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How COVID-19 lockdown measures could impact patients with bulimia nervosa: Exploratory results from an ongoing experience sampling method study

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ABSTRACT

Objective: The impact of COVID-19 lockdown measures on patients with an eating disorder remains unclear, but preliminary results indicate that some patients could be more vulnerable to experience an increase in eating disorder pathology than others. To provide possible directions for future research, this report explored the impact of the Belgian COVID-19 lockdown measures on patients with bulimia nervosa (BN).

Methods: The data of 15 female patients with BN from an ongoing experience sampling method study were analyzed. Mixed effects models compared surroundings, social context, negative affect (NA), positive affect (PA) and binge eating before and after the implementation of the lockdown measures.

Results: After the implementation of the lockdown measures, significant changes in surroundings and social context were found as well as an increase in NA and decrease in PA. Patients who experienced a higher binge eating frequency during the lockdown also experienced a stronger change in NA and PA.

Conclusions: Future research should also look at changes in surroundings, social context, affect and how these interact with factors such as personality traits and coping styles when investigating why some patients are more susceptible to the negative effects of lockdown measures than others.

1. Introduction

In the first half of 2020, many countries implemented lockdown measures to contain the spread of coronavirus disease 2019 (COVID-19; [World Health Organization, 2020](#)). For example, in Belgium, citizens were required to stay at home from March 18th, 2020 onwards and avoid contacts outside of the family as much as possible ([Belgian Federal Government, March 16, 2020a](#)). Furthermore, companies were obliged to organize working from home and nonessential stores were closed. These measures were later relaxed on the 10th and 11th of May with families being allowed to receive a maximum of 4 people at home and with stores being reopened ([Belgian Federal Government, May 06, 2020b](#)).

Such lockdown measures, which restrict the movement of individuals, are shown to negatively impact the mental wellbeing of the general population. Moreover, several studies found that this impact could be greater in patients with an eating disorder ([Fernández-Aranda](#)

[et al., 2020](#); [Pieh et al., 2020](#); [Singh et al., 2020](#)). For instance, studies found that 47.1% and 67% of patients with anorexia nervosa (AN) reported more restrictive eating ([Phillipou et al., 2020](#), [Schlegl, Maier, et al., 2020](#)). When it comes to patients with bulimia nervosa (BN), 35% and 47.3% of patients experienced more binge eating episodes ([Phillipou et al., 2020](#), [Schlegl, Meule, et al., 2020](#)). Also, studies looking at eating disorders in general found that 73.2% and 86.7% of patients reported a worsening of eating disorder symptoms ([Branley-Bell & Talbot, 2020](#), [Richardson et al., 2020](#)). However, in these studies, a number of participants experienced no change or even an improvement in eating disorder symptoms.

These results suggest that some patients with an eating disorder might be more vulnerable to the impact of lockdown measures than others. Several underlying reasons why this could be the case have been put forward. Firstly, as affect plays an important role in eating disorder pathology, increased feelings of loneliness, anxiety and uncertainty during lockdown measures could lead to an increase in eating disorder

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symptoms (Naish et al., 2019). Secondly, as some disordered eating behaviors such as binge eating (BE) primarily take place at home, being at home more often could lead to them occurring more frequently (Allison & Timmerman, 2007). Thirdly, since being less around friends and more around family has been linked to disordered eating, changes in these social factors can contribute to a worsening of eating disorder symptoms (Mason & Lewis, 2017).

When it comes to investigating how lockdown measures can impact patients with an eating disorder, most published studies were cross-sectional, lacked data from before the lockdown and used retrospective surveys. However, when using retrospective surveys, there is a risk of memory recall errors in the responses of participants (Ayhan & İşiksal, 2005). Also, as recruitment for these studies happened during or after a lockdown, there is a risk of recruitment bias. For example, patients who experienced more symptoms during a lockdown could be more inclined to participate in studies investigating the impact of lockdown measures.

