**Well-being during COVID-19-related first lockdown: Relationship with autobiographical memory and experiential diversity**

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Abstract

In March 2020, the Belgian government ordered a complete lockdown as an attempt to decrease the progression of the COVID-19. The aim of the present study was to examine lockdown-related changes in psycho-affective states as well as their relations with experiential diversity and autobiographical memory. A total of 186 Belgian citizens completed an online survey assessing lockdown-related changes in various dimensions: work, leisure activities, affective state, sleep quality, fatigue, and autobiographical memory. Results revealed that well-being during the lockdown was related to changes in experiential diversity and to the richness of participants’ memories. Moreover, the content and the phenomenology of memories were more negative when memories pertained to the lockdown situation. These findings provide new evidence that mental well-being of Belgian citizens during the first lockdown was related to how pandemic-related sanitary constraints affected the diversity of activities that they could undertake.

Keywords: COVID-19, experiential diversity, autobiographical memory, well-being

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**Introduction**

In Belgium, the outbreak of Coronavirus disease 2019 (COVID-19) started in February 2020. Because of high infection and mortality rates, the Belgian government ordered a complete lockdown starting on March 18th, 2020, as an attempt to slow down the pandemic. People had to stay at home except for essential workers when teleworking was not possible, urgent medical visits or grocery shopping. All leisure facilities were closed (e.g., culture, sports, and group activities). Outdoor activities (e.g., running, walking, cycling) were allowed, but citizens had to go out only with people living under the same roof and had to stay close to their home.

Many studies have reported that the COVID-19 pandemic and, more specifically, the lockdown situations across the world had a negative impact on the mental health of the population. During the lockdown, people manifested negative psychological reactions, such as stress, anxiety, depression, and reduced well-being (Luo et al., 2020; Salari et al., 2020; Vindegaard & Benros, 2020, for reviews). Such psychological outcomes are likely due to various factors, including fear of the disease, societal and economic impact of the situation, social isolation, and feeling of loss of control on one’s life (Carleton, 2016; Coulombe et al., 2020). Also, the general quarantine itself likely played a role as quarantines usually lead to increased stress and irritability, insomnia, poor mood, anger, emotional exhaustion, and fear (Brooks et al., 2020, for a review). However, a recent meta-analysis emphasized that, although significant, this psychological impact of COVID-19 lockdown was small and heterogeneous (Prati & Mancini, 2021). Here, we examined how three factors were related to each other during the lockdown period: psycho-affective variables, changes in experiential diversity and memory.

Because of the constraints imposed by the lockdown, the number and diversity of activities that people could undertake were reduced (Dhami et al., 2020). This decrease in activities can negatively impact well-being and psycho-affective status in several ways. First, experiential diversity is a fundamental driver of well-being both in animals (Brydges et al., 2011; Marashi et al., 2003) and in humans (Heller et al., 2020; Lee et al., 2018). The more people engage in novel, rewarding and diverse daily activities, the more they report positive affects (Heller et al., 2020) and higher well-being (Lee et al., 2018). Second, when confronted with stress, people tend to cope by relying on leisure activities and social networks (Kitzrow, 2003). Therefore, being deprived of activities may prevent from coping with the stress and anxiety generated by the pandemic situation. In line with this assumption is recent evidence showing that young individuals who were used to taking part in outside activities before the pandemic were those who reported the lower sense of mental well-being during the lockdown (Zhuo & Zacharias, 2021). We therefore predicted a significant association between experiential diversity and psycho-affective variables in the present study.

Moreover, the reduction of activities could also impact the quality and content of autobiographical memory in two ways. First, individuals who are engaged in more diverse everyday life activities have better episodic memory (Lachman et al., 2010; Lee et al., 2020). Also taking part in novel activities for a few weeks or months, such as physical exercises, exploration of a virtual environment or walks in public parks, leads to enhanced episodic memory performance after the activities compared to before (Clemenson et al., 2019, 2020; Erickson et al., 2011; Kolarik et al., 2020). While these studies suggest that being exposed to new and stimulating environments benefits episodic memory performance, the opposite might also be true, in that reducing the diversity of activities that people can undertake and minimize opportunities to discover new places may be detrimental for episodic memory, as suggested by a study showing that imprisonment leads to poorer memory (Lapornik et al., 1996). Second, the content of experienced events can modify how we remember them. More specifically, when we experience a large variety of situations that involve changes of actions and contexts, the flow of events is densely segmented to reflect the occurrence of many event boundaries. In contrast, when we experience a non-changing situation, there are few event boundaries and less segmentation. The more segmented an event is, the better it is remembered afterwards (Pettijohn et al., 2016). So, the lockdown could have reduced the diversity within everyday life experience, and thus may decrease segmentation of the ongoing stream of events, and this may in turn impoverish our memory for these events. Thus, we should observe associations between measures of experiential diversity and the quality of memories during the lockdown. As we cannot evaluate how accurate autobiographical memories are, we will consider level of details and phenomenological experience, as assessed by subjective ratings of memory characteristics.

