The "echo effect" of the pandemic in dreaming experience: a mixed-method study on contents, structure, and functions

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Summary. Recent research has shown several changes in sleeping patterns and dreaming during the COVID-19 pandemic. Research typically focused on dream phenomena changes, such as nightmare frequency and dream recall across the different waves of the pandemic. The current study aimed to explore the dreamers' experience of their dreaming during the lockdown (T1) and the third wave of the COVID-19 pandemic (T2), through a mixed-method. In particular, it provides a picture on dream narrative features, in terms of dream structure, content, and functions during these two phases of the COVID-19 pandemic. Out of a total of 815 participants, 60 people who narrated a dream both at T1 and T2 were included in the analysis. The Speech Graph analysis was used to assess the structure of dreams, whereas the T-Lab software was used to assess the contents and functions of dreams. Psychological distress and dreaming phenomena indexes were also integrated into the analysis. Wilcoxon matched-pairs signed rank test showed no difference in structural features of dreams from the lockdown to the third wave of the COVID-19 pandemic. From the analysis of the elementary context, four thematic clusters emerged: *Reaching for the sun, but it was just a dream, Caring, Suffering over a loss,* and *A very vivid dream life with many nightmares*. The factorial mapping also organized 3 vectors of meaning, representative of different dreaming modalities: *From the inside to the outside, From life to death scenarios*, and *Affective systems*. Findings showed a kind of "echo effect" of the pandemic on dreaming, considered as an index of psychic functioning on an individual and collective level. Psychological distress was positively associated not only with nightmares but also with 'sweet dreams' where an incoherent state of mind is experienced between waking and dream life.

Keywords: Dream, COVID-19 pandemic, mixed-method, clinical psychology

1. Introduction

The Corona Virus Disease-2019 (COVID-19) public health emergency, which has affected the world for the last 2 years, was publicly declared ended on May 5, 2023 (World Health Organization [WHO], 2023). The effect of the COVID-19 pandemic on night-time phenomena, including sleeping and dreaming has been widely shown in the scientific literature during these years (Wang et al., 2021b; Gorgoni et al., 2022; Margherita & Caffieri, 2022).

The term 'COVID-somnia' was coined by Gupta and Pandi-Perumal (2020) to indicate the general sleep disruption observed in the general population during the lockdowns (Yuksel et al., 2021). Indeed, sleep disturbances and general poor sleep quality emerged during the first phases of the COVID-19 pandemic (Johnson et al., 2022; Wang, et al., 2021a; Yuksel et al., 2021). In addition to sleep problems, changes in oneiric activity were observed during the COVID-19 pandemic worldwide, with no differences among countries and continents (Gorgoni et al., 2022; Margherita & Caffieri, 2022). Moreover, a clear gender difference was found, showing a greater change in the oneiric activity of women than men, together with a more intense dreaming activity observed in young adults (Alfonsi, et al., 2021; Gorgoni, et al., 2022; Scarpelli et al., 2022; Schredl & Bulkeley, 2020;). In general, dreaming was considered an index of the psychological health of the general population during the COVID-19 pandemic, though few and inconsistent results were provided on dreaming in clinical populations (Koppehele-Gossel et al., 2023; Margherita & Caffieri, 2022; Mariani et al., 2021; Scarpelli et al., 2021; 2021b; Schredl & Bulkeley, 2020; Solomonova et al., 2021, Sommantico et al., 2022). In particular, in Italy, the COVID-19 pandemic emerged as a risk factor for sleep disorders and dreaming disruption (Casagrande et al., 2020; Sommantico et al., 2021b).

Several dimensions of dreaming, such as dreaming phenomena, dream content, dream structure, and dreaming

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functions were investigated in relation to the COVID-19 pandemic, either separately or together. On one side, a broad interest in literature emerged for dream recall, nightmare frequency, and emotionality in dreams. Nightmare frequency increased during lockdowns compared to pre-pandemic and post-pandemic phases (Conte et al., 2022; Scarpelli et al., 2021). Considering emotionality, an increase in the intensity and negative tone of dreams was observed in the general population specifically during lockdowns more than in the other phases of the COVID-19 pandemic (Alfonsi et al., 2021; Scarpelli et al., 2021; 2021b; Sommantico et al., 2023). In particular, individuals mostly affected by the COVID-19 pandemic showed a higher nightmare frequency and negative emotionality than individuals less affected by the COVID-19-related traumatic aspects (Kumar et al., 2023). More contrasting results emerged for dream recall (Alfonsi et al., 2021; Conte et al., 2022; Fränkl et al., 2021; Scarpelli et al., 2021; 2021b; 2021c; Solomonova et al., 2021). Most of the longitudinal research showed a decrease in dream recall after the lockdowns (Alfonsi et al., 2021; Scarpelli et al., 2021; 2021b), in contrast with other studies that showed an opposite trend (Conte et al., 2022).

In addition, considering the structural features of dreams previously investigated in the literature from a different approach (Bulkeley, 2014; Zanasi et al., 2011), the interest in the effects of the COVID-19 pandemic on dreaming structure was mainly assessed through the speech analysis of dream reports (Mota et al., 2020). Speech analysis provided access to the length and complexity of dream reports, interpreted as indexes of psychological functioning (Martin et al., 2020). This approach, starting in the psychiatric field, considered the structure of dream reports more informative than reports of waking memories about the disorganization of the language and consequently of the thoughts, as it was observed in schizophrenic and bipolar patients (Mota et al., 2012). Graph connectedness also predicted cognitive functioning and reading ability in children of 6-8 years old (Mota et al., 2014), and was previously used to identify people with cognitive impairments in the elderly population (Bertola et al., 2014). In addition, a larger connectedness was found in REM dreams than in dreams reported after the non-REM phases (Martin et al., 2020).

The application of this model to dreams during the COVID-19 pandemic started from the hypothesis of the possible disruptive effect of the "collective trauma" of the pandemic on dreaming processing and thus on its narration (Margherita et al., 2021; Mota et al., 2020). Nevertheless, no differences emerged in the structural characteristics of dreams comparing dreams collected before and during the lockdown in two independent groups (Mota et al., 2020). No study in the scientific literature has yet examined longitudinally the structure of dreams between and within the different waves of the COVID-19 pandemic.