Therefore, to investigate how lockdown measures can impact patients with BN, this report analyzed data from an ongoing Belgian study using the experience sampling method (ESM). In an ESM study, participants report their current mood, cognition, behavior and context throughout the day in order to monitor variables in real-time, decreasing the risk of memory recall errors (Shiffman et al., 2008). Additionally, because the study is longitudinal, it is possible to compare variables before and during a lockdown. Furthermore, as participants were included before the start of the COVID-19 pandemic, there is no recruitment bias concerning lockdown measures.

With this data, the following hypotheses were explored. Namely, based on the lockdown measures that were in effect, we hypothesized that during their implementation participants were more at home, alone, with their family, with their partner or with their housemates and less with their friends. Based on previous studies, we expected that there would be higher levels of negative affect (NA) as well as lower levels of positive affect (PA) during the lockdown and that changes in BE frequency would vary among patients (Pfefferbaum & North, 2020; Philipou et al., 2020). Also, as previous research found that changes in affect precede a BE episode, we hypothesized that this relationship could be stronger during the lockdown and additionally, that there would be steeper changes in NA and PA in individuals who had a higher BE frequency during the lockdown compared to before the lockdown (Berg et al., 2015; Schaefer et al., 2020).

2. Methods

2.1. General

The data for the analyses come from the ongoing Belgian Spinning-Out-Of-Control study in which participants with recent-onset BN are followed during a 1-year period. From this parent study, a subset of participants was selected with data from before and during the implementation of the lockdown measures in Belgium.

2.2. Participants

For the Spinning-Out-Of-Control study, individuals were eligible to participate if they were female, over 18 years old and had a BMI of at least 18.5 kg/m². Individuals had to meet the criteria for BN of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) with a maximum illness duration of 5 years (American Psychiatric Association, 2013). Individuals were excluded if they suffered from any other severe psychiatric disorder (i.e. psychosis, bipolar disorder, learning disability, autism spectrum disorder) or medical disorder (e.g. severe liver or kidney disease, uncontrolled diabetes, cancer or untreated hyper- or hypothyroidism), if they chronically abused sedatives or substances and if they were pregnant. The Structured Clinical Interview for DSM-5 (SCID-5-S) was used to confirm the diagnosis of BN and to screen for other psychiatric disorders (American Psychiatric

Association, 2017). Participants were recruited through residential care facilities specialized in eating disorders, ambulatory care givers, universities as well as social media.

Of all individuals participating in the Spinning-Out-Of-Control study, 17 patients with BN had data available from before and during the implementation of the lockdown measures. Of these, 15 were included in the final analysis as 2 participants had a compliance rate below 10%, which was our pre-set cutoff. A detailed description of the patient characteristics can be found in Table 1.

2.3. Procedure

For the Spinning-Out-Of-Control study, ESM data were gathered over the course of 1 year during 3-week-long blocks which were separated by 5-week-long intervals. During each block, data were collected every Thursday, Friday and Saturday. This means that there were 9 days of data collection in each block. On a given day of data collection, participants received 8 signals that were sent on a signal-contingent (i.e. semi-random) basis (Shiffman et al., 2008). Therefore, 72 signals were sent out during each block. The signals were dispersed between the average wake-up and bed times for each participant and varied randomly around anchor points separated by an interval averaging 120 min. All ESM data in the study were collected through mobileQ, an open-source smartphone application developed at KU Leuven (Meers et al., 2020).

2.4. Measures

Participants were asked to report their location and social context by choosing from a list of possible options. For their location, participants could indicate that they were at home, at a friend or family member's, at work or school, at a bar or restaurant, on route or outside. For their social context, participants could report that they were alone, with friends, with housemates, with family, with their partner, with strangers, with colleagues, with acquaintances, talking online or with others.

