

Research on the Evolution of the Death Psychology of Chinese People in the Context of Lifting COVID-19 Pandemic Restrictions: A Mixed Study of Weibo Big Data

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ABSTRACT

Amid the novel coronavirus threat, individuals are compelled to ponder over profound existential matters like life and death. This study employs a mixed research methodology, merging grounded theory with big data mining techniques, to explore into the psychological adaptation mechanism when individuals confront death threats amidst epidemic deregulation. We fetched texts related to death psychology keywords from the Sina Weibo platform. Post data cleaning, the database incorporated 3868 Weibo texts. Grounded theory forms the basis for data coding and theory formulation. Subsequently, big data mining techniques, including topic mining and semantic network analysis, are employed to validate the formulated codes and theories. The findings demonstrate that within the "Emotion-Cognition-Behavior-Value" framework, the implications of death threats manifest in four aspects: Death anxiety, death cognition, coping efficacy, and sense of meaning. As time progresses, the study of death psychology can be segmented into four distinct phases: The tranquil phase prior to lifting pandemic restrictions, the threat phase at lifting pandemic restrictions onset, the coping phase mid-lifting pandemic restrictions, and the reformative phase post-lifting pandemic restrictions. The calculated outcomes of topic mining and semantic network analysis corroborate the coding results and theories derived from the grounded theory. This reaffirms that data mining technology can be a potent tool for validating grounded theory.

Keywords: Lifting pandemic restrictions; Death psychology; Weibo big data; Mixed research

INTRODUCTION

COVID-19 pandemic has led to a significant number of fatalities and widespread panic globally. Its high contagion and the current lack of effective treatments have instilled a fear of death among individuals, posing a serious threat to their physical and mental health. Recent data from a study involving 5000 international participants suggest a direct correlation between an individual's perception of COVID-19 and increased levels of anxiety, along with deteriorating mental health conditions [1]. The concept of death psychology encompasses a complex psychological response that includes emotion, cognition, and behavioural intention. This response arises when individuals confront death or related events [2]. Nevertheless, it remains inconclusive as to whether the threat of death precipitates fear, anxiety, personal growth, or instigates a re-evaluation of life's meaning [3]. In the realm of traditional Confucian thought, the notion of death intertwines closely with ancestor worship and filial piety. Consequently, the Chinese

populace's perception of death extends beyond mere fear, evolving into a more nuanced sensation of "Awe". Since the founding of the People's Republic of China, campaigns launched by the Party and the state to modify funeral customs, alongside the influence of Western pragmatist culture, have prompted the public to confront death more pragmatically and with increased diversity. However, the disintegration of traditional ideologies and the absence of firm new concepts have resulted in traits such as collective avoidance, the propensity for sudden emotional outbursts, and vulnerability of anxiety buffering mechanisms when Chinese individuals face death [4].

Since the onset of the pandemic three years ago, the Chinese government has steadfastly implemented a strategy known as "Dynamic zero," an approach centred on rigorous epidemic prevention and control. This strategy has involved extensive nucleic acid testing, enabling the tracking and containment of virtually all infected individuals and their close contacts. However,

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the institution of a new policy on December 7, 2022, marked the termination of the "Dynamic zero" strategy, effectively lifting epidemic restrictions. This policy shift was followed by a substantial increase in the epidemic, characterized by a sharp rise in the daily number of infections and death toll. Amid this environment of heightened mortality and escalating panic, a clear understanding of people's psychological response to the threat of death is essential. Therefore, delineating the foundational parameters of death psychology research can facilitate more nuanced future theoretical inquiries. Furthermore, it can help to build specialized, effective social psychological services. This study employs grounded theory within the context of qualitative research methodologies for data collection and analysis. Concurrently, to counteract potential subjective bias that may influence the findings inherent in grounded theory, we utilize big data mining technology to verify the emergent theoretical constructs.

