

A Literature Review of the Effects of Virtual Community of Practice on Medical Education in China (2013-2023)

Suyi Yan¹, MA Student;  Zhi Yang², MA Student;  Na Li^{3*}, PhD 

¹The University of Manchester, Manchester, UK

²The University of Melbourne, Melbourne, Australia

³Xi'an Jiaotong-Liverpool University, Suzhou, China

ABSTRACT

Background: Given the rapid development of technologies, virtual community of practice (VCoP) has been employed across various fields, including education. In this context, it is essential to identify the utilization of virtual community of practice in medical education settings in China, particularly its effects on teaching methods and student learning. By understanding the effects of the virtual community of practice on college medical education, we can better evaluate the feasibility of introducing this technology to universities in economically disadvantaged areas. To this end, this study reviewed the literature to identify the potential benefits and challenges of implementing a virtual community of practice in the Chinese context and provide insights into how such an initiative can be effectively designed and implemented.

Methods: To identify the effects of the virtual community of practice on teaching and learning in Chinese medical education settings, we searched multiple databases such as PubMed, Google Scholar, and the University of Manchester Online Library. We focused on peer-reviewed English-language publications on virtual technology and medical education from 2013 to 2023.

Results: In Chinese medical education, traditional face-to-face teaching remains the primary instructional approach. This is understandable, considering that supplying a costly virtual community of practice to each student might be impractical, particularly for universities in economically disadvantaged areas. Nevertheless, the literature reviewed in this study suggests that if the virtual community of practice are employed appropriately, it can significantly enhance teaching by substantially reducing the budget required for constructing realistic medical scenarios.

Conclusion: To effectively promote the virtual community of practice for universities in economically disadvantaged areas, we advocated for establishing a dedicated medical education volunteer association as a form of the virtual community of practice to support medical education, which is enhanced by the virtual community of practice.

Keywords: Medical education, Virtual community of practice, Virtual learning technology, Higher education, China, learning equality, Review

*Corresponding author:

Na Li, PhD;
Xi'an Jiaotong-Liverpool
University, Suzhou, China
Email: na.li@xjtlu.edu.cn

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Introduction

Medical education contributes a lot to medical development. During the past 150 years, medical education trained medical practitioners with specific knowledge, skills, and attitudes (1). In the process of learning, they also have access to theories and technologies in other fields. As these trained physicians enter the medical field, they contribute to advances in other technological fields of medicine for further development (2-4). Meanwhile, because in the period of Covid-19, it is necessary to use transnational collaboration to improve medical health, and the internationalization of medical education has been expanded nowadays (5). Some scholars put forward new pathways in medical education (6), indicating the challenges medical education faces in adjusting its leadership and methods for using technology and digitalization (5).

Medical education has developed in China for hundreds of years since ancient times. However, medical education in China faces numerous challenges, including medical students' inability to apply their knowledge to real-world situations (7). Scholars have recommended multimedia as a potential solution to this issue (7), leading some Chinese universities to incorporate platforms such as Tencent Meetings and WeChat into their classrooms (8, 9). However, medical teachers have expressed concerns that the functions of Tencent Meetings and WeChat in their classrooms are too simple to satisfy their teaching needs (10). Therefore, this study explores the feasibility of a teaching model for medical college education based on a virtual community of practice.

In the medical or healthcare field, Community of Practice (CoP) has been widely used (2-4), which is defined as a group of individuals with similar interests, motivations, and concerns to meet regularly and share ideas (11). Accordingly, a Virtual Community of Practice (VCoP) is one kind of CoP with information and communication technologies, including social networking (12). In other words, VCoP is a group of

individuals with the same interests and concerns who gather together to share ideas, knowledge, and experience through an online medium (13) and a kind of online learning community (14, 15). Due to the connection between VCoP and CoP, the structure of VCoP also consists of three participant groups, the same as CoP: the core, active, and peripheral groups (16).

