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Unfolding the notes from the walls: Adolescents' depression manifestations on Facebook

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Abstract

Little is known about the manifestation of teenage depression on Social Network Sites (SNS) in general, and in adolescents' Facebook status updates in particular. **Objective:** In this study, we compare the traditional 'offline' clinical picture of depression with its online manifestations and explore unique features of online depression that are less dominant 'offline'. **Method:** We collected 190 Facebook status updates of adolescents-at-risk (14-18 *yrs*), who receive psychosocial treatment. Ten licensed psychologists rated the extent to which a status update contained references to depression ($\alpha = .96$). **Results:** Based on both theory-driven as well as bottom-up approaches, a coding scheme was developed, resulting in a total of 13 features that significantly differentiated between 'depressive status updates' and 'non-depressive status updates'. Detailed descriptions and examples of these features are offered. Furthermore, a multiple regression analysis revealed four status update features that predicted status update depression scores: (1) DSM-5 depressive symptoms (including emotional and behavioral, *but not* somatic symptoms); (2) cognitive distortions; (3) poetic-dramatic form of verbal content; and (4) attitudes toward others. **Conclusions:** We discuss the findings and highlight unique features of online depression manifestation, which will ultimately contribute to early (and perhaps even automatic) detection of adolescents' depression from their online SNS activities.

Public Health Significance Statements. This study lays the ground for research aimed at early detection and prevention of depression, the "worldwide burden in the 21st century". The elaborated clinical picture of adolescents' depression on SNS, presented in this study, contributes to the development of automated screening tools for depression.

Key words: adolescents, depression, social media, detection, social networks

"Fortune is a traitor. I have cried and shouted to the stars, I have no love, I have no life… I hate life and I hate living, so I don't care anymore if it hurts others - apparently killing my self is the best way to solve my problems. So I would like to thank everyone who encouraged me to do so. Byyyyye…… BTW, those of you who see this and are thinking (again) that they are saving me by calling my mother, it's time that you understand: I don't want your help and believe me, you are just not helping, so go mind your own business and get out of mine!!! Bye and G-d willing, if he exists, I will see you in the afterlife" (documented Facebook status update of an adolescent girl).

Adolescence is characterized by major psychological changes, including a dramatic increase in rates of depression (Merrell, 2013). Depression is estimated to affect 10.7% of adolescents aged 12 to 17 (NIMH, 2013) and the highest rates of suicide attempts are documented among youth and young adults (Varnik, 2012). Many depressed adolescents endorse biased and maladaptive beliefs about themselves (Beck, 1974; Brent, Kolko, Allan, & Brown, 1990; Spirito, Esposito-Smythers, Wolff, & Uhl, 2011) and tend to ruminate about their negative experiences (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Rood, Roelofs, Bögels, Nolen-Hoeksema, & Schouten, 2009). Unfortunately, adult caregivers often underestimate, or are not aware of, their children's negative experiences (Rey & Bird, 1991; Velting et al., 1998). Nevertheless, because online Social Network Sites (SNS) have become extremely popular among adolescents (Brenner, 2012; Lenhart, Purcell, Smith, & Zickur, 2010), and because SNS are used by adolescents as a platform for emotional self-disclosure (Manago, Taylor, & Greenfield, 2012), our claim in this article is that SNS may be used as a novel tool for early detection of depression.

The number of active users of SNS is ever increasing and SNS actions accumulate to billions a day, worldwide (Rowan, 2014). Facebook is by far the most popular SNS, with an estimated 1490 million registered accounts as of August 2015, (Statista, 2015). In 2014, 96% of Israeli Hebrew-speaking teens[1] reported being active on at least one SNS (Ophir, Rosenberg, Asterhan, & Schwarz, 2016), with 89% having active Facebook

[1] This study did not include teens from the Ultra-Orthodox Jewish and the Arab-speaking populations.

accounts, on which they spend 2.3 *hrs* a day on average (Asterhan & Bouton, submitted). Teenagers and young adults use SNS technology for various activities, but most notably for self-presentation (Back et al., 2010), emotional self-disclosure and frustration "venting" (Manago et al., 2012), maintaining and creating social relations and affiliations (Hew, 2011) and even sharing learning materials (Asterhan & Bouton, submitted; Bouton & Asterhan, in press; Rosenberg & Asterhan, in press).

For better or for worse, online social networks have then become a central domain of adolescents' social life (e.g., Lenhart et al., 2010; Valkenburg & Peter, 2007). In popular media outlets as well as some academic literature, this often draws negative attention, highlighting concerns such as online bullying (e.g., Subrahmanyam, Reich, Waechter, & Espinoza, 2008), 'sexting' (e.g., Temple & Choi, 2014; Temple et al., 2014), and procrastination (Kirschner & Karpinski, 2010). In the present research, we argue for a more pragmatic approach and consider how the centrality of online social networks in adolescent life may be leveraged for detection and prevention of psycho-social distress.

Recent findings reveal that educational and other practitioners already use SNS data for such purposes in an intuitive way: Teachers and school counselors leverage their SNS connections with teenage students to monitor their emotional states and to detect signs of distress (Asterhan & Rosenberg, 2015). Ophir, Asterhan, and Schwarz (in press) report that social workers in urban youth-at-risk centers systematically scan the Facebook activities of adolescents under their care for risky behaviors and signs of depression. In times of war and political violence, Israeli high school teachers were found to provide their students with emotional support through Facebook and WhatsApp communication (Ophir et al., 2016). To date however, educational practitioners and counselors who use

SNS for monitoring and detection purposes do so intuitively, without formal knowledge about the phenomenology of adolescents' depression on social media. Moreover, little is known about adolescents' online manifestations of depression or other types of psychological distress.

The present study is a first study in a line of research that aims to gain a better understanding of how adolescents' depression may be detected from SNS activity log data. The goal of this study is to describe the manifestations of depression in teenagers' Facebook status updates, and how this compares to officially recognized, offline manifestations and symptoms of depression. Specifically, we compare teenage Facebook status updates that clinical professionals judged to be "depressive" with "non-depressive" ones, in order to extract and describe the content features that distinguish between the two.

Whereas some headway has been made regarding online signs of depression among college students (Moreno et al., 2011; Moreno, Jelenchick, & Kota, 2013), there is no research to date that focuses on adolescents in high schools. Moreover, previous attempts to detect depression have mainly focused on explicit manifestations of depressive symptoms, based on the Diagnostic and Statistical Manual (DSM) of mental disorders (APA, 2013). In the present work, we extend this scope in two ways: First, we include additional theoretical frameworks of depression such as cognitive distortions (Beck, 1974) and depressive rumination (Nolen-Hoeksema et al., 2008). Second, we use a bottom-up approach to reveal unique features of online depression that are not a-priori related to the clinical picture of 'offline' depression. By combining the two approaches, we address two research questions: (1) Which of the documented 'offline' depressive

manifestations are also likely to be found in online social network activity, and which are not? (2) What (if any) depressive manifestations are unique to online social network activities?