Furthermore, considering the dimension of content, studies focused mainly on the direct manifestation of pandemic imageries in dreams, the so-called 'pandemic dreams' (Kilius et al., 2021; MacKay & DeCicco, 2020; Marogna et al., 2021; Mota et al., 2020; Pesonen et al., 2020; Solomonova et al., 2021; Sommantico et al., 2021). Studies on "pandemic dreams" supported the hypothesis of dreaming-waking life continuity that shows how waking experiences and concerns are reflected in dream content (Barrett, 2001; 2017). To date, the few studies on the changes in dream content across the COVID-19 pandemic waves confirm Barrett's (2001; 2017; 2020) hypothesis and show higher negativity in dreams during the lockdown as well as a decrease in positive emotions from the second to the third wave (Sommantico et al., 2023).

In previous studies, we had proposed a different approach, not focused on the content, but interested in exploring the relationship between the dreamers and their dreaming experience during the COVID-19 pandemic (Margherita et al., 2020; 2022). This approach aimed to examine the content of dreams in relation to the functions that dreaming can assume for psychological functioning. In particular, in these studies dreaming was recognized as an emotional regulator (Margherita & Caffieri, 2022; Margherita et al., 2020; 2022). In this sense, dreams regulated emotional processes involved in lockdown challenges, as was previously evidenced by the rich interdisciplinary dialogue between psychoanalysis, cognitivism, and neuroscience (Ferro, 2002; Fonagy et al., 2012; Fosshage, 1983; Hartmann, 1984; Solms, 1995). To the best of our knowledge, no study has yet traced the changes in the relationship between the dreamer and their dreaming from the start to the final phase of the COVID-19 pandemic.

To date, several methods have been used to study dreaming phenomena. Among them, qualitative-quantitative methods have been considered among the most useful in providing comprehensive results on dreaming and its functions (Margherita & Caffieri, 2022). We have decided to fill in the gaps presented in the literature by investigating the relationship between the dreamers and their dreaming from the lockdown to the third wave of the COVID-19 pandemic. To reach this aim, we have used a mixed method integrating the study of the structure, content, and functions of dreaming. It helped to provide a broad picture on dreaming during the COVID-19 pandemic, involving the examination of the complexity and the richness of dreaming phenomena.

Aims

The overall aim of this study is to explore the experience of dreaming during different waves of the COVID-19 pandemic. Through a multidimensional approach, we will:

- Investigate the changes in the structure of dream narratives during the different waves of the COVID-19 pandemic.
- Explore the content and functions of dreams during the lockdown and the third wave of the COVID-19 pandemic.

2. Method

A mixed-method was used to assess the relationship between the dreamer and their dreaming across the COVID-19 pandemic waves. For this purpose, the dream narratives were chosen as units of analysis. In our approach, the dream narration is different from the dream report. The dream report focuses on the content of dreams, unlike the dream narration that explores the dreamer in a broad sense, involving elements that extend beyond the content, like the connections, links, and associations that a dreamer makes in a dream (Margherita et al., 2015, 2017, 2020, 2021, 2022; Margherita & Gargiulo, 2018; Martino et al., 2019). Hence, the dream narration involves the placement position and the point of view attitude of individuals of the dreamers vis-à-vis all the dreaming experiences. Through a qualitative-quantitative perspective, the structure of individuals' dreams and the collective content and the functions of dream narratives were analyzed.

2.1. Procedure and Participants

The study is part of a larger research project called "Resilience and COVID-19: How to React to Perceived Stress. Effects on Sleep Quality and Daytime Behavior/Thoughts" promoted by the University of Parma; University of Messina; Catholic University of Milan; University of Milan, La Statale; and University of Naples, Federico II, from which different articles were published with different objectives, methods and including data from different waves of the COVID-19 pandemic (Alfonsi et al., 2021; Borghi et al., 2021; Castelnuovo et al., 2022; Franceschini et al., 2020; Franceschini et al., 2022; Lenzo et al., 2021; Lenzo et al., 2022; Margherita et al., 2020; Margherita et al., 2021; Margherita et al, 2022; Musetti et al., 2021; Scarpelli et al., 2021; Quattropani et al., 2021).

For this study, we included data collected in two different waves of the COVID-19 pandemic in Italy: the "First phase"—total lockdown period lasting from the March 10, 2020 to the May 4, 2020 (T1), and the "Third phase" —lasting from the June 15, 2020 to October 7, 2020 (T2). Data were collected by means of a self-administered questionnaire delivered via an Internet survey, university communication channels, and online forums or WeChat groups. Ethical authorization was obtained from the Ethics Committee of the Center for Research and Psychological Intervention (CERIP) of the University of Messina. The study was conducted in accordance with the Code of Ethics of the Italian Psychological Association (AIP) and the American Psychological Association (APA).

The inclusion criteria were: being of adult age, speaking Italian, and living in Italy during the range time of data collection. From a larger group of 815 participants (of which 455 decided to narrate a dream at T2), a subgroup of 60 participants, who recounted their dreams both at T1 and at T2, were included in the analysis. All the participants gave their informed consent. Data were matched by a code generated by the respondents.

2.2. Measures and materials

2.2.1 Socio-demographic information

The sociodemographic variables, including gender and age were collected.

2.2.2 Dream narratives

To collect dream narratives, a voluntary description of a dream was collected through the following open task: "If you want, in the space below you can describe a dream you had during the last period. Feel free to describe it as you see fit." Starting from Domhoff's method (The Most Recent Dream technique; Domhoff, 1996, 2003), the proposed task reflects the interest to explore the text in a broad sense, including any form of content up to the difficulties of dreaming.

