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## **Word Use During COVID-19 in Female Bloggers: Changes in Emotional Negativity, Temporal Orientation, and Insight Words**

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Universiteit Leiden

**Psychologie**  
Faculteit der Sociale Wetenschappen



**Word Use During COVID-19 in Female Bloggers:  
Changes in Emotional Negativity, Temporal  
Orientation, and Insight Words**

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Master Thesis

Clinical Psychology

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## Abstract

Mental well-being has been shown to be reflected by several different linguistic markers, such as emotion words, temporal orientation, and insight words. Here, we investigated the effect of the COVID-19 stressor on the word use of those suffering from psychopathology and their healthy controls in a longitudinal design. 1556 blog posts written between February and June 2019 and the same period of time in 2020 were analyzed. In both the clinical and the control group, emotional negativity ( $d = -0.18$ ), a focus on the present ( $d = -0.31$ ), and use of insight words ( $d = -0.15$ ) increased with the appearance of the COVID-19 stressor. Focus on the past decreased in the clinical group ( $d = 0.32$ ). In the clinical group, the use of insight words was associated with emotional negativity and a focus on the present during the pandemic. In the control group, the use of insight words was additionally associated with a focus on the past and the future. Overall, these findings suggest that those suffering from psychopathology are no more vulnerable to the pandemic's consequences on mental health than their healthy controls, as reflected in their word use. Yet, since word use on online platforms does not seem to reflect actual well-being very accurately, and considering that our sample was relatively homogenous in terms of mental disorders presented, gender, and age, these results should be interpreted with caution. Future research should replicate our findings with more valid measures of mental well-being and in a more diverse sample.

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## **Word Use During COVID-19 in Female Bloggers: Changes in the Use of Emotion Words, Temporal Orientation, and Insight Words**

### **Linguistic Markers of Psychopathology**

Humans have many ways to communicate and express themselves, some of which are verbal and nonverbal expressions (Schrage et al., 2020), art (Brown & Bousalis, 2017), music (Cross, 2014), and dance (Vesper & Sevdalis, 2020). While some of these communication channels are used only by certain individuals and not by others, language poses a central component of expression used in all cultures and contexts (Bonvillain, 2019). For it is able to transfer information and to communicate emotions in complex ways, peoples' well-being is often reflected in their language use.

Previous research has shown several ways in which well-being is reflected in word choice, especially by pointing out differences that exist between people suffering from mental disorders and healthy individuals. Oxman et al. (1982) showed that only by the means of linguistic analysis, a computer was able to correctly ascribe patients to diagnostic categories according to the DSM-II. The idea that language use is specific to certain mental disorders is in line with Beck's cognitive content-specificity model (Beck, 1976). It builds on his cognitive model of depression that proposes that every individual holds certain core beliefs about themselves which were formed early in childhood (Beck, 1964). These core beliefs influence how the world is perceived and interpreted. Subsequently, they lead to automatic thoughts which then influence how one responds to situations. The cognitive content-specificity model leans onto Beck's cognitive model by proposing that all axis I disorders are characterized by distinct automatic thoughts and disorder-specific cognitive content (Beck, 1976). Some of the linguistic indicators of psychopathology are discussed below.

Themes such as danger and threat are common in anxiety disorders and are reflected in the language use of those affected (Beck et al., 1987). A negative attitude and self-depreciation, which is a measure of low self-esteem that is expressed with statements such as "I often think of myself as a failure" (Berkowitz & Perkins, 1988, p. 207), characterize depression. In line with this, Rude et al. (2004) found that depressed students referred more to themselves, used more negative than positive emotion words, and used slightly fewer positive emotion words than non-depressed students in written essays. This is confirmed in a study conducted by Sonnenschein et al. (2018), which showed that depressed individuals used more words related

to sadness. The opposite pattern in the use of emotion words was found in speeches of people with social anxiety disorder (SAD). These individuals made greater use of positive emotion words than their healthy controls (Hofmann et al., 2012). Gilbert et al. (2009) suggested that this speech pattern is a safety mechanism in people with SAD to prevent negative evaluation by others. Pennebaker et al. (2003), on the other hand, found that people made very little use of emotion words in general (less than 5% of their total words) and emotion words did not reliably predict affective states. Taken together, in spite of some inconclusive findings, evidence supports Beck's cognitive content-specificity model by suggesting that depression and anxiety are characterized by different linguistic patterns in the use of emotion words: while depressed people make greater use of negative emotion words, SAD is characterized by greater use of positive emotion words.

Lamberton and Oei (2008) challenged the cognitive content-specificity model with their findings that automatic thoughts which are supposedly specific to depression, such as negative emotion words, were in fact shared by several mental disorders. Consistent with this, different studies found that individuals suffering from different types of personality disorders (Molendijk et al., 2010), depression (Rude et al., 2004), and anxiety (Brockmeyer et al., 2015; Sommerschein et al., 2018) used more first person singular pronouns than healthy controls. Additionally, online forums about anxiety, depression, and suicidal ideation all comprised a higher number of absolutist words (e.g. always, nothing) than control forums (Al-Mosaiwi & Johnstone, 2018). Further, both people suffering from depression and anxiety made greater use of past tense when referring to negative verbs in written text (Smirnova et al., 2018). Temporal orientation, which can be defined as cognitive involvement with a primary focus on either the past, the present, or the future (Nuttin, 1985), has also been investigated in relation to psychopathology in other studies. Research showed that past temporal orientation is not only associated with depression (Boyd & Zimbardo, 2005; van Beek et al., 2011) but depressed patients who focused more on the past also reported more suicidal ideations (van Beek et al., 2011). Yufit (1977) explained that suicidality often results from distortions in temporal orientation. More specifically, he argued that those committing suicide want to escape from the mental suffering that is caused either by the preoccupation of a negative past or a lack of positive ideas about one's future. Overall, psychopathology seems to be associated with first-person singular pronouns, absolutist words, and a past temporal orientation.

## **Linguistic Markers of Mental Well-being**

Language patterns do not only reflect thinking in mental disorders but certain language patterns are also specific to well-being. Therefore, just as psychopathology is characterized by distinct patterns of language use with regards to emotion words and temporal orientation, mental health also has shown to be reflected by distinct patterns with regards to these word categories. For example, healthy individuals exhibited a positivity bias, the tendency to overly focus on and present positive content, as reflected in a higher ratio for positive as compared to negative emotion words (Dodds et al., 2015). This idea was evident in mood-congruent reporting, as positive mood is the norm in healthy individuals (Diener et al., 2018). Therefore, healthy participants used significantly more positive than negative emotion words when writing about positive, neutral events, and even negative events (Herbert et al., 2019). This might reflect the tendency in healthy individuals to find positive meaning in negative events (Diener et al., 2018). In support of this interpretation, it has been found that healthy subjects but not those suffering from a mental disorder made greater use of insight words when writing about negative stories as compared to neutral or positive stories, reflecting a cognitive coping mechanism to make sense of negative events and find meaning in these (Herbert et al., 2019). Another pattern in the use of insight words has been shown in a study with patients suffering from generalized anxiety disorder (GAD) (Dirkse et al., 2014). Since cognitive behavioral therapy aims at detecting distorted cognitive schemas and changing those, it can be assumed that patients in treatment change toward a word use that is reflective of mental well-being. Over the course of treatment for GAD, patients used fewer insight words and also fewer negative emotion words. Furthermore, these patients increased their use of past tense (Dirkse et al., 2014). At the same time, patients with personality disorders made greater use of present tense and less use of past and future tense over the course of treatment (Arntz et al., 2012). Some studies support the notion that a temporal orientation on the present indicates mental health. They pointed out that, irrespective of the valence of felt emotions, a present-moment focus on these emotions increased mindfulness, which is adaptive for mental health (Moore & Brody, 2009; Weinstein et al., 2009). In sum, mental health is characterized by a greater use of positive as compared to negative emotion words. While findings on temporal orientation are somewhat contradicting, the majority of research points to a greater use of present tense as compared to past or future tense in healthy and recovering individuals. Although there is some evidence that health is also reflected in greater use of insight words, other studies

revealed different results, hence no clear conclusion can be drawn.

