Digital technologies in mental health services for adolescents Under the COVID-19 Pandemic

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Abstract

In response to the COVID-19 outbreak, the international community has adopted a series of policies to encourage social distancing, which has increased their risk of developing psychological problems. The traditional psychological counseling model is difficult to play its due role under the quarantine measures of the epidemic, so mental health services based on digital technology have become an option. This study introduces the current situation of mental health of children and adolescents and systematically reviews the application of digital technologies such as network information technology, data analysis, and artificial intelligence in mental health services.The mechanism of applying artificial intelligence technology to students' mental health monitoring and the intelligent evaluation model of students' mental health based on data algorithm are introduced.A technical application model of child and adolescent mental health service is formed, and some suggestions for the digital development of child and adolescent mental health service are put forward.

Keywords: *Digital Health; Artificial Intelligence; Data Mining Algorithm; Mental Health; Adolescents;*

1 INTRODUCTION

The rapid spread of the COVID-19 pandemic across the country has caused great impact and harm to the whole society, as well as severe psychological trauma.

The mental health problems of children and adolescents are becoming more and more serious, and the resources of mental health services are limited, while the demand for mental health services is increasing. In the past, children's mental health intervention mainly based on offline consultation and guidance is limited by many conditions, which undoubtedly makes the mental health problems of children and adolescents worse. However, online mental health interventions based on big data, computing power, mobile technology and online information technology showed their advantages at this time and flourished during the epidemic. Digital technology is increasingly widely applied in the field of mental health, starting from mental health information collection, problem assessment and risk monitoring, to web-based interventions, and gradually forming a complete digital mental health solution.

Based on relevant research around the world, this paper explores the current situation of mental health of children and adolescents under the background of COVID-19 and the application progress of mental health services and interventions based on digital technology.Specifically, the mechanism of applying artificial intelligence technology to students' mental health monitoring and the intelligent evaluation model of students' mental health based on data mining are expounded.t. The study puts forward suggestions on how to improve digital mental health services for adolescents under the normal situation of epidemic prevention and control.

2 CHILD AND ADOLESCENT MENTAL HEALTH STATUS

We In the context of COVID-19, the closure of social places and schools, as an important non-drug intervention means to control the epidemic, has reduced the infection and death caused by COVID-19 to a certain extent, but a series of psychological problems caused by the epidemic and containment measures are prominent in children and adolescents.

B. Fox et al. (Eds.): IC-ICAIE 2022, AHCS 9, pp. 467-474, 2023.
https://doi.org/10.2991/978-94-6463-040-4_71

2.1 *The impact of lifestyle changes*

Shorter schooling time, limited peer interaction and changes in the structure of daily life may have hidden adverse effects on their physical and mental health. Studies have found that the closure of schools and other public places and the maintenance of social distancing may lead to the damage of children's social support system, and then affect their psychological development [16]. For children at home, lack of outdoor activities, abnormal eating and sleeping habits may disrupt the child's usual lifestyle and may promote monotonic, distress, impatience, irritability and various neuropsychiatric manifestations [9] [26].

2.2 *The impact of Mental disorders*

The COVID-19 pandemic may lead to an increase in mental disorders among adolescents, such as acute stress disorder and adjustment disorder [14], post-traumatic stress disorder, depression and anxiety.

The negative impact of the pandemic is also severe for children and adolescents already suffering from mental illness, who are at risk of disruption to their daily psychiatric and psychological treatment and corresponding care measures, which may exacerbate their mental symptoms [11].

According to estimates by UNICEF, in 2021, more than 13% of adolescents aged 10 to 19 suffer from mental disorders defined by the World Health Organization, and anxiety and depression account for about 40% of diagnosed mental disorders [22]. Studies have shown that children with pre-existing behavioral problems, such as autism and attention-deficit hyperactivity disorder, are at high risk of worsening their behavioral symptoms during the COVID-19 pandemic [19].

