DISCUSSION OF PUBLIC MENTAL HEALTH PROBLEMS BASED ON INTELLIGENT DATA ANALYSIS TECHNOLOGY UNDER THE BACKGROUND OF THE COVID-19 PANDEMIC

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Summary:

   Background: *In the past few years since the outbreak of the novel coronavirus, the public has been under tremendous pressure. Family, career, emotions, and other aspects are constantly pressing people's psychological defense of life. Modern urban governance is a centralized reflection of the urban space carrier and resource platform. Strengthening the public's guidance on mental health problems is conducive to promoting the modernization of urban governance system and governance capacity, improving the level of urban governance and the ability of grassroots to resolve conflicts.*

   Subjects and methods: *To study people's psychological changes and endurance in this situation, relieve the psychological pressure caused by the novel coronavirus outbreak, and ensure people's mental health, we propose an assessment method for psychological health based on data intelligent analysis, which is used to solve public mental health problems in modern urban governance. First, we extract information on sleep quality and physical exercise of people in pandemic areas through an online questionnaire survey. Then, we can achieve an overall picture of the public's mental state in the COVID-19 pandemic by analyzing the psychological changes of public and the aggregated information.*

   Results: *To evaluate the performance of the public mental state management method proposed in this study, we invited 1000 people to complete a comparative experiment of a questionnaire survey on the Internet. The questionnaire included information about physical activity at home and sleep quality. Home exercise information mainly includes exercise duration and exercise mode, while sleep quality information includes sleep score, sleep duration, and proportion of deep sleep.*

   Conclusion: *Through experiments, we find that the method we propose can realize the accurate identification and analysis of the changes of people's psychological conditions in modern cities. Moreover, it can provide data support and technical support for people's psychological counseling under the background of the novel coronavirus pandemic.*

   Key words: *mental health - data analysis - covid-19 pandemic - intelligent technology* *

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INTRODUCTION

   At the end of December 2019, the novel coronavirus pneumonia pandemic broke out globally. The pandemic not only poses a great threat to the public's physical health but also has adverse psychological effects on them, such as anxiety, depression, panic, insomnia, and other psychological problems (Qh A, 2021). People's fear and anxiety about the pandemic, information explosion and excessive attention, vicarious trauma, and life rhythm disorder also lead to an abnormal mental state and negative emotions, resulting in many psychological problems. To discover the changes in people's mental state in a timely manner and avoid possible psychological collapse, it has become particularly important to study public psychological problems in the pandemic. For fear and anxiety, the application, catharsis, and other methods to improve bad mood are examined. For vicarious trauma, while paying attention to patients, we can strengthen the psychological adjustment of the public to avoid the occurrence of negative emotions such as excessive sadness. For issues caused by disturbances of the rhythm of life, active regulation of such rhythm can achieve a virtuous cycle, which can help improve the immunity of the body to better cope with the epidemic. For information explosion and excessive attention, the necessary measures are to acquire information rationally and proactively, adjust mental state in time, and avoid negative emotions and psychological problems.

   During the pandemic, the public—faced with a wide-ranging, rapidly spreading, high-risk, and unknown COVID-19—received a lot of relevant information without a clear idea. This can cause so three problems: a) great psychological pressure in a short time, b) excessive panic about the living environment and c) the current situation of the pandemic, a large number of passive acceptances of the pandemic and excessive attention to the pandemic. These problems will lead to vicarious trauma, over-thinking and over-worry of the public. Without a timely adjustment of emotions, further excessive attention will develop into insomnia problems. Sleep quality is closely related to mental health (Jing W A, 2020). On

the one hand, poor sleep quality, such as sleep disorders and sleep deprivation, will have adverse effects on mental health (Zhu N, 2019). On the other hand, when mental health is seriously affected, it is more likely to produce negative emotions such as anxiety and depression, thus affecting the quality of sleep (Zhou SJ, 2020).

During a pandemic, the public's rhythm of life is disrupted, and the balance of diet, sleep, and exercise is broken, which will increase mental tension and anxiety and cause psychological damage. As a result of prolonged isolation, people lack exercise, which is linked to mental health. Studies have shown that proper sporting activities can decrease depression and anxiety and uplift emotion, which means that regular sporting activities can help avoid the development of depression. Exercise is also associated with a positive mood, improved self-esteem, and better sleep quality, which are the necessary conditions for a good state of mind. Thus, the mental health benefits of exercise cover all aspects of an individual's life.