### **Linguistic Markers of Stress**

In addition to reflecting psychopathology and mental health, language patterns also differ in response to stress. One possible explanation is the influence that stress has on mental health (Yang et al., 2018). Research demonstrated that prolonged stress led to loneliness (Segrin et al., 2017), a reduction in quality of personal relationships (Myers, 1994), as well as depression, emotional exhaustion, and anxiety (Radeke & Mahoney, 2000; Tyssen et al., 2001). Since stress has such a profound impact on mental health, it is not surprising that stress also affects mental health indicators in language use. A study conducted by Cohn et al. (2004) revealed that people in the U.S. were more cognitively and socially engaged and expressed more negative emotion words shortly after the 9/11 attacks, which however returned back to baseline after two weeks. Other research among trauma survivors revealed a decrease in the use of insight words when describing a traumatic event as compared to a neutral event. However, they also found this pattern of word use to be predictive for developing posttraumatic stress disorder (Klein et al., 2018). In line with this idea, Boals and Klein (2005) suggested that when facing an acute stressor the use of cognitive words, such as insight words, is reflective of an active search for meaning in and understanding of the stressful event and can buffer the negative effects of the stressor. In addition to the use of insight words, making greater use of positive emotion words can be a protective factor in times of crisis (Cohn et al., 2004). In a sample of trauma survivors, those with a past temporal orientation experienced greater levels of distress than those who did not primarily focus on the past (Holman & Silver, 1998), suggesting an impedimental effect of a past focus on recovering from a major stressor. Altogether, research suggests that when facing a stressor a past temporal orientation might indicate unhealthy coping with the situation while the use of insight words and positive emotion words might be a protective factor against negative effects of the stressor.

Since the appearance of the coronavirus (SARS-CoV-2) and its disease called COVID-19, in December 2019 in Wuhan City, Hubei Province of China, the world is facing one of the biggest global stressors that have ever been present (Shi et al., 2020). In order to contain the virus several safety measures, such as social distancing rules, travel bans, and the mandatory wearing of face masks have been implemented in most countries (Banerjee et al., 2021). Yet,



despite these measures, over 2.5 million people worldwide lost their lives due to being infected with COVID-19 in the first year after the virus' discovery (Johns Hopkins Coronavirus Resource Center, 2021). Since the beginning of 2020, a majority of the population does not only fear becoming contaminated but also face several other major problems. For example, one third of the population was forced to quarantine as a safety measure in order to contain the spreading of the virus (Bashir et al., 2020). As a result, rates of reported domestic violence showed an increase of 20% in Spain, 30% in Cyprus, and 40-50% in Brazil (Bradbury-Jones & Isham, 2020), and it can be assumed that the actual rates are much higher (Anurudran et al., 2020). Furthermore, unemployment rates increased dramatically within the first months after social distancing measures had been implemented. A clear example of this are minority groups in the United States, where unemployment rates among African Americans increased from 11.4% to 16.6% in the first 2 months after implementation of social distancing measures (Couch et al., 2020; McIntyre & Lee, 2020). As a consequence, COVID-19 not only impacted many people's physical health, their finances, and living situation, but also their mental health. In China, Italy, and Kuwait, an overall increase in anxiety, depression, and stress has been observed in the general population (Mazza et al., 2020; Ren et al., 2020; Xiang, et al., 2020) and especially in those with a history of psychopathology (Burhamah et al., 2020). People who were diagnosed with an anxiety- or mood-disorder prior to the virus outbreak experienced significantly more stress during the pandemic and were less able to cope healthily with the demands of the virus outbreak than healthy controls (Asmundson et al., 2020). In general, more people also suffered from emotional fatigue and insomnia (Fofana et al., 2020) and reported that their days were characterized by frustration and boredom (Brooks et al., 2020). Especially concerning is the great increase in projected suicide rates due to rising unemployment rates (Kawohl & Nordt, 2020; McIntyre & Lee, 2020). In sum, due to the great restraints the general population is dealing with as a consequence of COVID-19, many people experience a decrease in their mental health. Those who already suffered from a mental disorder seem to be especially vulnerable to the impact of the pandemic on their mental health.

### **Current Study**

Because the mental consequences of this global pandemic are so far-reaching, it can be expected that the described changes in mental well-being are reflected in general language

use. In fact, Li et al. (2020) investigated several linguistic markers indicating psychopathology in relation to COVID-19 over a two-week period in January 2020. They indeed found that people used more negative and less positive emotion words than before the appearance of the COVID-19 stressor. Another study conducted from February until April 2020 showed that fear, stigma, and apprehension were common themes that appeared in tweets of Arabic twitter users (Essam & Abdo, 2020). In both studies data collection occurred only over a short period of time. No studies analyzing the language use in relation to COVID-19 over longer periods of time have been published yet and only two studies compared results for healthy individuals and those suffering from psychopathology (Asmundson et al., 2020; Burhamah, 2020).

In this study, we attempted to answer the questions “What impact does the COVID-19 stressor have on the linguistic markers of emotional negativity, temporal orientation, and insight words? How does that impact differ between healthy individuals and those suffering from mental disorders?” We aimed to add to the current literature on linguistic markers of psychopathology and mental health by investigating how the clinical and control group differ in their word use of emotional negativity, temporal orientation, and insight words. In addition to that, we aimed to detect changes in the word use of both groups with the appearance of the COVID-19 stressor and to discover whether those suffering from psychopathology are specifically vulnerable to the detrimental effects the pandemic has on mental health as reflected in their word use. Thereby, a first step was made towards finding ways to protect the more vulnerable in the future. This study contributes to the understanding of how mental well-being is reflected in people’s language use, and more so how linguistic markers of well-being change in face of a major stressor.

Based on prior research, it was hypothesized that people used more negative than positive emotion words in the presence of the COVID-19 stressor as compared to the time before that stressor appeared. Further, it was expected that this increase was stronger in people suffering from a mental disorder than in healthy controls. Second, it was hypothesized that people had a greater past focus in the presence of the COVID-19 stressor as compared to the time before that stressor appeared. Moreover, it was expected that the increase of past focus was stronger in people suffering from a mental disorder as compared to healthy controls. Third, healthy controls were hypothesized to have a stronger present focus than those suffering from a mental disorder both before and during the presence of COVID-19. Since past and present

focus correlate highly with future focus (Newman et al., 2017), the effect of COVID-19 on future focus was explored. As previous research has shown that cognitive processing and understanding of stressful events can act as a protective factor when facing a stressor (Boals & Klein, 2005), the role of COVID-19 on the use of insight words as well as the use of insight words on linguistic markers of mental health before and during the pandemic was explored.

## **Method**

### **Design**

The study design was a retrospective case control design with both cross-sectional and longitudinal data.

### **Participants and Data Collection**

The sample consisted of blog posts written by individuals with a mental disorder and their matched control blogs written by healthy individuals. Inclusion criteria for the clinical group were female gender, self-reported suffering from a mental disorder, blogs written in English, German, or Dutch language, and at least 10 blog posts written during the time from January until November in 2019 and 2020. The same criteria applied to the healthy control group, except having a mental disorder. Further excluded were blogs that were mainly written about mental health. The control group was matched with regards to the blog content. Common contents were fashion, lifestyle, beauty, and health.

At first, we gathered data from January until November 2020. However, the second wave of the COVID-19 outbreak differed substantially from the first wave in terms of number of infections, symptom severity, age of people with severe course of illness, and the season of the lockdown (Saito et al., 2021). Thus, it is not unlikely that the different waves also had different effects on people's mental health and the resulting word use. In order to keep the waves separate, only the first wave was selected for our analyses, namely the time between February and June 2020. Data from the same time frame in 2019 has been selected as a control time frame.

### **Measures**

#### ***LIWC***

The word categories positive emotion words, negative emotion words, past focus, present

focus, future focus, and insight words were determined with the Linguistic Inquiry and Word Count (LIWC). This program analyzes word files by searching for over 2300 words or word stems and categorizing them into over 70 different linguistic dimensions (Pennebaker et al., 2003). These dimensions include standard language categories (e.g. pronouns), psychological processes (e.g. emotion words), relativity-related words (e.g. time), and content dimensions (e.g. occupation). Examples for the word categories used in our analyses are love, nice and sweet (positive emotion words), hurt, ugly, and nasty (negative emotion words), ago, did, talked (past focus), today, is, now (present focus), may, will, soon (future focus), and think, know (insight words). These dimensions are hierarchically organized and one word can fall into several categories (Pennebaker et al., 2003). For example, positive emotion words fall under the higher order word category of affective processes, which, in turn, fall under the higher order word category of psychological process words. Internal consistencies (Cronbach's  $\alpha$ ) for negative emotion words, positive emotion words, past tense, present tense, future tense, and insight words are .64, .55, .64, .66, .68, and .84, respectively (Pennebaker et al., 2015). The interrater reliability of the LIWC lies between .86 and 1, indicating very good construct validity (Pennebaker et al., 2001).

As most prior research investigated the use of positive and negative emotion words in relation to each other (Dodds et al., 2015; Herbert et al., 2019; Rude et al., 2004), we did not want to test for the effect of positive and negative emotion words separately but for the effect of using more negative as compared to positive emotion words. Therefore, the emotional negativity score was calculated by subtracting the LIWC score for positive emotion words from the score of negative emotion words. Positive scores indicated greater overall emotional negativity as compared to emotional positivity.

