Language Use Patterns in Depressed Patients

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Abstract

Language use patterns can reflect psychological states and psychopathological characteristics. Language use patterns differ between patients with depression and healthy populations, and identifying the language use patterns of depressed patients can facilitate the prediction and diagnosis of depression. Both traditional psychological research and social media-based studies have demonstrated that individuals with depression use first-person singular pronouns and negative emotion words more frequently, while using first-person plural pronouns and positive emotion words less frequently. Social media-based research has further identified additional linguistic markers in the daily lives of depressed individuals. Future research should further confirm more depression-specific linguistic markers and further explore the theoretical connections between linguistic markers and depressive symptoms.

Full Text

Linguistic Patterns in Depression: A Review

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Abstract

Language use patterns reflect psychological states and psychopathological characteristics. Individuals with depression exhibit distinct linguistic patterns compared to healthy populations, and identifying these patterns can facilitate the prediction and diagnosis of depression. Both traditional psychological research and social media-based studies have demonstrated that depressed individuals use more first-person singular pronouns and negative emotion words, while using fewer first-person plural pronouns and positive emotion words. Social media research has further identified additional linguistic markers of depression in daily life. Future studies should identify more depression-specific linguistic markers

and explore the theoretical connections between these markers and depressive symptomatology.

Keywords: depression, language use patterns, social media, prediction, diagnosis

Depression affects 4.4% of the global population (Friedrich, 2017) and 3.6% of the population in China (Huang et al., 2019). It severely diminishes quality of life, with 15% of patients dying by suicide (Gold et al., 2015), and constitutes a major contributor to the global disease burden while causing immense suffering for patients' families (Herrman et al., 2019; Ledford, 2014). Depression is projected to become the world' s leading cause of disease burden by 2030 (Lancet, 2012). Given the lack of early screening tools and limitations of existing diagnostic methods (e.g., difficulty of administration, time consumption), novel approaches to assessing depressive mood are critically important for timely intervention and treatment. Recently, researchers have identified a promising new method: examining individuals' language use patterns.

Language use patterns refer to tendencies in word choice during verbal expression. Specific linguistic patterns correlate with mental health indicators (Leis et al., 2019), suggesting that subtle clues about psychological well-being can be detected through language. These patterns shift with psychological states during both naturalistic settings and psychotherapy (Pulverman et al., 2015; Leis et al., 2019), and can distinguish depressed individuals from healthy controls (Hussain et al., 2019). Thus, observing language use patterns enables psychologists to assess depressive mood in both research and clinical practice. For instance, during psychotherapy, clinicians can potentially track patients' depressive trajectories by analyzing recorded sessions or written texts. In many contexts, linguistic analysis may offer a relatively accessible method for detecting and evaluating depression.

The National Institute of Mental Health (2012) encourages researchers and practitioners to assess psychological disorders through multiple methods, emphasizing the development of behavioral measures that capture specific psychological states. Examining language use patterns provides an innovative and convenient approach for evaluating mental health, applicable to early prediction and auxiliary diagnosis of depression. Research in this area originated in traditional psychology and has gained increasing attention with the rise of social media studies. However, the field remains in its infancy, particularly in China. This review synthesizes findings from both traditional psychological research and social media studies to characterize the linguistic patterns of depressed patients, providing a foundation for future research in China.

2. Psychopathological Features of Depression and Corresponding Linguistic Markers

The linguistic patterns of depressed patients encompass various word-use tendencies that serve as linguistic markers of psychopathological features, translating

internal psychological characteristics into observable behaviors (Boyd & Pennebaker, 2016). These markers have been central to traditional psychological research.