Lockdown-related changes in experiential diversity are thus expected to be related to experienced well-being and the quality of autobiographical memory during that period, but these two aspects should also relate to each other. Yet, currently, the link between COVID-19 lockdown related changes in well-being and memory has scarcely been studied. One study showed that narrative coherence (i.e., how structurally and thematically cohesive a narrative is) in telling positive autobiographical memories two years prior to the pandemic predicted emotional well-being during the first peak of COVID-19 pandemic (Vanaken et al., 2021). Another study revealed that individuals who reported depressive symptoms, higher anxiety, and an increase in stress during the COVID-19 pandemic judged their memories from that period as being more negative and less detailed (Niziurski & Schaper, 2021). These findings are in line with previous evidence on the impact of affective states on the richness and the content of autobiographical memory. For instance, past studies suggest that being in a depressed mood decreases the speed of retrieval of positive memory events (Teasdale & Fogarty, 1979), and that induction of anxiety leads to more anxiety-related memories (Richards & Whittaker, 1990). Depressed patients report autobiographical memories that are less specific and more general than controls (Lemogne et al., 2006; Söderlund et al., 2014), and they also subjectively re-experience these past events in a less vivid and positive way than healthy controls (for a review, see Holmes et al., 2016). These studies are in line with autobiographical memory theoretical accounts, which posits that one’s current self-view and state might influence the content and the quality of one’s recollection (Wilson & Ross, 2003).

Yet, the relationship between affective states and autobiographical memory content might be bidirectional, so that the richness of memory recollection might also impact current affects (Wilson & Ross, 2003). Notably, autobiographical memory may influence affects through its social function. For instance, it has been shown that sharing memories in a specific way promoted feeling of closeness between partners (Beike et al., 2016). Similarly, participants who report episodic memories that lacked specificity also report suffering from a lack of support from their friends and romantic partner during the following year, which in turn increased general distress (Barry et al., 2019). Besides, autobiographical memory capacities shape one’s sense of identity by integrating meaningful past events in the self (Addis & Tippett, 2004), so that impoverished autobiographical memory might negatively impact the sense of identity, which might in turn decrease emotional well-being (Jetten et al., 2010). Together, recent COVID-related findings (Niziurski & Schaper, 2021) and previous autobiographical memory evidence (Barry et al., 2019; Holmes et al., 2016) converge to suggest that we should observe a significant relation between the level of richness of autobiographical memories of Belgian citizens during the first lockdown and their well-being during that period.

Because we expected relationships between our three variables of interest (i.e., experiential diversity, richness of autobiographical memory, and well-being), we additionally examined whether one variable could mediate the association between the two others. Here, we will consider psycho-affective state as the dependent variable because ample research has indicated that the lockdown situation was related to stress, depression, anxiety, and reduced well-being (Luo et al., 2020; Salari et al., 2020; Vindegaard & Benros, 2020, for reviews). If variables are significantly related as predicted, mediation analyses were planned to test whether the association between experiential diversity and psycho-affective state is partially mediated by changes in memory quality.

Beyond a decrease in the richness of memories, we also expected a change in their content. As the lockdown was associated with perceived stress and fear among the Belgian population, retrieved autobiographical memory events for that period might relate more to negative emotions than memories for events that occurred before the pandemic. Relative to recollections pertaining to neutral life events, negative memories are subjectively re-experienced with a stronger and more negative emotional intensity (Comblain et al., 2005), and they also contain more negative words (Schryer et al., 2012). Therefore, we could expect that memories during the lockdown period contained more anxiety and more negative words than memories for the period before the pandemic.

In a more exploratory way, we investigated the relationships between our measures of interest (i.e., changes in experiential diversity, memory and psycho-affective variables) and other variables which have also been shown to be affected by the lockdown situation and could have had a negative impact on people’s psycho-affective state and well-being: subjective sleep quality –that also impacts cognitive performance (Yaffe et al., 2014)- which was poorer during lockdown (Cellini et al., 2021; Franceschini et al., 2020), time spent on screens that increased in 80% of people (Constant et al., 2020), media exposure to COVID-19-related news which has been linked to anxiety (Gao et al., 2020), social sharing of memories and COVID-19-related information, and the valence of dreams. Indeed, dreams may be used as a window into people’s well-being and mood as situations that we experience in daily life are usually transposed into our dreams (Revonsuo, 2000; Schredl, 2012). As a matter of fact, during the pandemic, dreams included more threatening events (Wang et al., 2021), negative words (Mota et al., 2020) and strange content (Gorgoni et al., 2021).