At present, the increasing proportion of children and adolescents with mental health problems and the deepening severity of the problem are in great conflict with the limited resources of mental health services and the difficulty of offline services. Recently, the World Health Organization highlighted the urgent need to increase the capacity of mental health services to respond to the COVID-19 pandemic.

3 DIGITAL MENTAL HEALTH SERVICES

In order to deal with contradictions and relieve the pressure of mental health service for children and adolescents, digital psychological service based on information technology has become the best choice. It is believed that the application of digital technology can solve some problems in adolescent mental health service [8].

3.1 *The development of digital mental health service*

Even before the COVID-19 pandemic, the technology of the digital information age has been applied in mental health services.

At the beginning, only part of psychological service functions were transferred from offline to online with the help of digital technology, such as online video consultation [3], online mental health training and courses [2][21], or the psychological consultation mode combining online consultation with offline consultation services [24].

Subsequently, applications of intelligent psychological services based on big data, intelligent applications, artificial intelligence, wearable monitoring devices and other technologies have emerged. There are also a number of experiments that have explored digital interventions. Ben-zeev's experiments [4] suggest that mobile psychological interventions for patients with severe and persistent mental illness using mobile apps may yield healing outcomes comparable to traditional clinical treatment. Bucci's study [5] demonstrates the effectiveness and acceptability of a digital health intervention based on a psychosis cognitive model called Actissist, which can monitor the distressing experiences of people with early psychosis and provide positive intervention strategies in real time to improve the speed and quality of psychiatric recovery. Gilmore and Ward-Ciesielski [10] studied the possibility of providing telemedicine to patients at risk of suicide. Using artificial intelligence, researchers [15] created a mobile mental health app called “Wysa” to provide a supportive, empathetic text-based conversation service for users with depressive symptoms and achieved positive results.

The study divided Wysa's users into (1) highly engaged application user groups (NH =108) and (2) less engaged application user groups (NL =21). They were pretested and posttested using the patient health Questionnaire (PHQ-9) during the dialogue service. After 14 days of ai service, phQ-9 data of the two groups of users were analyzed by a mixed method. Results shows that the average improvement rate of major depressive symptoms was significantly higher among high Wysa users.

These findings are encouraging and confirm the future development prospects of AI-based chatbots in the field of mental health services.

The integration and application of these digital technologies bring hope for the mental health of teenagers.

3.2 *Application of digital mental health services for children and adolescents*

Due to the attention to the mental health of children and adolescents, countries all over the world have carried out exploration and practice of digital psychological services for children and adolescents. Specifically, smartphone application as a digital intervention way, artificial intelligence (AI) as a means of students' mental health detection, big data algorithm as a way of students' mental intelligence assessment, have played a huge role in the digital psychological services for children and adolescents. A combination of these technologies is beginning to emerge.

3.2.1 The application of mobile apps

For smartphone apps, Lim provided a 6-week program [17] for the loneliness of children and adolescents, designed and used a digital smartphone application (app) called +Connect, which aims to provide positive psychology content to improve the quality of relationships to improve the loneliness of children and adolescents. A digital intervention [18] for Kenyan adolescents was effective in reducing depressive symptoms among local adolescents. For children with special needs [23], video conferencing and self-guidance websites were used to provide training for parents of children with ASD, and at the same time, certain service resources were provided for parents, which played A positive role in improving the behavior of children with ASD.

3.2.2 The application of AI

A Chinese research [13] adopted AI to collect and comprehensively analyze students' mental state, and used multi-dimensional indicators for mental health evaluation, which realized the transformation of mental health monitoring from static monitoring to dynamic management, and mental health evaluation from subjective evaluation to big data algorithm evaluation. The overall architecture is divided into four steps, as shown in Figure 1.