Self-focused attention represents a prominent feature of depression, defined as "awareness of internally generated information based on self-reference, in contrast to awareness of externally generated information received through the senses" (Ingram, 1990), emerging during self-evaluation processes that compare actual and ideal selves (Duval & Wicklund, 1972). When individuals perceive discrepancies between their actual and ideal selves, they engage in continuous discrepancy-reduction behaviors and self-evaluation until the gap closes. Those experiencing negative life events or unfulfilled important goals may judge their ideal state as unattainable, developing a maladaptive self-focus style. This excessive and rigid self-focus contributes to psychopathology (Pyszcynski & Greenberg, 1987). Research has confirmed the association between self-focus and depression (Nejad et al., 2019), with the degree of self-focus reflected in first-person singular pronoun usage (Pyszcynski & Greenberg, 1987; Silvia & Abele, 2002). Thus, first-person singular pronouns serve as linguistic markers of self-focus, with their relative frequency in written or spoken language indicating self-focus levels (Zimmermann et al., 2017).

In social relationships, depressed patients exhibit social isolation. Social connections constitute a vital component of human life with significant impacts on mental health, influencing well-being through social activities, social support exchange, and access to material resources (Kawachi & Berkman, 2001). Poor social relationships correlate with depression (Liu et al., 2020), with common indicators including being single, living alone, having weak or small social networks, and infrequent social interaction (Chan et al., 2011). While first-person singular pronouns in subject and object forms emphasize the self as an isolated individual, first-person plural pronouns emphasize the self as part of social relationships. Their usage correlates not only with depression but also with multiple indicators of social relationship quality, including interpersonal and marital relationship quality (Abe, 2009; Rohrbaugh et al., 2012; Schoch-Ruppen et al., 2018). Consequently, first-person plural pronoun usage serves as a linguistic marker of social relationship quality.

Additionally, depressed patients' cognition shows negative bias and positive deficit characteristics. Specifically, they attend more to negative stimuli and less to positive stimuli, tend to interpret ambiguous emotional events or stimuli negatively, ruminate on negative material, and inhibit positive emotional responses (Suslow et al., 2019; Vanderlinde et al., 2020). Individuals' inner worlds are reflected through language expression, with most studies indicating that depressed individuals use more negative emotion words and fewer positive emotion words than healthy controls (e.g., Schoch-Ruppen et al., 2018).

3. Linguistic Patterns of Depressed Patients: Findings from Traditional Psychological Research

Traditional psychological research primarily employs constructed-response data analysis, requiring participants to complete designated open-ended tasks (e.g., writing or speaking tasks) within specified timeframes, then analyzing the generated text content. Task instructions might include "Please discuss your future career" or "Please talk about your deepest thoughts and feelings regarding your interpersonal relationships" (Newell et al., 2017; Tackman et al., 2018). This open-ended assessment process, unconstrained by structured measurement limitations, increases expressive freedom while providing insights into subjective inner worlds.

Researchers predominantly use Linguistic Inquiry and Word Count (LIWC) software to analyze linguistic patterns in produced texts (Pennebaker et al., 2007). LIWC rapidly and systematically transforms qualitative data, such as speech or text, into quantitative data, enabling quantification of depressed patients' language use patterns. As an alternative to structured interviews and questionnaires, LIWC avoids common method bias and content overlap. Quantified text content can be analyzed statistically to identify linguistic markers of depression and understand characteristic patterns. Longitudinal comparisons can also assess psychological changes following psychotherapy or stress. Based on these methods, traditional psychological research has yielded the following findings.

3.1 Increased Use of First-Person Singular Pronouns by Depressed Patients

Rude et al. (2004) pioneered the use of constructed-response data analysis to study linguistic patterns in depression. In their study with college students, participants completed a writing task: "Please describe your deepest thoughts and feelings since starting college." Results indicated that depressed college students used more first-person singular pronouns in their writing (e.g., "Since I started college, I have felt very lonely. It' s not that I' m unhappy, but···"). College students with past depression who were not currently depressed showed gradually increasing first-person pronoun use during writing, possibly due to depressive vulnerability traits where cognitive load or information processing tasks trigger depressive-like thinking patterns. Subsequent studies have also examined the relationship between first-person singular pronoun use and depression (e.g., Fast & Funder, 2010; Molendijk et al., 2010; Zimmermann et al., 2013). Although most studies found increased first-person singular pronoun use in depressed patients, some failed to replicate this finding (e.g., Zimmermann et al., 2017; Schoch-Ruppen et al., 2018). Edwards and Holtzman (2017) conducted a meta-analysis of 21 studies with 3,758 participants, revealing a weak correlation between first-person singular pronoun use and depression. Tackman et al. (2018) suggested that inconsistent findings might result from small sample sizes producing unstable effects and failure to control for moderating variables. They collected data from 11 samples across 6 laboratories in 2 countries (total-