In the next sections, we shortly outline the foundation for the assumption that adolescents' SNS activity will include (either overt or covert) references to depression. We then review cognitive, emotional, and behavioral characteristics of depression, which may be manifested on SNS from a top-down approach. We complement this approach with the presentation of a bottom-up, a-theoretical approach and review previous attempts to link language usage and depression.

References to emotional states in social network activity

One of the reasons why we believe that depression could be detected from Facebook activity is because SNS are used for emotion sharing: Adolescents report that they often disclose more about themselves on SNS than they do in person (Christofides, Muise, & Demarais, 2009) and that emotion sharing is one of their main motives for using SNS (Hew & Cheung, 2012). In other research, Facebook status updates were indeed found to be used primarily for emotional self-disclosure (Manago et al., 2012). In comparison with off line experiences, the advantage of emotion sharing on SNS allows the individual to reach broad and diverse audiences (Bazarova et al., 2013; Kivran-Swaine et al., 2011) and therefore increases the number of replies (Bazarova et al, 2015). When users receive 'likes' or 'comments' such as "*hang in there*" or "*it will get better*" in response to their status updates, they essentially receive acknowledgement (Moreno et al., 2011) and experience a sense of belonging to a group of friends and acquaintance who acknowledge them (Holleran, 2010; Pickett, Gardner, & Knowles, 2004).

In some cases, status updates may include direct references to negative emotions, experiences, and distress (e.g., “When will all this stop? Just leave me be, I can’t take it anymore!”). Research by Moreno and colleagues (Moreno, Brockman, Wasserheit, & Christakis, 2009; Moreno, Egan, & Fleming, 2011; Moreno, Jelenchick, Grant, Pumper, & Richardson, 2011) screened college students' Facebook status updates for direct references to a range of health risk behaviors and for depression. They found that status updates included direct references to substance use and sexual behavior, as well as to negative emotional states and depression symptoms, as defined in the DSM-IV.

Mere reliance on top-down keyword searches for depression however, may prove to be problematic for detection. What may seem as an overt sign of adolescent depression at face value may not necessarily be a genuine cry for help, but an act of teasing, sarcasm or theatrical playfulness (e.g., “OMG, I just want to die! ;-) ha ha ha”). Moreover, people usually express fewer negative emotions in visible communication channels (i.e., status updates) than in one-on-one private communication (e.g., Choi & Toma, 2014; Sas et al., 2009). Therefore, public, overt reference to depression may be infrequent (Moreno et al., 2011). *Positive* emotions in contrast, may occur in higher frequencies because they serve the user's self-presentation management efforts (Bazarova et al, 2013). The question of whether online self-presentation is some form of embellished, idealized self (Paulhus & Trapnell, 2008; Siibak, 2009; Walther, 2007) or a real reflection on the user's inner feelings (Bargh, McKenna, & Fitzsimons, 2002) and personality (Back et al., 2010; Buffardi & Campbell, 2008; Ong et al., 2011) has been a central question in research on internet psychology for over a decade.

The question of whether a depressed adolescent will share his/her negative emotional state and directly refer to it in a SNS status update, is then not as straightforward: On the one hand, they may not want to share their negative emotional states in order to maintain a positive online image (Carlson & Heth, 2010). On the other hand, they may wish to use the social capital embedded in their online social network and express their negative feelings to recruit social and emotional support.

In conclusion, over-reliance on direct textual references to negative emotional states may not provide sufficient information for accurate and reliable detection of adolescents' depression. It is therefore important to complete the search for signs of depression with more covert aspects of online social network behavior. In the present study, we search for both overt as well as covert indicators of depression in Facebook status updates. We address the research questions by combining a *theory-driven, top-down approach* alongside a *bottom-up* grounded search for indicators of depression.

Top-down, theory-driven indicators of depression

The top-down approach consists of examining to what extent the traditional 'offline' clinical picture of depression is manifested in online status updates. The Diagnostic and Statistical Manual (DSM-5) of Mental Disorders (American Psychiatric, 2013) describes nine possible *symptoms of depression*, including: (1) depressed mood, (2) diminished interest or pleasure, (3) significant changes in appetite or weight, (4) insomnia or hypersomnia, (5) psychomotor agitation or retardation, (6) fatigue or loss of energy, (7) feelings of worthlessness and guilt, (8) diminished ability to concentrate and, in some cases, and (9) recurrent thoughts of death or suicide. *Suicide ideation* and suicide attempts range from a passive wish not to awaken in the morning, to transient but

recurrent thoughts of committing suicide, to a specific suicide plan. Motivations for suicide may include a desire to give up in the face of perceived insurmountable obstacles, a wish to end a continuous painful emotional state, or the wish to not be a burden to others (APA, 2013).

Depression, according to Aaron Beck's (Beck, 1974) cognitive theory of emotional disorders, is perpetuated by cognitive distortions, irrational, exaggerated and negative thought patterns. Cognitive distortions govern and bias ordinary cognitive processes such as screening and organizing information and they "paint" stimuli and experiences in depressive colors (Greenberg, Vazquez, & Alloy, 1988). Representative cognitive distortions in depression are: black-and-white thinking, overgeneralization, and catastrophizing (Beck, 1967; Burns, 1999). Black-and-white thinking is a tendency to see the world in dichotomous terms of success and failure or good or bad. Overgeneralization is defined as drawing broad and usually negative conclusions based on a single event, and catastrophizing is the exaggeration of minor setbacks (Burns, 1999).

Depressed individuals do not only perceive the world in distorted, "dark" colors, they tend to dwell and ruminate about their difficulties and negative mood. Depressive rumination, a main predictor of depression, is a maladaptive form of self-focus (Mor & Winquist, 2002; Watkins, 2008) in which people think about their depressive symptoms, and the causes and consequences of these symptoms (Nolen-Hoeksema & Morrow, 1991). Ruminative thoughts are typically (a) negative, (b) repetitive, and (c) focus on abstract "why me?" issues (e.g., "Why did he/she leave me", "What am I doing to deserve this?", or "Why can’t I handle problems better?"). Instead of engaging in instrumental behavior, individuals who tend to ruminate often remain stuck in a vicious cycle of stress

and negative thoughts. Essentially, they tend to go over past events, contemplate negative aspects and raise abstract questions why these events happened to them (Nolen-Hoeksema et al., 2008).

We hypothesized that these inherent cognitive, emotional, and behavioral characteristics that have been described in the clinical literature of "offline" depression (i.e., DSM-based symptoms of depression, suicide ideation, cognitive distortions, and depressive rumination) will serve as the "frontline" indicators for depression judgements of SNS behavior and therefore distinguish between depressive and non-depressive status updates. Although 'suicide ideation' is included in the DSM list of nine symptoms, it was also examined as a separate feature because of its potential predictive value of the *severity* of the depression.