An abbreviated version of the Positive and Negative Affect Schedule (PANAS) was used for data collection on affect (Watson & Clark, 1994). A total of 6 emotions were assessed for NA (afraid, lonely, insecure, sad, distressed, guilty) and 3 emotions for PA (satisfied, enthusiastic, relaxed). At each assessment, participants were presented with a statement concerning each specific emotion (i.e. this moment, I feel ...) and asked to rate it on a 7-point Likert scale ranging from 'Totally Disagree' to 'Totally Agree'. These items and their scaling match those of previous ESM studies investigating NA and PA (Rintala et al., 2020). To obtain a single parameter for NA as well as PA, the scores for the underlying emotions were averaged. A between- and within-subject Cronbach's alpha was calculated for NA and PA. The between-subject Cronbach's alpha was based on the entire dataset while the within-subject Cronbach's alpha was the average of the Cronbach's alpha for the data of

Table 1
Patient characteristics at inclusion.

Characteristics	Median (Q1–Q3) or % (N)
Age (years)	23 (21.5–25.5)
Body Mass Index (kg/m ²)	25.5 (21.5–27.5)
Formal Education (years)	15 (13–16.5)
Ethnicity	
European	87% (13)
Asian	13% (2)
Illness duration (years)	3 (2–5)
Binge eating episodes in the month prior to inclusion	4.5 (2–8.75)
Co-morbidities	
Major depressive disorder	6.7% (1)
Social anxiety disorder	6.7% (1)
Post-traumatic stress disorder	13.3% (2)
In treatment	26.7% (4)

each participant. The between- and within-subject Cronbach's alpha were 0.86 and 0.80 for NA and 0.83 and 0.82 for PA respectively.

At each assessment, participants were asked if they had eaten. If so, they had to identify the eating episode as *undereating*, *normal eating* or *overeating*. Participants were also asked whether they had experienced a *loss of control* over their eating behavior since the last assessment. Participants were trained on the terms undereating, normal eating, overeating as well as loss of control. As in previous ESM studies, a binge eating episode was defined as an episode of overeating where the participant experienced a loss of control over their eating behavior, coded as 0 (no binge) or 1 (binge) (Ambwani et al., 2015; Goldschmidt et al., 2014).

2.5. Statistical analysis

Only the data from the 3-week-long block before and during the implementation of the lockdown measures were analyzed. As participants were included at different timepoints, the data from before the lockdown measures were collected between January 10th and March 14th and the data during the lockdown were collected between March 19th and May 9th.

Patient characteristics as well as behavioral measures such as compliance (i.e. the proportion of signals that were answered by participants), NA and PA were described using the median and the upper and lower quartile or the percentage and number. To aid in the interpretation of the clinical significance of the results, the number of participants with a median NA level of 4 or higher and a median PA level of 4 or lower before and during the lockdown were calculated. A participant with a median NA level of 4 or higher is neutral to or in agreement with the questions concerning NA at least half of the time. The same applies to a participant with a median PA level of 4 or lower but in the opposite direction. This could be the clinical equivalent of a patient reporting a neutral or high NA or a neutral or low PA over a certain period of time.

In the analyses, the lockdown was treated as a binary effect where the data before and during the measures were coded as 0 and 1 respectively. Also, in the different analyses, age and body mass index (BMI) were included as covariates. Each model was a mixed effects model with random intercepts where assessments (level 1) were nested within days (level 2) which in turn were nested within participants (level 3).

In a first analysis (a), the impact of the lockdown measures on the surroundings and social context of participants was assessed. Of all the items, only those relevant to the hypotheses were examined, namely, at home, with friends, with family, with partner, with housemates and alone. In order to do so, a generalized linear mixed model with a binomial distribution was fitted to the data of each item with the item (coded 0 or 1) as outcome and lockdown (0 or 1) as a fixed effect.

In a second and third analysis (b and c), the effect of the lockdown measures on NA, PA and BE was explored. Therefore, a general linear mixed model for NA and PA or a generalized linear mixed model with a binomial distribution for BE was fitted to the data with lockdown (0 or 1) as a fixed effect.

In a fourth analysis (d), participants were divided into groups based on a higher, constant or lower BE frequency during the lockdown compared to before the lockdown. This categorical group factor was added as a main effect and in interaction with lockdown (0 or 1) in the models of analysis (b). Afterwards, contrasts were defined to compare changes in NA and PA between the higher BE frequency group and the other groups. A similar analysis for surroundings and social context could not be performed because some models could not be fitted to the data. This is because a number of factors occurred infrequently in the study sample (i.e. that participants were only seldom in a certain surrounding or social context).