**Methods**

***Participants***

Two hundred and twenty-five participants completed an online questionnaire between April 9th, 2020, and April 23rd, 2020. This period was characterised by full-lockdown conditions and by culminating diagnosed cases and death rates identified as the first peak of COVID-19 infections in Belgium (Sciensano, 2020). We included in the present manuscript only the respondents that were in Belgium (n = 186) during the lockdown. Participants were aged between 18 and 77 years old (M = 42.3, SD = 16.6). The sample was composed of 144 women and 42 men. Regarding the highest diploma of education1, 113 participants completed a master’s degree or higher, 47 participants had a bachelor's degree, 19 had a secondary school diploma and three completed primary school. In the analysed sample, seven participants (3%) reported that they were currently having symptoms compatible with COVID-19. We did not exclude them as they were confined at home as all other participants.

Participants were recruited via social networks and email contacts. According to the Declaration of Helsinki, all participants gave informed consent to participate to the study, which was approved by the local ethics committee.

***Materials and procedure***

The questionnaire was an online survey created via a local software. Questions concerned the lockdown period (i.e., “during” condition, defined as from March 13th, 2020, when partial restrictions were enacted, to time of survey completion) and before the lockdown period (i.e., “before” condition, defined as the period between March 1st, 2019, and March 1st, 2020). All participants responded to questions pertaining to both periods. The survey consisted of three parts. The first part contained demographic questions (age, sex, country of residence, education), questions relative to COVID-19 symptoms and lockdown situation (presence of symptoms compatible with COVID-19, agreement with lockdown governmental decision, duration of confinement in days, number of hours out of home per week), questions about work or studies (frequency of teleworking before and during the lockdown, effort related to work or studying), questions about activities (time spent on social media, outdoor, doing physical activities, or on screens before and during the lockdown, the extent of changes in valorising, satisfying, diverse and novel activities since lockdown, how similar days seem to each other), evaluation of general affective state relative to the current situation (mood, stress, fear), the six items from the short version of State scale of the State-Trait Anxiety Inventory - STAI (Spielberger, 1977), 13 items about well-being (balance, sense of control and happiness) from the Échelle de Mesure des Manifestations du Bien-Être Psychologique - EMMBEP (Massé et al., 1998) and 9 items about psychological distress that are sensitive to changes (e.g., interest for life, happiness, intrusive thoughts…) from the Outcome Questionnaire - OQ-45.2 (Beckstead et al., 2003).

The second part consisted of a series of questions relative to sleep quality and timing, fatigue, and mental workload. From these questions, we only considered the following items for the current study: subjective sleep quality before and during the lockdown as assessed with the Pittsburgh Sleep Quality Index - PSQI (Buysse et al., 1989), and the emotional valence of dreams during the lockdown (on a 5-point scale from very negative to very positive).

Finally, the third part questioned autobiographical memory. Participants had to try and recall personally experienced events that occurred before and during the lockdown based on cue-words (see Rubin and Schulkind (1997) for a similar approach). There were four cue words (anxiety, surprise, discussion, food), leading to 4 memories per period (total of 8 memories per participant). Memories for the period during the lockdown were assessed first, followed by memories for the period before the lockdown. Participants were instructed that the memories had to concern events that lasted less than a day, were unique and situated in time and place. If the participants could not think of any event within a two-minute interval, they had to write “no” in the text box and the survey moved to the next cue-word; if a memory came to their mind, the participants had to rate the phenomenology of the memory on several dimensions (clarity, richness of visual details, richness of sensory details, precision of location, precision of time, precision of memory for people involved, precision of memory for objects involved, precision of emotions and thoughts during event, feeling of reliving, intensity and valence of emotion) using a visual analogue scale (VAS) from 0 (not at all) to 100 (extremely). After the four cue-words of each period, the participants were invited to write down as many details that they could remember about one of the four memories that were recovered for each period. Participants were free to select the memories of their choice. The flowchart of the procedure for the memory questions is presented in Figure 1.

After the memory questions, participants were asked the frequency of sharing memories and sharing information about COVID-19 with other people, how many days they felt had elapsed since the first day of confinement, and how frequently they search for information about the COVID-19.

***Measures and statistical analyses***

The dataset analysed in the current paper is publicly available at <https://osf.io/mzpwa/>

*Correlational analyses*

The main goal was to assess relationships between the phenomenology of autobiographical memories during the lockdown, affective state, and changes in experiential diversity. To reduce data dimensionality, we first applied factor analyses with a Principal Component method with Statistica 13 software.