Bottom-up, non-theoretical approaches for detection of depression

We complement this theory-driven approach with a bottom-up, a-theoretical search for unique indicators of online depression manifestation. Depression may “leak” through in other aspects of SNS behavior that a priori do not seem related to the official clinical picture of depression. Research from the pre-SNS era corroborates this expectation (Ramirez-Esparza, Pennebaker, Garcia, & Suria, 2007): Rude, Gortner and Pennebaker (2004), for example, compared written essays of depressive and non-depressive adults with the help of automated linguistic analysis tools. They found that these essays differ not only in terms of explicit emotion references (e.g. sad, worthless), but also on other non-clinical indicators, such as cognitive words (e.g., think), first person pronouns (e.g., I, me), and past tense verbs (e.g., had). Similar results were found in research on the detection of personality traits from individuals' writing samples (e.g., daily diaries):

People who tend to neuroticism were found to use more 'first person' grammar (e.g., I, me, my), whereas extroversion was associated with words that refer to positive emotions (e.g., happy, amazing) (Pennebaker & King, 1999). Using bottom-up data mining methods, others have succeeded in predicting age, sex, and even different types of personality (e.g., extroversion vs. introversion; neuroticism vs. emotional stability) from social media users' activity (Schwartz et al., 2013).

Similar to the approach in the abovementioned studies, we will also explore whether depressive and non-depressive Facebook status updates differ in linguistic or stylistic aspects. In alignment with this bottom-up approach, we did not have specific hypotheses as to which particular aspects would distinguish between depressive and non-depressive postings.

Method

Data collection

In this study, we analyzed 190 Facebook status updates of adolescents (age 14-18 *yrs*) who receive psychosocial treatment at the municipal division for the welfare and treatment of youth at risk in metropolitan Jerusalem.

The adolescents in this division range from low levels of risk (e.g., youth in formal institutions with low self-esteem or behavioral problems) to high levels of risk (e.g., youth who dropped out of school, involved in criminal actions, and are living in unsafe environments). These characteristics are accompanied with a relatively high proportion of psychopathologies such as anxiety, depression, and substance abuse. In light of these difficulties, the treatment in the division of youth-at-risk includes outreach services at different locations within the city limits. The youth-at-risk center also hosts a social

media unit, established to maintain contacts, provide mental health first-aid, and monitor signs of distress among the adolescents' in their care.

For five months, prior to and independently of the current study, social workers at this social media unit 'harvested' troubling Facebook status updates of their patients, as part of their daily monitoring activities. This yielded a collection of 95 status updates that were deemed 'troubling' (e.g., "I feel terrible. I cannot bring myself to get up"). Upon the authors' request, the personnel at the unit then harvested an equal number of status updates that they deemed 'neutral' (e.g., "Good morning everyone"), from the same pool of at-risk adolescents. All status updates were anonymized[2] by the members of the social media unit and were then delivered to the authors.

Procedure

The procedure of the study has been approved by the Ethics Committee of the School of Education at the Hebrew University of Jerusalem. The 190 status updates were presented to ten expert judges. These expert judges were licensed psychologists in clinical training, in a major city. At the time of the study, all ten judges (seven females) were active psychologists in their early 30's. Six judges worked in a family-community clinic with children, adolescents, and parents. Four judges worked in a clinic that specializes in the treatment of adolescents. Judges had a MA degree in psychology and at least four years of clinical experience.

Each status update was presented separately and in random order, upon which an expert judge was asked to rate the extent to which it was indicative of each of the following types of psychosocial distress: depression, anxiety, and peer victimization.

[2] Though no personal details were supplied, in many cases the language (Hebrew) reveals the gender of the writer of the status. For example, present tense verbs in Hebrew are different for male and female.

Anxiety and peer victimization were added in order to distinguish depressive manifestations from other types of distress, such as other mood disorders (anxiety) or problematic online behaviors (cyber bullying or peer victimization). Experts rated the extent that the status contained reference of each type of distress separately on a 6-point Likert scale (0 = not at all, 1= low, 2 = somewhat, 3 = moderate, 4 = very, 5 = high). The level of agreement among judges (inter-rater reliability) was substantial for anxiety (α = .78) and high for depression (α = .96) and peer victimization (α = .90). Judges worked independently and individually without meeting one another.

Results

The following analyses were conducted: First, we computed mean depression scores for each status based on judges' ratings, and identified depressive status updates. Second, we analyzed and contrasted the content features of depressive and non-depressive status updates. By using a verbal analysis method (Chi, 1997), we developed a quantitative coding scheme to differentiate between the two. Finally, we applied a bottom-up multiple regression analysis to the quantified data, to test which of these features contribute most to the prediction of depression judgement scores.

Part 1. Identifying depressive status updates based on judges' ratings

Mean ratings were computed for each of the three types of distress for each status, separately. Thus, each status updates received a mean score of depression, anxiety and peer victimization (range = 0-5, N = 190). Table 1 presents the mean scores across the full sample, as well as the cutoff-scores for the lower and upper percentiles for each of the three types of distress scores. The data in Table 1 show that depression was the most dominant type of distress in the collected sample of status updates (M = 1.6, SD = 1.5). A

little over a quarter of the total number of status updates (N = 49) achieved moderate-to-high scores on the depression judgement scale (≥ 3). In comparison, the cut-off point of the upper quartile of anxiety and peer victimization was very low (.50 and .40, respectively). From here onwards, we will refer to the upper quartile of status updates on the depression scale (N = 49, depression-scores ≥ 3) as *depressive status updates*, and to the lower quartile (N = 46, depression-scores = 0) as *non-depressive status updates*.

Part 2. Distinguishing features of depressive and non-depressive status updates

In order to extract features that distinguish between *depressive* status updates and *non-depressive* status updates, we analyzed and compared the content of status updates from these two categories. Content analyses relied on two complementary approaches: (1) A top-down, theory-driven approach that included the cognitive, emotional, and behavioral features of depression from the clinical assessment literature (i.e., DSM symptoms, suicide ideation, rumination and cognitive distortions); and (2) a bottom-up approach, based on verbal analysis methods (Chi, 1997). In alignment with this latter method, we first scrutinized all the status updates and marked notable differences between depressive and non-depressive status updates. We then extracted and defined content features that may serve as indicators for depressive (as well as non-depressive) status updates. Finally, we developed a coding scheme and trained two members of the research team to independently rate the collected status updates upon the extracted features.

The procedure described above yielded a coding scheme that comprises 13 different features organized in five coding categories that distinguished between depressive and non-depressive Facebook status updates (see Table 2 for a full overview). The content

categories are: (1) theory-based characteristics of clinical depression; (2) the usage of first person pronouns; (3) the valence of the content of the status; (4) the poetic function of the verbal message[3]; and (5) the status update author's attitude towards other people.