## **Procedure**

Each blog post was converted into a word file, which was then analyzed with the LIWC for the above mentioned word categories. Subsequently, the LIWC output was converted into an SPSS data set and a Comprehensive Meta-Analysis (CMA) data set.

## **Ethics**

Ethical approval has not been obtained since we used existing blog posts that have been made available to the public and, therefore, no ethical approval was required.

## Statistical Analyses

For the analyses IBM SPSS 27.0 (IBM Corp., 2020) and CMA (Borenstein et al., 2005) were used. Descriptive statistics were calculated for the word categories emotional negativity, focus past, focus present, focus future, and insight words over all time frames. Spearman's rank order correlation ( $r_s$ ) analysis was conducted to test for correlations among the outcome variables. The same analysis was conducted to test if greater use of insight words was associated with the other main variables as indicators of mental health, both for the overall sample and for the clinical and control group separately to detect differences among the subgroups. As it has been suggested by prior research that the use of insight words is a coping mechanism when facing a stressor, we were mainly interested in these correlations during COVID-19. Yet, to see if the associations differed when no stressor is present, the correlation analyses were done separately for the time pre COVID-19 and during COVID-19. In order to explore the relation between insight words and emotion words in more detail, not only the correlations with emotional negativity but also with positive and negative emotion words individually were included. We tested for language effects by performing a MANOVA. Strong main effects of language were found, which is why the hypotheses were tested with a multiple case study analysis with a random effects meta-analysis over the cases in CMA instead of a MANCOVA. It was also checked whether word count had a main effect on the other variables. If so, it would have been controlled for in the analyses. Main effects of patient status over both years were tested with an independent t-test for which patients and controls were paired for language. Main effects of the presence of COVID-19 were tested with a random effects meta-analysis in CMA. A moderation analysis was conducted to test for effect moderation between patient status and language. The outcome measure was the effect size Cohen's  $d$ , which indicates the standardized differences between means (Peng & Chen, 2013) with a confidence level of 95%. We used the interpretation suggested by Cohen of  $d$  being small ( $d = 0.2 - 0.3$ ), medium ( $d = 0.5$ ), and large ( $d = 0.8$ ) (Cohen, 1977). Overall higher use of positive than negative emotion words was tested with a one-sample t-test of emotional negativity against the predicted value of 0. Before analyzing, the assumption of heterogeneity of the effect sizes across studies was checked and met. The significance level for all analyses was  $\alpha = .05$ .

## Results

### Sample Characteristics

The initial sample consisted of 3,239 blog posts out of which 1,618 posts were written from January until November 2019 (638 (39.5%) by the clinical group and 980 (60.5%) by the control group), while 1,621 posts were written from January until November 2020 (610 (37.6%) by the clinical group and 1,011 (62.4%) by the control group). After selecting only the time frame from February until June for our analyses, the final sample consisted of a total of 1,556 blog entries, out of which 585 (37.6%) were written by the clinical group and 971 (62.4%) were written by the control group. The average blog post consisted of 686 words (SD = 460.25) with a range from 25 words up to 3,168 words per post. The age in the clinical group ranged from 20 to 44 years (Mean = 30.29 years old, SD = 8.56) while the age of the control group ranged from 24 to 38 years (Mean = 25.95 years old, SD = 1.86). The distribution of entries written in 2019 and 2020 as well as across languages is presented in Table 1. Descriptive statistics of the main variables are presented in Table 2.

**Table 1**

*Sample distribution of blog posts written by patients and controls across languages and years*

		Patients	Controls
		<i>n (%)</i>	<i>n (%)</i>
Language	English	238 (35.7)	428 (64.3)
	German	174 (73.7)	62 (26.3)
	Dutch	173 (26.5)	481 (73.5)
Year	2019	304 (38.7)	481 (61.3)
	2020	281 (36.4)	490 (63.6)
Total		585 (37.6)	971 (62.4)

### Correlations

Overall, emotional negativity correlated significantly positively with past focus ( $r_s = .271$ ), present focus ( $r_s = .156$ ), future focus ( $r_s = .261$ ), and insight words ( $r_s = .187$ ). Past focus correlated significantly negatively with present focus ( $r_s = -.052$ ), and positively with future focus ( $r_s = .357$ ), as well as insight words ( $r_s = .085$ ). Present focus correlated significantly

positively with future focus ( $r_s = .456$ ) and insight words ( $r_s = .211$ ), while future focus also correlated significantly positively with insight words ( $r_s = .180$ ) (see Appendix A).

**Table 2**

*Descriptive statistics of the main variables*

	<i>Min.</i>	<i>Max.</i>	<i>M</i>	<i>SD</i>
Emotional Negativity	-9.74	8.00	-2.77	2.00
Focus past	0.00	15.15	3.80	2.56
Focus present	1.36	20.91	10.60	3.01
Focus future	0.00	20.53	1.82	1.25
Insight words	0.00	11.43	2.34	1.18

### **Preliminary Analyses**

Before performing the within-subjects analyses, we tested for main effects of language and word count. When performing a MANOVA, strong main effects of language were found for emotional negativity ( $F(2, 1553) = 55.646, p < .001$ ), focus past ( $F(2, 1553) = 560.123, p < .001$ ), focus present ( $F(2, 1553) = 325.815, p < .001$ ), focus future ( $F(2, 1553) = 432.497, p < .001$ ), and for insight words ( $F(2, 1553) = 31.302, p < .001$ ). Consequently, for the within-subjects analyses the hypotheses were tested with a multiple case study analysis with a meta-analysis over the cases.

When performing a MANOVA, main effects of word count on focus past ( $F(937, 618) = 1.475, p < .001$ ) and insight words ( $F(937, 618) = 1.268, p = .015$ ) were found. Therefore, in the multiple case study analysis the effects of word count were controlled for (For the correlations of word count with the main variables see Appendix D).

### **Main Effects of Patient Status**

Over both time frames, differences between the clinical and control group were found for emotional negativity. While both groups used more positive than negative emotion words, thereby displaying greater emotional positivity rather than negativity ( $t(1555) = -54.49, p < .001$ ) (see Appendix B), emotional negativity was greater in the clinical than in the control group ( $p < .01$ ). Further, the control group had a greater present focus than the clinical group ( $p < .001$ ), displayed greater focus on the future ( $p < .001$ ), and used less insight words than

the clinical group ( $p < .001$ ) (see Table 3).

**Table 3**

*Main effects of patient status on the five main variables.*

	Cohen's <i>d</i>	95% CI		<i>p</i>
		Lower bound	Upper bound	
Emotional Negativity	-.17	-.3	-.04	< .01
Focus Past	-.01	-.15	.14	.87
Focus Present	.25	.19	.31	< .001
Focus Future	.36	.28	.44	< .001
Insight	-.30	-.22	-.39	< .001

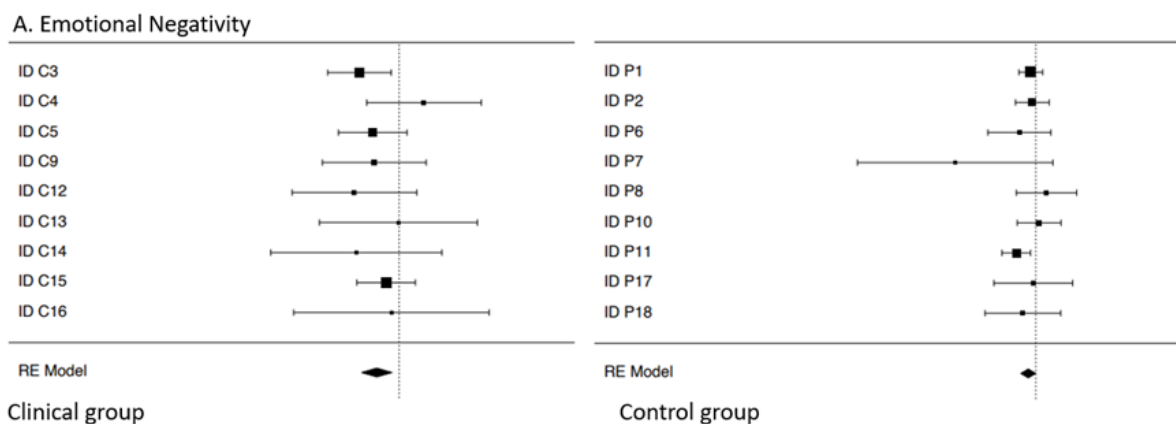
### Main Effects of COVID-19

#### *Emotional Negativity*

Emotional negativity increased with the presence of COVID-19 ( $Z = 3.21$ ,  $p < .001$ ;  $d = -0.18$ , 95% CI [-0.28, -0.08]) due to a decrease in the use of positive emotion words ( $Z = 2.914$ ,  $p = .028$ ;  $d = 0.113$ , 95% CI [0.012, 0.214]) as well as an increase in the use of negative emotion words ( $Z = -2.758$ ,  $p = .006$ ;  $d = -0.183$ , 95% CI [-0.313, -0.053]). No difference between the clinical and the control group was found ( $Z = 0.14$ ,  $p = .89$ ) (see Figure 1).