ing 4,754 participants, including college students, clinically depressed patients, and community adults) under various controlled conditions completing writing or speaking tasks, again finding a weak correlation between first-person singular pronoun use and depression.

Some studies have examined specific types of first-person singular pronouns (i.e., subject "I," object "me," and possessive "my") and their relationship to depression (e.g., Rude et al., 2004; Zimmermann et al., 2017; Tackman et al., 2018). Tackman et al.' s (2018) study of 4,754 participants found that depressed individuals used more subject (e.g., "I feel like an ugly and stupid person") and object (e.g., "No one in this world will miss me") forms of first-person singular pronouns, but not more possessive forms. This suggests different psychological processes underlie different pronoun forms. Possessive first-person singular pronouns reflect attention to relationships between the self and others or objects, while subject and object forms reflect isolated self-focus (with subject and object forms representing self as agent and target, respectively; James, 1890). Overall, these results indicate that depression correlates with language reflecting isolated self-focus, not relational self-focus.

Other studies have examined how communication context affects first-person singular pronoun use in depressed individuals (e.g., Edwards & Holtzman, 2017; Tackman et al., 2018). Edwards and Holtzman' s (2017) meta-analysis found slightly stronger correlations between first-person singular pronoun use and depression in private communication contexts (e.g., personal diaries) than in public contexts (e.g., online blogs), though the difference was not statistically significant. Tackman et al. (2018) examined differences in correlations between first-person singular pronoun use and depression under personal versus impersonal conditions. Results showed the correlation existed only in personally relevant communication contexts (e.g., discussing one' s interpersonal relationships) but not in impersonal contexts (e.g., describing objects or pictures). Thus, current findings suggest that self-focused language generation is primarily influenced by personal-impersonal communication contexts.

Rumination—repetitive, persistent, primarily negative thinking about the self —represents a significant factor in depression onset and maintenance (杨营凯, 刘衍玲, 2016). Considered a special form of self-focus, rumination comprises two components: brooding and reflection. Reflection involves "purposefully turning inward to solve cognitive problems and alleviate depressive symptoms," while brooding involves "negative comparisons between one' s current state and desired but unachieved states" (Treynor et al., 2003). Brooding represents the more maladaptive component of rumination (Gooding et al., 2012). Brockmeyer et al. (2015) found that during negative recall tasks (e.g., asking participants to describe their saddest life moments), first-person singular pronoun use positively correlated with brooding but not reflection. Thus, as a linguistic marker of self-focus, first-person singular pronouns appear to reflect maladaptive components more than adaptive ones.

Women are more likely than men to engage in ruminative self-focus regarding

depressive mood (Johnson & Whisman, 2013), suggesting that the correlation between depression and first-person singular pronoun use might be stronger in women. However, previous studies have not found this gender difference (Fast & Funder, 2010; Edwards & Holtzman, 2017; Tackman et al., 2018). Tackman et al. (2018) conducted post-hoc partial correlation analyses by gender, providing evidence for gender differences in psychological processes. Their results indicated that gender differences primarily emerge in the development of emotional distress: women' s distress stems mainly from low-arousal negative emotional experiences (e.g., depression), while men' s distress derives primarily from high-arousal negative emotional experiences (e.g., anxiety, mood volatility). Thus, first-person singular pronouns appear to be a better linguistic marker of depression in women and a better marker of anxiety or mood volatility in men. These findings provide a foundation for developing gender-specific linguistic indicators for emotional assessment.