In this study, we proposed a mental health assessment method with data intelligent analysis by the network big data analysis technology, which was combined with people's sleep quality information and autonomous movement information during isolation period obtained from the network questionnaire. The main contributions of this study are as follows:

(1) Establishing an Internet-based information collection system for people's sleep quality and exercise status.
(2) Proposing the recognition model of public mental state change to realize the fusion of sleep quality information and autonomic movement information.
(3) Using the model to obtain the psychological changes of the public in real time and provide data support and technical support for the psychological counseling of the public.

Influence of exercise on psychological health

Sports have a special appeal mainly because it provides people with the excitement of meeting the physical challenge in their chosen activity and the satisfaction of improving their abilities. The result of physical exercise is to train both the muscles and the nervous center. Regular, scientific physical exercise can prevent the occurrence of negative emotional problems while scientific physical exercise can effectively treat mental illness. Although the etiology of some mental illnesses and the underlying mechanisms of why physical activity contributes to their elimination are not fully understood, physical activity has become popular as a means of psychotherapy. In this era of COVID-19, proper exercise at home is one of the ways to achieve mental health. Research shows

that the mechanism of the influence of sports on improving mental health has an interactive effect in the aspects of intelligent development, emotional control, improving self-perception, eliminating fatigue, and enhancing social adaptability. Bahrke et al. (1978) showed that meditation or quiet rest can reduce people's anxiety level just like physical exercise. However, Toshiya (2013) showed that long-term physical exercise is more effective in reducing negative emotions than relaxation exercises or other distracting and enjoyable activities. The task mastery hypothesis suggests that when the body successfully completes a task, it generates confidence, positive emotions, and a desire to try again. Physical exercise gives the body a sense of independence and success. They take that sense of control and success into their daily lives and improve their mental health. In addition, self-efficacy theory holds that people's confidence in athletic ability is closely related to their realistic ability to perform this behavior. Non-exercisers have less confidence in their ability to perform the same tasks than regular exercisers. People who have the habit of physical exercise can improve their mood and get healthy psychology.

As a means of intervention under the normal epidemic prevention and control, physical exercise can be used as an intermediary factor between risk perception and mental health. Thus, a virtuous cycle among risk perception, physical exercise, and mental health can be realized. In the context of normal epidemic prevention and control, people are faced with the possibility of home isolation at any time; however, prolonged home isolation can cause stress and emotional problems, reduce the immune function of the human body, and destroy the balance of normal physiological mechanisms. Physical exercise can relieve anxiety and depression, regulate mood, and improve mental health by regulating human sympathetic nervous system, hypothalamic-pituitary-adrenal axis, brain-derived neurotrophic factor, and self-efficacy. Yet higher intensity is not always better. The "window-opening" theory of the immune system after exercise suggests that weaker-than-normal immunity occurs after intense exercise, but not at moderate intensity.

Influence of sleep movement on psychological health

We believe that the relation of sleep quality and psychological health is strong. Research shows that sleep quality positively associates with psychological health. Therefore, people can achieve a higher level of mental health with higher sleep quality. On the contrary, mental health level will be low with poor sleep quality. A variety of studies about sleep quality and psychological health

have been conducted. Better sleep quality can not only make the brain powerful and effectively replenished but also cause the excitement and inhibition process to reach a new balance. Therefore, we can eliminate fatigue and prepare to accept new information. Sleep disorders can also result in the dysfunction of mutual regulation and antagonism between sleep substances in the central nervous system, which significantly affects cognitive, emotional and behavioral psychological activities. As the COVID-19 pandemic continues, people's mental health status deteriorates further, a finding that is similar to the research results of Fujita et al. (2021). During the pandemic, individuals' psychological health problems, such as anxiety and depression, will increase. Previous studies have shown that during major infectious disease outbreaks, such as the SARS epidemic, the mental health of the public generally deteriorates (Chih-Hung, 2010). Another international survey result shows that the psychological health of people in 33 countries has decreased significantly, specifically manifested as insomnia (Yuksel D, 2021) within the COVID-19 pandemic. This may be because some people often worry that they or their family members will be infected with the novel coronavirus (Bin L G, 2021) and pay too much attention to the information of the pandemic (Sx A, 2021), including unconfirmed news. Thus, they show deep worry and fear, which have a negative psychological impact. In addition, there are some special groups, namely, empty-nesters, who lack companionship and support and are more likely to suffer

from insomnia, sleep deprivation, and other adverse psychological problems during the pandemic (Hou W, 2021). Some studies likewise suggest that there is a one-way correlation between mental health and sleep quality (Cai Z, 2022; Bao M, 2022). This may be because sleep quality is more influenced by the surrounding environment and tends to be stable in the long run. When stimulated by external stressors, people with poor sleep quality show more severe symptoms of depression and anxiety, resulting in poorer mental health.