**Figure 1**

*Forest plot with the main effect of the presence of COVID-19 on Emotional Negativity*



*Note.* The forest plot shows the standardized mean differences (Cohen's *d*) from 2019 (pre-



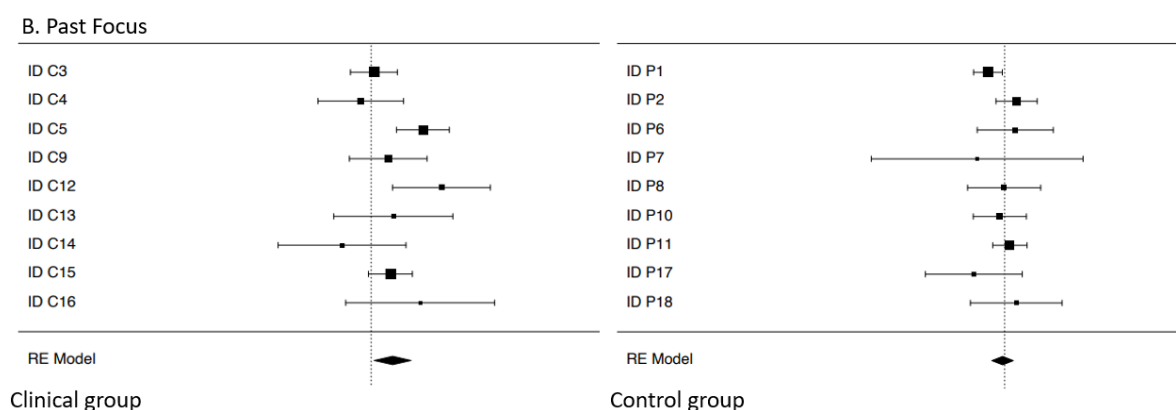
COVID-19) to 2020 (presence of COVID-19) for each blogger as well as the pooled effect for each group. The negative effect indicates an increase in emotional negativity from pre-COVID-19 to presence of COVID-19.

### ***Temporal Orientation***

While no overall main effect of the presence of COVID-19 on past focus has been found, the groups differed significantly ( $Z = 2.01, p = .01$ ). The control group did not change in their past focus in the presence of COVID-19 ( $d = -0.03, 95\% \text{ CI } [-0.19, 0.13]$ ) but the clinical group decreased in their past focus in the presence of COVID-19 as compared to before ( $d = 0.32, 95\% \text{ CI } [0.05, 0.58]$ ) (see Figure 2).

### **Figure 2**

*Forest plot with the main effects of the presence of COVID-19 on Past Focus*

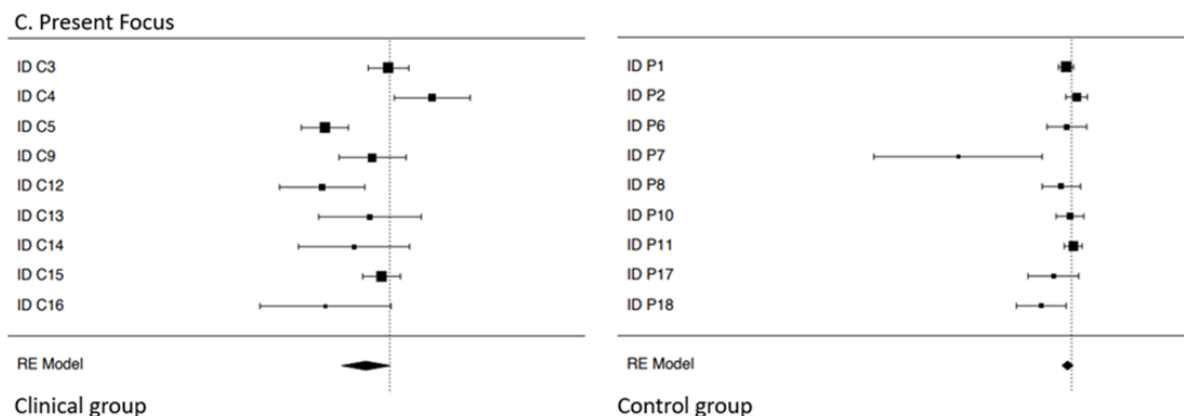


*Note.* The forest plot shows the standardized mean differences (Cohen's  $d$ ) from 2019 (pre-COVID-19) to 2020 (presence of COVID-19) for each blogger as well as the pooled effect for each group. The positive effect in the clinical group indicates a decrease in past focus from pre-COVID-19 to presence of COVID-19.

An overall effect of present focus has been found ( $Z = -2.33, p < .001$ ), showing that people had a greater present focus in the presence of COVID-19 than before ( $d = -0.31, 95\% \text{ CI } [-0.53, -0.08]$ ) in both the clinical and the control group (see Figure 3).

**Figure 3**

*Forest plot with the main effect of the presence of COVID-19 on Present Focus*

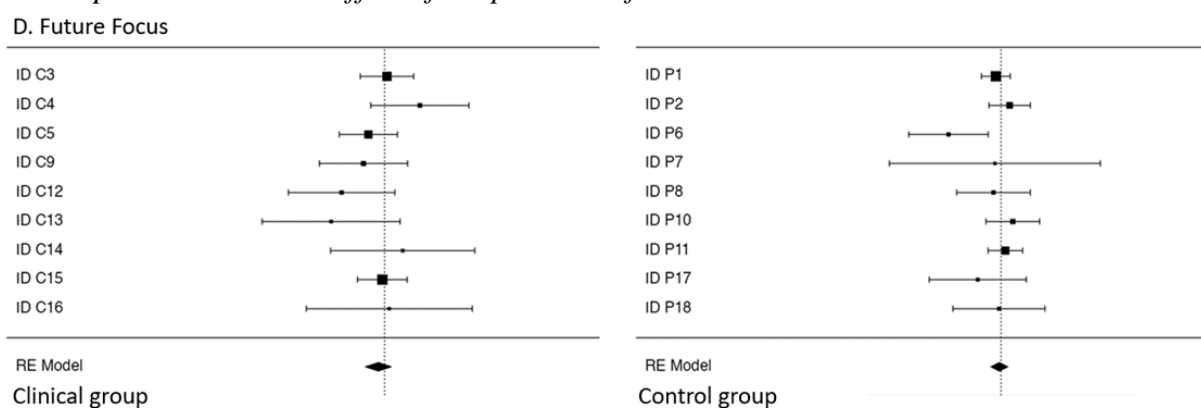


*Note.* The forest plot shows the standardized mean differences (Cohen's  $d$ ) from 2019 (pre-COVID-19) to 2020 (presence of COVID-19) for each blogger as well as the pooled effect for each group. The negative effect indicates an increase of present focus from pre-COVID-19 to presence of COVID-19.

No overall main effect of future focus has been found and that did not differ between the clinical and control group (see Figure 4).

**Figure 4**

*Forest plot with the main effect of the presence of COVID-19 on Future Focus*



*Note.* The forest plot shows the standardized mean differences (Cohen's  $d$ ) from 2019 (pre-COVID-19) to 2020 (presence of COVID-19) for each blogger as well as the pooled effect for each group.

### ***Insight Words***

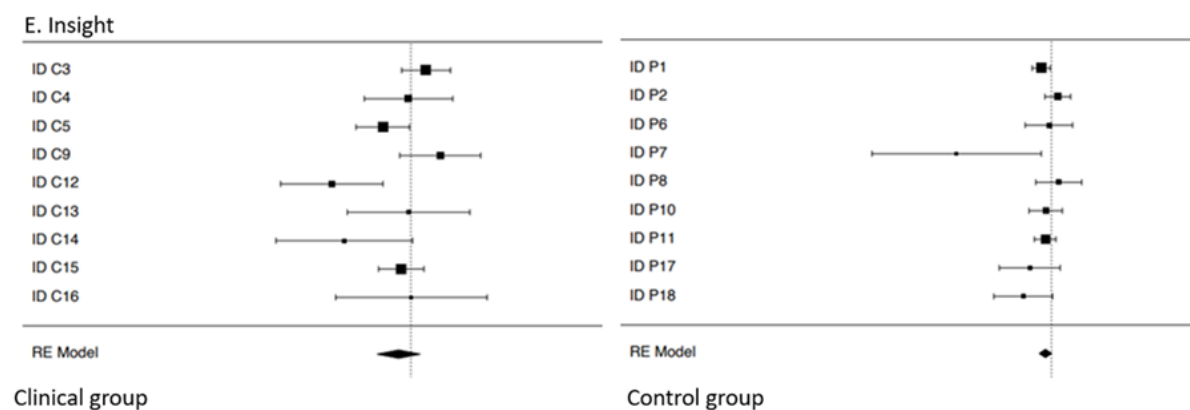
Overall, the use of insight words increased with the presence of COVID-19 ( $Z = 1.99$ ,  $p < .01$ ;

$d = -0.15$ , 95% CI [-0.30, 0.00]). No difference between patients and controls has been found (see Figure 5). For none of the variables effects within language were found (all  $p$ -values  $> .10$ ) (For all graphs presenting main effects of the COVID-19, see Appendix C).