3.2 Decreased Use of First-Person Plural Pronouns by Depressed Patients

Increased use of first-person plural pronouns (we, us, our) reflects an adaptive psychological process of embedding oneself in social relationships (Zimmermann et al., 2013). Multiple studies have found significant negative correlations between depression and first-person plural pronoun use (e.g., Frost, 2013; Zimmermann et al., 2013; Schoch-Ruppen et al., 2018), though some studies found no correlation (e.g., Rude et al., 2004). These inconsistent results may stem from communication context factors. For example, first-person plural pronoun use negatively correlated with depression when pregnant women described their thoughts and feelings during pregnancy (Schoch-Ruppen et al., 2018) and when individuals in long-term relationships described relationship events, decision-making experiences, and goal achievement (Frost, 2013). However, no correlation emerged when college students described their deepest thoughts and feelings since starting college (Rude et al., 2004). Thus, social isolation language may primarily be influenced by interpersonal-noninterpersonal communication contexts, with depressed individuals tending to use fewer first-person plural pronouns in interpersonal communication situations.

Reduced first-person plural pronoun use correlates with greater interpersonal distress and lower subjective well-being (Frost, 2013; Zimmermann et al., 2013). Schoch-Ruppen et al.' s (2018) study of pregnant women found that miscarriage experiences led to decreased first-person plural pronoun use, suggesting that social relationship loss caused distress and that women may have emotionally distanced themselves from their unborn children due to fear of subsequent miscarriage (MacWilliams et al., 2016). Therefore, individuals using fewer first-person plural pronouns may experience maladaptive social relationships and interpersonal distress.

3.3 Increased Negative Emotion Words and Decreased Positive Emotion Words in Depressed Patients

Depressed individuals' cognitive characteristics of negative bias and positive deficit lead them to use more negative emotion words (e.g., sad, depressed, oppressed, down) and fewer positive emotion words. Some studies have found significant positive correlations between depression and negative emotion word use, and significant negative correlations with positive emotion word use (e.g., Rude et al., 2004; Molendijk et al., 2010; Schoch-Ruppen et al., 2018), while others have not (e.g., Van der Zanden et al., 2014; Bernard et al., 2015). These inconsistent results may be due to communication partner factors. Ireland and Mehl (2014) proposed that depressed individuals may conceal emotional language to avoid negative social consequences (e.g., rejection by non-depressed individuals). Baddeley et al. (2012) used tracking devices to study community populations and found that depressed patients used more negative emotion words, with the correlation moderated by communication partner—depressed individuals expressed more negative emotions to close friends or partners. Thus, emotional word biases may not be readily observable under experimental writing or speaking task conditions.

Due to factors including small sample sizes, high participant homogeneity, short time spans, and weak inherent correlations between specific word use and depression, results from traditional psychological methods have been unstable. Collecting large-scale, diverse, longitudinal data is extremely difficult, posing challenges for research on depressed patients' language use patterns. Recently emerged social media-based research can partially overcome these limitations, further testing existing findings while generating new discoveries.

4. Social Media-Based Research on Language Use Patterns

Due to limited mental health resources and help-seeking awareness, patients typically seek treatment only after developing severe depressive disorder (Zhao et al., 2018). Identifying depressed users on social media can partially address this issue while providing an efficient, economical approach to improving population mental health (Trotzek et al., 2018). Social media-based depression prediction research can identify individuals in early stages, facilitating timely intervention and optimal treatment planning (董健宇 et al., 2020).

Current depression prediction research predominantly employs machine learning methods. Briefly, this involves using demographic information, linguistic features from personal posts, and behavioral data as input variables, with depression scores from standardized measures or clinical diagnosis as output variables to construct predictive models. This identification approach has proven feasible in numerous studies (e.g., Leis et al., 2019; Hussain et al., 2019) and provides information about depressed individuals' daily language use patterns, supplementing and refining traditional psychological research. presents examples of personal posts from depressed users.