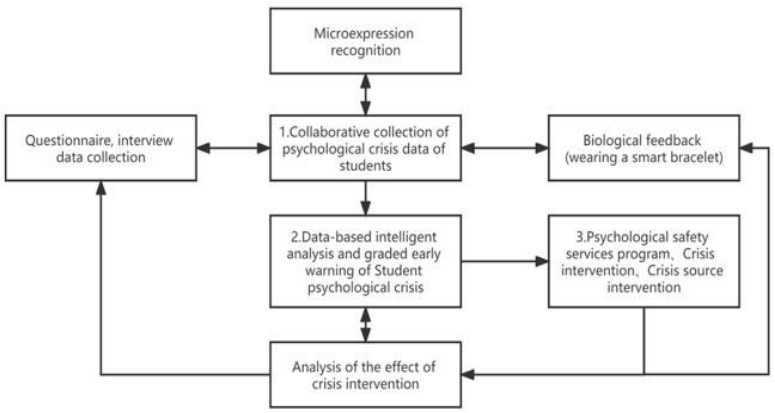

Figure 1. Student mental health monitoring and evaluation system based on artificial intelligence.

- The first step is to collect students' psychological crisis data in three different ways.
- The second step is to make big data analysis based on students' comprehensive psychological crisis data to complete intelligent classification of psychological crisis degree and warning level.
- The third step, according to the psychological security service plan to implement the students' crisis intervention or crisis source intervention.
- The fourth step is to analyze the effectiveness of crisis intervention through big data algorithm.

In order to realize the artificial intelligence analysis of students' mental health data, the classified data obtained through collaborative collection can be uniformly input into intelligent psychological equipment, and the artificial intelligence algorithm can be constantly optimized.

3.2.3 The application of data mining algorithm

Some researchers designed an intelligent assessment method of students' mental health based on big data algorithm [25].

- Firstly, the intelligent evaluation index system of students' mental health was constructed, and the data of the intelligent evaluation index of students' mental health was collected and preprocessed.
- Then, the coefficient of variation method is used to determine the weight of each index of mental health assessment of students. The weight describes the contribution of each index to the results of mental health intelligent assessment of students.
- Finally, the grey clustering algorithm was used to establish the intelligent evaluation model of students' mental health, and the test samples were tested to

output the intelligent evaluation results of students' mental health.

Its process and principle are shown in Figure 2.

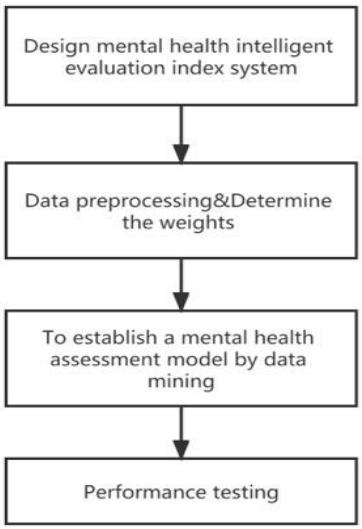

Figure 2: Principle of Intelligent Mental Health Assessment of students based on data Mining

Among the process, the intelligent evaluation index system of students' mental health is shown in Figure 3.

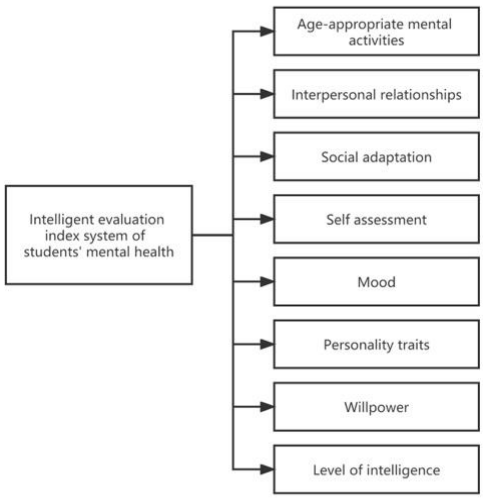

Figure 3 Mental health intelligent evaluation index system.

