A Research on Hot Spots of Psychological Warning Based on Co-word Analysis and Visualization

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Abstract. Offering reference for sustainable researches of psychological warning field by analyzing hotspots in it in the latest decade. 589 literatures relevant to psychological warning conformed to standard, were extracted keywords. Co-occurrence matrix and lexical matrix were exported by using python software, and the correlations among high frequency keywords were received by analyzing the combination between social network and semantic network which also drew the semantic network graph. The hierarchical clustering function was used to draw the high frequency keywords clustering analysis diagram, and the Euclidean range model was used to draw the two-dimensional scale analysis graph. The combination between co-word analysis and knowledge graph revealed, explored, and summarized the current research hotspots and their relationships in the field of psychological warning. Hotspots research showed the necessity of researches in the psychological warning field. The construction of psychological warning evaluation system and the analysis of key elements of psychological warning should be attached importance. Keywords: Psychological warning, Co-word analysis, Knowledge graph, Research hotspots.

1 Introduction

Psychological warning can effectively prevent and reduce the occurrence of psychological crisis events. It reduces the incidence of psychological crisis events by confirming the warning objects, dynamic monitoring, evaluating, analyzing, and studying warning indicators, discovering and identifying the factors that affect psychological crisis and taking the corresponding preventive measures in time according to the analysis results [1].

Feng S [2] discussed different approach to improve the adolescents’ health literacy according to the psychological characteristics of teenagers in different ages, based on the assessment and alarm of psychological events. Kroesen M [3] regarded mental factors as an important role in predicting changes in individuals’ behavior and related choices. Liao S [4] proposed a design idea for structuring an online psychological warning system according to the daily performance of patients and built it which contributed psychologists to know about the status of patients’ mental health and intervene them quicker.

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However, psychological warning also has limitations, such as the uncertainty of artificial judgment, the hysteretic nature of information collection and feedback, and the deception of information content [5]. Many psychological crisis signal data are semi-structured data and unstructured data, which are not the traditional structured data. The traditional structured data can be realized by using two-dimensional table structure, such as scale data. Whereas semi-structured data are those consisting of E-mail, word processing files and a large amount of information saved and published on the network, such as crisis signal information released in QQ space, Wechat moments and so on [6]. And the unstructured data are those without a fixed construction, mainly including text data, image, voice, network, spatial trajectory, time series. There is a strong pattern in the behavior of groups composed of individual behaviors [7]. The group behavior laws can be found from the mass individual information emerging online to estimate the development trend in the field of psychological warning under the prevailing circumstance. By predicting the process of the future development in this field, it can realize the highly effective auxiliary decision of psychological warning [4]. The hotspots in psychological warning, where collation and induction of literature seem to be missing, are different at present. Based on Zipf’s law of bibliometrics, this article used cluster analysis, co-occurrence network and multi-dimensional scale analysis to sort out and summarize hotspots and directions in the field of psychological warning [8], which provided some references for subsequent research.

2 Materials and Methods

2.1 Source of Materials

Literatures related to psychological warning were searched in the database, and the selected were taken as the research object. Ensure the specific concept of subject terms by using the topic retrieval function to prevent false detection and missing detection. The discrimination of psychological warning is conducive to the early intervention and prevention of derivative crisis. It has passed two rounds of screening with two standards, one is that psychological warning should be the theme, the other is the period need to be limited from 2012 to 2022. In the first screening, based on the source of literature, those from newspapers, conference proceedings, calls for papers were excluded. In the second screening, according to the arrangement of subject, literatures with incomplete information, invalid institutions, missing author and nonstandard abstracts were excepted. Thus, 589 valid literatures were selected.

2.2 Research Methods

Bibliometrics has a variety of analysis methods, such as citation analysis, co-word analysis, co-authorship analysis. Co-word analysis belonging to content analysis, refers to a bibliometrics method that confirms hotspots in scientific research field according to the frequency of subject terms or keywords that can explain the core content of the literature in the certain field [9], which is suitable for the research of the new branch of science. The brand new issue, psychological warning, was born in the outbreak of the COVID-19. It is reasonable to use the co-word analysis method to sort out and analyze its literature.

Co-word analysis has a number of forms, such as subject words co-occurrence, keywords co-occurrence, and headwords co-occurrence. This article took keyword co-occurrence as the carrier of co-word analysis, and used keyword co-occurrence frequency to reveal the research status and hotspots in this field. Co-word analysis enhances the credibility and accuracy by adopting the visual scientific map to intuitively display the structural characteristics of the research field.
2.3 Statistics Methods and Procedure

(1) Python was used to extract the keywords in literatures, repeatedly clean the data, screen the high frequency keywords and generate the co-occurrence matrix and the lexical matrix on the basis of the threshold set by the Donohule, J.C formula, which can distinguish the high frequency words from the low frequency words. (2) According to the co-occurrence matrix, the correlations between high frequency keywords analyzed from the combination between social network and semantic network were received and semantic network graph was drawn by applying python. (3) Combined with the lexical matrix, the clustering analysis diagram of high-frequency keywords was drawn by using the system clustering function. (4) The "I-Ochiai" coefficient was used to generate the dissimilarity matrix, and the Euclidean distance model was used to draw the two-dimensional scale analysis diagram by using the SCALE function multidimensional analysis tool.

3 Result

3.1 Annual Distribution of Literature Quantity

A total of 589 literatures on psychological warning from 2012 to 2022 were selected. From 2012 to 2018, the number of literatures fluctuated steadily and that from 2019 to 2022 increased significantly compared with the previous period. The quantity of literature in 2022 was 10.5 times that of 2012.