### Figure 5

*Forest plot with the main effect of the presence of COVID-19 on Insight Words*

*Note.* The forest plot shows the standardized mean differences (Cohen's  $d$ ) from 2019 (pre-



COVID-19) to 2020 (presence of COVID-19) for each blogger as well as the pooled effect for each group. The negative effect indicates an increase in insight words from pre-COVID-19 to presence of COVID-19.

We also tested the correlations of insight words with the other main variables as well as positive and negative emotion words. In 2019, before COVID-19 appeared, the clinical group's use of insight words correlated significantly positively with their use of negative emotion words ( $r_s = .201$ ) and their future focus ( $r_s = .171$ ). In the presence of COVID-19, the use of insight words correlated significantly positively with emotional negativity ( $r_s = .181$ ) due to an increase of negative emotion words ( $r_s = .377$ ), with a greater present focus ( $r_s = .155$ ) but no longer with a future focus ( $r_s = .050$ ).

In 2019, before COVID-19 appeared, the control group's use of insight words correlated significantly positively with emotional negativity ( $r_s = .165$ ) due to both a decrease in positive emotion words ( $r_s = -.112$ ) and an increase in negative emotion words ( $r_s = .207$ ), present focus ( $r_s = .344$ ), and future focus ( $r_s = .366$ ). In the presence of COVID-19, the use of insight words correlated significantly positively with emotional negativity ( $r_s = .208$ ) due to both a decrease in positive emotion words ( $r_s = -.147$ ) and an increase in negative emotion words ( $r_s = .377$ ).

= .227). The use of insight words also correlated significantly positively with past focus ( $r_s = .100$ ), present focus ( $r_s = .261$ ) and future focus ( $r_s = .182$ ) (see Appendix D).

## Discussion

This study investigated the impact of the COVID-19 stressor on linguistic markers of emotional negativity, temporal orientation, and insight words. Further, we examined whether that impact differed between people suffering from psychopathology and healthy controls. We found that overall the clinical group expressed greater emotional negativity, lesser focus on the present and the future, and used more insight words than the control group. With the appearance of COVID-19, both groups increased in their expressed emotional negativity, their focus on the present, and their use of insight words. Only the clinical group decreased in their focus on the past with the appearance of COVID-19 while the control group did not change. Both groups also did not change in their focus on the future with the appearance of COVID-19. During the pandemic, greater use of insight words was associated with greater emotional negativity due to greater use of negative emotion words and greater focus on the present in the clinical group. In the control group, greater use of insight words was additionally associated with lesser use of positive emotion words, as well as greater focus on the past and the future.

Based on prior research, we hypothesized that people used more negative than positive emotion words in the presence of the COVID-19 stressor as compared to the time before that stressor appeared and that this increase was stronger in people suffering from a mental disorder than in healthy controls. Our findings partly align with these hypotheses and the presented literature. As expected, the use of emotion words in our sample confirms the idea of a positivity bias. However, opposite to prior research (Dodds et al., 2015; Herbert et al., 2019) we did not find the tendency to use more positive than negative emotion words only in the healthy sample but also in the clinical group. This pattern could be explained by the relatively high proportion of individuals diagnosed with SAD in our clinical sample, as prior research revealed that those with SAD used more positive than negative emotion words (Hofmann et al., 2012). Two out of the nine clinical bloggers suffered from SAD and others did not specify which kind of anxiety disorder they have been diagnosed with, making it possible for the proportion of SAD in our sample to be even higher. This might have shifted our results in the clinical group, accounting for overall emotional positivity. Despite finding overall emotional positivity in both groups, in line with Dodds et al. (2015), emotional positivity was greater in

the control group. Confirming prior research (Cohn et al., 2004; Mazza et al., 2020; Xiang, et al., 2020), emotional negativity increased in face of the COVID-19 stressor. While we did not measure self-reported well-being but only used word use as an indicator, our results still suggest that both those with a mental disorder and healthy individuals experienced greater emotional negativity with the appearance of COVID-19. At first, it is surprising that the impact of COVID-19 on the use of emotion words is the same for those suffering from psychopathology and their healthy controls as it contradicts prior research findings (Asmundson et al., 2020). However, González-Blanco et al. (2020) found that in the first weeks of the pandemic, in a Spanish sample 85% out of those individuals suffering from a severe mental disorder coped quite well with the situation. In fact, these individuals reported to enjoy their free time and they engaged in more relaxing activities and practiced meditation more often than healthy controls (Gonzalez-Blanco et al., 2020). In order to specify which groups need special support by mental health care to deal with the challenges of the pandemic, future research should further investigate differences in emotional negativity between the healthy population and those suffering from psychopathology.

Based on prior research, we hypothesized that people had a greater focus on the past in the presence of the COVID-19 stressor as compared to the time before the stressor appeared and that this increase of past focus was stronger in people suffering from a mental disorder as compared to healthy controls. Our findings do not confirm these hypotheses and do not align with the presented literature. Prior research found that depressed and anxious individuals made greater use of past tense than healthy controls (Smirnova et al., 2018). In our sample those suffering from a mental disorder and healthy controls did not differ in their overall use of past focus. With the appearance of COVID-19, the clinical group even decreased in their past focus. Eysenck et al. (2006) studied the timing of negative events in anxious and depressed participants. Their findings revealed that only depressed individuals mentioned mainly past events when talking about negative events while the anxious participants expressed a concern for the future, suggesting a greater past orientation only in depressed patients when thinking about or being confronted with negative events (Eysenck et al., 2006). Even though depression and anxiety share many symptoms due to overlapping thinking styles (Clark & Watson, 1991), temporal orientation is distinct in both disorders. While depression is characterized by rumination about the past, anxiety is characterized by worrying about a possible future (Eysenck et al., 2006). Our clinical subsample included more anxious than

depressed participants, which might account for not finding the expected increase in past focus during the pandemic. Holman and Zimbardo (2009) pointed out that temporal orientation itself is not indicative of mental health but more so the valence associated with the temporal orientation: a negative past time perspective is associated with psychopathology and a positive past time perspective is protective against psychopathology (van Beek et al., 2011). Our study is the first to demonstrate a decrease of past focus in the clinical population. Thus, future research should further investigate possible mechanisms explaining this pattern.

Based on prior research (Moore & Brody, 2009; Weinstein et al., 2009), we hypothesized that healthy controls have a greater present focus than those suffering from a mental disorder both before and during the presence of COVID-19. Indeed, this is what we found. Considering that a focus on the here and now is adaptive to cope with a current stressor (Moore & Brody, 2009), our results suggest that both healthy individuals as well as those suffering from a mental disorder were able to choose a present focus as a coping mechanism to face the challenges evoked by COVID-19. Since we did not investigate specific coping mechanisms per se but only a present focus in written text, future research would be needed to confirm this interpretation of our results.

We explored the effect of COVID-19 on a focus on the future. Our finding that the control group focused more on the future than the clinical group is in line with prior research showing that individuals with personality disorders increased in their future focus over the course of treatment (Arntz et al., 2012). As we did not find any effect of COVID-19 on future focus in the clinical or control group, our findings suggest that future focus is not affected by stress exposure, such as the COVID-19 crisis. Another explanation is provided by Boniwell et al (2010), who found that, instead of having one strong temporal focus, healthy individuals had a balanced temporal orientation, which can be described as one in which past, present, and future temporal orientation blend together and engage in a way that allows one to learn from past experiences, fully engage with and enjoy the present, and actively plan and prepare for a successful future (Boniwell et al., 2010; Drake et al., 2008). Focusing mainly on the future can lead to academic success but it can also become dysfunctional when it prevents from relaxing (Boniwell & Zimbardo, 2003) or takes away a focus on the present moment which is ultimately the only one in which happiness can be experienced (Boniwell et al., 2010). Further, they argue that being able to engage in a flexible way with the situation at hand and its demands, people with a balanced time perspective are better able to cope in stressful

situations (Boniwell et al., 2010). As we only tested for the effect of COVID-19 on past focus, present focus, and future focus individually, future research should investigate past, present, and future orientation in relation to each other and test whether a balanced time orientation changes in the presence of a stressor.