2.2.3 Dream experiences and related phenomena

The Mannheim Dream questionnaire (MADRE; Schredl et al., 2014; Italian validation by Settineri et al., 2019) is a self-report questionnaire useful for evaluating dream experiences and related phenomena. It includes 20 items, each of which measures a unique dreaming dimension. In this study, the following variables were included: dream recall (Item 1), and nightmare frequency (Item 4). Although these items were assessed with a 7 or 8-point Likert scale, each variable was dichotomized (HIGH/LOW) as was shown in previous studies (Margherita et al., 2021; Scarpelli et al., 2021).

2.2.4 Psychological distress

The Depression, Anxiety, and Stress Scales-21 Items (DASS-21) (Lovibond & Lovibond, 1995; Italian validation by Bottesi et al., 2015) is a self-report questionnaire that evaluates the severity of depression, anxiety, and stress symptoms. It includes three subscale scores, which were dichotomized considering the cutoffs for moderate depression, anxiety, and stress, which are ≥7, ≥6, and ≥10, respectively (Lovibond & Lovibond, 1995).

2.3. Data Analysis

A total of 120 dream narratives were analyzed (T1=60; T2=60). All the analyses were conducted on the dream narratives in the original language (Italian), and were then translated into English to report the results. The analyses, including the preparation of the text, were performed by two members of the research team and the supervision of a third member.

2.3.1 Speech Graph analysis

For the analysis of the structure of the dream narratives, the Speech Graph software was used (Mota et al., 2012; 2014; 2020). This approach applied to dreams narratives showed information on the length and non-semantic complexity of dream reports, providing a lens into thought and its integration processes (Mota et al., 2012). Speech graphs are part of the 'co-occurrence graphs' class, which models the co-occurrence of word sequence patterns. It considers each word in the text as a node and the semantic and grammatical relationships between words as directed edges (Mota et al., 2012; 2020). For each dream narrative, we calculated the number of words (word count, WC) and the following connectedness characteristics: the number of nodes in the largest connected component (LCC) (each node is interconnected through a path in the sub-graph- undirected version of the graph), and the number of nodes in the largest strongly connected component (LSC) (there is a path from node *a* to node *b*, and there is a path from node *b* to node *a*). Graphical examples of LCC and LSC are provided in Figure 1. We chose these attributes following Mota et al.'s (2020) guidelines, for which these features were mainly associated with a disorganization of thought (Mota et al.,2012., 2014). Then, the Wilcoxon matched-pairs signed rank test (through Jamovi software) was performed to compare the WC, LCC, and LSC scores between T1 and T2.

2.3.2 T-Lab software

To examine dream contents and function, the T-LAB software, a qualitative-quantitative software for text thematic analysis, was used (Lancia, 2004). This software is focused on the analysis of the relations between words or lexical units within the text (in terms of occurrence and co-occurrence). This analysis seemed to be appropriate for our research question, aimed at investigating themes of narratives and bringing them back into collective semantic universes,

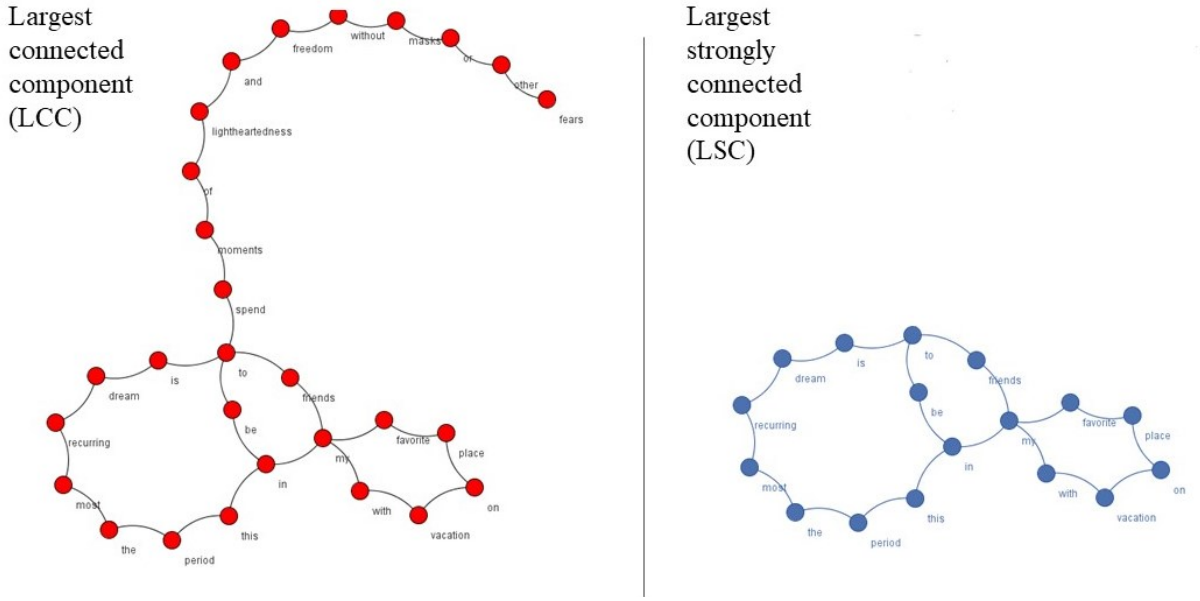


Figure 1. Graphical representation of LCC and LSC

linking fragments of text in common symbolic clusters. Moreover, T-LAB is particularly appropriate for automatic and systematic analysis of texts of large size. Specifically, the Analysis of Elementary Context and the Analysis of Multiple Correspondences were performed in this study. These types of analysis are consequential and required preliminary steps. First, dream narratives were grouped together as one text corpus. Hence, T-LAB aggregated the single narratives in an entire collective corpus that represents the unit of analysis regardless of considering the specificities of each narrative. Then the corpus was prepared for analysis through the operations of disambiguation, lexicalization, and cleaning the vocabulary. As a third step, a list of keywords was automatically produced based on the frequency of the lexical units within the corpus (occurrence). At this point, the Analysis of the Elementary Context was performed. This analysis produces a few significant clusters characterized by a set of elementary context units (e.c.u.) (sentences, paragraphs, fragments of text) created on the basis of the same patterns of keywords, along with a set of the most frequent lemmas and variables which characterized the e.c.u., ranked according to the decreasing value of 2. Comparing lexical profiles, this analysis identifies dimensions of meaning that characterize the text (Bolasco, 1999). We choose this analysis because it allows us to interpret the meaning of the words through their relationship with the context, that is, through their distribution within a portion of text (Greimas, 1983; Rastier et al., 2002). We included the "Times of pandemic" (T1, T2), gender, age-range (18-25; 26-30; 31-40; 41-50; 51-60; >60), dream recall (high/low), nightmare frequency (high/low), depression (yes/no), anxiety (yes/no) and stress (yes/no) in the e.c.u. analysis.