Findings regarding language use patterns in personal posts are primarily obtained through two methods (Guntuku et al., 2017). First, LIWC software quantifies linguistic patterns in text content, which are then compared cross-sectionally or longitudinally through statistical methods or feature engineering. Second, topic models infer topic distributions in texts. Latent Dirichlet Allocation (LDA) is a common topic model that automatically generates different numbers of topics for various text categories in probability distribution form, and statistics word frequencies across topics. Extracting topic distributions through topic models also enables text comparison and classification to obtain language use pattern results (曹奔 et al., 2018). Compared to LIWC, topic models are not limited to dictionary-defined word categories and can understand texts at higher meaning units such as context, sentences, and paragraphs (Imel et al., 2015).

Language use pattern results from depression prediction models are largely consistent with traditional psychological research (detailed findings in), while also providing new, consistent discoveries: (1) Depressed individuals use fewer second- and third-person pronouns, possibly representing another aspect of social isolation—poor social relationships (e.g., being single, living alone, having weak or small social networks, and infrequent social interaction) result in less frequent reference to others in language; (2) Increased use of death-related words. Previous research has confirmed that a substantial proportion of depressed patients express suicidal ideation and behavior through language (Li et al., 2019); (3) Increased use of anxiety words, swear words, and anger words. Besides high comorbidity between anxiety and depression, research indicates that non-comorbid depressed and anxious individuals do not differ statistically in worry levels, suggesting that depressed individuals also exhibit anxiety-related psychopathological features reflected in their language (Merino et al., 2016). Additionally, depressogenic stimuli or events (e.g., stressful events) may generate emotions beyond depression, such as anxiety and anger (Newell et al., 2017); (4) Increased use of religious and health-related words, indicating that depressed individuals' awareness of their condition prompts them to seek escape routes—they may seek religious support or pay greater attention to their health status; (5) Increased use of causal and negation words, possibly resulting from their tendency toward negative attribution and interpretation biases.

4.2 Language Use Patterns in Depression Communities

Online health communities, as another form of social media, provide platforms for individuals with mental disorders to exchange social support and connect with others (Pendry & Salvatore, 2015). Users can freely express themselves on these platforms, partially overcoming societal stigma and discrimination toward mental disorders (Li et al., 2018). Text content posted by users can serve as research data for language use patterns, enabling sentiment analysis, cross-sectional comparison of language patterns between different communities, and longitudinal analysis of individual language changes after community participa-

tion (Lyons et al., 2018; Park & Conway, 2017). Consistent with aforementioned findings, depression communities contain more first-person singular pronouns and negative emotion words, and fewer first-person plural pronouns and positive emotion words than control communities (Nguyen et al., 2014; Xu & Zhang, 2016; Lyons et al., 2018).

Although online peer support can enhance individuals' social connection and sense of belonging (Uden-Kraan et al., 2009), some researchers have proposed emotional contagion theory, suggesting that communication with depressed individuals may be a potential risk factor for depression (Bastiampillai et al., 2013). Therefore, how depression communities affect depressed individuals remains an open question. Park and Conway' s (2017) longitudinal study found that after participating in a depression community for some time, users' depression-related linguistic markers changed in positive directions (though some changes were non-significant), with more positive changes associated with greater communication volume, suggesting that community interaction had beneficial effects. However, as depression communities represent an emerging form of social media, the specific mechanisms through which depressed individuals influence each other remain unclear. Research in this area needs further development to improve community functioning and better assist depressed patients.

5. Theoretical Explanations of Depressed Patients' Language Use Patterns

Researchers have proposed various theories and models of depression from different perspectives, which can help explain depressed patients' language use patterns. The behavioral model of depression understands depression through the individual' s relationship with the external environment, viewing it as resulting from a series of behaviors that fail to obtain reinforcement/rewards (Leahy et al., 2012). Typical depressive behaviors include isolation, complaining, and rumination, which manifest linguistically as frequent first-person singular pronouns (especially subject and object forms), fewer first-person plural pronouns, fewer second/third-person pronouns, more negative emotion words, and even increased swear words and anger words.