Under the guidance of artificial intelligence multidimensional indicators, schools will be able to dynamically monitor students' mental health in different scenarios under natural conditions. At the same time, with the help of processing and analysis technology of big data technology, students with psychological problems can be screened out in a timely and efficient manner, and the screening results can be quickly sent to the person in charge for follow-up treatment, and psychological crisis intervention can be carried out in time.

3.2.4 Comprehensive technical solution

Besides, the Centre for Brain and Mind (BMC) at the University of Sydney has developed an innovative digital health solution [7] which is data-driven and analyzes the results of multi-dimensional mental health testing conducted under the guidance of experts. Professional and coordinated mental health teams at all levels provide highly personalized hierarchical intervention mental health services for adolescents, and establish a psychological crisis escalation warning mechanism.

These diversified and integrated digital projects have effectively alleviated the resource problems of psychological services for children and adolescents during the epidemic, provided us with new intervention paths, and provided inspiration for further improving psychological services for children and adolescents.

3.3 *Pros and cons of digital mental health services for children and adolescents*

For children and adolescents growing up in the age of network information, their adaptability to network means provides potential advantages for digital psychological intervention [12]. However, it still has some limitations.

3.3.1 The advantages of digital mental health service

For children and adolescents growing up in the age of network information, their adaptability to network means provides potential advantages for digital psychological intervention [7].

That is, compared with traditional mental health services, digital psychological services have many unique advantages.

At first, the most important feature in the context of the epidemic is that it is not limited by time, space and other factors.

Secondly, intelligent health monitoring measures can record all physiological indicators of adolescent patients in real time.

Thirdly, the realization of artificial intelligence, digital mining algorithm and other technologies promotes the progress and perfection of adolescent mental health service system. Artificial intelligence has been shown to serve as a supplementary or intermediate support system for psychological service resources [10]. The application of big data algorithm technology to dementia, schizophrenia, depression and other diseases will be of

great help to clinical decision-making, diagnosis and prediction and improve the quality of life of patients

3.3.2 The defects of digital mental health service

Although the digital psychological services and intervention measures for children and adolescents have many advantages and have made some achievements, there are still many problems.

Ethical issues need to be considered first. Teenagers' information collected through smart devices and programs faces the question of whether their privacy can be reasonably protected. At the same time, the conversational services provided by artificial intelligence and other technologies may cause empathy among teenagers, which will also cause some ethical hidden dangers.

Secondly, as for the effectiveness of digital intervention services, although some studies have shown positive effects, due to the attractiveness of digital intervention measures [20], evaluation methods and other factors, more large-scale clinical intervention studies and more perfect evaluation methods are needed to prove it.

Finally, for the new telemedicine method, the original psychotherapy theory and treatment technology may have adaptation problems, which can not play the due effect perfectly.

4 RESULTS & DISCUSSION

The above research and results show that technologies such as network technology, artificial intelligence, and digital algorithms have been applied to all aspects of adolescent psychological services, and a systematic development trend has also emerged. The application of these technologies has its advantages and is also limited by various aspects.

4.1 *The composition of digital services for children and adolescents' mental health.*

Under the background of COVID-19, the dilemma of mental health services for children and adolescents always exists. However, through the study of digital psychological services, we can use a positive attitude to alleviate its negative impact in practice.

Based on these studies and practices, this study summarizes and forms the model of digital services for children and adolescents' mental health.