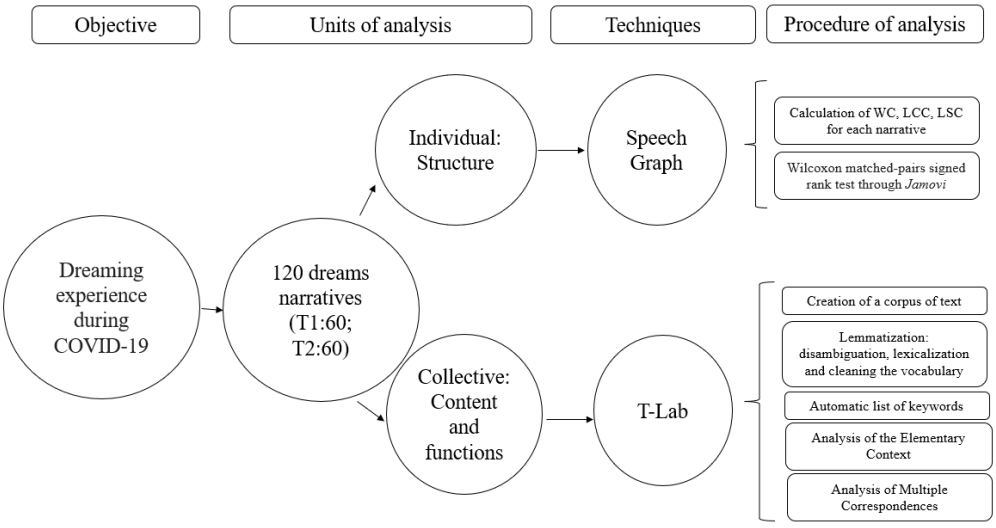


Figure 2. Graphical representation of methodological procedure.
Note. WC= word count; LCC= the number of nodes in the largest connected component; LSC= the number of nodes in the largest strongly connected component.

Table 1. Characteristics of participants.

Variable	N (%)	T1	T2
Gender			
Women	50 (83.3%)		
Men	10 (16.7%)		
Age			
18-25	26 (43.33%)		
26-30	11 (18.33%)		
31-40	9 (15%)		
41-50	7 (11.67%)		
51-60	3 (5%)		
>60	4 (6.67%)		
Dream recall			
Low dream recall		31 (51.6%)	38 (63.3%)
High dream recall		29 (48.4%)	22 (36.7%)
Nightmare frequency			
Low nightmare frequency		37 (61.7%)	43 (71.7%)
High nightmare frequency		23 (38.3%)	17 (28.3%)
Depression			
Low depression		49 (81.7%)	43 (71.7%)
Severe/Extreme Severe Depression		11 (18.3%)	17 (28.3%)
Anxiety			
Low anxiety		49 (81.7%)	44 (73.3%)
Severe/Extreme Severe Anxiety		11 (18.3%)	16 (26.7%)
Stress			
Low stress		45 (75%)	38 (63.3%)
Severe/Extreme Severe Stress		15 (25%)	22 (36.7%)

In addition, the Analysis of Multiple Correspondences was performed, using the variable "Times of pandemic" (T1, T2) as an active variable. Active variables are those that actively participate in the identification of the factorial space and therefore contribute to the determination of the factors considered. Through the projection of the clusters and the variable "Times of the pandemic" (T1, T2) on the factorial plane, it was possible to explore the relationships (in terms of oppositions and closeness) between the different themes and times, interpreting the latent factors that link them. These factors are represented by the Axes of the factorial plane, each of which opposes two polarities (+/-). The aim of this procedure was to explore the possible specificities of the universe of collective meanings prevalent in the two phases of the COVID-19 pandemic in the same group of participants. A graphic representation of the overall methodological procedure is presented in Figure 2.

3. Results

The main characteristics of the participants were presented in Table 1.

3.1. Changes in the structure of dreams narratives during the COVID-19 pandemic waves

No difference was found vis-à-vis the number of words between T1 and T2 (Z= 902, p= 0.927). In addition, no difference emerged for word connectedness, expressed by LCC and LSC values between the two measurements (Z=913, p= 0.991; Z= 527, p= 0.395) (Table 2). Hence, the structural characteristics of dream reports did not change across the COVID-19 pandemic waves. Figures 3 and 4 provide two examples of graphical representations of dream reports at T1 and T2.

Table 2. Results on dream narrative structure (Wilcoxon signed-rank test results).

Structural component	T1 (Median)	T2 (Median)	Z	P-value
WC	27.50	35.00	902	0.927
LCC	24.50	30.00	913	0.991
LSC	9.50	22.00	517	0.395

Note. WC= word count; LCC= the number of nodes in the largest connected component; LSC= the number of nodes in the largest strongly connected component.

3.2. Changes in the content and function of dreaming during the COVID-19 waves

The corpus of text is characterized by 6166 occurrences, 1317 of which are hapax (forms with occurrence=1). Within the corpus, 181 e.c.u. and 1451 lemmas were identified.