The cognitive model of depression emphasizes that symptoms result from negative cognitive biases. In terms of cognitive content, depressed patients hold negative beliefs about themselves, the world, and the future (Beck & Alford, 2009), which may manifest linguistically as frequent death-related and anxiety words. Regarding cognitive processes, depressed patients exhibit biases such as excessive focus, rumination on negative thoughts, feelings, and problems, with minimal attention to positive aspects (Nolen-Hoeksema et al., 2008; Wells, 2009), reflected linguistically in frequent negative emotion word use. Additionally, depressed patients tend to attribute errors and failures to internal factors like insufficient ability (Abramson et al., 1978; Abramson et al., 1989), manifested in frequent causal and negation words. Some cognitive models also view depression as resulting from egocentrism and self-focus, where excessive self-

attention increases negative affect (Leahy et al., 2012), reflected linguistically in frequent first-person singular pronouns and negative emotion words.

Interpersonal and social behavior researchers view depression as resulting from maladaptive interpersonal behavior or dysfunctional relationships. Coyne' s (1989) interpersonal reward model proposes that depressed patients gain attention from others through complaining, thereby obtaining positive reinforcement; however, persistent complaining and self-preoccupation lead to rejection, worsening depression. Depressed patients' help-seeking behaviors manifest linguistically as frequent religious and health-related words. Interpersonal dysfunction in depression (Klerman et al., 1984), including interpersonal conflict and relationship difficulties, leads to increased loneliness, resentment, and negative cognitions and emotions, reflected linguistically in frequent first-person singular pronouns, negative emotion words, and anxiety and anger words. Joiner and colleagues' (2009) interpersonal theory of suicide suggests that suicidal intent relates to patients' perceptions of their interpersonal relationships (feeling burdensome or lacking belongingness), leading to frequent death-related words when describing their condition.

6. Limitations and Future Directions

6.1 Insufficient Specificity of Linguistic Markers

Linguistic markers identified in traditional psychological research correlate not only with depression but also with broader psychopathology (e.g., anxiety) (e.g., Sweeny et al., 2015; Tackman et al., 2018; Schoch-Ruppen et al., 2018). Social media-based studies attempting to distinguish depression from other mental disorders using LIWC linguistic markers have also yielded inconsistent results (Nguyen et al., 2014; Cheng et al., 2017). Current linguistic markers may thus represent a general emotional distress tendency rather than depression-specific features. To assess specific emotions through language use patterns, future research should explore more refined features or combine them with other features. For example, research has found that depressed patients exhibit vocal characteristics including slow speech rate, low volume, limited pitch variation, long and frequent pauses, short speech duration, and delayed initiation (Wang et al., 2018). Depressed patients also show physical characteristics such as slow walking speed, reduced sensorimotor space, and decreased upright posture time when standing or sitting (Scheffers et al., 2018). Integrating these nonverbal behavioral features could improve accuracy in assessing depressive mood in research and clinical practice.

Furthermore, although using LIWC to quantify language use patterns has proven effective, current findings remain limited by LIWC' s predefined word categories. Future research should continue exploring more refined depression-specific markers within existing categories. Additionally, with changing times, emerging, nonstandard spellings and slang not included in LIWC categories have become common in daily life and online communication.

Researchers should continuously update language analysis methods and tools to explore other potential depression-specific markers, while clinicians should more openly and cautiously understand the psychological meanings behind patients' language use.

6.2 Factors Influencing Language Use Patterns Require Confirmation

Although assessing depressive mood through linguistic markers is feasible, the relationship between language use patterns and depression may be influenced by numerous internal and external factors. Traditional psychological research has primarily focused on external factors affecting depressed patients' language use patterns (e.g., communication context effects on first-person singular and plural pronoun use, communication partner effects on emotion word use), yielding preliminary results. Future research should explore external factors affecting language use patterns based on new social media findings. For example, anxiety word, swear word, and anger word use may be moderated by stimulus type—loss events (e.g., death of a loved one or partner) may induce only depressive mood, while stressful events (e.g., being scolded or discriminated against) may induce depressive, anxious, and angry emotions simultaneously. Death, religious, and health word use may be moderated by communication context—depressed individuals may more readily discuss these topics when seeking escape from their predicament (e.g., suicide, seeking religious support, focusing on health). Similarly, causal and negation words may be more likely used when attributing causes to negative events.