In order to determine interrater reliability, two members of the research team were trained to use the coding scheme and independently rated each of the 95 status updates (49 depressive and 46 non-depressive) on each of the 13 features. Each feature was rated on a dichotomous scale to estimate whether the status contained a reference to the measured feature (0 = no, 1 = yes). Two exceptions were "depressive symptoms" and "the word I", which were rated on a continuous scale to measure the exact amount of mentioned symptoms and the exact number of the word "I", respectively. Interrater reliability for all features was good (see Table 2). Discrepancies between the two raters (e.g., whether a status contained one or two symptoms of depression) were discussed and given a final rating by the authors.

Finally, non-parametric Mann-Whitney analyses were conducted to measure whether the mean scores for each extracted features significantly differed between depressive and non-depressive status updates. These analyses demonstrated that significant differences were found for each of the 13 features (see Table 2).

The overview in Table 2 shows that, depressive status updates included references to not only theory-based characteristics of depression (i.e., DSM depressive symptoms, suicide ideation, rumination, and cognitive distortions), but also a number of additional distinctive features, such as excessive usage of first person singular pronouns, negative content and curses, a poetic-dramatic linguistic style, and negative attitudes towards

[3] The term 'poetic function' (the form in which the message was chosen to be presented by the Facebook user) is further explained in the description of coding scheme.

others. Interestingly, four out of the 13 features characterized the non-depressive status updates: first person *plural* pronouns (e.g., we), positive content, a prosaic and concrete linguistic style, and positive attitudes towards others.

In the following section, we describe in further detail how we arrived at and coded each of the features presented in Table 2. The sample quotes were translated to English. In the translation process, an effort was made to maintain the style and content of the status updates intact, including spelling errors, slang words, curses, emoticons[4], and excessive usage of punctuation marks.

Depressive symptoms. Each status was coded whether it contained zero, one, or two references to DSM-5 symptoms of depression. Coding the amount of depressive symptoms in a given status can be challenging. First, even though the DSM describes distinct symptoms, some of the expressed symptoms overlapped each other, especially in the case of the features 'depressed mood' and 'diminished interest or pleasure'. Second, one status update is usually not enough to indicate a process over time, which is required for some of the DSM criteria, such as *diminished* interest or pleasure. We were then forced to make judgement calls and infer diminished pleasure or interest: Content that implies that the status' author is not enjoying something that is usually considered to be pleasurable by others ("being surrounded by people and yet, feeling all alone"), or that he/she does not find pleasure altogether (e.g., "everything sucks") was coded as an indicator of *diminished* interest or pleasure. Third, references to suicide ideation ranged from a subtle, covert content (e.g., "going to sleep, hoping to not get up") to explicit and

[4] Facebook status update box includes the option to select an emoticon (i.e., an emotion icon) that reflect upon the user current mood. The chosen emoticon appears with its description (e.g.,  feeling happy) on the user's profile page.

overt references to acts of suicide ("Killing myself is the best way to solve my problems").

We identified 94 references of DSM depressive symptoms (56 with one and 19 with two symptoms). Figure 1 presents the frequency of each one of the 9 DSM depressive symptoms. We did not find any references to somatic symptoms of depression (i.e., decrease or increase in appetite, insomnia or hypersomnia, psychomotor agitation, and diminished ability to concentrate). The depressive symptom that appeared most frequently (44.7% of total number of references) was depressed mood. References to diminished interest or pleasure (26.6%) and thoughts of death or suicide (19.1%) were dominant as well.

Following are examples of status updates that contained at least one symptom of depression. Because some status updates included references to two symptoms, some examples may qualify for more than one symptom.

1. Depressed mood
    a.  "Feeling down" – When will all this stop, the rumors, the text messages, the humiliations, the calling from blocked numbers?...
    b. When I am sad and high I couldn't care less if a car is to ran me over.
    c. I am sad sad sad :(
2. Diminished interest or pleasure
    a. FFFFFFuck everything sucks !!!!!!
    b. I have been left with myself, with a bitter taste of love… nothing is left after she left… [A quote from a tragic poem]
    c.  "Feeling lonely" – being surrounded by people and yet, feeling all alone.
3. Suicide ideation
    a. I hate life and I hate living, so I don't care anymore if it hurts others - apparently killing my self is the best way to solve my problems. So I would like to thank everyone who encouraged me to do so. Byyyyye…… BTW, those of you who see this and are thinking (again) that they are saving me by calling my mother, it's time that you understand: I

don’t want your help and believe me, you are just not helping, so go mind your own business and get out of mine!!! Bye and G-d willing, if he exists, I will see you in the afterlife

b. FFFFFuckkkkk, I want to commit suicide, life is shit.

c. Going to sleep, hoping not to get up...

d. Do not try to get hold of me!!! I am going and this time it's forever! Goodbye cruel world.

Cognitive distortions. Cognitive distortions reflect a general cognitive bias, in which stimuli and experiences are screened, organized, and "painted" in depressive colors (Greenberg et al., 1988). The literature on cognitive biases (Beck, 1967; Burns, 1999) differentiates between several cognitive distortions common in depression disorder, such as black and white thinking, overgeneralization, selective thinking, and catastrophizing. Even though reliable coding of the mere appearance of a cognitive distortion in status updates was successful, further attempt to distinguish between *different* distortions was not. Therefore, raters were instructed to judge whether the status contained any cognitive distortion (0 = no, 1 = yes), without committing to one specific distortion. Nevertheless, in the examples below we try to make a rough classification in order to demonstrate a range of cognitive distortions.

1. Catastrophizing - exaggerating negative affect and events

   a. Wohoo life sucks sooooo much!! Yaallaa, oooffffff

   b. How come all of you are leaving me in the most difficult time of my life, where is everybody

   c. My life is soooo difficult

   d. Wow! What a bad day and what a bad mood!!!!!""""""

2. Overgeneralization - drawing sweeping conclusions based on a single incident

   a. Love hit my life.

   b. Today is shit, life is shit

   c. When the pain increases, you forget from everything else and it falls on you in one huge boom! Life is disappointing

   d. FFFFuckkkk, until, finally, you've found a place where you are understood and you have fun, this place is taken. Every good thing in life is to be taken from me, ha?!?!?!

3. Selective thinking - focusing on negative aspects whilst ignoring positive ones

a. You can be surrounded by a million people and yet feel alone ☹

4. Black and white – dichotomous thinking of good or bad, success or failure

a. Nothing is left after she left…

b. Final status for today, I am not ugly, the world is ugly

c. I surrender! Whoever wants to keep fighting is welcomed to do so it without me.

d. When father could not talk to me, I had to keep everything in a small room… oh how I choose to withdraw from society, to run away from everything.