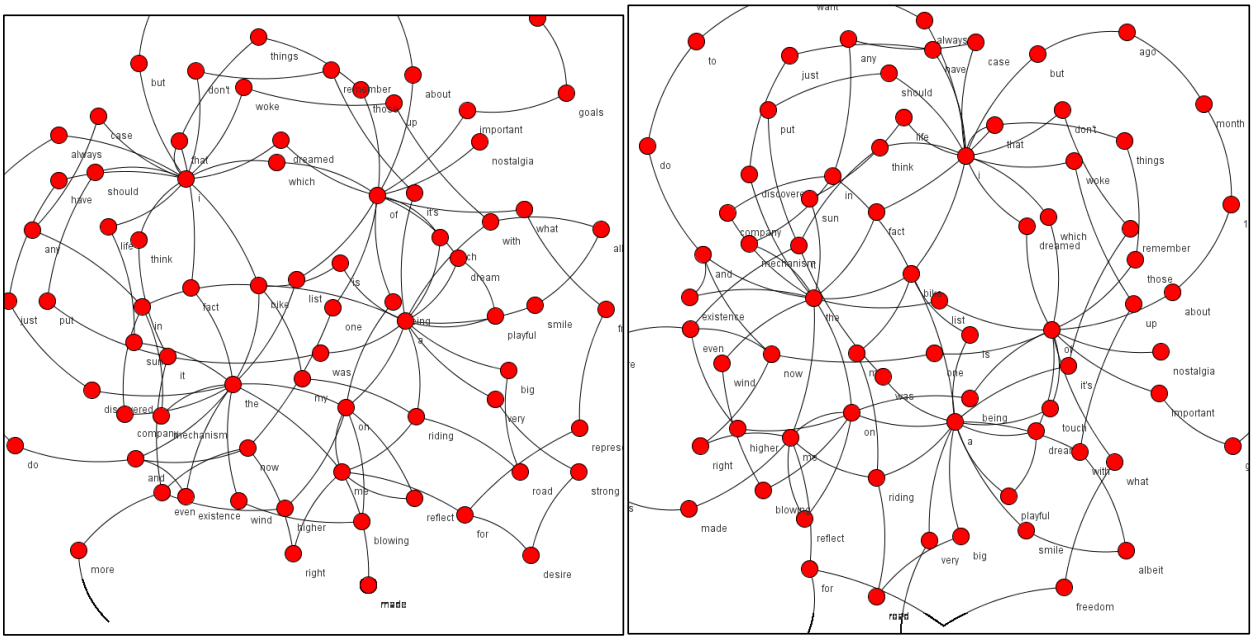
From the Analysis of the Elementary Context, four core clusters emerged, labeled as (Table 3): *"Cluster 1— Reaching for the sun, but it was just a dream"*, *"Cluster 2 - Caring" "Cluster 3 - Suffering over a loss"*, *"Cluster 4 -A very vivid dream life with many nightmares"*. The clusters are here ordinarily reported following their statistical weight (Table 3).

Cluster 1— *Reaching for the sun, but it was just a dream.* In this cluster, it is possible to find lemmas such as "sun" "vacation" and "sea", along with lemmas such as "mask" and "to hide". These lemmas seem to oppose a "light" semantic area and a "hidden/dark" area. This cluster also contains the lemmas "strong" and "feeling" that remind us of something emotionally intense. In this cluster, the affective system of research emerged, in terms of a desire difficult to reach. "Severe/Extreme-Severe levels of Depression", "Severe/Extreme-Severe levels of Anxiety" and "Severe/Extreme-Severe levels of Stress" fall within this cluster. This suggests the possibility that this dreaming modality could be associated with a state of psychological distress.

Cluster 2—*Caring*. This cluster is characterized by lemmas such as "children" "dogs" and "animals". Moreover, verbs such as "understand" "see" "look" "carry" can be found, which refer to recognition and understanding of others. This cluster seems to reflect the affective dimension of the cure and the protection of defenseless others.

Cluster 3 - *Suffering over a loss*. Verbs like "to die", "to lose", "to recall" and "to find" characterize this cluster. In addition, lemmas such as "relationship", and "man" also emerge. This cluster reflects the loss and the death of significant others and the theme of mourning.

Cluster 4 - *A very vivid dream life with many nightmares*. Within this cluster, there are both lemmas such as "situation", "dreams", "and living" and elements related to "waking up", "alarm clock" and "anguish". This cluster aggregates some references to a great variety and complexity of oneiric experiences associated with waking up. Here, the variable "*High nightmare frequency*" is represented, along with the "Age range: 26-30". This cluster seems to aggregate nightmares experiences and appears as a dreaming modality characteristic of young adult participants.



Figures 3 and 4. Examples of graphical representations of dream reports at T1 and T2

3.3. Interpretation of the Clusters considering pandemic waves

Projecting the clusters and variable "Times of pandemic" on the factorial plane, we were interested in how the thematic clusters would re-organize considering the times in which they were recalled (Figure 5).

The Axis I, the horizontal axis, labeled "*From the inside to the outside*", opposed the "Cluster 3 - *Suffering over a loss*", "Cluster 4 - *A very vivid dream life with many nightmares*" and "*T1*" on one side, with "Cluster 1— *Reaching for the sun, but it was just a dream*", "Cluster 2— *Caring*" and "*T2*" on the other side. On one side, this axis presented "Lockdown dreaming", which indicates a dreaming modality that involves a retirement or a withdrawal of investment from the external world or from the dreaming itself. On the other side, we found "Dreaming of the world, dreaming of reality" which indicates a dreaming modality that involves the desire of re-investing in the external world. On Axis II, the vertical axis, we can observe a continuum called "From life to death scenarios" that goes from the lower polarity of the factorial plane, the "Life scenarios" polarity, in which concrete and symbolic references to life can be found ("Cluster 4 - *A very vivid dream life with many nightmares*" and "Cluster 2— *Caring*") to the higher polarity of "Death scenarios", in which symbolic references to the deal with death emerged ("Cluster 3 - Suffering over a loss" and "Cluster 1— *Reaching for the sun, but it was just a dream*"). Otherwise, along