Until now, VCoPs have been explored widely in the world. Many scholars from developed countries have investigated the feasibility of using VCoP to deal with some issues or improve treatment in a medical and medical-related field. Some have achieved some effective outcomes. In healthcare practice and performance, VCoPs are becoming effective knowledge-exchange tools (17). In sum, these studies focused on the method of using VCoPs in providing opportunities for participants to translate knowledge which has been seen to help bridge the gap between evidence and practice (18); this means that participants have access to increase their scope of knowledge through VCoPs, like the VCoP of general training practice in Australia, which aims to decrease the isolation in profession and structure (19). In other words, these studies indicate that VCoPs in medical and medical-related fields mainly function as learning communities. Most studies in this field have focused on the effect of specific VCoPs in specific fields. For instance, in 2016, the VCoP "clinic" - The Miners' Wellness TeleECHO - was built to educate various groups of professionals to care for miners in pneumoconiosis in the USA (9).

Only now, there is an obvious answer to whether using VCoP in medical education is suitable, so further research is required. This paper aims to make a theoretical contribution to the development of this field by conducting a holistic literature review. This study will focus on medical education in China to mitigate the cultural influence (20). There are three research questions: 1) What are the limitations in Chinese traditional medical education? 2) What are the

benefits and problems of VCoPs in Chinese medical education? and 3) How can VCoP be implemented in Chinese medical education?

Methods

This literature review followed Alexander’s guidance through identification, screening, and eligibility (4).

The Identification Procedure

The research team started the identification procedure in PubMed, Google Scholar, and the University of Manchester Online Library. As to the comprehensiveness of research articles, the keyword research included several keywords: “virtual community of practice”, “medical college”, “medical education”, and “model of instruction”. In keyword searching, the research team found selecting suitable articles to explore medical education difficult. They then examined those articles that included VCoP and issues or improvements in medical and medical-related fields. Meanwhile, the research method took advantage of title research, which means that the title included various terms related to the virtual community of practice and medical education. Moreover, in this research, we used snowball methods to check the citations following each article to find those related to the topic in this study. It can provide definitions for some specific terms.

We completed the last search on the 1st

of January 2024 and retrieved 53 records from the database search. To check the cited references of the eligible articles, we conducted a backward search and found another 17 records. By removing the duplicates of the overall 6 records, we kept the unique records for further screening (Figure 1).

The Screening Procedure

In the second step, the researchers screened the 64 articles by checking their titles and abstracts. The inclusion was: (1) VCoP must be the object which is explored in studies; (2) the content of studies must be in a medical and medical-related field instead of other fields; (3) the research methods in studies need to be controlled trial, and (4) it is necessary to use articles in the last five years. However, while reviewing previous studies, it was difficult to satisfy the third criterion because many articles prefer to use a mixed research method through control trials, surveys, focus groups, etc. After that, the third criterion was modified to include a controlled trial in research methods. After that, to ensure the comprehensiveness of the studies, we modified the last criteria to allow access to articles from recent ten years in addition to selected studies in the recent five years. Articles that provided definitions were excluded from this criterion. At this stage, there was a total of 45 suitable articles left for the next full-text screening.