MATERIALS AND METHODS

Data sources

This study was approved by the Institutional Review Boards of the Anhui Normal University. Because the data comes from public Weibo, and the users are anonymous, so the permission of the participants is not required. Amid the epidemic, social media has emerged as a primary conduit for the public to access information, voice opinions, and share emotions [5]. It has proven effective in gauging public sentiment and implementing epidemic-related interventions. According to the Blue Book of China's Social Mentality, approximately 74.3% of posts on Weibo—a prominent social media platform—are expressive of personal emotions. Notably, negative emotions propagate more readily within the Weibo network than positive ones [6,7]. During the epidemic, Weibo initiated several epidemic-related topics such as "What to do if you're anxious staying at home," "What to do if you always suspect that you're sick," and "What would make you feel anxious?" These emotionally-charged topics spread swiftly across the Internet. Contrasting with conventional research data collection methods such as questionnaire surveys and in-depth interviews, studies by Liu and Heikinheimo demonstrate that social media data alleviates the problem of reporting time lag caused by physical limitations. Moreover, given the dynamism of social media platforms and the presence of personal information tags, more effective data can be obtained through the monitoring of temporal and spatial patterns [8,9].

Consequently, this research sourced text data from Sina Weibo to build a study database. Employing keywords pertinent to death psychology, we extracted relevant text spanning the period from December 1, 2022, to March 1, 2023. Following data cleaning processes, including de-duplication and elimination of text entries with insufficient word count, we accrued 3,868 valid data entries for inclusion in our study.

Mixed research methods

Mixed research methods include qualitative and quantitative research. Qualitative methods involve theory construction based on grounded theory while quantitative research involves validity testing based on data mining.

Theory construction based on grounded theory: Text data analysis is fundamentally a "bottom-up" process. Its primary objective is to inductively ascertain the rules of association and transformation of

behaviours from the actions detailed in the original text. It further seeks to abstract higher-level principles to explicate the progression from individual behaviours to specific outcomes, as well as to elucidate how various social interaction modes coalesce to create distinctive, recognizable social processes [10]. As per Strauss et al text analysis in qualitative research entails the dissection of raw materials through three stages of encoding: Open coding, spindle coding, and choose coding [11]. Open coding, or first-level coding, every word, sentence, and paragraph of the imported raw data is analyzed using Nvivo software. With "death psychology" as the core concept, sentence-by-sentence coding refines the keywords in the raw data, culminating in the first level of conceptualization. Spindle coding, or second-level coding, forms categories, properties, and dimensions based on open coding, and constructs and tests the relational rules between categories. The objective here is to develop rules from first-level coding and to cluster or segregate first-level coding according to these rules, thereby accomplishing the second level of conceptualization. Choose coding, or third-level coding, further generalizes and categorizes axial coding, forming explanatory theories. The process tests whether the concepts discerned in spindle coding have reached theoretical saturation. Concepts that have achieved theoretical saturation are deemed the core categories of third-level coding. Upon completion of third-level coding, the analysis process revisits first- and second-level coding for iterative verification. Through continuous verification of the entire text data, from open coding through to choose coding, theoretical saturation of node integration and classification is finally achieved, establishing the final theoretical construct. The intrinsic logic of these three stages embodies the scientific induction process of "induction-iterative verification-re-induction-iterative verification".

Validity testing based on data mining: Established methods for validity testing in qualitative research encompass raw data inspection and expert evaluation [11,12]. Raw data inspection entails reviewing the concepts and relationships derived from the analysis. Here, "concepts" originate from the raw data, while "relationships" emanate from the model developed through layered induction from the raw data. Expert evaluation, on the other hand, assesses the validity of research outcomes via expert review, hence providing an additional layer of validity testing.

One of the key strengths of grounded theory is its inductive nature—it does not begin with the testing of pre-existing hypotheses but rather fosters the use of data and its subsequent analysis to formulate concepts and theories. However, this approach has a potential pitfall—it is susceptible to "researcher bias," whereby investigators' preconceptions may unduly influence their findings. Traditional methods of validity assessment have not adequately addressed this phenomenon. Thus, this study advocates for the application of big data mining techniques as a data-driven means to verify the validity of the resultant theory.