We explored the use of insight words during COVID-19 and our findings do not align with the presented literature. In our sample, the clinical group used more insight words than the control group over both time frames, contradicting prior research findings that only healthy subjects but not those suffering from a mental disorder made greater use of insight words (Asmundson et al., 2020; Herbert et al., 2019). The increase in the use of insight words observed in our sample confirms that people are more cognitively engaged right after facing a stressor (Cohn et al., 2004). Yet, if insight words can indeed be seen as a coping mechanism that helps finding meaning in a stressful event (Boals & Klein, 2005), one could also expect an association between the use of insight words and other indicators of mental health. In our sample, greater use of insight words in the presence of COVID-19 was associated not only with linguistic indicators of mental health but also with indicators of psychopathology. Therefore, in light of our results, the conclusion that the use of insight words can be seen as a coping mechanism of healthy individuals to find meaning in a stressful event and thereby promotes mental health is questionable. In order to bring more clarity into the role of insight words when facing a stressor, future research should investigate the role of insight words on the relationship between stressful events and actual mental health, as defined by, e.g. self-reported mental well-being or DSM-5 diagnoses.

### **Limitations**

Our findings should be interpreted considering the following limitations. First, people manage their expressions on online platforms in order to portray a certain image of themselves and thus these might not reflect reality (Bazarova et al., 2012). For example, while someone responds on social media that they are happy for a friend who just got a promotion, they might actually feel jealous (Kross et al., 2019). Thus, posts on the internet are not the most reliable source to capture people's actual well-being. Second, word categories from the LIWC fail to take context into account (Panger, 2015). In fact, a study challenged the validity of the LIWC word categories of positive and negative emotion words to reflect actual mental well-being. They found that the use of positive and negative emotion words in student's

facebook posts did not predict self-reported well-being nor was the use of positive and negative emotion words predicted by mental well-being (Kross et al., 2019). Pennebaker et al. (2003) warned to interpret findings on mental well-being that rely on the use of emotion words exclusively. As word categories from the LIWC do not reliably capture people's actual well-being, future research should investigate mental well-being as measured by more valid measures of well-being such as self-reports. Third, our sample included only fairly young females. As it is known that men and women differ in their vulnerability to develop certain mental disorders (Gustavson et al., 2018) as well as in their word use measured by LIWC categories (Newman et al., 2008), our findings are not readily generalizable to the male population. Further, most bloggers are rather young and thus our sample included bloggers aged 20 to 44 years old. Pennebaker and Stone (2003) found however, that people change in their use of the LIWC word categories investigated in our research as a function of age. Therefore, future research should replicate our findings in a male or mixed gender sample with a greater age range and test for gender as well as age differences. Fourth, in order to categorize the bloggers into the clinical or the control group, we relied on self-reports of mental disorders on the blogger's websites. Since many individuals suffering from a mental disorder experience stigmatization and shaming (Krendl & Freeman, 2017), many of those who struggle with a mental disorder do not express that openly to the public (Dinos et al., 2004). Thus, we cannot be absolutely certain that the bloggers from the control group did not suffer from a mental disorder. Lastly, the variety of mental disorders in our sample is very limited. Eight of our nine bloggers in the clinical group suffered from anxiety disorders and depression, some of which have been diagnosed with another comorbid disorder and one blogger suffered from Borderline Personality Disorder. Hence, our data represent mainly anxiety and mood disorders, while most other mental disorders are underrepresented or not included in our sample at all. As prior research findings have shown different linguistic patterns in different disorders (Hofmann et al., 2012; Sonnenschein et al., 2018), our results are not readily generalizable to other forms of psychopathology. In order to test Beck's cognitive content-specificity model (Beck, 1976), it would add to our findings if future research would replicate our study with distinct subsamples categorized by mental disorders to detect differences among the different disorders or clusters of disorders.

Next to these limitations, it is also worth noting some strong points of our study. First, our study was one of the first to investigate the impact of the COVID-19 stressor on



word use. In over 100 years, since the Spanish flu, there has not been a global stressor that was as deadly and resulted in as many constraints for the entire world as the COVID-19 pandemic (Gavrilova & Gavrolov, 2020). Being able to investigate blog posts written by individuals throughout the first wave of the pandemic gives great insight into the effect of major stressors on word use. Second, our design was both longitudinal and cross-sectional, thereby giving us the opportunity to investigate not only differences between those suffering from mental disorders and healthy controls but also investigate their changes in word use during the pandemic. Third, by performing a random effects meta-analysis over the cases all our bloggers served as their own controls when testing for main effects of the appearance of COVID-19. Thereby, we controlled for language effects and other possible covariates. Fourth, including bloggers from four different countries who wrote in three different languages increased the diversity of our sample. Even though our findings cannot be readily generalized to all countries and all languages, the diversity of languages and countries represented in our sample increased the external validity of our study. Last, our data set was very large with 1556 blog posts during the first COVID-19 wave. Thus, the power of our study was large and the likelihood of a Type II error less likely.

### **Implications and Conclusion**

Psychopathology is reflected in many areas of the lives of those affected. By discovering how it is reflected in language use we can gain a deeper understanding of the processes involved leading to the symptomatology of the different disorders, thus taking a step further to help those suffering from a mental disorder. Our research contributes to the understanding of how the use of emotion words, temporal orientation, and insight words differ between the clinical and the healthy population, thereby giving insight into how these linguistic markers can be understood to reflect mental health. Further, our research sheds light on changes in these linguistic markers in response to the appearance of a global stressor, thereby finding out that those who suffered from psychopathology before the appearance of that stressor seem to be equally vulnerable to its effects as the healthy population as reflected in their word use. Both groups showed changes in many of the word categories investigated, with especially their increase in emotional negativity hinting at a decrease in mental well-being. Increases in a focus on the present in both groups might reflect coping mechanisms to deal with the pandemic. Finding that these changes seem to be existent in the healthy population as much as

in the clinical population shows the need for improvement in the availability of mental health services not only for patients but for the general population during this pandemic.

To conclude, our results on the increase of emotional negativity, focus on the present, and insight words aligned with prior research. Our results that the clinical group decreased in past focus and that the control group made overall greater use of insight words than the clinical group contradicted prior research. We also discovered that the use of insight words during COVID-19 was associated with indicators of both psychopathology and mental health, thus leading to no clear conclusion about whether the use of insight words in face of a stressor acts as a coping mechanism to deal with the negative event. No effect of COVID-19 on future focus was found. These findings add to the current literature by revealing differences in the language use of those suffering from a mental disorder and their healthy controls, thereby increasing the understanding of thinking patterns in mental disorders. Further, our results demonstrate the effect of the current pandemic on these linguistic markers, thereby indicating people's reaction to this major stressor. Since some results were inconclusive or in contrast to previous research findings, future research should further investigate how mental well-being is reflected in language use and how linguistic markers change in response to a major stressor, such as COVID-19.

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### Appendix A

#### Correlation Matrix With Spearman's Rho for the Main Variables and Word Count

	Emotional Negativity	Positive Emotion words	Negative Emotion words	Focus Past	Focus Present	Focus Future	Insight Words	Word Count
Emotional Negativity								
Overall	-							
Clinical group								
Control group								
Positive Emotion Words								
Overall	-.885**	-						
Clinical group	-.837**							
Control group	-.925**							
Negative Emotion Words								
Overall	.518**	-.133**	-					
Clinical group	.574**	-.100*						
Control group	.491**	-.186**						
Focus Past								
Overall	.271**	-.355**	-.052*	-				
Clinical group	.236**	-.357**	-.104*					
Control group	.276**	-.354**	-.055					
Focus Present								
Overall	.156**	-.171**	.041	-.052*	-			
Clinical group	.325**	-.359**	.071	.123**				
Control group	.064*	-.044	.101*	-.139**				
Focus Future								
Overall	.261**	-.349**	-.046	.357**	.456**	-		
Clinical group	.246**	-.361**	-.071	.316**	.532**			
Control group	.314**	-.347**	-.068*	.394**	.343**			

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Insight Words							
Overall	.187**	-.070**	.275**	.085**	.211**	.180**	-
Clinical group	.142**	.028	.291**	.026	.125**	.126**	
Control group	.192**	-.135**	.220**	.088**	.305**	.276**	
Word Count							
Overall	.160**	-.070**	.286**	-.045	.019	-.057*	.063* -
Clinical group	.351**	-.230**	.283**	.026	-.021	-.152**	.011
Control group	.080*	-.290	.251**	-.040	.018	.000	-.240**

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\*\* p < .01 level (2-tailed), \* p < .05 level (2-tailed).