5. Arbitrary inferences - drawing negative conclusions without sufficient evidence

a. Why does it seem that everyone forgot me, or perhaps it 'does not seem', this is how it is!! :(((

6. Personalizing – blaming oneself for unpleasant things

a. I wish I was someone else. Oh God make me someone else. [A quote from a tragic poem]

b. Look at me, lord of the universe, how I distanced myself from everyone. [A quote from a tragic poem]

c.  "feeling sad" – FFuck, I am desperate; I don't know what do I want from myself.

d. Make it stop because I have no more power left in me. [A quote from a tragic poem]

Depressive rumination. Depressive rumination is a form of self-focus in which people engage in repetitive and negative thoughts about their depressive symptoms (Nolen-Hoeksema & Morrow, 1991). Rating rumination in Facebook status updates was especially challenging. First, rumination, involves by definition repetitions and elaborations that exceed the archetypal short form of Facebook status updates. Second, rumination includes thinking about depressive symptoms. Thus, the rating of rumination might overlap with other content features such as depressive symptoms or negative content. Coders were therefore instructed to only rate repetitions of content and/or frustrated impractical questions (e.g., "why do bad things always happen to me"), which may be distinctive to rumination. Individuals who tend to rumination search for the causes for their depressive feelings (Ophir & Mor, 2014; Papageorgiou & Wells, 2001), and focus on abstract "why me?" questions (e.g., "I think, *what* am I doing to deserve this?") and on obstacles to overcoming problems (e.g., "I think, *why* can't I handle

problems better?") (Nolen-Hoeksema et al., 2008; Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Even with this reduction of rumination to limited manifestations, 55% of the depressive status updates were coded as including references to rumination. We exemplify here instances of repetitions and questions, which were deemed as indicative of depressive rumination:

1. Repetitions
    a. Turning the volume of the music to the maximum, to shut all the pain, and the misery, and the sadness, and the agony that in my head.
    b.  "feeling sad"  :(:(:(Depression, Depression Depression, and even more Depression, I am sick of it.
    c. What a bad day, and a bad mood, bad bad bad!!!!!
2. Questions
    a. Why everything is so dammmm shittyyy????
    b. Why is it like this?... When will it stop? This ugly situation of mine :(
    c. I have no friends and no one cares about me… Why ??????????????????????????

Content valence. Depressive status updates were mostly negative whereas non-depressive status updates were mostly positive in content. Almost all of the depressive status updates (93%) included either swearing and curses (e.g., fuck, shit, dick) or words with distinct negative valence (e.g., disappointment, I'm burning, falling). In many cases, coding negative content overlapped with the coding of depressive symptoms or with the coding of cognitive distortions. This interdependency between the variables is considered in the subsequent regression analyses, reported further on. Interestingly, the majority of the non-depressive status updates (76%) included distinct positive content (good, pretty, blessed, fun, nice). This finding may indicate that the content valence base-rate of general (non-depressive) Facebook status updates is positive (rather than neutral). The following

examples demonstrate instances of negative and positive content, in depressive and non-depressive status updates, respectively.

1. Negative content
    a. Life is garbage… disgusting :(((((
    b. My dreams are all broken, all of these disappointments ruin me, everyone neglect me.
    c. Feeling defeated, Everything is fucked up, life sucks.
2. Positive content
    a. [Have] A Great and blessed week :))))
    b. Hurray!! I've got a new IPhone! I am so happy! I've waited for this moments for so long.
    c. A year of success, a year of love, a year of happiness, a year of health…
    d. I am happy to tell you guys that a nice cab driver found my purse and brought it to me all the way home with everything in it!!!
    e.  "feeling love"– happy valentines everyone 

Poetic function. Linguist Roman Jakobson (1960) defined six functions in acts of verbal communication. Each function refers to one of six different factors of verbal communication (addresser, addressee, context, message, channel, and code). For example, the *conative* function engages the addressee of the message (e.g., using imperatives: Jack! Come here now) and the *referential* function focuses on descriptions of places or events (e.g., the coffee place, next to the restaurant, at 42nd street). The *poetic* function of a verbal communication, on the other hand, focuses on the code of the verbal message for its own sake (Waugh, 1980). When authors craft their message and deliberately choose specific words, signs, or metaphors over other words, they "play" with the language code (e.g., "a green carpet" instead of "grass"). Poetry, according to Jakobson, is the ultimate example of the poetic function, because the poet deliberately chooses specific words to create "a work of art".

The comparison between depressive and non-depressive status updates revealed that communication messages in depressive status updates were in many cases lyrical, abstract and directed to the transcendent, in contrast with non-depressive status updates, which were more mundane, concrete and anecdotal. The so-called lyrical, abstract and transcendental characterization of poetic-dramatic function appeared in different ways in the Facebook statuses: Quotations from poems, references to more abstract concepts such as life (world, life, death), time (forever, time, period), and values (justice, fight, hope, love), as well as transcendent references to religion and metaphysics (God, the Lord, after-life). Altogether, 65.3% of the depressive status updates were coded as being crafted with poetic-dramatic function. Approximately 1 out of 5 depressive status updates (18.3%) included quotes from tragic poems. This finding suggests that depression manifestations in Facebook status updates may take a poetic and somewhat dramatic form.

The mirroring side of the poetic-dramatic form is the *prosaic* form, which was characteristic of many of the non-depressive status updates. The text in a status update was coded as prosaic when the author referred to concrete and mundane events or when they included anecdotes of personal experiences. Seventy percent of the non-depressive status updates (i.e., the lower quartile of status updates in the depression-scores scale) included reference to specific items (e.g., my new iPhone), days (e.g., Valentine's Day), actions (e.g., shopping), events (e.g., being at the finals of the basketball season), and places (e.g., Tel Aviv), or anecdotes. We contrast here examples of poetic-dramatic with prosaic status updates:

1. Poetic-dramatic
    a. Hearing but not listening, to hurt himself - returning... [A quote from a tragic poem]

b. [A full quotation of a tragic poem. The poem named "God" and it addresses the writer's pain, abandonment, suffering and hopelessness. The user ends the citation poem with a phrase:] shitty day, shitty life ☹.
c. Fuck with life, fuck with this knife, fuck with all. Where is God when he is really needed? Perhaps I am an atheist for a reason, since forever……
d. Fortune is a traitor. I have cried and shouted to the stars, I have no love, I have no life, I stand alone in front this pain with nothing to be done. [A quote from a tragic poem]
e. I am burning like a cigarette… slowly and painfully.

2. Prosaic

a. Got new phonnnne, send your numbers! Have a quiet and fun night, X-:
b. Ayyyy, there is nothing like Friday's soup.. have a great weekend everybody
c. Come on! Today is the final exam, the last one for this year, I wish I will make it!
d. This moment when the bath curtain sticks to you and you shoot it with the water ha ha ha ha ha
e. Finally, some raiinnnn! Have a great night guys.
f. Chillin' here in Eilat, there is no and will be no place like Eilat, I swear!!!!
g. Whhhhaaaat iiiiiiis thiiiiiiis coooooollllld? Whhhhhaaaaat???
h. Had no Internet access last night so I sat with my parent for a while.. seem like very nice people ☺ ☺ ha ha ha have a great weekend.