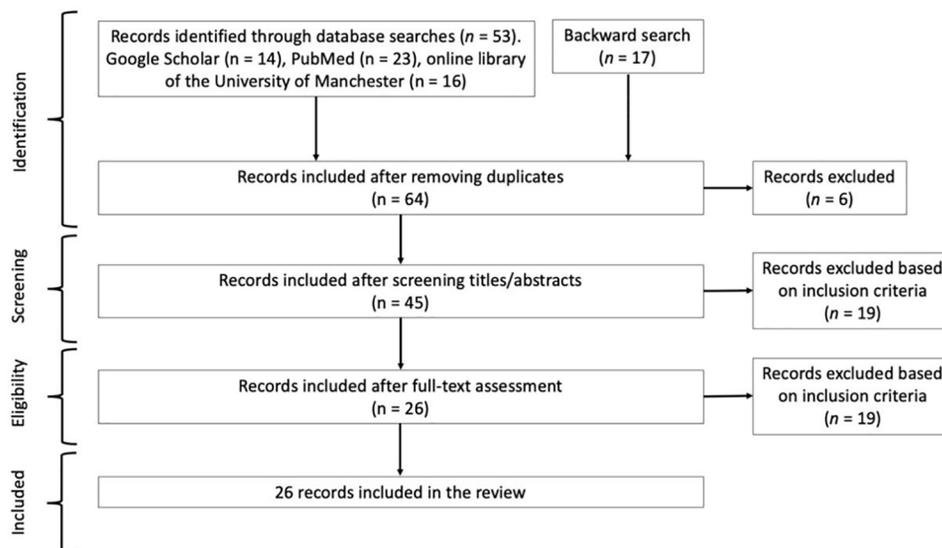


Figure 1: Article inclusion procedure flow chart of the literature review.

The Eligibility Procedure

It was the last stage of screening selected articles to determine which articles were suitable for the study based on the literature review. Researchers downloaded full-text PDF files of these 45 articles. In this process, the content of these articles was classified into several categories: the author, publication time, publication journal, journal rank, research purpose, research questions, and research target. Considering the criteria mentioned in the second stage, articles that did not meet the inclusion criteria were excluded from the dataset. At the same time, the findings and limitations of these articles were recorded as well. Finally, 26 articles were selected as the final review articles for the study.

Article Characteristics

Overall, researchers reviewed these academic articles in the past ten years, most of which were in the recent five years. Most of these articles explored one kind of VCoP function in a specific aspect of the medical and medical-related field. These studies were conducted in different countries and regions using several research methods. The sample size ranged from dozens to hundreds of participants. The participants were mainly medical practitioners and non-medical people, including workers, teachers, managers, etc. In most studies, the research methods used were mixed research strategies, including a controlled trial that classified research participants into two or more groups, asking them to use VCoP and collecting their feedback regularly.

Data Analysis

This study applied a literature-based method to analyze data from review articles. This introduced the reasoning that researchers discovered a confusing finding in examining inductive data and then attempted to explain the collected data to explore the research questions (21). This study collected data about the benefits of VCoPs and medical achievement and the limitations of using

VCoPs in medical education. The process of coding information from the literature review included three steps: initial coding, focused coding, and theoretical coding (21). In the initial coding step, researchers considered the basic information of the selected articles, including the background, research purpose, research questions, research targets, methods, limitations, and findings. Before reading the selected articles, researchers had to create hypotheses based on the abstract to build a brief understanding of the structure. Then, it turned to the second step, focused coding. Researchers focused on more important factors from this basic information to the synthesis of large segments of data (21). In other words, researchers analyzed the articles based on the focused section, including research methods, limitations, and findings. According to this information, we concluded that the data collected from the reviewed articles were the findings from the perspective of theoretical coding.

Results

Chinese Traditional Medical Education

The analysis of the current literature indicated that China's medical education system has undergone numerous reforms over the past 70 years to achieve significant advancements. It is currently recognized as the world's most extensive medical education system (15). Face-to-face courses and hospital training are the primary methods of training medical college students. While the system was previously course-centred, recent years have seen that China has actively promoted competency-based medical education, focusing on student-centred learning to enhance the quality of training. However, even though the scale of Chinese medical education is the largest in the world, several factors exist which negatively influence the quality of Chinese medical education.

The first factor is the expansion of college enrollment, which causes a decline in the quality of medical education (22). In the academic year from 2018 to 2019, there were 286,219 undergraduate students, 81,128

postgraduates, and 14,044 MD students entering medical colleges (15). The medical education faculty and teaching resources still need to satisfy the expansion of the increasing number of students (15). In other words, the number of teachers and teaching resources is yet to keep up with the increase in the number of medical students, making it difficult for medical students to receive timely assistance from teachers in their coursework.