Regarding internal factors, individuals may report lower psychopathology levels on self-report measures to achieve social desirability (Hampson et al., 1987). Additionally, depressed patients' cognitive biases may reduce self-awareness, clinically manifesting as more severe pathology. For instance, Fast and Funder (2010) found that first-person singular pronouns correlated only with clinician-rated depression levels, not self-reported levels. Thus, compared to self-report measures like questionnaires, language use patterns can serve as an objective behavioral indicator for research and clinical assessment. Furthermore, individuals with high neuroticism, low self-esteem, and low self-efficacy show elevated depression risk, and these traits may themselves influence language use patterns (Merino et al., 2016; Orth et al., 2016; Zhang & Jin, 2014). However, few studies have examined internal factors' influence on language use patterns; identifying these factors could better control variables and improve assessment accuracy.

6.3 Applicability to Chinese Populations Requires Verification

Most previous research has used Western samples, and whether these findings apply to Chinese populations remains unverified. Cross-cultural research indicates that due to social stigma and cultural values, Chinese depressed patients tend to express somatic rather than psychological symptoms (i.e., fewer emotional and cognitive symptoms), causing frequent misdiagnosis (Zhou et al., 2016; Zhao et al., 2018). Additionally, some individuals unaware of their mental health prob-

lems may primarily report somatic symptoms (e.g., insomnia, headaches), also leading to misdiagnosis. Therefore, somatic symptom-related words (e.g., physiological process words, body words) may represent a Chinese population-specific linguistic marker. Future research should not only test the applicability of previously identified linguistic markers to Chinese populations but also integrate language use patterns with symptomatology research to improve identification accuracy.

6.4 Theoretical Research on Depressed Patients' Language Use Patterns Requires Strengthening

Social media-based research has revealed many new findings about depressed patients' language use patterns, some of which can be explained by depression theories (see Section 5). However, other findings lack adequate theoretical explanation, such as how emerging online depression communities affect depressed individuals. Moreover, while depressed patients' distinct language use patterns reflect their psychopathological features, do these patterns in turn influence psychopathology levels? What are the mechanisms? Existing cognitive-behavioral psychotherapy emphasizes helping depressed patients increase positive self-(verbal) statements; research on language use patterns' effects on depressive mood could help clinical researchers and practitioners develop novel depression interventions from a language use perspective.

In summary, traditional psychological research and social media-based research complement each other, partially addressing respective limitations and enhancing understanding of depressed patients' language use patterns. However, the field currently faces challenges including insufficient specificity of linguistic markers, inadequate research on influencing factors, unclear applicability to Chinese populations, and insufficient theoretical research. Future researchers should explore more depression-specific linguistic markers, identify factors influencing language use patterns, conduct studies with Chinese samples, and strengthen theoretical research to continuously optimize findings and apply them in clinical practice.

**** Examples of personal posts from depressed users

"Are you okay?" Yes···. I understand that I am upset and hopeless and nothing can help me···I' m okay···but I am not alright

"empty" feelings I WAS JUST TALKING ABOUT HOW I I HAVE EMOTION OH MY GOODNESS I FEEL AWFUL

I want someone to hold me and be there for me when I' m sad.

I actually made sure no one knew about my feelings or thoughts.

**** Differences in language use patterns between depressed patients and controls

Platform	First-Person Singular	First-Person Plural	Negative Emotion	Positive Emotion	Second-/Third-Person
Facebook	+	-	+	-	-
Facebook	+	-	+	-	/
Twitter	+	-	+	-	-
Twitter	+	-	+	-	-
Twitter	+	-	+	-	-
Twitter	+	-	+	-	-
Twitter	+	-	+	-	-
Facebook	+	-	+	-	-

"+" indicates depressed patients use more of the word category, "=" indicates no difference, "-" indicates less use, "/" indicates result not provided.

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Note: Figure translations are in progress. See original paper for figures.