Attitudes towards others. Despite the fact that all the collected status updates in the study were taken from the same sample of adolescents-at-risk, many of the non-depressive status updates included positive references to other people and to feelings of belonging (76.1%). Positive attitudes to others included those to friends, peers, and families, but also to larger groups of affiliation, such as the community soccer fans or even the whole nation. In contrast, thirty percent of the depressive status updates included negative references to such "others". Following are several examples:

1. Positive attitudes towards others

a. After a great weekend with my bros. Have a great blessed week ☺ (Three Facebook users are tagged in the status)
b. 🙂 Friends, friends, till you start smiling from each text message you receive from him.
c. Every day is a new morning with a new chance and a new smile.. :) good morning to the people of Israel!!! Going to the beach with my bros ;)

d. Seven Facebook users are tagged to the status - Sometimes, friends are more than family, love you guys, and I am sorry for those I haven't tagged.

e. Another princess joined the family. MAZAL TOV everyone ☺

f. Six million, is a human being, and another human being, and another human being… will remember and will never forget ☹. Proud to be part of our nation.

2. Negative attitudes towards others

a. People are such assholes!!!!!!! No one loves me!!!

b. How many times more am I to be disappointed?! No one is to be trusted in this world!

c. 😣 "feeling depressed" - Feeling like shiiiiiiiit"…. Friends, ha? Tchhhh!! Don't lloookk for meee any mooore byyye]-:

Part 3. Predicting depression scores by status update features

In order to test which features contribute most to the prediction of depression scores, we conducted a set of consecutive analyses, which we present here. To consolidate and avoid duplications of the independent variables, each one of the 'bottom-up categories' was aggregated into one score, such that the value of the non-depressive feature score was subtracted from the value of the depressive feature score in the category. For example, the aggregated variable for category 3, content valence, was recoded as follows: -1 = contains only positive content, 0 = contains both positive and negative content, and 1 = contains only negative content. This procedure resulted in a total of eight variables, four from category 1, and four aggregated 'bottom-up' variables (Table 3).

In order to examine the inter-dependency between variables, zero-order correlations were computed between each of the eight variables for all 190 status updates. Table 4 presents the correlations between the eight features, as well as with the dependent variable of the study, the mean expert judges' depression-scores. The results show that content valence (negative minus positive) was highly correlated with attitudes towards others (negative minus positive), depressive symptoms, and cognitive distortions. Content valence was therefore omitted from the subsequent regression analyses.

To test which features contribute to the prediction of the mean depression score of a status update, a multiple regression analysis was performed on the entire sample (*N* = 190). It was hypothesized that the variables relating to theory-driven features of depression (DSM depressive symptoms, suicide ideation, rumination and cognitive distortions) would significantly contribute to the prediction of depression scores. However, we did not have specific hypotheses regarding the rest of the categories, as they resulted from a bottom-up approach. We therefore conducted a bottom-up analysis method of regression, in which the choice of predictive variables is carried out without an underlying theory. Seven variables were entered into the regression model: DSM-based depressive symptoms, suicide ideation, cognitive distortions, depressive rumination, first person usage, poetic function, and attitudes towards others. Tests for multicollinearity indicated low levels of multicollinearity (tolerance > .48 and < .83, for all independent variables).

The overall regression model significantly predicted depression scores, $r^2 = .83$, $F(7,182) = 126.61$, $p < .001$. The analysis yielded four distinct predictors of depression: In partial support of our hypothesis, two of the main predictors were from the theory-driven categories, namely the number of DSM-based symptoms of depression *(Beta* = .57, $p < .001$) and the inclusion of cognitive distortions (β= .26, $p < .001$). Two additional variables that significantly added to the prediction of depression scores were a-theoretical features, namely poetic function (β= .17, p < .001) and attitudes towards others (β= .09, p = .02). The other three variables, namely suicide ideation (β= .014, $p = .72$), depressive rumination (β= .02, $p = .56$), and 'first person usage' (β= .009, $p = .78$), did not add to the prediction of depression score.

Discussion

In this study, we explored adolescents' depression manifestations on SNS. We analyzed 190 teenage Facebook status updates that were rated on a depression scale by mental-health experts. Based on both theory-driven as well as bottom-up approaches, a coding scheme was developed, resulting in a total of 13 features that significantly differentiated between 'depressive status updates' and 'non-depressive' status updates. We described and illustrated these features in detail above, with many vivid examples.

The methodology and findings of the present study extend previous literature on detection of depression from SNS activities, which focused mainly on DSM-based symptoms of depression among college students (e.g., Moreno et al., 2011; Moreno et al., 2013). The analyses presented here demonstrated that, in addition to DSM-based depressive symptoms, depressive status updates were more likely to include cognitive distortions, poetic-dramatic function of content, and negative attitudes towards others.

The first feature, the number of DSM-based depressive symptoms, served as the "first line" SNS sign for depression. The explicit online manifestations of these depressive symptoms are mostly similar to those that are manifested in 'offline' behavior. However, our findings suggest that online manifestations of depressive symptoms usually involve references to the psychological and the behavioral aspects of depression, rather than to its more physical aspects, i.e., changes in appetite, sleep disturbances, psychomotor agitation or retardation, and loss of energy. Whereas SNSs are often used for emotion sharing (Manago, Taylor, & Greenfield, 2012), it makes sense that changes in physical indicators are less likely to be detected through SNS activities for several reasons: First, some of these symptoms are in fact reductions in action (appetite, energy). People rarely share

non-actions on a social platform such as Facebook. Others are not noticeable through the content and style of written verbal content (i.e., psychomotor agitation). Finally, sleep disturbances may be better detected from coding the hour of postings (e.g., nocturnal Facebook activity), rather than their content.

Interestingly, out of the other three hypothesized, theory-driven, features of depression (i.e., suicide ideation, cognitive distortions, and rumination), only cognitive distortions contributed to the prediction of depression scores. In the current sample, we witnessed a range of cognitive distortions: (a) black and white thinking, (b) overgeneralization, (c) selective thinking, (d) arbitrary inferences, (e) catastrophizing, and (f) personalizing (Beck, 1967; Burns, 1999). It is possible that the short and concise nature of Facebook postings does not leave room for "an array of colors or complexity", facilitates the depressive cognitive bias to "paint" the world in depressive colors (Greenberg et al., 1988). In contrast, depressive rumination might be less likely to leave traces on SNS, because rumination, by definition, involves repetitions and elaborations that do not lend to the typical short length and concise form of Facebook communication.