The topic coherence score is a metric that evaluates the semantic consistency of high-probability words associated with each topic generated by a model. A higher topic coherence score suggests superior model performance. Given its efficacy in assessing model quality, this study utilizes the topic coherence score to determine the optimal number of topics. If the coherence score elevates concurrently with an increasing number of topics, and eventually plateaus at a certain value, the number of topics corresponding to the highest coherence score prior to stabilization is considered the optimal topic count.

Semantic network analysis serves to extract high-frequency co-

occurring words at different stages following the removal of epidemic restrictions. This method constructs a co-occurrence matrix of high-frequency words, thereby revealing the focal points of public death psychology during the research period. High-frequency words are further divided into clustering subgroups based on the results of the co-occurrence matrix. The evolving mechanism of public death psychology at distinct stages is manifested through changes in the number of high-frequency word nodes and the interconnections between subgroup nodes (Figure 1).

RESULTS

Psychological coding of death results

Through comparative analysis of the materials and three-level coding using Nvivo software, we interpret death psychology in the context of the COVID-19 pandemic from four dimensions: "Emotion-cognition-behaviour-value". Consequently, we construct four core categories: Death panic, death cognition, coping efficacy, and sense of meaning (Table 1).

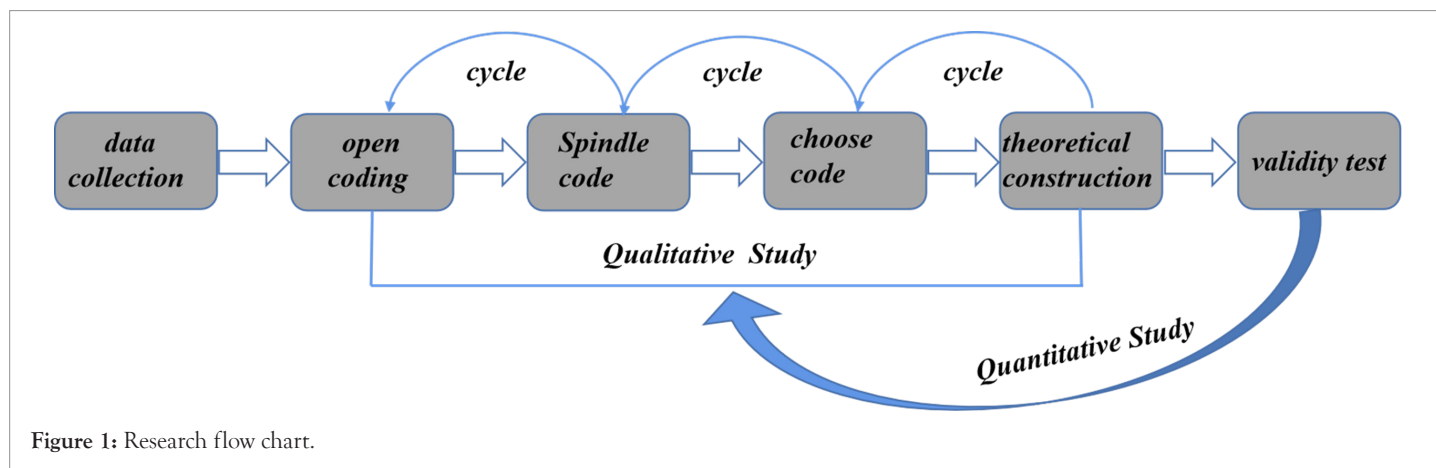


Figure 1: Research flow chart.

Table 1: Four categories of death psychology.