*Autobiographical memory*. Ratings of memory phenomenology for the different dimensions were averaged across the four memories for the lockdown period. The mean VAS ratings on the 11 dimensions were submitted to a factor analysis with a normalized varimax rotation.

*Experiential diversity*. For the experiential diversity domain, five items (i.e., the extent of changes in valorising, satisfying, diverse and novel activities, how similar days seem to each other2) were entered in a factor analysis.

*Psycho-affective variables*. Responses to the two scales assessing well-being (EMMBEP, OQ-45.2), to the STAI and to the questions about mood, stress, and fear were also entered in a factor analysis.

Next, factor scores from the different domains were correlated by means of Pearson analyses. The statistical threshold with Bonferroni correction for multiple comparisons was p = .01. Finally, if all relationships between experiential diversity during the lockdown, memory characteristics and psycho-affective measures are significant, we planned to perform mediation analyses with the PROCESS package in SPSS.

*Autobiographical memory thematic content*

The second type of memory measure came from the 2 narratives produced when participants had to explain in detail one of the retrieved memories for each period. In order to evaluate whether the thematic content of autobiographical memories changed during the lockdown compared to before the lockdown, automatic scoring of autobiographical narratives was performed with Linguistic Inquiry and Word Count (LIWC (Pennebaker et al., 2007) that includes a dictionary in French) to count words referring to social situations, family, friends, work, leisure, and home, words related to anxiety and sadness, positive words, as well as negative words. Word counts were compared before and during the lockdown by means of Student T-tests (p Bonferroni-corrected = .05/10 variables = .005). Of note, the phenomenological ratings were not compared between before- and during-lockdown memories given the confound of temporal distance: before-lockdown memories are older than during-lockdown memories, and memory phenomenology is expected to decrease in vividness and details with time (D'Argembeau & Van der Linden, 2004). Moreover, in the process of reconstruction of memories, older events may be remembered in a way that is influenced by the uncommon present context (i.e., lockdown).

Moreover, during-lockdown narratives were coded as containing description of events that were related to the sanitary context versus containing description of events that were unrelated to the sanitary context. We coded as related to the sanitary context events that were directly related to the virus (e.g., someone remembering the moment they learned that a close relative had been tested positive for the virus) or to the lockdown-related changes (e.g., someone remembering an online call for a birthday party that could not be celebrated in person due to the lockdown). Memories were coded by NC. AF coded a random selection of 20% of the data. Intraclass Coefficients of Correlation (ICC) revealed excellent agreement between the two raters regarding whether memory events were related – or not- to the sanitary context, IC = 0.94. Moreover, each narrative was attributed to one of the 4 cue words (anxiety, surprise, discussion, food) based on the nature of the description. The VAS ratings provided following the corresponding cue word presentation (1st part of the memory test) were retrieved for each narrative. Then, VAS ratings of the phenomenology of memories on the different dimensions and word counts obtained with LIWC were compared between sanitary context-related and sanitary context-unrelated memories with T tests (p Bonferroni-corrected = .0045 for VAS ratings and .005 for word counts). Finally, we calculated the frequency of each theme (food, discussion, anxiety, and surprise) in the narrative that the participant chose to write.

*Relations between well-being, experiential diversity, and autobiographical memory*

*factors and other variables*

We explored associations between our variables of interest (based on factor analyses –see below) and other variables that could have been impacted by the lockdown: subjective sleep quality changes during the lockdown, emotional valence of dreams, frequency of social sharing and time spent on screens (p Bonferroni-corrected = 0.05/4 = 0.0125).

**Results**

***Correlational analyses: Relations between psycho-affective state, experiential diversity, and autobiographical memory***

*Factor analyses*

Table 1 shows descriptive statistics for each score of the scales. There was large individual variability as reflected in the range of scores. On average, memories were qualified as rather detailed and vivid; participants provided ratings for psycho-affective variables close to the neutral point; and they reported less valorising, satisfying, diverse and novel activities during the lockdown than before.

Factor analyses were performed on the different scores of each domain. For the 11 VAS scores referring to memory phenomenological ratings during lockdown, there were two factors: one factor explaining 35% of the variance and that could reflect the **episodic richness of the memories** (with the highest loadings for dimensions of clarity, richness of visual details, precision of the location, of people and objects) and another factor explaining 28% of variance that may correspond to the **intensity of reminiscence** (with the highest loadings for richness of sensory details, reliving and emotional intensity). High values on these factorial scores corresponded to reports of richer and more intense memories. For the 5 variables reflecting **experiential diversity**, only one factor (53% of variance) emerged with high loadings for the extent of changes in valorising, satisfying, diverse and novel activities, but modest loading for how similar days seem to each other. Participants who had higher values of the factorial score reported that they performed more activities during the lockdown compared to before than participants who had lower values of the factorial score. For psycho-affective measures, the factor analysis yielded one factor (66% of variance) that may reflect general **well-being** (with the highest loadings for the STAI, well-being, mood, and stress). Higher factorial scores reflected more well-being, better mood, and less stress.
*Relationships between factors*