METHOD

By using the Internet to collect information on people's sleep quality and home exercise while we are trapped in our homes during COVID-19, this study proposes a psychological health assessment method with data intelligent analysis. The proposed method, shown in Figure 1, is used to collect people's mental health status online and provide psychological data and technical support for people's psychological counseling in modern urban governance.

To explore people's psychological changes and ability to bear in this situation as well as relieve people's psychological pressure caused by the novel coronavirus pandemic, we use the Internet to collect the public's sleep quality information and home exercise information and analyze the two modes of information through
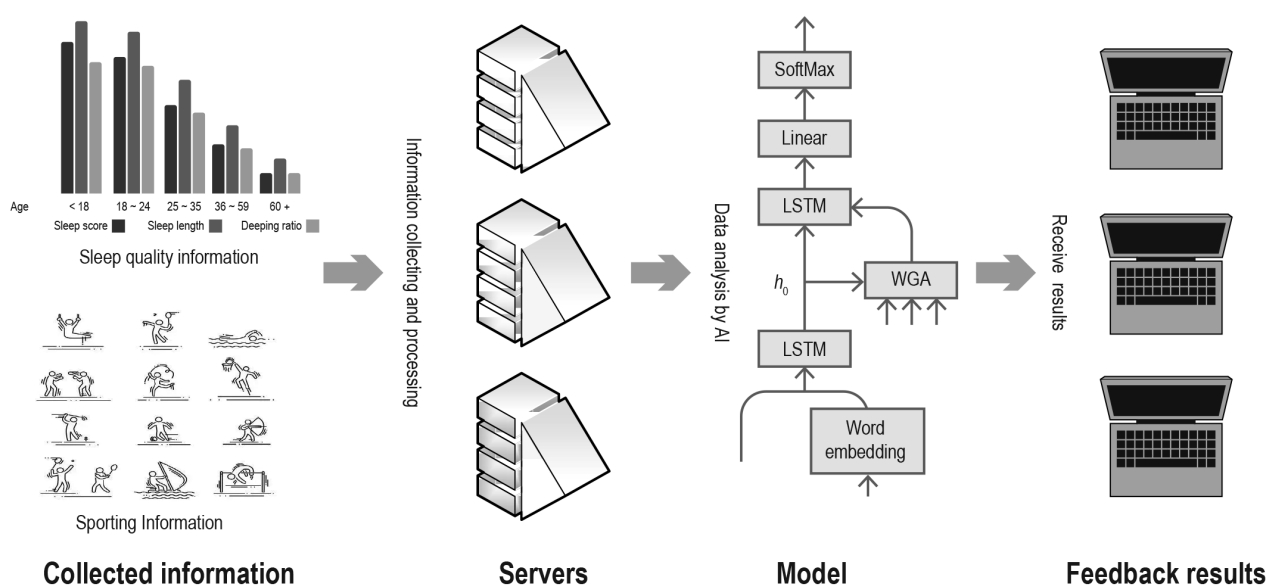

Figure 1. Method of mental health status assessment

the network transmission technology. Accordingly, we can conduct the timely management of people's mental health status in modern urban governance. In the whole data processing process, we believe that sleep quality information and home exercise information can accurately reflect people's mental health during the pandemic. To intelligently process these two kinds of information, we adopt the artificial intelligence processing method shown in Table 1. The information fusion technology in deep learning is used to process the collected information and then the prediction and classification of mental states are realized. Therefore, public psychological health management within the COVID-19 is essentially a prediction and classification of people's mental health status.

Table 1. Deep learning methods for mental health analysis

Prediction methods for mental health analysis	Faster-rcnn
	SSD
	Transformer
	Bi-LSTM
Classification methods for mental health analysis	Convolutional Neural Network
	Vit

RESEARCH RESULTS AND DISCUSSION

To evaluate the performance of the public mental state management method proposed in this study, we invited 1000 people to complete a comparative experiment of a questionnaire survey on the Internet. The questionnaire included information about physical activity at home and sleep quality. Home exercise information mainly includes exercise duration and exercise mode, while sleep quality information includes sleep score, sleep duration, and proportion of deep sleep. The information summary is shown in Table 2.