Although 'suicide ideation' is an overt sign of depression and requires immediate intervention, it did not predict depression rates over and above the other predictors in the regression model. This may be attributed to an increased use of references to death and suicide in adolescent SNS communication in general, even in non-depressive status updates. In one status update from our sample, for example, an explicit reference to suicide was framed as a joke: "*OK, I want to die, Let's go, I am jumping from a building, who wants to join me? Ha ha ha, hot men and women are waiting for me in heaven*". Thus, keyword searches for suicide references in adolescents' Facebook communication

might suffer from high levels of 'type 1 error' and wrongly detect depression in otherwise non-depressive status updates. In a personal communication with the authors of the current study, volunteers from 'Sahar', an Israeli internet-based psychosocial support service, admitted the high occurrence of such Type I errors in detection, when using a keyword-based algorithm to detect suicide intentions from web-blogs and SNS. These volunteers reported that many of these automated suicidal tendency detections turned out to be "false alarms". Our data show that other features could be taken into account and entered into such detection algorithms.

The third feature, poetic function, showed that whereas depressive status updates were often lyrical, abstract and referred to the transcendental, non-depressive status updates contained references to the mundane, concrete and anecdotal. The poetic-dramatic style of the depressive status updates included tragic poems ("*hearing but not listening, to hurt himself – returning*"), glorified depression ("*fortune is a traitor, I have cried and shouted to the stars… I stand alone in front this pain*"), and usage of abstract pseudo-philosophical terms ("*perhaps I am an atheist for a reason, since forever*"). Differences in the poetic function of the message are uncommon in descriptions of offline clinical pictures of adolescent depression, but contributed significantly to the prediction of the depressive nature of Facebook status updates, over and above more common features of depression. More research is then needed, both to replicate our findings concerning poetic-dramatic function, as well as to uncover the roots for this characteristic of online depression manifestation and the extent to which it is (or is not) unique to a certain communication medium.

Three research directions are suggested: First, the study of computer-mediated communication (CMC) has identified several features that are specific to its online, written format, such as its condensed form, the omission of punctuation, and the use of emoticons, contractions and abbreviations (e.g., Herring, 2002). It stands to reason depressed individuals who wish to be noticed in a continuous stream of updates and to receive reactions from their online friend, will make efforts to be short, concise, and original. However, we are not aware of studies that have directly studied the poetic function of SNS communication.

A second explanation may be found in the literature on negative, melancholic mood or depression and creativity (Akinola, & Mendes, 2008; DeMoss, Milisch, DeMers, 1993), in particular in the field of the language arts (e.g., Kyaga, Landén, Boman, Hultman, Långström, & Lichtenstein, 2013; Post, 1994). Interestingly, the induction of negative mood in an experimental environment facilitated creativity (e.g., Akinola & Mendes, 2008). Accordingly, the higher frequency of poetic-dramatic content in depressive status updates may be a particular instance of a more general tendency towards increased creativity. If so, then similar findings should be found in other textual outputs that are created by individuals in a depressive mood (such as, essays, diaries, online blogs).

Finally, we suggest to explore whether poetic-dramatic style result from the intersection between depression, SNS communication, and adolescence. The period of adolescence is generally characterized by an increased tendency toward self-centeredness (Elkind, 1999), such as beliefs that others are as concerned about them as they are (i.e., imaginary audience) and that their thoughts and experiences are unique

(i.e., personal fable) (Goossens, Beyers, Emmen, & Van Aken, 2002). Thus, the adolescent who suffers from depression, might believe that he or she is experiencing unique feelings. With the emergence of online SNS, these egocentric beliefs can even be augmented and, in a way, carried into effect, because every member is given a personal soapbox, as well as a large audience. Future research that involves comparisons between adult and teenage depressive status updates could determine whether increased emphasis on a message's poetic function is then a unique feature of adolescent SNS behavior or of depressed individuals in general.

The fourth distinctive feature that contributed to the prediction of depression scores was attitudes towards others. Peer relationships are extremely important in adolescence (Carlson & Heth, 2010) and unconstructive peer relationships are associated with adolescents' depression (Hecht, Inderbitzen, & Bukowski, 1998; La Greca & Harrison, 2005). The finding that thirty percent of the depressive status updates included negative attitudes towards others fits this literature on peer relations and depression. They rarely included positive references to others or references to group belonging. In contrast, more than three quarters of the non-depressive status updates included positive attitudes towards others and feelings of belongingness. This emphasizes the significance of status updates who include negative attitudes towards others. An adolescent standing on the Facebook podium shouting at his peers, as it were ("*Friends, huh? assholes!!!!!!! No one loves me!!! No one is to be trusted, Don't seeearch for meee any mooore*") is an exception that proves the rule. He or she might suffer from social rejection, loneliness and low self-esteem and, thus, be at risk for depression (Coie, 1990; McDougall, Hymel, Vaillancourt, & Mercer, 2001).

Limitation and future directions

In the present study, we aimed to extract features that differentiate depressive from non-depressive Facebook status update, based on the content of the status update, which was rated by mental health experts. Due to confidentiality issues, we did not have access to detailed personal mental health information of the adolescents who wrote the status updates. This means that although it was known that the at-risk population included many depressed adolescents, and in spite of the fact that the (non-)depressive character of the statuses was established by experts, no information was available about the mental health status of each of the adolescent. This limits the predictive validity of the findings. Future research should examine what features can be considered as valid and informative signs of depression by examining Facebook activity of individuals with and without a diagnosis of depressive disorder.

Despite this limitation, the findings presented here offer an elaborated clinical picture of adolescents' depression on SNS and lay the ground for research aimed at detecting depression online. We were able to extract 13 features that differentiate between depressive and non-depressive status updates (Table 2). We conclude that, from a top-down, theory-driven approach, the 'offline' depressive manifestations that are likely to be found in online social network activity are: DSM-based symptoms and cognitive distortions. Rumination and suicide ideation may also be tracked on SNS but in the current study, they did not contribute to the prediction of depression scores beyond other variables. In this sample, we did not find references to somatic symptoms of depression. The bottom-up approach yielded the communicative poetic function of the message and the attitudes towards others that are crucial for establishing whether a status is depressive

or not. Altogether, the distinct features that were found in this study, may contribute to early detection of adolescents' depression and to the development of an automated screening tool for depression. Computerized language processing techniques that are currently being developed may contribute to this endeavor.

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Table 1.

Descriptive statistics of the mean expert judges' scores, for three types of distress (N = 190)

		Depression	*Anxiety*	*Peer victimization*
Mean		1.6	.36	.35
SD		1.5	.49	.70
Percentiles	25	.10	0	0
	50	1.4	.20	0
	75	**3.0**	.50	.40

Note. Experts' scores are the extent to which a status update contained reference to each type of distress on a 6-point Likert scale (range = 0-5).