Second, Pearson correlations were computed between all factor scores (Table 2). Higher levels of well-being were significantly and moderately associated with increased experiential diversity (r = .32, p < .001, 95% CI [0.18, 0.44]). More well-being was also associated with greater episodic richness of autobiographical memories (i.e., the factor reflecting mainly higher ratings of clarity, richness of visual details, precision of the location, of people and objects) (small to medium effect size, r = .24, p = .001, 95% CI [0.10, 0.37]). There were no further significant correlations across factors.

As only two out of the three correlations between well-being, experiential diversity and episodic richness were significant, we did not conduct the mediation analysis.

***Autobiographical memory thematic content***

Memories that were narrated for the lockdown period were classified as related to the cue “discussion” in 38% of the cases, “food” in 24% of the cases, “anxiety” in 20% of the cases, and “surprise” in 18% of the cases. On average, narratives contained 107.82 words (SD = 115.12, median = 66).

*During vs. before the pandemic*

Table 3 presents the mean number of words of different types, as calculated by automatic lexical content analysis with LIWC, which were contained in the written narratives of each autobiographical memory (before and during lockdown memories). The analysis indicated that the autobiographical narratives for memories of events that happened during the lockdown contained less work-related, t(185) = 3.33, p = .001, Cohen’s d = 0.36, 95% CI [0.37, 1.46], and more home-related, t(185) = -4.1, p < .001, Cohen’s d = 0.39, 95% CI [-1.29, -0.45], words than narratives of memories for pre-lockdown events. There was no significant difference for words related to other domains (social, family, friends, positive, negative, anxiety, sadness, and leisure).

*Related vs. unrelated to the sanitary context*

 During-lockdown narratives mentioned events that were related to the sanitary context in 62% of the cases. For each narrative, the cue word that matched the content of the narrative was inferred and ratings provided following memory retrieval associated with this cue word in the first part of the task were analysed. Table 4 presents the ratings of the phenomenology of the memories across several dimensions as a function of whether the event was related to the sanitary context or not. Results revealed that participants subjectively re-experienced events that were not related to the sanitary context with a greater richness of sensory details than events related to the sanitary context, t(176) = 3.48, p < .001, Cohen’s d = 0.55, 95% CI [7.49, 27.12] (see Table 4). We next examined lexical content (LIWC word counts) as a function of whether the event was related to the sanitary context (Supplementary Table S1). None of the comparisons reached the statistical threshold for significance (p Bonferroni-corrected = .005).

***Relations between well-being, experiential diversity, and autobiographical memory***

***factors and other variables***

Finally, we examined correlations between the main factors of interest (well-being, experiential diversity, episodic richness of memories, and intensity of reminiscence) and several additional variables: changes in subjective sleep quality during the lockdown, emotional valence of dreams during the lockdown, time spent on screens and frequency of social sharing. Pearson correlations between these two sets of variables are presented in Table 5. Higher experiential diversity was mildly associated with more frequent social sharing of personal memories (r = .20, p = .009, 95% CI [0.05, 0.34]). Greater well-being was moderately associated with better subjective sleep quality during the lockdown (r = -.31, p < .001, 95% CI [-0.44, -0.17]) and more positive dreams (r = .23, p = .002, 95% CI [0.08, 0.36]). Finally, intensity of reminiscence was mildly related to better subjective sleep quality during the lockdown (r = -20, p = .006, 95% CI [-0.34, -0.05]) and mildly related to more frequent search of COVID-19-related news (r = .23, p = .002, 95% CI [0.08, 0.36]). There were no further significant correlations.

**Discussion**

The present study aimed at examining the impact of the COVID-19 related lockdown on the degree of experiential diversity, the psycho-affective state (notably, well-being), and the memory content of Belgian citizens, and indicated several relationships between these variables. Concerning participants’ well-being, we found that it was significantly associated with changes in experiential diversity during the lockdown period. People who reported that they performed less valorising, satisfying, diverse and novel activities during than before the lockdown scored lower on various scores reflecting well-being, consistently with previous findings (Dhami et al., 2020; Zhuo & Zacharias, 2021). This reflects a fundamental relationship between experiential diversity and well-being that exists in animals as well as in humans. Animals that can freely explore enriched environments offering variable experiences exhibit more behavioural manifestations of well-being than those reared in impoverished environments (Mellen & Sevenich MacPhee, 2001). In humans, a geolocation tracking study revealed that increased diversity in participants’ daily spatial environment was associated with greater positive affect (Heller et al., 2020). One contributing factor was novelty, in line with the rewarding effect of exposure to novel environments (Lisman & Grace, 2005).