Core category	Choose coding	Spindle code	Open coding	Reference point
Death scare	Lost control	Avoid	Unable to face emotional isolation	103
		Emotional response	Death anxiety, death scare, Emotional overflow, emotional contagion, asphyxia	451
	Emotionally stable	Actively face	Put aside, ignore, emotional desensitization	187
Awareness of death	Cognitive loss of control	Unexpected death	Indeterminate death, accidental death, death of the elderly, unceremonious death, innocent death, conformant death, death in develop life	225
		Out of control	Coronary pneumonia symptoms, basic illness	87
		Broken relationship	Separation of loved ones, companion separation, die alone, interpersonal conflict, implicate relatives and friends, separation empathy	112
	Cognitive stability	Intimacy buffer	Parent-child communication, husband and wife communication	141
		Human interaction buffer	Ritual gathering, peer support, interpersonal avoidance	115
		Compensatory gratification for the relationship	Intimacy deepens, Strangers deepen	377
Coping with out-of-control effectiveness	Relationship enhancement	Uncertain information	Prevention is uncertain, cure uncertain, uncertain death figures	236
		Excessive behavior	Excessive hoarding, Unreasonable collection of resources	196
	Information confirmation	Access to authoritative information, rule obedience, rational expectations	108	
Coping efficiency	Stable coping efficiency	Materials determined	Hoarding, government funding	116
		The course of treatment is determined	Preventive control, successful medical treatment, symptom control, posthumous planning	197
		Runaway prevention	Death avoidance, cherish the existing, fulfill last wish	97

Stress response	State of nothingness	Unrealistic, conformity, give up survival, believe in fate, pay attention to the body, nothingness, numbness, vulnerability, value shock	246
	Values	Educational experience, cultural background, can't survive	115
Sense of meaning	Individual mentality	Optimism, doubtful, rational understanding, experience understanding	294
	Post traumatic growth	Scientific knowledge learning, tragic comparison, positive meaning	254
		Sense of responsibility, religious belief, belief in survival	

Mechanism of death psychology evolution

Over time, death psychology evolves through four stages: The tranquil phase prior to lifting pandemic restrictions, the threat phase at lifting pandemic restrictions onset, the coping phase mid-lifting pandemic restrictions, and the reformative phase post-lifting pandemic restrictions.

Tranquil phase: Prior to the lifting of restrictions, individuals maintained a dynamic equilibrium in the face of death, characterizing a period of calm. Confronted with the death of someone distantly related, they often exhibited a nonchalant attitude: "Just ignore it for now. It really won't provoke a substantial emotional response in me." Confronted with the potential threat of their own mortality, individuals typically respond passively. For instance, some study subjects reported having "written wills". Professional roles also influence responses to death; medical groups, when facing mortality, often choose to "engage in discussion and summarization of the specific (death) case", thereby maintaining a sense of control and stability.

Threat phase: With the lifting of pandemic restrictions and the subsequent explosive increase in infection numbers and epidemic-related fatalities, the impact of death's threat can be summarized across four aspects: Loss of emotional control, loss of cognitive control, decrease in coping efficacy, and emergence of traumatic stress responses.

Emotional out-of-control: Nearly every participant alluded to the death panic instigated by the epidemic's outbreak, using phrases like "so scary" and "unable to face it". Numerous cases reported elevated levels of emotional panic, often accompanied by symptoms such as "inability to sleep at night", and in more extreme cases, "fear to go out" and "hesitation to meet people".

Cognitive out-of-control: This chiefly presents as unanticipated death, physical loss of control, and fractured relationships. Unlike the predictable mortalities of the elderly or late-stage cancer patients, the death threats posed by COVID-19 are challenging to foresee and accept. Patients may "not want to die, but they might be informed in two weeks that they could die, causing immense distress to both patients and their families". Individuals with underlying diseases worry about losing physical control upon infection, such as experiencing sensations of suffocation and pain. For instance, a participant's father who "had weak lungs" was perceived to be "quite dangerous". The impact of death threats on the social level manifests as anxiety about broken relationships. On the one hand, death leads to "long-term separation". Concurrently, under the influence of the COVID-19 epidemic, even the death of strangers can trigger vicarious grief. One participant reflected on seeing a deceased person's wife "crying heartbreakingly behind the car, at that moment, I felt on the verge of tears".