In a fifth analysis (e), it was explored if the relationship between NA or PA and BE was impacted by the lockdown measures. To begin, a

generalized linear mixed model with a binomial distribution was fitted with the fixed effects NA_{t-1} or PA_{t-1} (i.e. the levels of NA and PA at the previous signal) and binge eating (0 or 1) as the outcome. Afterwards, lockdown (0 or 1) was added as a main effect and in interaction with NA_{t-1} or PA_{t-1} . The signal after every BE episode was not included in this analysis to control for the effects of BE episodes on NA and PA (Schaefer et al., 2020).

As the Spinning-Out-Of-Control study follows patients with BN over the course of one year, it is possible that some participants experience prolonged periods without BE episodes. It was decided to keep these participants in the analyses, but as there could be differences in affect and its relationship with BE, analyses (b), (c) and (e) were also rerun without these participants.

All models were fit using R 3.6.1 with the package *lme4* (Bates et al., 2015). The significance level for these analyses was set at $p < 0.05$. Due to the exploratory nature of this report, no correction for multiple testing was applied.

3. Results

The median compliance of the 15 participants included in this report was 62% (range: 28%–86%). Before and during the lockdown, the median compliance was 58% (range: 28%–85%) and 66% respectively (range: 21%–88%). The median amount of days on which a participant answered signals was 9 (range: 4–9) before the lockdown and 9 (range: 3–9) during the lockdown. Across all participants, the median number of responses per day was 6 (range: 1–8) before the lockdown and 6 (range: 1–8) during the lockdown. During this time, BE episodes were reported by 87% ($n = 13$) of participants with a median of 10 episodes per participant (Q1-Q3: 4–14). The median level for NA before and during the lockdown was 3.5 (Q1-Q3: 2.5–4.5) and 3.83 (Q1-Q3: 2.67–5) respectively. The percentage of participants with a median NA level of 4 or higher was 27% ($n = 4$) before the lockdown and 47% ($n = 7$) during the lockdown. The median level for PA before and during the lockdown was 4 (Q1-Q3: 3–5) and 3.67 (Q1-Q3: 2.67–5) respectively. Of all participants, 53% ($n = 8$) had a median PA level of 4 or lower before the lockdown while this was 60% ($n = 9$) during the lockdown.

The results from the analyses are found in Table 2. Looking at the results from analysis (a), it can be seen that participants were significantly more at home ($\beta = 3.19$, $se = 0.37$, $p < 0.001$), with their family ($\beta = 0.99$, $se = 0.35$, $p = 0.005$) and with their housemates ($\beta = 3.91$, $se = 1.51$, $p = 0.005$) while also being significantly less with their friends ($\beta = -2.45$, $se = 0.88$, $p < 0.009$) and their partner ($\beta = -2.39$, $se = 1.01$, $p = 0.026$). No significant change in being alone was found ($\beta = 0.25$, $se = 0.18$, $p = 0.159$). From the results of analysis (b), it can be concluded that there were significantly higher levels of NA ($\beta = 0.15$, $se = 0.04$, $p < 0.001$) as well as significantly lower levels of PA ($\beta = -0.10$, $se = 0.04$, $p = 0.015$) during the lockdown. No such effect for BE frequency was found in analysis (c) ($\beta = 0.11$, $se = 0.19$, $p = 0.548$). For analysis (d), 47% ($n = 7$) of the participants belonged to the higher BE frequency group and 40% ($n = 6$) to the lower BE frequency group. For 13% ($n = 2$) of the participants, the BE frequency remained constant as they experienced no BE episodes before or during the lockdown measures. It can be seen that the higher BE frequency group experienced a more pronounced change of NA ($\beta = 0.16$, $se = 0.06$, $p = 0.012$) and PA ($\beta = -0.16$, $se = 0.07$, $p = 0.026$) than those of the lower BE frequency group. Of the participants in the higher BE frequency group, 14% ($n = 1$) had a median NA level of 4 or higher before the lockdown, while this was the case for 57% ($n = 4$) during the lockdown. For PA, 29% ($n = 2$) had a median level of 4 or lower before the lockdown and 86% ($n = 6$) during the lockdown. No significant effect of the lockdown measures on the relation between BE and NA_{t-1} ($\beta = 0.20$, $se = 0.87$, $p = 0.815$) or PA_{t-1} ($\beta = -0.37$, $se = 0.95$, $p = 0.694$) was found in analysis (e). Performing analysis (b), (c) and (e) without the 2 participants who did not report BE episodes did not change the significance of the findings.