It is also well-established that well-being is closely related to leisure engagement, mainly because taking part in recreation activities may provide satisfaction (Kuykendall et al., 2015). Importantly, it appears that it is the diversity, rather than the duration, of leisure activities that predicts well-being to the greatest extent (Kuykendall et al., 2015). The positive affects resulting from the engagement in leisure activities also allow people to better deal with daily-life stressors (Denovan & Macaskill, 2017; Qian et al., 2014). A lockdown-related reduction in the availability of leisure activities may thus have had a detrimental effect on people’s positive affect and stress. When being in a bad mood, people often engage in mood-modifying activities such as chatting with people, doing sports, or going to cultural events (Taquet et al., 2020). Because of the reduction in the rate of these positive mood-modifying activities, COVID-19 related lockdown has decreased people’s ability to regulate their emotional state (Taquet et al., 2021). Considered together, above-mentioned studies and our own results converge to suggest that maintaining diverse and novel activities even when they are limited by sanitary constraints may be critical for maintaining a positive mood and well-being.

Drawing on previous evidence emphasizing the beneficial effects of novel and diverse activities on episodic memory (Clemenson et al., 2019, 2020; Kolarik et al., 2020), and the fact that experiences containing many event boundaries are better remembered (Pettijohn et al., 2016), we hypothesized that the reduction in experiential diversity due to the lockdown would be related to changes in episodic memory. Contrary to our expectations, we did not find any significant relationship between changes in experiential diversity and the richness of memory or the intensity of reminiscence. Several reasons could explain this pattern of finding. Since participants filled in the survey at the beginning of the COVID-19 pandemic, it could be that the lack of diversity in daily-life activities was not sufficiently pronounced at that time to affect episodic memory. Relatedly, the measure we used reflected the extent of changes in diversity of activities, but not how many activities were performed. It could be that it is the quantity and diversity of activities that matters for memory quality, no matter what was done in the past. An alternative, but not mutually exclusive, possibility is that the strength of the relationship between experiential diversity and richness of memory could have been weakened by factors that are known to influence autobiographical memory retrieval, such as the congruence of events with participants’ personal goals (Conway, 2009) or narrative style (Gaesser et al., 2011).

Results further revealed that participants’ well-being was significantly associated with the subjective richness of remembered events. Poorer well-being is associated with an increase of depressive symptoms in young adults (Grant et al., 2013), and depressed individuals remember past events in a less detailed and coherent fashion (Burt et al., 1995; Lemogne et al., 2006; Vanderveren et al., 2019). To explain the link between memory and depression, it has been argued that reduced memory specificity might decrease social problem-solving skills (Raes et al., 2005), which might in turn reduce well-being and favour depressive symptoms (Holmes et al., 2016). A reduction in well-being is also observed in people suffering from dementia. In that instance, memory loss might prevent patients from using meaningful memory events to foster their sense of identity, which would subsequently hinder their well-being (Jetten et al., 2010). Being able to recollect satisfying and meaningful memories might thus be critical for one’s current self-view and well-being (Addis & Tippett, 2004; Jetten et al., 2010).

We also examined whether the thematic content of autobiographical memories was impacted by the COVID-19 related lockdown. These analyses revealed that autobiographical memories of events that happened during the lockdown contained less work-related but more home-related words than memories for pre-lockdown events. This finding might reflect changes in daily-life activities and occupations of the respondents, which is consistent with the lockdown rules solicited by the Belgian government (i.e., to stay home as much as possible) during that period. More specific analyses focusing on memories pertaining to the lockdown period revealed that half of these memories were directly related to the sanitary context. These memories were judged as poorer in sensory details than memories that were not related to the sanitary context. This might reflect the contrast in variety of events: sanitary context-related events were mainly about the disease and a few activities that were still possible (e.g., online calls) whereas unrelated events were diverse and idiosyncratic.

Finally, additional analyses examined associations between well-being, memory quality and experiential diversity with other variables that were also affected by the lockdown situation. One such factor was sleep. Indeed, compared to the period before the COVID-19 crisis, sleep time shifted towards later hours, time spent in bed increased, but subjective sleep quality decreased during the lockdown in Italian and Belgian participants (Cellini et al., 2021). Moreover, poorer sleep quality was associated with higher rates of anxiety, depression, and stress (Cellini et al., 2021; Franceschini et al., 2020). The correlations in the current study extend these findings by showing a link between worsening of subjective sleep quality during the lockdown and poorer well-being. Our data are only correlational and cannot inform about the directionality of the relationship. However, a recent longitudinal study conducted during the lockdown suggested that it is poor sleep quality that induces more rumination and psychotic-like experiences on the following day, and not the opposite (Simor et al., 2021).