Loss of coping efficacy: This primarily exhibits as uncertainty of information and excessive behaviors. A common sentiment is the perceived mystery surrounding the virus, with doubts such as whether "its transmission route is contact or aerosol". Respondents also acknowledge the uncertainty, stating "it's there, and it's very dangerous." In China, the previously implemented dynamic zero policy often led to city lockdowns, instigating a public tendency to stockpile supplies. However, under the threat of death, many study participants displayed excessive hoarding and unreasonable accumulation of resources. Statements such as "my fridge can't fit anything else," and "there's stuff everywhere at home" exemplify this behaviour.

Trauma stress response: The threat of death during the COVID-19 pandemic can trigger an existential crisis in respondents, primarily manifesting as a diminishing of self-psychological representation, culminating in a psychological "Void state" and a physiological "Survival state". The specter of death compels individuals to ponder existential matters profoundly. Death is often characterized as "A kind of vast void, you don't know what it is." After witnessing numerous deaths, individuals perceive that "Life is truly fragile." Moreover, when coping mechanisms falter, people's internal subjectivity diminishes, leading them to "leave it to fate, to destiny." Externally, they place heightened emphasis on physical health, with the sentiment that "physical health is more important than anything else."

Additionally, for some COVID-19 patients and frontline workers, the thinking and meaning-making functions at the psychological level have been supplanted, resulting in a biological "survival state," centered on "preserving their own lives" and "saving the lives of others." Individuals "won't contemplate the future at all; survival becomes the primary focus." For those with close family members infected with COVID-19, their immediate concern pivots to helping relatives secure a hospital bed "as soon as possible."

Coping phase: After a phase of emotional turmoil, public panic regarding the novel coronavirus has subsided, and the overall level of comprehension and responsiveness has progressively improved. Emotionally, individuals are confronting the situation proactively rather than passively accepting it. A greater number of people are adopting a mindset of "let it be" and "going with the flow."

Cognition: Cognitive coping strategies can be enacted in two ways: Relationship buffering and relationship enhancement. Firstly, the relational disruption incited by the threat of death can be mitigated by "spending more time with children" and "increasing family time." Frontline workers can gain social support by "sharing experiences" and "encouraging one another" within their professional circles. Communication between individuals with shared experiences can also alleviate feelings of fear, as "everyone is facing a common enemy," and "we are comrades-in-arms." Moreover, for medical

professionals who need to maintain rationality, when dealing with patients, they adopt the strategy of "treating him solely as a patient" to insulate themselves from potential emotional fluctuations.

Response efficacy: This can be developed in four primary ways: Information certainty, material certainty, treatment process certainty, and prevention of loss of control. Firstly, obtaining authoritative information, such as "professional studies by the health commission," allows individuals to feel a sense of control. Doctors "organize learning" and processes gradually become "standardized". "Preventing the virus is like a computer program, if you do 'a', it inevitably leads to 'b', and 'b' inevitably leads to 'c'." Secondly, the availability of sufficient resources also provides the public with a sense of control. In the early stages of the outbreak, some interviewees "rushed out to buy rice and oil, and a lot of vegetables. Then they just sat at home comfortably." The government's large-scale and timely supply of resources also alleviated the sense of losing control, "the country gathered such a large force to contribute, the state did not want a penny, the disease was cured, and lives were saved." Additionally, doctors who had already experienced many death events at work before the outbreak have become desensitized, "so we are used to it." If treatment is ineffective, the individual's planning for what comes after death can also alleviate the loss of control brought about by the threat of death, "if we go, I tell him (relatives) how to educate the children," and "how to face the occurrence of such things." Finally, an individual's planned execution of their last wishes can also prevent the loss of control. "Hope to fulfill all the promises before dying." By indirectly avoiding the issue and immersing oneself in "enjoying the present moment," one can also gain a sense of control.

Post-traumatic growth: Coping at the level of meaning can be developed through two primary aspects-Meaning reconstruction and individual mentality.