### Appendix B

#### One-Sample T-Test on Emotional Negativity to Test for a Difference in the Use of Positive and Negative Emotion Words

Emotional Negativity	<i>t</i>	<i>df</i>	<i>p</i>	<i>M Diff</i>	<i>95% CI</i>	
					<i>Lower bound</i>	<i>Upper bound</i>
Overall	-54.485	1555	< .001	-2.767	-2.866	-2.667
Clinical group	-30.894	584	< .001	-2.552	-2.714	-2.389
Control group	-45.212	970	< .001	-2.896	-3.022	-2.770

## Appendix C

## Forest Plots With Main Effects of Presence of COVID-19

Figure C1

## Emotional Negativity Overall

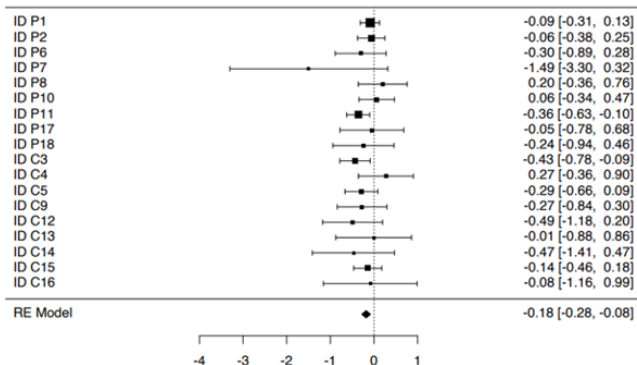


Figure C2

## Emotional Negativity Control Group

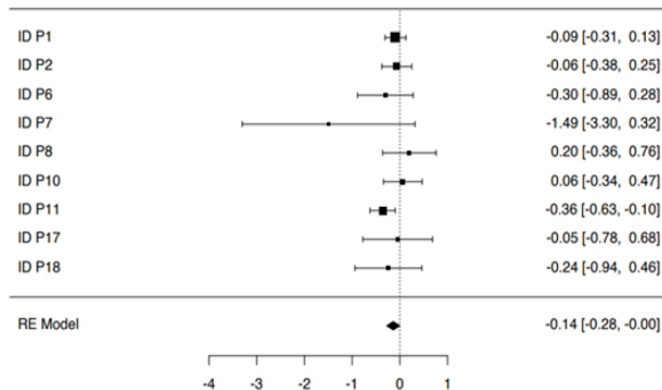


Figure C3

## Emotional Negativity Clinical Group

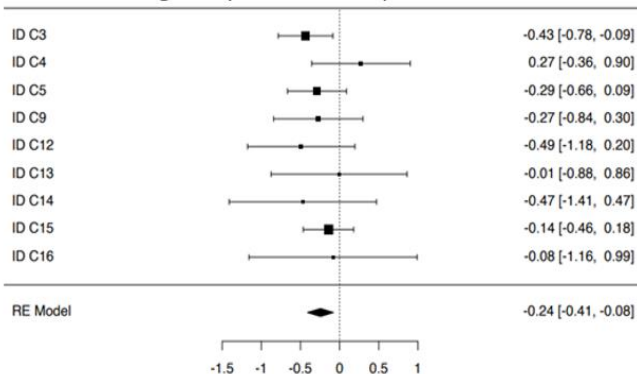


Figure C4

## Focus Past Overall

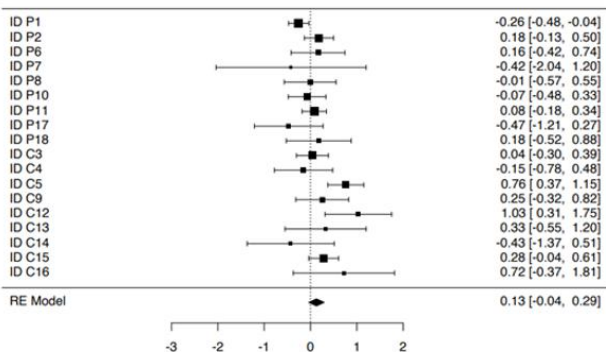


Figure C5

## Focus Past Control Group

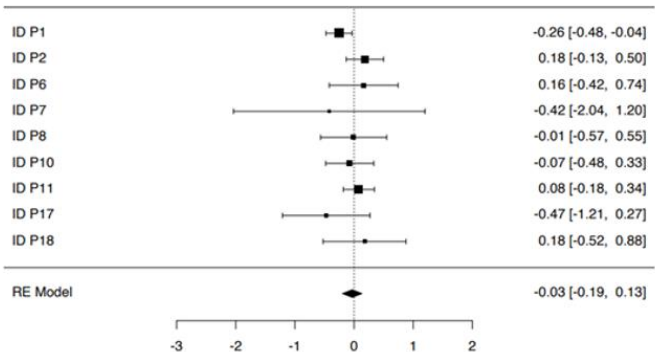
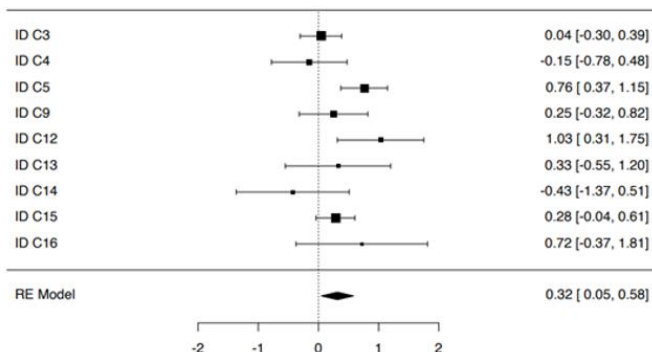