Table 2

Results from the different statistical analyses. In the table, each analysis is represented in bold and additional information on the nature of the analyses is shown in cursive. For each model, the outcome is listed with underneath, the relevant main and interaction effects (analysis a, b, c and e) or contrasts (analysis e). For each of these, the standardized coefficient, standardized standard error and *p*-value is given with significant findings displayed in bold. NA and PA represent negative and positive affect respectively while BE stands for binge eating. For analysis e, there are 4 different models with BE as the outcome. There are two with either NA or PA of the previous signal (NA(t-1) and PA(t-1)) and two that include an interaction with lockdown measures.

	Standardized coefficient (β)	Standardized standard error (se)	<i>p</i> -Value
Analysis (a): impact of the lockdown measures on the surroundings and social context			
At home			
Lockdown measures	3.19	0.37	< 0.001
Alone			
Lockdown measures	0.25	0.18	0.159
With family			
Lockdown measures	0.99	0.35	0.005
With partner			
Lockdown measures	-2.39	1.01	0.026
With housemates			
Lockdown measures	3.91	1.51	0.005
With friends			
Lockdown measures	-2.45	0.88	0.009
Analysis (b): impact of the lockdown measures on negative (NA) and positive affect (PA)			
NA			
Lockdown measures	0.15	0.04	< 0.001
PA			
Lockdown measures	-0.10	0.04	0.015
Analysis (c): impact of the lockdown measures on binge eating (BE)			
BE			
Lockdown measures	0.11	0.19	0.548
Analysis (d): differences in changes of NA or PA between participants with an higher BE frequency and those with a constant or lower BE frequency during the lockdown			
NA			
Lockdown measures* Higher BE vs Lockdown measures*Lower BE	0.16	0.06	0.012
Lockdown measures*Higher BE vs Lockdown measures*Constant BE	-0.09	0.31	0.779
PA			
Lockdown measures*Higher BE vs Lockdown measures*Lower BE	-0.16	0.07	0.026
Lockdown measures*Higher BE vs Lockdown measures*Constant BE	-0.02	0.11	0.864
Analysis (e): Relation between BE and NA			
BE			
NA(t-1)	0.61	0.31	0.047
Impact of the lockdown measures on the relation between BE and NA			
BE			
NA(t-1)*Lockdown measures	0.20	0.87	0.815
Relation between BE and PA			
BE			
PA(t-1)	-0.33	0.302	0.267
Impact of the lockdown measures on the relation between BE and PA			
BE			
PA(t-1)*Lockdown measures	-0.37	0.95	0.694

4. Discussion

Literature suggest that some patients with an eating disorder are more vulnerable to experience an impact of lockdown measures than others. Therefore, to adapt care, it is vital to identify why this would be the case in certain patients but not in others. By analyzing data from an ongoing ESM-study, this report wanted to investigate how COVID-19 lockdown measures could impact patients with BN.

Firstly, this report showed that during the lockdown, participants were significantly more at home, with their family and housemates and less around friends. This reflects the nature of the lockdown measures where individuals were ordered to stay at home and avoid contact with anyone not living at the same address (Belgian Federal Government, March 15, 2020a; Belgian Federal Government, May 06, 2020b). However, participants were also significantly less with their partner and no change in being alone was found. This could be due to the young age of the participants as they might not live alone or with a partner. Previous research has shown that context could play an important role in triggering disordered eating behavior (Allison & Timmerman, 2007; Mason & Lewis, 2017). Changes in these factors could therefore underlie changes in binge behavior during lockdown measures. A comprehensive and proper investigation of this hypothesis was not possible in this report. However, as this report has shown that there are significant differences, future research should look at these factors as well when investigating the impact of lockdown measures on eating disorder pathology.