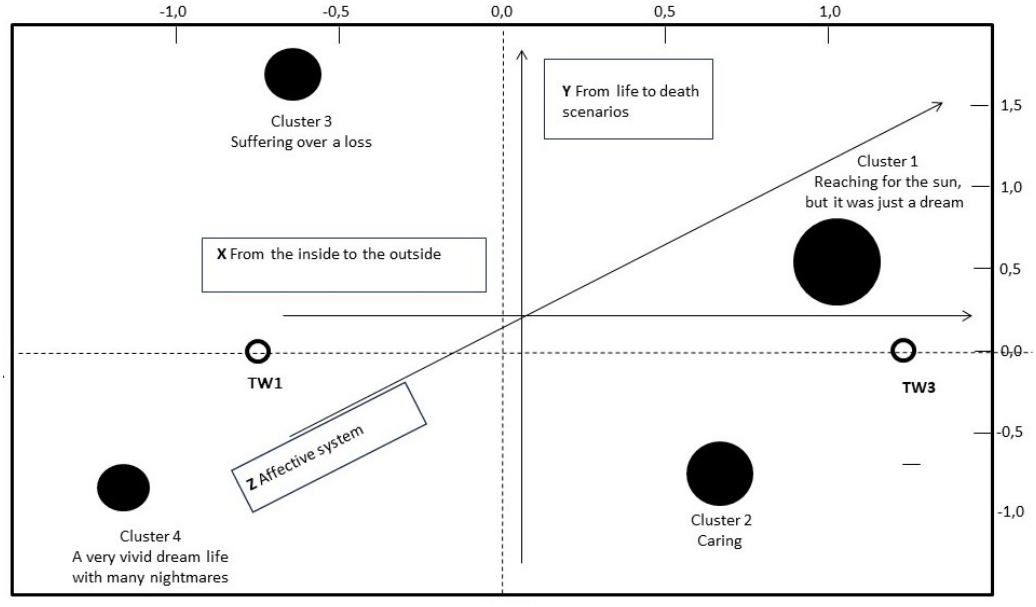


Figure 5. Factorial plane

Note. In the figure, the "fill circles" indicate the Clusters, and their size is proportional to the statistical weight of any cluster within the entire corpus of text. The "hollow circles" represented the active variable (Times of pandemic). The names and the directions of the axes are represented by the overlapping axes and their labels are reported in the corresponding squares.

Table 3. Description of clusters

Clusters (percentage of variance)	Lemmas that mainly characterize the cluster (χ^2)	Representative sentences of the cluster (score)
1 - Reaching for the sun, but it was just a dream (consisting of 50 e.c.u. out of a total of 181, which equals 32.05%).	Dream (17.422), sun (15.427), mask (12.843), she (12.843), strong (12.843), last (9.102), hear (8.925), sea (6.69), walk (6.69), holiday (6.69), moment (4.715), period (4.715), grandparent (4.436), think (4.366), hide (4.366), notice (4.366), sensation (4.366), sleep (4.366) *"Severe/Extreme-Severe levels of Depression"* (7.499), *"Severe/Extreme-Severe levels of Anxiety"* (6.736), *"Severe/Extreme-Severe levels of Stress"* (5.53)	«I often dream about going back to work, sometimes it's a good dream but sometimes it's a nightmare when we are all attached, and no one has a mask on and I start to feel a feeling of panic» (15.790) «I dreamed that I was walking on a beach at a resort where I go to the beach every summer. I was with two girls, and we were walking together chatting lightheartedly» (14.914) «I dreamed of happy moments and sharing with a couple of friends I haven't heard from in a very long time» (8.815) «The most recurring dream is to be in my favorite place on vacation, without face-masks or other fears» (6.099)
2 - Caring (comprised of 38 e.c.u. out of a total of 181, equal to 24.36%).	Child (31.346), dog (15.565), see (12.876), understand (11.926), animal (11.096), room (10.7), door (9.774), bring (9.774), cardiac (8.868), nurse (8.868), friend (5.584), uncle (5.584), life (5.333)	«I stand in front of a door; it looks like a hospital. In the front door there is a kind of picture with a child playing with dogs. And the inscription, " Wish fulfilled: playing with animals.'» (44.892) «I am in my parents' room, and I see a white bird, very pure white, the window in my parents' room has an open shutter, and this bird is on a chair in front of almost the window, I see it taking flight» (20.009) «I had to take some children in my care to safety. Taking care of animals» (15.346) «I found a hole in the floor with lots of light underneath, and with a room full of light and children dancing and laughing» (10.984)
3 - Suffering over a loss (comprised of 36 e.c.u. out of a total of 181, equal to 23.08%).	Die (20.886), person (19.252), building (17.388), proud (13.897), inside (13.897), character (13.897), towards (13.897), relationship (12.876), lost (9.734), man (9.579), arrive (8.201), discover (7.448), telephone (6.794), night (6.384), tv (6.384), scream (6.384), call (4.886)	«Whatever it is, it ends badly. Either way I find myself sleeping badly and waking up badly» (9.210) «I dreamed of a loved one who is now gone» (7.138) «I dreamed that I had lost my boyfriend» (5.808) «I dreamed that my uncle had died» (4.177)
4 - A very vivid dream life with many nightmares (consisting of 32 e.c.u. out of a total of 181, equal to 20.51%).	Situation (40.569), alive (22.449), dreams (15.675), waking up (12.804), different (10.546), anguish (8.642), family (5.85), found (4.46), live (4.157), put (4.061) *"Age range: 26-30"* (4.916), *"High nightmare frequency"* (6.15)	«Lately I have been having only disturbing dreams, which often wake me up in the middle of the night in a distressed condition. They involve people I know and with whom I am in dangerous situations» (60.489) «I have had many extremely disturbing dreams, always different, in which the protagonists were people close to me and there were quite likely situations of violence and/or death» (25.252) «Very complex dreams in which several people appear, I have to escape very often, and there is a lot of changing of environments» (9.577)

Axis III, the transversal axis called "*Affective system*", the negative polarity was represented by the "Primitive affective polarity". It represented the activation in dreams of primitive emotions (from an evolutional perspective) such as research and fear/anguish that characterize "Cluster 1— *Reaching for the sun, but it was just a dream*" and "Cluster 4 - *A very vivid dream life with many nightmares*". On the opposite side, the "Social affective polarity" is represented, which involves a dreaming function that deals with the sadness/loss of others and the cure (considered as affective systems that uniquely identify social living beings) expressed in the "Cluster 3 - *Suffering over a loss*" and "Cluster 2— *Caring*".