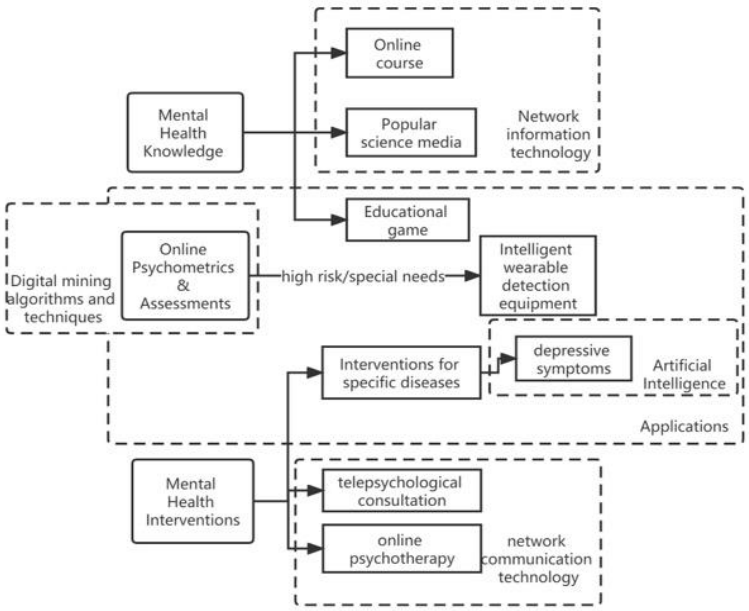

Figure 4: The model of digital services for children and adolescents' mental health.

The model respectively from the three pathways of child and adolescent mental health service, every link lists the specific content, and use the words in the box dashed line shows that the content can use technology, including network and multimedia technology, application, network communication technology, the technology of big data algorithm algorithms, artificial intelligence technology, etc.

The popularization of mental health knowledge can run through the whole process of adolescent mental health services. The Internet and multimedia technology make it easy to provide learning resources such as cloud classroom, popular science social media and e-books to those who need them. This knowledge is not only available to children and adolescents with psychological needs to help them alleviate or even solve their own

problems, but also to their social support systems, such as parents, teachers, relatives, friends and other relevant staff. Mental health education games are also an effective way to learn mental health knowledge [6]. This kind of game will integrate various computer technologies to form a complete game application, and achieve the purpose of spreading mental health knowledge by virtue of the natural attraction of electronic games to teenagers.

Online psychometric and assessment. The application platform for online psychological measurement and evaluation is developed, which can collect data in real time and provide effective reference for psychological evaluation of children and adolescents. When a child is assessed to be at high psychological risk or has other health needs requiring real-time monitoring, the child's condition can be monitored in real time by wearing a smart detection device. At the same time, mental health data can be easily analyzed, compared and established norms through the app. Further analysis of the data using digital mining algorithms helps to provide prognosis and a deeper understanding of mental illness classification [1].

In terms of specific psychological intervention for children and adolescents, there are many kinds of digital technologies applied in different intervention methods. Online psychological counseling with network communication technology is a routine intervention. For the intervention of some specific psychological problems, applications based on artificial intelligence technology are being developed and researched [10], aiming at conversational intervention for children and adolescents with psychological problems.

In conclusion, this study forms a model for the application of digital technology in adolescent mental health services by combing mental health knowledge, online psychological measurement and evaluation, and digital intervention of mental health. The application of these technologies still needs more research and development, and the combination of technical means and mental health services has great development potential.

5 CONCLUSIONS

To sum up, the COVID-19 epidemic will continue to cause mental and psychological problems for a large number of children and adolescents. Facing the limited mental health service resources and the increasing mental health problems of children and adolescents, this study based on their psychological characteristics and needs under the epidemic prevention and control, comprehensively elaborated digital technologies such as network communication technology, artificial intelligence and data mining that have been applied to remote mental health services, and proposed a digital psychological service model for children and adolescents that combines offline and online. This study suggests that such online model should be combined with offline psychological services to form an online and offline mental health service scheme for children and adolescents.

To this, this paper puts forward the following Suggestions:

- Continue to deeply explore the study of psychological service programs based on digital technology, improve the effect of remote mental health services, and improve effective evaluation methods.
- The comprehensive application of the digital technology to solve the problem of mental health.
- Digital mental health service and traditional offline psychological service have their own scientific and limitations, so we should promote the combination of digital technology and offline psychological service.

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