The second factor is geography. On the one hand, due to the unbalanced development of the regions in the economy, the level of medical education in underdeveloped regions is still slower than the expected standards of undergraduate medical education in China (15). It means that the teachers' sources and quality of textbooks in undeveloped regions are lower than those in developed regions. Meanwhile, due to the distance between different provinces, it is unavoidable for the communication among medical teachers to be influenced, further causing inconsistency in medical training, which harms building high-quality and reliable medical systems (15).

The third factor is its inflexibility. In the process of college medical education, medical schools have an inflexible teaching model (15). The primary pedagogic method in Chinese medical college education is teacher-controlled didactic lecturing, a passive teaching model. Students listen to teachers' imparting instead of thinking and exploring actively, which is viewed as an ineffective method (22). It is more evident in the classes held during the Covid-19 pandemic when teachers impart knowledge based on e-learning classes through Zoom, WeChat, and other online video apps. Most students preferred to turn off their microphones and cameras in classes, increasing teachers' difficulty in receiving feedback. Except for the teaching model, another issue displaying inflexibility is in the course contents. Biomedicine, medical technology, and clinical practice are often emphasized in medical college education (15), while other medical knowledge is neglected.

These factors mentioned above are social reasons. Nevertheless, given that Chinese

medical education is a state-led system (23), the government plays an important role. The coordination mechanism between the education sector (supplier) and the health sector (demander) could be better (15), indicating that the cooperation between the education department and the medical department cannot satisfy the requirement of present China.

VCoPs in Medicine

Studies related to VCoPs in the past mainly focused on their function in specific medical issues. This study found some common points based on the literature review of the selected articles. VCoPs are viewed as learning communities with some factors; for example, there is an online space to share ideas and knowledge, participants interact with each other, and isolation is avoided (24). The participants of VCoPs are classified into the core, active, and peripheral groups (15). Due to the multiple characteristics of participants, their performance reflects the participation rate and the level of satisfaction for VCoP. Therefore, the benefits and problems of VCoPs are shown in the analysis.

Benefits of VCoPs: VCoP has high flexibility, which is one of the most important benefits. VCoP offers opportunities for participants to interact through forums and inactive video-conferencing sessions, making it easier to interact with different people (25). Its teaching and learning model allows the participants to attend classes at home and at their convenience rather than at a fixed time and place (26). Compared to medical college education in China based on face-to-face classes and e-learning through online video apps, it is evident that VCoP can provide more flexibility in time and place for people to learn. It is beneficial for the participants to learn from other experiences. At the same time, VCoPs occur at a central location in searching for information, which provides more accessible methods to identify materials and knowledge with a specific topic, decreasing users' time to search for resources (7) and then further providing more time for

users to learn and improve themselves.

Another benefit is that VCoP can provide comprehensive knowledge, referring to different fields which participants need in their learning or studies but have no access to. Studies in the past indicate that VCoP provides valuable materials for participants, defined as the latest knowledge and information (26). In Chinese medical education, isolation in medical knowledge appears widely due to limitations in the course content. It has been proven that VCoP allows interprofessional learning activities and collaboration among participants with different majorities (27). Meanwhile, VCoP provides the participants with tutorials and demonstration videos to manage independently (26). Barnett reported that the resources are most valued by doctors-in-training and tutors in VCoPs (28). Therefore, many people learn through VCoPs online learning and learning activities (29).

Problems in VCoPs: In addition to benefits, problems are unavoidable in VCoPs as well. The problems with which VCoPs are faced generally consist of the participants and technology. The first is related to participants. In a learning community, participants in VCoP can be classified into the core, active, and peripheral groups (30). These groups represent multiple roles necessary for vCoP success (31). Among multiple roles, the sense of belonging often plays an essential role in communities, ensuring that the community can operate by connecting the participants. It indicates that VCoPs need to consider the sense of belonging as well. Participants' trust in the specific platform determines their sense of belonging. However, after reviewing these selected articles in medical fields, it is hard to build a trusting relationship between VCoP users and the platforms. The main reason is that the online environment in VCoPs makes it hard to figure out other participants' identities through facial expressions and body language (32). It is better to build trust through face-to-face contact (33).