Secondly, higher levels of NA and lower levels of PA were observed during the lockdown when compared to before the implementation of the lockdown measures, which is in line with previous studies in patients with a psychiatric disorder (Hao et al., 2020). The clinical implication of these statistical results can be appreciated from the observation that 47% of participants experienced a neutral or high NA level at least half of the time during the lockdown compared to 27% before the lockdown. Also, participants who experienced a higher BE frequency during the lockdown showed a stronger change of NA and PA during the lockdown. Furthermore, the majority of the participants with a neutral or high median NA as well as a neutral or low median PA during the lockdown were participants who experienced a higher binge eating frequency. These results suggest that caregivers should be attentive to affect and changes in affect when lockdown measures are active as this could be associated with more eating disorder symptoms.

Finally, no significant difference in the relation between NA or PA and BE was found during the lockdown. Consequently, it could be the change in affect and not a change in how patients deal with affect that leads to changes in BE frequency during a lockdown. Future research should therefore explore why certain patients experience more pronounced changes in affect than others. For instance, by exploring factors such as personality traits and coping styles as these have been shown to mediate the relationship between affect and BE (Fischer et al., 2018).

5. Limitations and strengths

A first limitation of this report is the number of statistical tests. Since we wanted to provide future research with possible directions, a multiple testing correction was not implemented. However, to limit the number of tests, it was chosen to focus on specific items that were supported by previous research. Even so, this limitation needs to be kept in mind when interpreting the results.

A second limitation of this report is the sample size. For example, the percentage of participants that experienced a higher binge eating frequency during the lockdown is in the range of previous studies (Philippou et al., 2020. Schlegl, Maier, et al., 2020). However, no significant change in BE frequency across patients was found. There is a risk that this could be the result of the sample size. To have an idea of the power of this report, a comparison can be made to other studies. Here, it can be seen that the number of participants and measurements per participant

are similar to other ESM studies that have investigated the impact of certain factors on binge eating (Fischer et al., 2018; Wonderlich et al., 2017). However, as no a priori power calculation is available, there is still a risk that the current study is underpowered and this needs to be kept in mind when interpreting the results.

A third limitation could be the use of agreement to score NA and PA instead of the original scale of the PANAS as this might not reflect the intensity of the emotions as well as the PANAS (Watson & Clark, 1994).

This report has several strengths in comparison to previously published studies on the impact of lockdown measures on patients with an eating disorder. Firstly, as participants were included before the COVID-19 pandemic, no recruitment bias concerning the lockdown measures is present. Secondly, as the data were gathered in a naturalistic way, the risk of memory recall errors is reduced. Thirdly, as data from before the implementation of the lockdown measures was available, this report is able to give a unique insight into differences in surroundings, social context and affect during the lockdown.

6. Conclusion

This report shows that lockdown measures are associated with changes in surroundings, social context and affect in patients with BN. Additionally, patients who experience more extreme changes in affect could be more vulnerable to experience a worsening of binge eating frequency. Future research should therefore also look at changes in surroundings, social context, affect and how these interact with factors such as personality traits when investigating why certain patients are more vulnerable than others for the negative effects of a lockdown.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author.

Ethical statement

The Spinning-Out-of-Control study has been approved by the ethical committee UZ/KU Leuven (Herestraat 49, 3000 Leuven, Belgium) and has been performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki. All participants gave their informed consent to participate as well as publication.

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CRediT authorship contribution statement

Nicolas Leenaerts: Conceptualization, Methodology, Formal analysis, Writing – original draft **Thomas Vaessen:** Supervision, Writing - review & editing **Jenny Ceccarini:** Writing - review & editing **Elske Vrieze:** Supervision, Writing - review & editing.

All authors have approved the final manuscript.

Declaration of competing interest

The authors have no conflict to declare.

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