By continuously expanding professional scientific knowledge, individuals can renew their explanatory system and strategies for dealing with the threat of death, meaning reconstruction. For example, medical staff "discuss and summarize cases." Some members of the public gain a kind of psychological comfort by comparing their plight with others. For instance, "So many people online are saying whose elderly people have died. The elderly in my family are still alive, maybe I am luckier." Positive attributions to death events can also bring relief, stating: "On the one hand, it may be a disaster, but on the other hand, it is indeed a good change for the people of Wuhan."

For frontline workers, strengthening their sense of responsibility can alleviate the crisis brought about by the threat of death, which in other words is termed as individual mentality. Individuals with religious beliefs deal with the threat by reinforcing their faith, "If you believe in God, He will take you to heaven." For the general public, a strong will to live is an effective strategy when dealing with the threat of death, "As in Chairman Mao's era, there was often a saying called 'Man conquers nature,' which is the power of the spiritual atomic bomb." Individuals who have been cured show an "unselfish side" by performing acts of selfless aid, such as "donating" supplies or "donating blood plasma," and so forth.

Reformative phase: After the coping period, individuals gradually enter a new period of tranquility, during which the psychological mechanisms for facing death are reshaped. Individuals no longer merely evade or passively accept the impact of death. Instead,

they "cherish life more," "pay more attention to their bodies and strengthen exercise," and proactively focus on life itself to gain a new sense of life's meaning. The approach to interpersonal relationships also becomes more proactive, with "interactions friendlier than before." A new understanding and sense of meaning towards the world is also rebuilt, "I originally thought the world was gray, and suddenly the world is bright again." However, for survivors who have lost loved ones, "surviving feels even more painful."

Validity test based on big data mining technology

Topic modeling: This article uses Latent Dirichlet Allocation (LDA) for topic mining by the pyLDAvis library in Python. This article determines the number of topics using topic coherence scores. As shown in Figure 2, if the coherence score increases with the increase of the number of topics until it stabilizes at a certain value, then the number of topics corresponding to the highest coherence score before stabilization is the optimal number of topics (Figure 2).

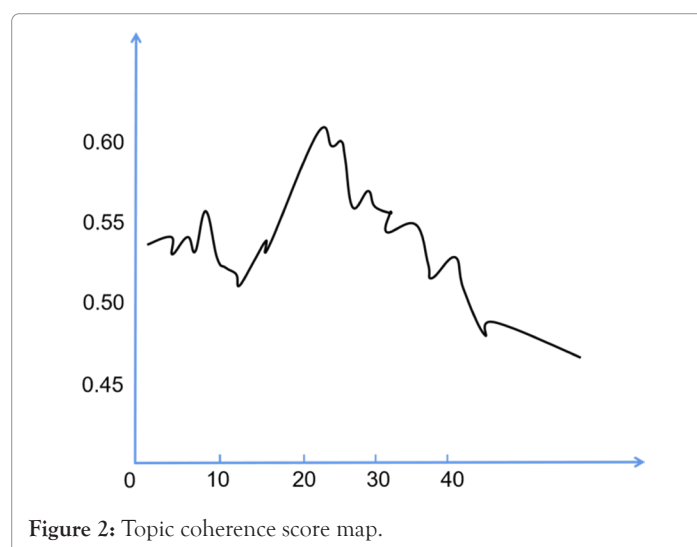


Figure 2: Topic coherence score map.

As can be seen from Figure 2, the topic coherence score gradually increases until it reaches its maximum when the number of topics is 20. Subsequently, as the number of topics increases, the topic coherence score gradually stabilizes amidst fluctuations. Therefore, according to the topic coherence score, the text content in this article is ultimately generated into 20 topics, as shown in Table 2.

Table 2: Topic model description table.