3.2 Statistics on High Frequency Keywords

Keywords highly condense and summarize articles. More specific convergence between psychological warning and other research areas can be visualized by using Python to crawl the results with the keyword "psychological early warning", classifying and making frequency statistics from words. Data were cleaned without unnecessary words and saved in a txt file by using the delete functions and text comparison methods such as sorting, filtering and searching in Excel, the replacement function in Word and jieba tokenizer in Python. The Donohule, j.C. Formula which can distinguish from high frequency to low frequency was the base [10]:

\[ T = \frac{1}{2} \left( -1 + \sqrt{1 + 8I_1} \right). \]

\( I_1 \) refers to the frequency of keywords whose occurrence frequency is 1, and \( T \) is the high frequency threshold. When \( T \) value is 12, the keyword can be considered as a high-frequency word whose frequency exceeds 12. The top 100 high-frequency keywords in the field of psychological warning were selected.

The self-defined word list and filtered word list were established in the ROST CM6 software. Word separation and word frequency statistics were received by operating the ROST CM6 software. Word cloud visualization for the result of word frequency statistics was obtained from minitagcloud, as shown in the figure below.

3.3 Clustering Analysis of High Frequency Keywords

On the basis of birds of a feather flock together, cluster analysis collects the keywords with high co-occurrence frequency into the same category. This paper divides 100 high-frequency keywords into 6 categories. It is necessary to further study the hot category with multi-dimensional scaling analysis as the small distance of some parts is not conducive to more
3.4 Co-occurrence Network of High Frequency Keywords

Based on the interaction between research objects, social network analysis explores the research status in scientific field, effectively avoids the one-sidedness and singleness of the attribution in cluster analysis, and displays the connections among related words totally.

Combining social network and semantic network, the correlation between high-frequency words can be obtained by analyzing psychological warning on the basis of word frequency analysis, which provides a more accurate analysis for the hotspots discussion. The semantic network diagram is shown as the figure. 3. The keyword is the circular node in the figure.
The more lines the node has, the more important it is in this field and the stronger its control over other nodes. The closer these lines are, the more researches there are in the field. With the psychological warning as the center radiating outward, influencing factors and negative emotions are the main research topics at present. Other nodes, such as behavior and children are studied around the central node.

The co-occurrence relation of keywords is revealed by the line between nodes, and the line density showed the co-occurrence frequency. The more lines and the shorter the distance, the tighter the connection. As shown from the figure, psychological warning is closest to factors, potential, negative and symptoms, and the association with effectives, social, perceived was the second.

![Figure 3. Semantic Network Diagram](https://example.com/figure3.png)

The co-occurrence frequency of psychological, warning, potential and negative is higher on the basis of co-occurrence relationship. Psychological warning combined with its influencing factors, negative emotions and symptoms is the current research direction, which will also be the trend in the future in psychological warning field.

### 3.5 Multidimensional Scale Analysis

The two-dimensional scale analysis diagram takes centripetal degree as the horizontal axis, which showed the intensity of interaction between different fields [11], and density as the vertical axis, which reveals the intensity of internal connections in a field. It finds the similarity of research objects through plane layout and generalizes the structure of subfields.
The research hotspot of psychological warning shown in the two-dimensional scale map is basically consistent with that shown in the cluster tree map. However, they also have new features. As shown from the figure 4, the five relatively concentrated research groups shown in the two-dimensional scale atlas were the recombination of the analysis results of the cluster tree map. The first quadrant is the research group of psychological warning status, the keywords of which are the hotspots of psychological warning, and the connection of keywords is relatively close. The first and the second quadrants are the research group of the affecting factors and the strategies inspection in psychological warning, which has scattered keywords.

As a part of the system for evaluating the psychological warning effect, it can find problems and put forward countermeasures and suggestions. The second and the third quadrants are the group of satisfaction in psychological warning, which has an obvious structure of keywords and mainly include psychological warning management and satisfaction. The third and the fourth quadrants is the group of psychological warning management path, whose research objects are closely related. However, some research results are still not updated in time. The fourth quadrant is the research group of information communication related to psychological warning, whose keywords are closely relevant, which is the relatively core content in the field of psychological warning.

![Euclidean distance model](https://doi.org/10.1051/e3sconf/202340902007)

**Figure 4.** The two-dimensional scale analysis diagram of high frequency keywords in the field of psychological warning
4 Conclusions

The combination of co-word analysis and visual knowledge mapping can show the hotspots and development trend of psychological warning accurately. It indicates that the importance and urgency of psychological warning research with the number of literatures increasing significantly and the contents expanding continuously in the past 10 years. However, studies in this field still shows some deficiencies, such as few empirical studies and incomplete warning system. In view of the above results, in order to accelerate the construction of psychological warning and guide the diversified development of it, this paper put forward the following suggestions for related research.

Attach importance to researches on the evaluation system of psychological warning. The implementation of psychological warning needs timely supervision and feedback to make clear the effect. There are few literatures on evaluation, and most of the indicators are basic, which can’t properly assess the prognostic effect of psychological warning [12]. In addition, the model, behavior, analysis and influence are at the most edge of the network diagram, and there is no direct line with the warning. Therefore, it is suggested to pay attention to build fully equipped evaluation system for psychological warning in the future, focus on evaluation indicators such as warning model and warning behavior, and construct a scientific and reasonable evaluation system for the effect on the basis of the subjects’ satisfaction.

Strengthen researches on key elements of psychological warning. Through the statistics of high-frequency keywords and cluster tree map, key elements such as the construction path and influencing factors of psychological warning have not received attention it deserves, and many intervention measures have not appeared, either. Future studies need to lay emphasis on the boosting role of intervention measures in psychological warning, pay more attention to the field, attach importance to the construction path and analysis of influencing factors.

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