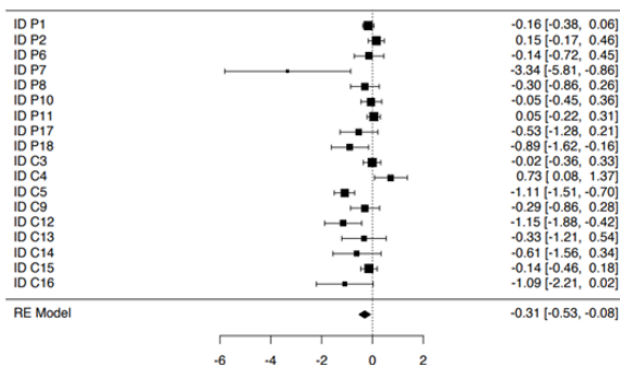
Figure C6

## Focus Past Clinical Group



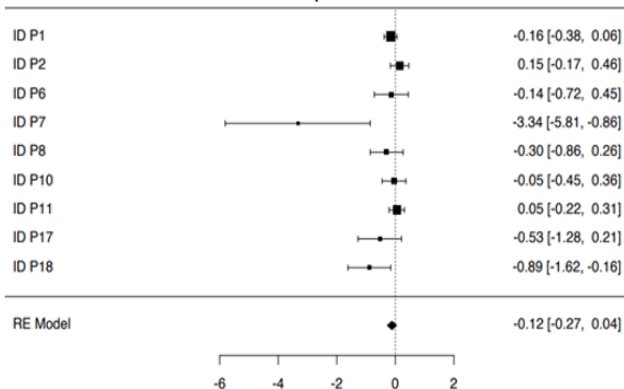
**Figure C7**

Focus Present Overall



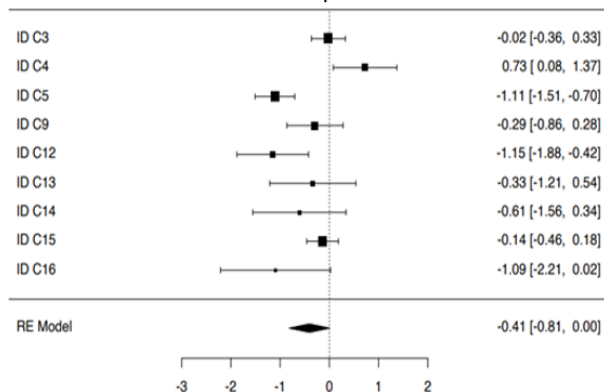
**Figure C8**

Focus Present Control Group



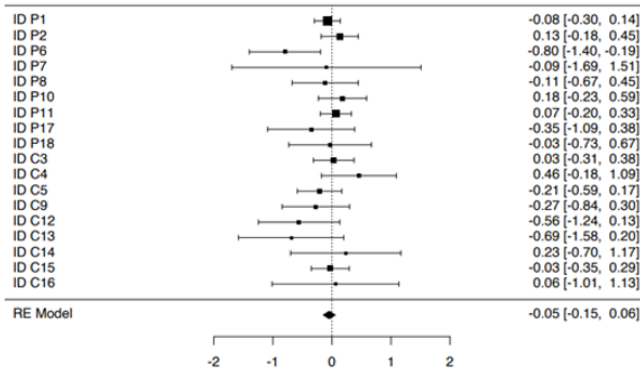
**Figure C9**

Focus Present Clinical Group



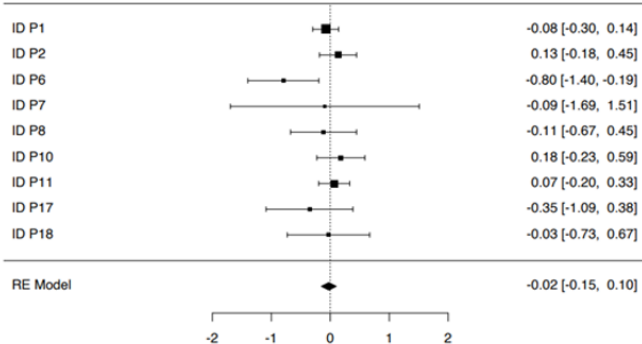
**Figure C10**

Focus Future Overall



**Figure C11**

Focus Future Control Group



**Figure C12**

Focus Future Clinical Group

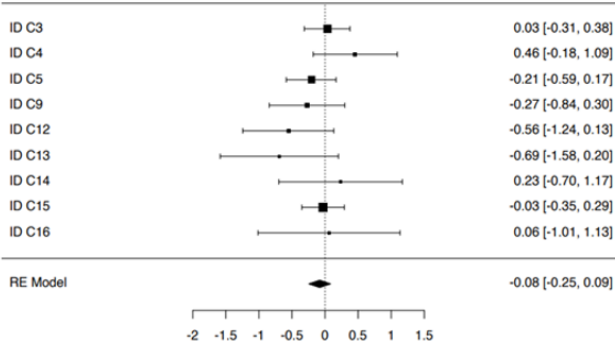




Figure C13

Insight Words Overall

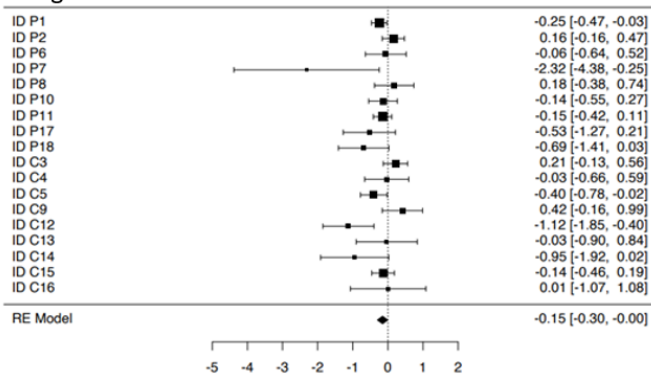


Figure C14

Insight Words Control Group

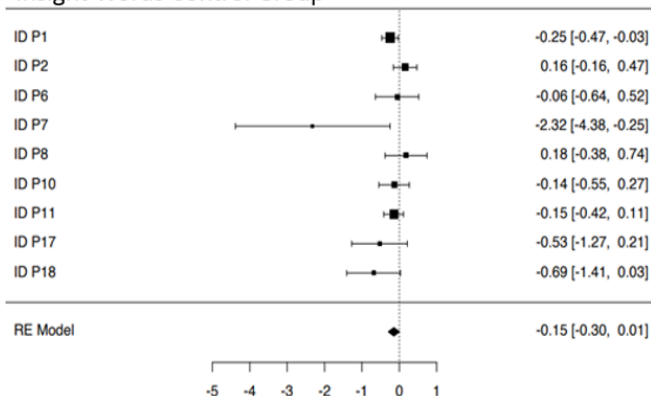


Figure C15

Insight Words Clinical Group

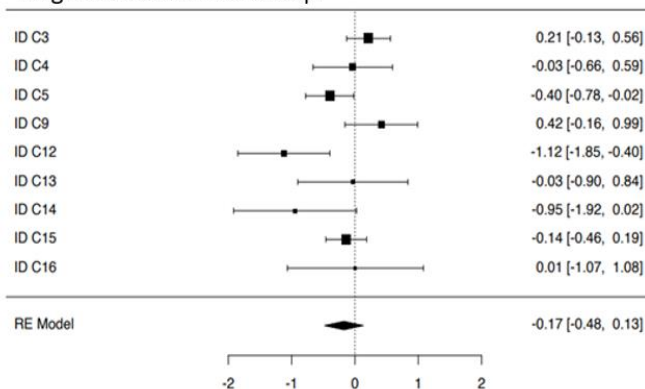


Figure C16

Word Count Overall

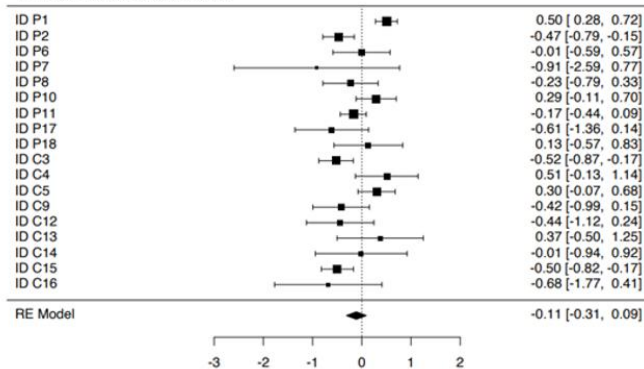


Figure C17

Word Count Control Group

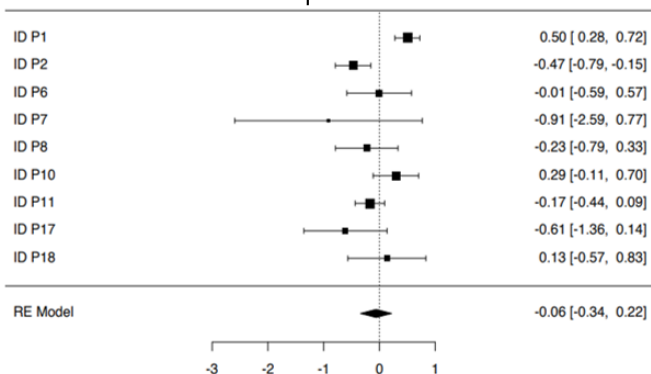
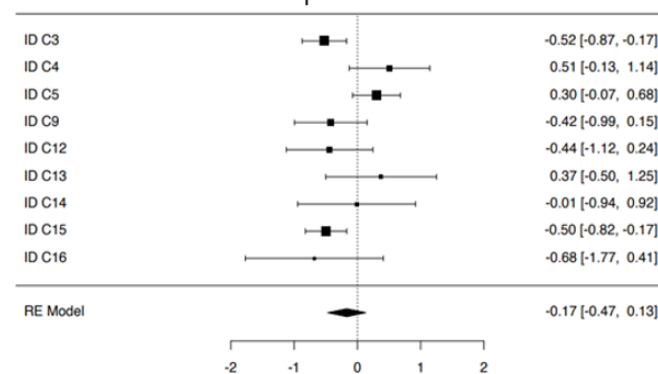


Figure C18

Word Count Clinical Group



### Appendix D

#### Correlation Matrix With Spearman's Rho for Insight Words and Word Count

	Emotional Negativity	Positive Emotion Words	Negative Emotion Words	Focus Past	Focus Present	Focus Future	Insight Words
<b>Insight Words</b>							
Overall	.187**	-.070**	.275**	.085**	.211**	.180**	-
<b>Clinical group</b>							
Overall	.142**	.028	.291**	.026	.125**	.126**	-
Pre-COVID-19	.085	.048	.201**	.039	.081	.171**	
COVID-19	.181**	.029	.377**	.190	.155**	.050	
<b>Control group</b>							
Overall	.192**	-.135**	.220**	.088**	.305**	.276**	-
Pre-COVID-19	.165**	-.112*	.207**	.073	.344**	.366**	
COVID-19	.208**	-.147**	.227**	.100*	.261**	.182**	
<b>Word Count</b>							
Overall	.160**	-.070**	.286**	-.045	.019	-.057*	.063*
Clinical group	.351**	-.230**	.283**	.026	-.021	-.152**	.011
Control group	.080*	-.290	.251**	-.040	.018	.000	-.240**

\*\* p < .01 level (2-tailed), \* p < .05 level (2-tailed).