Subject keywords	Theme description	Theme strength
Unable to face; can't sleep; crazy; mood; unban; dare; afraid to go out	Avoid	0.116235
Scared; headache; anxiety; depression; lockdown; annoying; hurts; over; asphyxia; how to do; what should i do; do what; epidemic; virus;	Emotional response	0.113655
Palliation; uncomfortable; ignore; hold; unblock	Actively face	0.131414

Indeterminate death; accidental death; coronary pneumonia symptoms; family separation; conformant death; separate; death; unknown; uncertainty	Unexpected death	0.09807
Basic illness; uncomfortable; spreading	Out of control	0.237483
Separation; miss him; unable to meet; date; bye; elder; unblock	Broken relationship	0.059234
Close; great	Intimacy buffer	0.092909
Daily life; home	Human interaction buffer	0.169244
Gathering; nice guy	Compensatory gratification for the relationship	0.160141
Friends; common experience	Relationship enhancement	0.065803
Uncertain; gossip; afraid; number of deaths; fake	Uncertain information	0.187819
Excessive behavior; hoarding; full	Excessive behavior	0.152803
Listen; official notice; Zhong Nanshan	Information confirmation	0.096886
Control; sufficient supplies; got used to	Materials determined	0.113655
Ibuprofen; one week	The course of treatment is determined	0.375114
Vacation; how much longer; last wish	Runaway prevention	0.12237
Fragile; nothingness; fate; numbness	State of nothingness	0.133683
Unanimous; help; save	Values	0.219094
Fate; ignorance is bliss; happiness comes first; insights into life; figured out	Individual mentality	0.435909
Do well; future; selfless	Meaning reconstruction	0.363244

Evolution of themes in semantic network analysis: The Network X package in Python is used to extract high-frequency co-occurring words from the four stages. To more intuitively display the popular topics of public discussion at each stage, a high-frequency word co-

occurrence matrix is further constructed and visualized, with the results seen in Figure 3. According to specific interpretations, they can be divided into four clustered subgroups, with nodes of the same colour belonging to the same category. The lines between the nodes represent the connections between the high-frequency words (Figures 3-6).

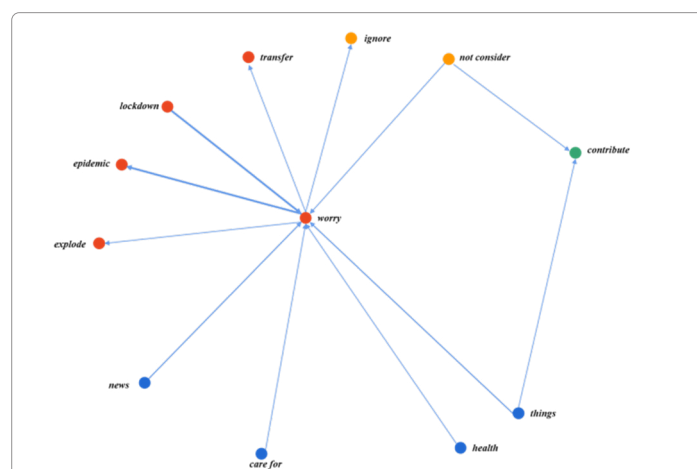


Figure 3: Tranquil phase prior to lifting pandemic restrictions. **Note:** Emotion category (■); cognition category (■); behaviour category (■); and value category (■).

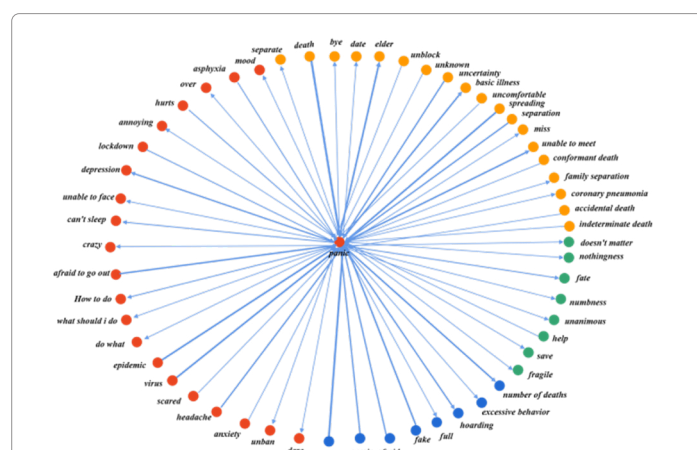


Figure 4: Threat phase at lifting pandemic restrictions onset. **Note:** Emotion category (■); cognition category (■); behaviour category (■); and value category (■).