Table 2. Home exercise information and sleep quality information

Sporting Information	Sleep quality information
Sports duration and type	Sleep score
Sports type	Sleep duration
Calorie consumption	Deep sleep ratio

According to the different platforms of the questionnaire survey, we set some questionnaires online so as to

achieve many services, including designing questionnaires, distributing questionnaires, and analyzing results. We can also obtain the advantage of these questionnaires, such as no geographical restriction and little resource costs. However, we must accept their disadvantage, that is, high-quality answers to the questionnaires cannot be guaranteed. The age distribution of our questionnaire is shown in Table 3.

Table 3. Age distribution of the questionnaire

Age	Number
15–25	205
26–40	295
41–55	287
56–70	213

We judge people's mental health status through a pre-questionnaire survey, including typical questionnaires such as the Big Five Inventory and Psychological Symptom Inventory-100. We set up two mental states as well: calm and anxiety. We apply artificial intelligence strategy to classify the movement information and sleep quality information and get comprehensive recognition results. By combining motion information and sleep quality information, our model can reach an accuracy rate of 88.36%. Using the exercise information alone, we can predict the mental state after exercise through different exercise degrees and the accuracy rate can reach 82.44%. If sleep quality information is used alone, we can analyze the sleep quality associated with mental state and the accuracy rate of our model can reach 86.36%. At the same time, we further explore the impact of the proportion of deep sleep on mental state. We show the results in Table 4, where the length of deep sleep is shown to have a direct impact on people's psychology and emotions. If deep sleep is kept to a low level, then people's anxiety can be particularly pronounced. If the proportion of deep sleep can be higher, people will be calmer during the pandemic.

Table 4. Influence of deep sleeping on mental state

Emotion	Proportion of deep sleep
Anxious	20%–35%
Anxious–Peace	35%–60%
Peace	Over 60%

This year, the COVID-19 pandemic is still in a state of outbreak. People are always under great psychological pressure from the outbreak that may suddenly appear around them. People's sleep quality and mental health are both worse after the outbreak than before. Therefore, relevant departments should not only pay attention to the containment of infectious diseases during the pandemic but also focus on the sleep quality and psychological health of the public. In addition, people with poor sleep quality are more likely to suffer from psychological distress, suggesting that relevant authorities should identify groups that are at high risk of psychological distress as early as possible to better intervene. Through this study, we can find that physical exercise during home isolation can relieve psychological stress caused by COVID-19. In the context of pandemic prevention and control, people are faced with the possibility of home isolation at any time. Prolonged home isolation will cause people stress and emotional problems, which will reduce the immune function of the human body and destroy the balance of normal physiological mechanisms. Physical exercise can relieve anxiety and depression and improve mental health by regulating the interactive senses of the body. However, higher intensity is not always better, and numerous studies have shown that only light to moderate intensity exercise can reduce anxiety and depression and improve well-being.

To sum up, this study proposed a mental health status assessment method with emotional data that can make use of home movement information and sleep quality information to achieve real-time management of public mental emotions through the model in this paper. Although the method still has room for improvement, the current effect can fully provide data support and technical support for the psychological counseling of the public. Among the positive mental health effects of exercise, the most prominent is the ability to reduce symptoms of anxiety and depression. Of course, exercise is associated with positive emotions, increased self-esteem, and improved sleep quality; these are the necessary conditions for a good state of mind. The mental health benefits of exercise cover all aspects of an individual's life. When we worry about our body shape, or hesitate to exercise to

improve our image, we can think about its benefits to our spiritual world. Sleep quality and mental health are both worse after the outbreak than before. Therefore, during the epidemic, we must not only pay attention to the containment of infectious diseases, but to the quality of sleep and mental health of the people. At the same time, we have also begun to learn to adapt to the situation and constantly adjust psychological states. In many psychological aspects, a significant advantage over 2019 is observed. Through research, we can better understand the effect of the epidemic on public psychology, and provide the direction and basis for subsequent targeted mental health education.

CONCLUSION

Within the COVID-19 pandemic, drawing from the Internet and artificial intelligence technology, this study proposes a mental health status assessment method based on emotional data to achieve real-time management of the public's mental state. First, sleep quality information and physical activity information are obtained through an online questionnaire survey. The data are then analyzed using the proposed model and changes in public psychology are perceived. Finally, network transmission and other technologies are used to transmit and summarize the physiological status of the people to get the general physiological situation of the public under the background of the novel coronavirus pandemic. In the experimental test, we find that our method can realize high-precision identification and analysis of the changes in psychological conditions of the people in modern cities as well as provide data support and technical support for the psychological counseling of people under the background of the novel coronavirus pandemic. In future studies, we will expand the range of information collection, collect more types of information, and further improve the accuracy of the method.

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