SITBs (Arendt et al. 2019). Findings also suggest that *sharing* self-injury content was specifically associated with history of NSSI. It has been found that not only does sharing wound images on social media generate twice as many comments from other users than non-wound images, but also that as wound severity increases, so do the number of comments (Brown et al. 2018). It is therefore possible that sharing self-injury related content may reinforce self-injury engagement, which may account for the current findings. However, given that the directionality of effects is not known, it is also possible that youth with histories of NSSI and suicidal ideation are simply more likely to engage in each of these activities. Further work will be needed to explore these possibilities, and to investigate the relationship between sharing content related to self-injury and the frequency and severity of future NSSI engagement.

Interestingly, the only activity associated with a history of suicide attempts was talking about self-injury with ‘online friends’, highlighting a potential unique risk associated with this activity. Interpersonal theories of suicidal behavior highlight the role of thwarted belongingness, including social isolation and loneliness, in increasing risk for suicide (Joiner 2005; Van Orden et al 2010). Adolescents who have made a suicide attempt may have fewer offline friendships (i.e., thwarted belongingness), leading them to rely on online friends for support around self-injury. Given that both selection and socialization effects have been documented in regard to adolescents’ self-injurious behavior (e.g., Prinstein et al. 2010), these online friends may also be more likely to engage in self-injurious and suicidal behavior themselves, as well as to reinforce such behavior in their friends. However, longitudinal studies testing mechanisms of contagion in online adolescent friendships would be needed to evaluate these hypotheses. Regardless, these findings suggest that it is important to assess specific social media behaviors, rather than overall ‘social media use’, to gain a more nuanced understanding of risk, and ultimately to be able to inform clinical efforts.

Adolescent Identity Development and Online Activities

Three distinct subgroups emerged in regard to the reported functions of engaging in online self-injury activities. One group reported low levels of endorsement of all functions, one reported moderate levels of endorsement, and one high levels of endorsement. Notably, however, the high function endorsement class reported significantly higher levels of two functions in particular: recovery (or trying to get better) and identity exploration (being part of a group of others like me and expressing who I really am). There may be a subset of youth for whom posting about, viewing, and discussing self-injury online represents a facet of identity and a means of connecting with similar others and/or seeking resources and support. Adolescents in this class were at heightened risk for NSSI and suicidal ideation, and endorsed high levels of potential negative consequences of online self-injury activities, including thwarting recovery, normalizing self-injury, social comparison, learning new self-injury methods, and triggering engagement in self-injury. However, this class is notable due to the fact that despite these negative consequences, they reported significant positive beliefs about these activities – that they were aiding their recovery and serving an important component of their identities.

These findings may be understood within the context of developmental models of adolescent identity development (e.g., Christie and Viner 2005; Erikson 1968, 1980). Adolescence represents a critical period for the formation of a cohesive self-identity (Erikson 1968). This process is informed by the navigation of other developmental tasks, including the establishment of intimate peer relationships and building a sense of autonomy (e.g., Christie and Viner 2005). On social media, the ability to explore various self-presentations and to connect with similar others may be heightened (Nesi et al. 2018). However, for some youth, the online environment may create unique challenges in regard to these traditional developmental processes. When vulnerable youth, such as those at high risk for SITBs, seek to connect with others and explore burgeoning identities online, they are often doing so without clinical guidance or supervision. When these online processes involve self-injury activities, risk for SITBs may increase and recovery efforts may be hindered. This has implications for intervention with this group, including the importance of supporting other means of identity exploration and help-seeking, and noting contradiction between perceived and actual benefits of these online activities.

Limitations and Future Directions

This study had a number of strengths, including the use of a large clinical sample and focus on a burgeoning topic

in adolescent mental health with limited research. Future research should build on limitations of this work. First, analyses were based solely on self-report measures and were cross-sectional in nature. Use of real-time monitoring and ecological momentary assessment methods may provide more detailed and objective measures of online self-injury activities, and feelings/functions perceived in the moment while engaging in these behaviors. Relatedly, this study lacked continuous assessment of frequency, severity, and recency of SITBs, which are likely related to class membership and engagement in specific online activities, and thus will be important to measure in future research. Such continuous assessment could also discern nuances in the relationships between these constructs, such as examining associations between frequency, recency, and amount of online self-injury activities with SITBs and functions. In addition, although the use of latent profile analysis has limitations, these results add important initial insight into adolescents' motivations for engaging in online self-injury activities and associated risk for SITBs. Future research should explore these possibilities using in-depth, longitudinal investigations of individual profiles of online self-injury activities. Longitudinal studies are needed to inform directional and bi-directional relationships between online self-injury activities and SITBs. In addition, future studies should examine the degree to which the functions and perceived consequences of online self-injury activities differ from those of actual engagement in SITBs.

Given efforts to balance detailed data collection with feasibility and ease of administration within the context of usual care in an inpatient psychiatric setting, the created measure used may not have assessed the full spectrum of motivations for, or consequences of, engagement in online self-injury activities. In addition, each of the online self-injury functions was assessed using only one or two items. Thus, future efforts should seek to empirically develop and validate a comprehensive measure of online self-injury activities and functions, providing measures of concurrent and discriminant validity and reliability. In addition, such a measure should include multiple items per function and perceived consequence to allow for factor analyses. Furthermore, given the small sizes of subgroups within the groups of youth identifying as SGM, these subgroups were collapsed for analyses. Future work should examine, for example, potential differences between youth identifying as bisexual versus those identifying as gay or lesbian in regard to online activities and SITB risk (see Thoma et al. 2019). Finally, given that only adolescent report was collected, it is unknown how peers or larger social networks respond to online self-injury activities (e.g., via reinforcement, ignoring/isolation, or connecting to resources and/or services). Thus, future research should incorporate a multi-method, multi-informant approach to capture the broad impact online self-injury activities may

have on relationships, psychosocial functioning, and psychopathology from various perspectives.

Clinical Implications

Findings suggest that thorough assessment of online activities, particularly among psychiatrically impaired youth, may be an important component of clinical practice in the digital age. Such information may identify those at high risk for SITBs based on their online behavior, and those who therefore may require more intensive monitoring and intervention. Psychoeducation and treatments could be individually tailored based on identified functions of adolescents' online self-injury activities. For instance, adolescents who communicate online about their self-injury for affect regulation could learn alternative emotion regulation strategies, whereas adolescents who do so to reduce social isolation could learn online and offline social skills to improve the quality of social interactions and friendships. In addition, caregiver monitoring of online activity for self-injury related content may be particularly important for this high-risk group. Finally, given that rates of online self-injury activities were greatest among SGM youth, self-injury related online activities may serve as a potential mechanism underlying increased risk for SITBs among SGM youth, which could be examined and targeted in future intervention work. Findings highlight the array of online self-injury activities and potential functions of these behaviors in psychiatrically impaired youth, associations with risk for SITBs, and the need to further research into these online behaviors among vulnerable adolescents.

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Compliance with Ethical Standards

Conflicts of Interest The authors have no financial relationships or conflicts of interest related to this study to disclose.

Ethical Approval The Lifespan Hospitals Institutional Review Board (IRB) approved this research.

Availability of Data and Material The measures administered for this study were part of a standardized admission process for all adolescents admitted to a psychiatric inpatient unit. This study consists of a retrospective chart review, and thus the IRB approved a waiver of informed consent. Given the sensitive nature of such data, the authors will handle requests for data access on a case-by-case basis.

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