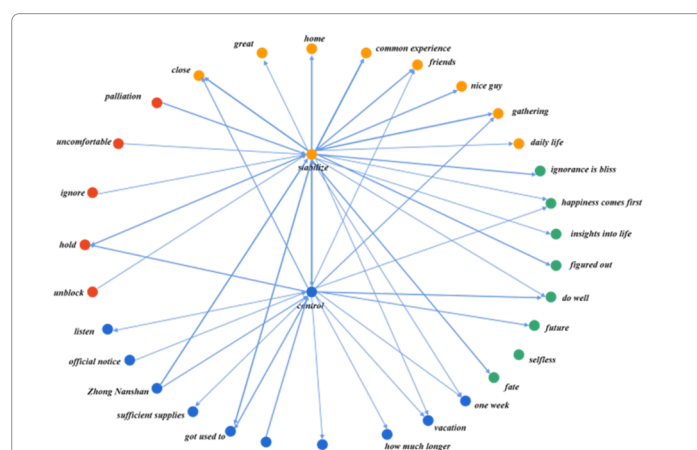


Figure 5: Coping phase mid-lifting pandemic restrictions. **Note:** Emotion category (■); cognition category (■); behaviour category (■); and value category (■).

suggest that individuals of high compassion, especially those who have experienced trauma, are more proficient at discerning and empathizing with the suffering of others, more inclined to offer assistance, and thus more prone to engage in acts of rescue, donation, blood donation, and volunteering. These behaviours are crucial for self-assistance, mutual aid, and post-disaster reconstruction [27-30].

Future research endeavours could therefore amplify the focus on cross-cultural studies pertaining to death psychology, potentially offering empirical evidence for the longstanding debate between the "cultural holistic view" and the "cultural specificity view". Secondly, as this study constitutes an exploratory grounded theory investigation, the exploration of the psychological mechanism of death during an epidemic may not be sufficiently detailed. As such, future research could develop appropriate scales based on this study to verify the psychological mechanisms of death under the impact of the COVID-19 pandemic, providing a more precise weighting for each factor [31].

CONCLUSION

This research delves into the transformation of mortality-related psychology against the backdrop of COVID-19 restriction easing, utilizing grounded theory as the methodological framework. Based on the temporal progression and death-associated factors such as emotions, cognition, behavior, and values, four stages can be delineated: The tranquility phase prior to restriction lifting, the mortality threat phase in the early stage of relaxation, the coping phase during the middle stage, and the restructuring phase in the later stage. The psychological implications of death triggered by the pandemic onset can be bifurcated into two trajectories from the vantage points of mental, social, and physical realities—loss of control and stability. The 'loss of control' trajectory encompasses emotional volatility, cognitive instability, diminished coping efficacy, and traumatic stress responses. In contrast, the 'stability' trajectory comprises emotional equanimity, cognitive steadiness, stable coping efficacy, and post-traumatic growth. Subsequent to the threat and coping stages, individuals gradually transition into a renewed period of serenity, during which the psychological mechanisms employed for grappling with death undergo reshaping.

This research dismisses the conventional validation technique associated with grounded theory, critiquing its excessive dependence on the researcher's subjective interpretation, which may foster "researcher bias". In lieu of this, the study employs LDA topic modeling and semantic network analysis to authenticate the preliminary theory's credibility. Findings suggest that the quantitative outcomes derived from topic mining and semantic network analysis robustly corroborate the coding outcomes and theoretical constructs of grounded theory. This implies the potential of data mining technologies as efficacious validation tools for grounded theory.

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