Also related to sleep, the content of dreams was previously found to have slightly changed during the first times of the pandemic compared to before the epidemic situation, so that dreams during the pandemic contained more non-aggressive threatening events like pursuits, accidents, failures, and catastrophes (Wang et al., 2021). Here, we did not collect the content of dreams, but rather asked participants to rate the valence of their recent dreams during the lockdown. More negative dreams were associated with poorer well-being. In our sample, the psychological mental state might have transposed into the dreams of the participants. Support for this assumption comes from recent evidence showing that dreams during the COVID-19-related lockdown were judged by Italian citizens as containing more emotional load and fear-related content (Gorgoni et al., 2021). Critically, emotional load of dreams was found to be predicted by depressive symptoms (Gorgoni et al., 2021). Together, these findings thus suggest that the emotional content of dreams during sleep is tightly related to the emotional well-being during the day. More broadly, these findings are in line with theories about dreaming that suggest that situations encountered in waking life are transposed into our dreams either for an adaptive function (e.g., threat simulation during dreaming rehearses the cognitive mechanisms required for efficient threat perception and threat avoidance in waking life) (Revonsuo, 2000) or because of mere continuity of cognitive processing across consciousness states (Schredl, 2012).

To conclude, the data reported here suggest that the psycho-affective state of Belgian citizens during the first lockdown due to the COVID-19 pandemic was in part related to how the lockdown-related sanitary rules affected the level of experiential diversity of activities that were undertaken during that period. Well-being was also correlated with changes in the quality of sleep and in the valence of dreams, although no causal relation could be established based on the present data. Future studies should aim at examining whether sanitary measures ordered since the end of the first lockdown (including the second lockdown) had similar, additive, or different effects on mental well-being, the content of memory and the quality of sleep of Belgian citizens. Investigating the potential long-lasting effects of such restrictions also requires further attention in the future.

Footnote

1. This information was missing for four participants.

2. The items assessing the extent of changes in valorising, satisfying, diverse and novel activities were evaluated on a VAS ranging from 0 = far less activities during than before the lockdown to 100 = far more activities during than before the lockdown. The item assessing how similar days seem to each other was evaluated on a VAS from 0 = I totally disagree that days look alike to 100 = I totally agree that days look alike.

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Table 1. Descriptive statistics of scores of interest

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Score** | **Mean** | **SD** | **Min** | **Max** |
| Psycho-affective variablesa |
| Mood | 59.01 | 24.05 | 1 | 100 |
| Stress | 47.99 | 29.75 | 0 | 100 |
| Fear | 35.37 | 27.17 | 1 | 100 |
| STAI | 12.82 | 4.09 | 6 | 23 |
| EMMBEP | 61.41 | 21.98 | 15.4 | 100 |
| OQ-45.2 | 28.83 | 6.50 | 10 | 40 |
|  |  |  |  |  |
| Memory variables (averaged across the 4 memories during lockdown) |
| Clarity | 75.32 | 19.08 | 4 | 100 |
| Richness of visual details | 69.00 | 22.37 | 2 | 100 |
| Richness of sensory details | 56.20 | 23.46 | 2 | 100 |
| Precision of location | 88.12 | 15.10 | 11.5 | 100 |
| Precision of time | 61.40 | 24.54 | 0.75 | 100 |
| People | 89.11 | 14.67 | 9 | 100 |
| Objects | 73.75 | 23.57 | 4 | 100 |
| Emotions/thoughts | 75.80 | 18.21 | 6.5 | 100 |
| Reliving | 54.99 | 25.18 | 0 | 100 |
| Emotion intensity | 46.18 | 24.48 | 0 | 100 |
| Emotion valence | 60.25 | 18.32 | 17.75 | 100 |
|  |  |  |  |  |
| Experiential diversity b |
| Valorising activities | 42.57 | 23.80 | 0 | 100 |
| Satisfactory activities | 46.44 | 25.54 | 0 | 100 |
| Diversity of activities | 37.29 | 26.83 | 0 | 100 |
| Novelty of activities | 40.53 | 26.47 | 0 | 100 |
| Days look alike | 65.85 | 31.84 | 0 | 100 |

Note. a Four participants did not complete all scales; b Five participants did not complete all scales.

Table 2. Pearson correlations between memory, experiential diversity, and well-being factorial scores.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Episodic richness | Intensity reminiscence | Experiential diversity |
| Well-being | .24p = .001\*[0.10, 0.37] | .06p = .415[-0.09, 0.21] | .32p < .001\*[0.18, 0.44] |
| Episodic richness |  | .02p = .805[-0.13, 0.16] | .13p = .079[-0.01, 0.27] |
| Intensity reminiscence |  |  | .17p = .022[0.02, 0.31] |

\* Significant Pearson correlation, p Bonferroni-corrected < .01. In brackets, 95% CI.

