PSYCHOLOGY

Depressive cognition on Twitter

Psychologists have long known that people with depression often have unhelpful, negative patterns of thinking, known as cognitive distortions. Bathina et al. now show that these thought patterns can be detected in the everyday language of social media and that individuals who report a diagnosis of depression express more cognitive distortions.

David J. A. Dozois

Cognitive distortions are unhelpful, inaccurate, and (usually) negative thoughts commonly exhibited by individuals with depression. Although this type of negative thinking has been demonstrated consistently among individuals with depression[1,2], research has not yet examined the language of depressed persons in 'real-world' settings, such as through social media. A fascinating study in *Nature Human Behaviour* by Bathina et al. that analyzed over 1.5 million tweets addresses this gap[3].

In this article, the authors used advanced data analytic techniques to assess cognitive distortions in tweets from 1,035 individuals who stated, through social media, that they have been diagnosed with depression, and compared them to a random comparison group. The authors identified distortions by searching for words or strings of words characteristic of different types of distorted thinking. For example, for the distortion of overgeneralization, terms included 'all of the time', 'always happens', and 'no one ever.' Tweets from individuals with self-reported depression were found to have a greater proportion of cognitive distortions than the comparison sample, a finding that did not appear to be due to other confounding variables (for example, valence of content).

This is an innovative and sophisticated study, with interesting methodology and research design and with appropriate checks on the sensitivity and specificity of the data. The topic is important, especially given recent concerns over the negative effects that social media can have on mental health[4].

Although these findings are intriguing, it is important to point out a few caveats that might help to contextualize their significance. The authors appropriately acknowledged the important limitation that they could not verify self-reported diagnoses of depression. Even if diagnoses could be confirmed, however, another concern is the extent to which tweets posted online reflect the actual content of depressive thinking.

This study clearly demonstrated that the tweets of individuals with self-reported depression contained more cognitive distortions than the tweets of non-depressed individuals. However, one cannot rule out the possibility that there may be a selection bias in the sample. Participants in the depressed group were people who had stated on social media that they have been diagnosed with depression, yet many individuals with depression never report this on Twitter. Therefore, as the authors note, it is possible that this study captured the thoughts of a subgroup of individuals who were particularly vocal and open about their negative thinking, rather than being representative of most individuals with depression.

Another factor to consider, as the authors point out, is the extent to which the thoughts reflect 'distortions' per se. Without analyzing the context in which these statements were made it is difficult, if not impossible, to determine their (in)accuracy. A related issue is whether online platforms like Twitter can accurately represent what people think in the real world. On one hand, there may be impression management[5]; on the other hand, it is possible that some people use social media as a strategy for obtaining social support. Regardless, research demonstrates that when people are aware that they are being observed, their behaviour can change in a manner that may not be representative of their usual behavioural repertoire (for example, the Hawthorne effect)[6].

Notwithstanding these limitations, the study is interesting and opens up several possibilities for future assessment of cognitive vulnerability and the treatment of depression. As the authors argue, cognitive behavioural therapists have developed strategies for assessing and challenging negative thinking in depression. Cognitive behavioural therapy (CBT) is a highly efficacious intervention and one that is also prophylactic against relapse[7]. The technology used in this study may help us better understand how patterns of language impact vulnerability to depression and how these patterns change with CBT. In addition to classifying the proportion of negative thoughts and distortions, this technology might also be useful for assessing deeper schema structures[2]. For example, it might be possible to assess deeper schema structures by determining whether there are common themes that recur within an individual's tweets.

The technology reported in this article may also complement well some of the recent advancements in CBT-related digital therapeutics. Typically used with a smartphone and delivered through an app, digital therapeutics can help patients to modify their lifestyle and behaviour in ways that are antidepressant[8]. As one example, a patient could receive text messages to encourage them to get out and do some physical activity. Using global positioning systems (GPS), the app could also recognize that someone has taken a shortcut on a walk to a friend's house and encourage them to take a longer route. These apps can also be used to improve treatment compliance, managing sleep–wake cycles, and modifying other lifestyle habits. The technology described by Bathina et al.[3] could be used to help individuals recognize depressotypic language in social media and then encourage them to monitor, challenge, and change biased thinking or develop a new relationship with their thoughts (for example, acceptance or decentring).

Further research is needed to assess the reliability, validity, and ecological utility of the techniques described in this article. Assuming that these findings are reliable and robust, there are numerous avenues that future research could address, including testing the utility of this (and related) technology for psychotherapy outcome assessment, appropriate timing for treatment

termination, relapse prevention, and efficacy of treatment. ❐

David J. A. Dozois
University of Western Ontario Psychology, Westminster Hall, London, Ontario, Canada.
✉*e-mail: ddozois@uwo.ca*

Published online: 11 February 2021
https://doi.org/10.1038/s41562-021-01054-3

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Competing interests

D.J.A.D. is a member of the Medical & Scientific Advisory Committee, Otsuka Pharmaceutical, which is developing digital therapeutics for depression.