Table 2

Features that differentiate between depressive and non-depressive status updates

Category	*Feature*	*Definition and examples*	*Kappa*	*Type of status*	*Mean*	*SD*	*Frequency*		*Sig**
Clinical picture of depressive disorder	1. DSM Depressive symptoms	References to one or two of the nine DSM symptoms of depression e.g., "life is shit - feeling depressed" :-(((((((	.812	Non-depressive	.00	.00	0%		<.001
				Depressive	1.34	.52	1	61.1%	
							2	36.7%	
	2. Suicide ideation	Reference to suicide or death wishes e.g., "I don't want to live anymore!!!"		Non-depressive	.00	.00	0%		<.001
				Depressive	.34	.47	32.7%		
	3. Cognitive distortions	Reference to at least one cognitive distortion e.g., overgeneralization: "can't trust *anyone*"	.97	Non-depressive	.00	.00	0%		<.001
				Depressive	.95	.19	95.9%		
	4. Rumination	Ruminative questions or repetitions e.g., "Why why, no one is listening?"	.93	Non-depressive	.04	.20	4.3%		<.001
				Depressive	.55	.50	55.1%		
First person usage	5. First person singular	First person singular words e.g., "I", "me", Hebrew singular verbs	.98	Non-depressive	.34	.48	34.8%		<.001
				Depressive	.61	.49	61.2%		
	6. First person plural	First person plural words e.g., "we", "us", Hebrew plural verbs	1	Non-depressive	.23	.43	23.9%		.001
				Depressive	.02	.14	2%		
	7. The word "I"	The exact count of the word "I" in each status	1	Non-depressive	.15	.41	1	10.9%	<.001
							2	2.2%	
				Depressive	.51	1.02	1	18.4%	
							2	2%	
							3	4.1%	
							4	4.1%	
Content valence	8. Negative content	Negatively valenced content e.g., "shit", "bad", "hate"	.94	Non-depressive	.13	.34	13%		<.001
				Depressive	.93	.24	93%		
	9. Positive content	Positively valenced content and news. e.g., "nice", "good", "love", "I got a driving license!"	1	Non-depressive	.76	.43	76.1%		<.001
				Depressive	.02	.14	2%		
Poetic function	10. Poetic-Dramatic	Lyrical and sublime, abstract, or transcendent e.g, Poems, G-d, life, after life	.94	Non-depressive	.21	.41	21.7%		<.001
				Depressive	.65	.48	65.3%		
	11. Prosaic	Anecdotes and concrete places, time, or actions e.g., "I got a new iphone", "chillin' at the beach"	.85	Non-depressive	.69	.46	69.6%		<.001
				Depressive	.10	.31	10.2%		
Attitudes to others	12. Loneliness or negative attitudes to others	Negative references to others and expressions of loneliness. e.g., "no one cares about me"	1	Non-depressive	.08	.28	8.7%		.008
				Depressive	.30	.46	30.6%		

	13. Companionship or positive attitudes to others	Positive references to others and joined experiences. e.g., "my friends are the best :-)".	.87	Non-depressive	.76	.43	76.1%	<.001
				Depressive	.02	.14	2%	

Note. 1. All features were rated on a dichotomous scale (0 = no, 1 = yes) beside "depressive symptoms" (exact number of symptoms) and "the word I" (exact number of the word "I"). 2. Sig = significant differences that were obtained from non-parametric Mann-Whitney analyses. 3. Ratings of first person, singular and plural, were based on words such as "I" or "we" alongside verbs because Hebrew verbs usually include pronouns (e.g., 'I went' may be said in one word). 4. 'Positive content' is different from 'Positive sharing'. Whereas the first signifies all status updates that contain positive content, the latter is a specific sharing of "good" news. This feature may be seen as the mirror picture of sharing depressive feelings (which is included in the first cluster).

Figure 1.

Relative frequency (in percentage) of depressive symptoms (N = 94)

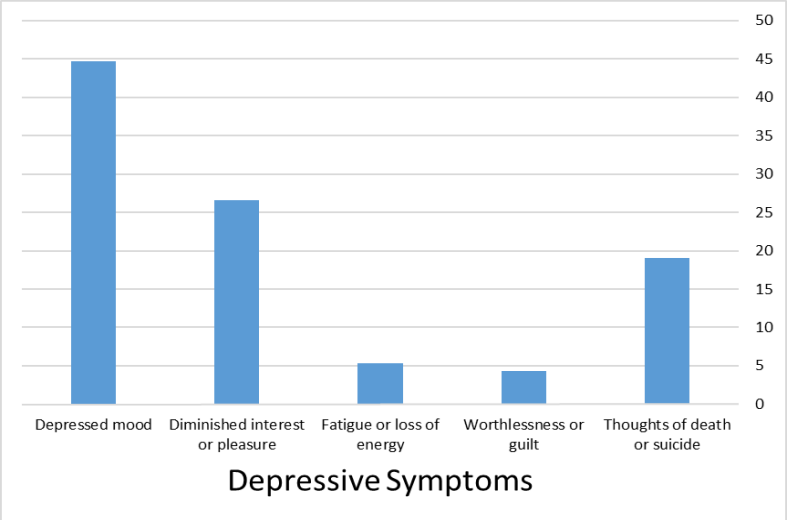

Table 3.

Descriptive statistics for the four new aggregated variables

Aggregated variable	*Status update*	*Mean*	*SD*	*Frequency*		*Significance*
First person singular – First person plural	Non-depressive	.10	.67	-1	17.4%	<.001
				0	54.3%	
				1	28.3%	
	Depressive	.59	.49	-1	0%	
				0	40.8%	
				1	59.2%	
Negative content – Positive content	Non-depressive	-.63	.67	-1	73.9%	<.001
				0	15.2%	
				1	10.9%	
	Depressive	.91	.27	-1	0%	
				0	8.2%	
				1	91.8%	
Poetic-dramatic – Prosaic	Non-depressive	-.48	.58	-1	52.2%	<.001
				0	43.5%	
				1	4.3%	
	Depressive	.55	.54	-1	2.0%	
				0	40.8%	
				1	57.1%	
Negative – Positive attitudes towards others	Non-depressive	-.67	.63	-1	76.1%	<.001
				0	15.2%	
				1	8.7%	
	Depressive	.28	.50	-1	2%	
				0	67.3%	
				1	30.6%	

Note. Except for the first category of depressive disorder, aggregated variables were computed for each category by subtracting the non-depressive feature (e.g., positive content) from the main depressive feature in the category (e.g., negative content).

Table 4.

Spearman correlations between the eight features and depression-scores (N = 190)

	Depression scores	**Depressive disorder**				**First person**	**Content valence**	**Poetic function**
	Experts ratings	DSM-IV symptoms	Suicide ideation	Cognitive distortions	Depressive rumination	Single - plural	Negative - positive	Dramatic - prosaic
Depressive symptoms	.839**							
Suicide ideation	.449**	.472**						
Cognitive distortions	.748**	.686**	.336**					
Depressive rumination	.452**	.470**	.064	.500**				
First person Singular – plural	.246**	.223**	.162*	.214**	.134			
Content valence Negative – positive	.698**	**.647****	.262**	**.648****	.430**	.178*		
Poetic function Dramatic – prosaic	.513**	.281**	.235**	.389**	.190**	.096	.351**	
Attitudes to others Negative – positive	.552**	.504**	.189**	.490**	.319**	.189**	**.764****	.333**

Note. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).