Table 3. Lexical content of autobiographical narratives as a function of period

|  |  |  |  |
| --- | --- | --- | --- |
| **Type of words** | **Before lockdown** | **During lockdown** | **T value (p value)** |
| Social | 6.55 (6.79) | 6.47 (7.40) | 0.13 (p = .889) |
| Family | 1.33 (2.71) | 1.53 (3.17) | -0.84 (p = .397) |
| Friends | 1.40 (3.22) | 0.88 (1.90) | 1.89 (p = .059) |
| Positive | 4.07 (4.06) | 3.45 (2.95) | 1.63 (p = .102) |
| Negative | 1.42 (2.49) | 1.26 (2.18) | 0.67 (p = .498) |
| Anxiety | 0.34 (1.03) | 0.45 (1.11) | -0.93 (p = .351) |
| Sadness | 0.28 (0.85) | 0.32 (1.00) | -0.42 (p = .668) |
| Work | 1.96 (3.07) | 1.05 (1.80) | 3.33 (p = .001)\* |
| Leisure | 1.57 (3.07) | 1.23 (2.31) | 1.43 (p = .153) |
| Home | 0.76 (1.62) | 1.64 (2.66) | -4.10 (p < .001)\* |

Note. Scores represent the mean number of words of each type in the narrative (and standard deviation). \* Significant difference at p Bonferroni-corrected < .005

Table 4. Ratings of memory quality for autobiographical memories as a function of whether the narrated events were related to the sanitary context or not

|  |  |  |  |
| --- | --- | --- | --- |
| **Dimensions** | **Context-related** | **Context-unrelated** | **T value (p value)** |
| Clarity | 79.15 (21.51) | 81.40 (20.15) | 0.7 (p = .493) |
| Richness of visual details | 69.40 (29.26) | 76.23 (26.52) | 1.5 (p = .123) |
| Richness of sensory details | 52.85 (33.79) | 70.17 (28.41) | 3.5 (p < .001)\* |
| Precision of location | 89.97 (16.07) | 93.98 (10.41) | 1.8 (p = .073) |
| Precision of time | 66.88 (31.03) | 67.90 (29.68) | 0.2 (p = .829) |
| People | 90.75 (17.72) | 93.81 (12.55) | 1.2 (p = .221) |
| Objects | 76.73 (29.55) | 79.16 (27.61) | 0.5 (p = .588) |
| Emotions/thoughts | 82.10 (19.21) | 80.35 (24.42) | -0.5 (p = .597) |
| Reliving | 59.07 (30.91) | 60.58 (27.95) | 0.3 (p = .749) |
| Emotion intensity | 52.11 (30.01) | 50.60 (30.41) | -0.3 (p = .747) |
| Emotion valence | 59.60 (31.21) | 69.80 (30.76) | 2.1 (p = .036) |

Note. \* Significant difference at p Bonferroni-corrected < .0045

Table 5. Correlation between memory, experiential diversity, and well-being factorial scores on the one hand and changes in sleep quality during lockdown, emotional valence of dreams during lockdown, time spent on screens and frequency of social sharing on the other hand.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | PSQIa | Dream valence | Screen timeb | Number of peoplec | COVID-19-chatsd | COVID-19-newse |
| Experiential diversity | -.15p = .040 | .12p = .112 | -.09p = .193 | .20p = .009\* | .10p = .183 | -.09 p = .238 |
| Well-being | -.31p < .001\* | .48p < .001\* | -.17P = .021 | .11p = .138 | .11p = .153 | -.04P = .550 |
| Episodic richness | .01p = .867 | .14p = .052 | .03P = .684 | .16p = .028 | .11p = .163 | .03p = .696 |
| Intensity reminiscence | -.20p = .006\* | .17p = .027 | -.13P = .085 | .08P = .279 | .02p = .804 | .23p = .002\* |

Note. a Higher score indicates worse subjective sleep quality during lockdown compared to before lockdown; b number of minutes per day spent on the screen, whether for work or leisure; c With how many people does the participant speak about events from their life; d With how many people does the participant speak about the COVID-19; e At which frequency does the participant look for information about the COVID-19; \* Significant Pearson correlation, p Bonferroni-corrected < .0125

Figure caption

Figure 1. Illustration of the procedure: Assessment of autobiographical memory for the lockdown period. This was followed by the same questions for the pre-lockdown period (“Based on the following cue word, try and remember in detail an event that you personally experienced between March 1st, 2019, and March 1st, 2020, BEFORE the lockdown”).