4. Discussion

To our knowledge, the current study is the first one to explore the dreamers' experience of their dreaming between the lockdown and the third wave of the COVID-19 pandemic by adopting a mixed method that includes the analysis of the structure, content, and functions of dreams.

First, our results showed no difference in the structure of dreams' narratives between the lockdown and the third wave of the COVID-19 pandemic. This differs from previous studies which showed differences in terms of contents, nightmare frequency, and dream recall frequency among the different waves of COVID-19 (Alfonsi et al., 2021; Conte et al., 2022; Scarpelli et al., 2021; Scarpelli et al., 2021; Sommantico et al., 2022; 2023; Wang et al., 2021b). However, our results are in line with a study by Mota et al. (2020) that showed no difference in dream report speech organization between lockdown and pre-pandemic control group. Hence, our study is in line with previous studies that showed that the lockdown did not have severe consequences on the integration of language and thought, expressed in dream narratives (Mota et al., 2012; 2020). These results on the structure of dreams must be interpreted with caution. First, although COVID-19 could be interpreted as a "collective trauma" (Marogna et al., 2021; Monaco et al., 2022), its effects on psychological functioning have to consider other factors such as the impact of individual experiences lived during the pandemic (loss of significant others, stressors, traumas) and personality traits (Margherita & Caffieri, 2022, Sommantico et al., 2022). Second, we analyzed the dreams of participants who decided to spontaneously narrate their dreams. We hypothesized that people who recall and narrate a dream through writing have already carried out a form of re-organization of dreaming experience and consequently of the possible traumatic experience (Sommantico, 2018;

Velotti & Zavattini, 2019). Third, we must consider the collection strategy used in this study. The speech graph analysis was in fact used upon oral narrations (Mota et al., 2012; 2014; 2017) whereas, for the current study, we collected dream narratives through an online survey.

On the content and functions level, dreaming emerges as a process aimed at expressing different types of affects, organized around the research system (Cluster 1), caring for others (Cluster 2), the loss of others (Cluster 3), and anguish (Cluster 4), transversally to the COVID-19 phases. This organization and terms referred to the affects were deliberately and metaphorically summed up by Panksepp's model on affective systems (Panksepp, 1992; Panksepp, 2004).

Panksepp, from the perspective of affective neuroscience, has identified seven big primary affective systems: *Search, Fear, Anger, Sexual Desire, Care, Panic/Suffering*, and *Play*, which have their roots in the subcortical structures of the brain that humans share in part with other mammals. These systems, controlled by regulators of cerebral activation, generate specific or combined affective experiences, some primary ones such as anxiety, anger, or sexual arousal, others more evolved, considered "social" experiences, related to *secondary and tertiary processes* such as shame and guilt.

An important result is that the cluster *Reaching for the sun, but it was just a dream* is the cluster where the high psychological distress (severe/extreme severe depression, anxiety and stress) falls, opening a window on a peculiar dreaming modality in cases of clinical symptoms. Higher psychological distress during the COVID-19 pandemic was in general associated with a higher nightmare frequency (Giardino et al., 2020; Pérez-Carbonell et al., 2020) and higher frequency of COVID-19-related dreams (Korukcu et al., 2022; Li et al., 2021; Monterrosa-Castro et al., 2020; Musse et al., 2020; Schredl & Bulkeley, 2020; Wang et al., 2020; 2021a; Wu et al., 2020). In our study, higher psychological distress resulted surprisingly associated to a higher frequency of idealized, positive, and unreachable scenarios.

We hypothesized that in this case the dreamers' mental state is characterized by a state of incoherence between what is experienced and represented in the dream and the anguish of the waking life, which does not find expression. It seems, in this case, difficult to incorporate the emotional experience of wakefulness in a sort of checkmate for mental life (Wright & Koulack, 1987; Adams-Silvan & Silvan, 1990). This result confirmed results collected before the COVID-19 pandemic, which showed the absence of predominance of traumatic or depressive contents in depressed patients (Skancke et al., 2014). In line with these studies, our results, moving from contents to functions, highlighted how dreaming in people with high psychological distress involved a prevalence of emotional undertones (positive emotions, joy, rest) which seemed dissociated from the typical affects observed in stressed people in waking life. This hypothesis reminded us of the typical dissociation process involved in trauma (Bromberg, 2012).

An additional form of distress, associated with a high nightmare frequency emerged in the cluster named *A very vivid dream life with many nightmares*. In this case, dreaming lost its restorative (Fosshage, 1983) and reparative (Hartmann, 1984) functions associated with the functional regulation of emotions, disrupting the dreaming-waking life continuity. This result is also in line with studies that considered fear and anguish as the most frequent emotions associated with nightmare frequency (Kilius et al., 2021; Giovanardi et al., 2022; Gorgoni et al., 2021; Guerrero-Gomez et al., 2021). This cluster resulted to be characteristic of young adulthood, confirming the studies highlighting an increase in nightmare frequency and negative emotions in dreams of young adults during the COVID-19 pandemic (Conte et al., 2022; Goncalves et al., 2022; Kumar et al., 2023; Mariani et al., 2021; Musse et al., 2020; Ramos Socarras et al., 2021; Scarpelli et al., 2021; 2022a; 2022b; Sommantico et al., 2021).

It is worth noting that the dream recall was not associated with any cluster. Dream recall remains one of the hardest dreaming aspects to interpret in terms of function, as was shown by a large number of contrasting results in this field (Margherita & Caffieri, 2022; Schredl, 2010). Nonetheless, we only can reflect on the aspect of the "recalled dreams", unlike the dimension of the "dreamed dreams" that remains beyond consciousness (Schredl, 2010; Velotti & Zavattini, 2019). In fact, dream recall is recognized in the literature to be influenced by several factors, including individual and personality differences (Eichenlaub et al., 2014; Schredl, 2007; Schredl et al., 2014; 2022; Schredl & Bulkeley, 2019), which could mediate or moderate the effect of the COVID-19 pandemic on this dreaming phenomena. Considering the factorial plane, different modalities of emotional processing in dreaming emerged. Although the phases of the COVID-19 pandemic did not seem to organize any specific function of dreaming (the variable did not fall in any cluster), the two periods of the COVID-19 pandemic considered in this study shared some similarities with some specific affective processes lived by individuals in dreams (axis x). Thus, the isolation, the limitation of social contacts, and the uncertainty due to the lockdown restrictions resulted similar to the withdrawal from relationships, from the dream itself, and from the intense emotions that emerged in dreams. At the same time, the final phase of the COVID-19 pandemic required individuals the challenge of re-investing and re-habiting the post-pandemic world, as it emerged also in the dream imageries of caring and searching for something. The continuity hypothesis, which shows how waking experiences and concerns are reflected in dream contents (Barrett, 2001, 2020) was often cited by studies to explain the results on dreaming during the COVID-19 pandemic mainly in terms of the recurrence of COVID-19-related imageries in dreams (Gorgoni et al., 2022). Our results highlighted some aspects of continuity between dreaming and waking life (Barrett, 2001; Berrett 2017), though more in terms of emotional processes than in terms of contents.

Moreover, life and death scenarios resulted opposed in dreams (axis y). On one side, the dreamer accessed to what was lost, in terms of significant others or in terms of ideas, and desires. On the other side, in dreams, the vitality of the affective life emerged, up to interrupting the state of sleep through nightmares.

Finally, an opposition between the clusters of emotions into links (cure and loss) and the clusters involving primitive evolutive emotions (search, anguish, fear) emerged (axix z). Through dreaming, the dreamer's ego can meet others through the emotion of loss, real or imaginary, and through the affective dimension of caring and it emerged as a protective factor. On the other side, there are dreaming modalities, associated with nightmares and psychological distress, that dealt with primitive emotional undertones which emerge to consciousness intensively without social links.

In addition, it is important to underline that as long as the variable "Times of pandemic" did not fall within any cluster, no specific dream modality seemed to be characteristic of lockdown or third way.

5. Limitations and future research directions

This study has some limitations. First, as in most of the studies in the dream research field (Gorgoni et al., 2022), our group of participants mainly consisted of women. In addition, participants were not balanced either for age range or for psychological distress levels. Second, our study comprises methodological biases related to online survey, e.g., self-selection bias. Third, we must consider the influence of the remote and written modality through which dream narratives were collected. In fact, the speech graph method is typically applied to oral narrations, which are more fluent and less structured than written ones. This limited the generalizability of our results on the structural level.

In addition, considering that we aggregated dreams deriving from the same group of participants, together with the large size of our group of participants for qualitative research, T-LAB seemed to be a fair compromise. In fact, T-LAB aggregates narratives into a single corpus of text. Thus, renouncing to match subject narratives, we maintained the possibility of exploring the specificities of contents and functions during the two considered COVID-19 pandemic waves by means of thematic T-LAB analysis.

To conclude, the long and ongoing effects of the COVID-19 pandemic need to be addressed in further research, considering both the general population and clinical groups.

6. Conclusion

To sum up, this study contributes to the consideration of dream processes as indices of health. In fact, we added evidence to the importance of exploring the effects of the COVID-19 pandemic through dream-wake continuity.

Our results showed what we might call a "long wave" homogeneous effect of the COVID-19 pandemic on dreaming and mental functioning. Moreover, psychological distress was positively associated not only with nightmares but also with 'sweet dreams'. On one side, nightmares enhanced the negative tone of dreams up to a disruption of the state of sleep. On the other side, in the dreams reports we found an uncoherent state of mind between waking and dream life, highlighting another form of the interruption of the dreaming-waking life continuity. These aspects were not exclusively found in terms of dream content as in terms of discordant affective states. In this sense, it seems to us that affective distress is associated with the difficulty of incorporating the waking emotional experience into the dream, which appears 'dissociated', referring to typical defenses against traumatic experiences (Bromberg, 2012).

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Glossary - Supplementary material

Speech graph software (Mota et al., 2012; 2014)

Node: Each word in the text

Edges: Connections between the nodes - the semantic and grammatical relationship between words

Word Count (WC): Number of words in the text

LCC (Largest Connected Component): Number of nodes in the maximal subgraph in which all pairs of nodes are reachable from one another in the underlying undirected subgraph.

LSC (Largest Strongly Connected Component): Number of nodes in the maximal subgraph in which all pairs of nodes are reachable from one another in the directed subgraph (node a reaches node b, and b reaches a).

T-LAB software (Lancia, 2004)

Disambiguation: An operation that tries to resolve cases of word sense ambiguity, particularly the ones when there are words with the same graphic form but different meanings.

Lexicalization: An operation that turns the unit into string phrases consisting of two or three words that refer to a unitary meaning.

Cleaning the vocabulary: By means of this operation words from empty to insignificant, such as te abbreviations, proper nouns, articles, and conjunctions, are deleted.

Elementary context unit (e.c.u.): The elements in which the corpus is segmented for the analysis. In the current study, a segmentation based on chunks was performed. Hence, each elementary context unit was a sequence of words interrupted by full stop and carriage return, whose dimensions were inferior to 400 characters; in the absence of a full stop within the maximum length, other punctuation marks were considered; in the absence of any punctuation statistical criteria were used by the software.

Analysis of Elementary Context: This analysis explores a representation of corpus contents through few and significant thematic clusters, each of which: consists of a set of elementary contexts characterized by the same patterns of keywords; is described through the lexical units (i.e. words, lemmas or categories) and the variables (if present) most characteristic of the context units from which it is composed.

Analysis of Multiple Correspondences: This analysis explores the relationships between two or more categorical variables. In the current study, the variables were the thematic cluster previously calculated by the Analysis of Elementary Context and the other variables indicated in the manuscript.

Active variable: It is a variable that actively participates in identifying the factorial space and therefore contributes to determining the factors, within the Analysis of Multiple Correspondences.