Participants' identities have an impact on their attitudes to VCoP platform as well. These individuals who begin their careers are more

likely to accept VCoP online forums than those who have worked for a long time (34).

The second is the requirement for technology. In the study of e-MPODERA VCoP, the researchers found that it is pretty hard for the participants to use VCoP in their workplaces because the computers and other equipment are outdated, making it impossible to access the VCoP platform (26). Or there is another situation in which the organization of the forums needs to be in order, causing it to be challenging to search for information (17). If it is easier for the participants to search for helpful information or open the website, they are more likely to feel disappointed (35), further influencing their attitudes toward VCoPs. On the other hand, it is difficult to find a suitable place and time to use VCoPs in a meaningful way (26). Even though VCoPs ensure that participants can use them at home, it could take much time for people to learn how to use them (26). It indicates that users must explore suitable methods to balance work and learning time through VCoPs.

Meanwhile, there is an exciting point in technology. Participants responded that it is inconvenient to remember their username and password in the platforms, limiting access to the VCoP platform (26). If participants need to remember this information, platforms need a satisfying method to help retrieve them. In general, VCoPs need a technological infrastructure supporting the online operation, which requires a more detailed design than traditional education, which takes advantage of teachers' imparting (26).

Discussion

The Usage Method of VCoPs in Chinese Medical College Education

A review of current literature shows that the strengths of VCoPs in class content are beneficial to address the problems in expanding medical school enrollment and the inflexibility of medical courses in Chinese traditional medical college education. With the development of Chinese society, the number of medical college students maintained an upward trend in the following years based on

the data from Wang's study (15). It is unlikely to solve such a problem by restricting medical school enrollment. Under such circumstances, finding another method to assist medical education is necessary. For the expansion, which causes the decline in education quality due to an imbalance between the number of medical students and that of medical teachers, it is beneficial to use VCoPs as a class aid which helps students reorganize acquired knowledge and supplement extra professional knowledge (36).

Then, it is helpful for VCoPs to decrease the imbalanced development in geography. Previous research has proven that VCoPs are a valuable tool for solving the problems caused by geographical boundaries (37). This study defines the VCoP as a virtual learning community based on online learning platforms that provide meaningful learning opportunities (38). In this aspect, VCoPs guarantee that the teaching and learning process can operate without considering the time and place. Besides geographical issues, knowledge isolation can be avoided by VCoPs as well. As mentioned in the section on benefits, VCoPs include various types of knowledge other than the course content, indicating that it is helpful for students to widen their scope of knowledge and think about knowledge from different perspectives of subjects.

Meanwhile, in traditional medical college education, teachers take advantage of the passive teaching style; teachers impart in classes, and students listen without interaction. After classes, there is no accessible method for college students to interact with their teachers in China, further hitting their motivation to learn actively. VCoPs provide forums after classes where students can share ideas and put forward questions, and teachers can answer questions and show their experience. It is effective in active learning for students.

The Barriers to Implementing VCoPs in Chinese Medical College Education

The analysis of the connection between the strengths of VCoPs and traditional medical

education problems in China proves that using VCoPs to teach medical college education is feasible. However, it is unavoidable to have some barriers influence implementation. Only now, there is a specific platform provided for medical education. Even though VCoPs have been widely researched and explored abroad, it is still a start in China or a kind of advanced technology never used in medical education. At the same time, considering many medical students and that most college students live in schools, colleges cannot provide students with enough equipment to satisfy the technology requirement. Due to cultural and social background differences, VCoPs abroad mismatch Chinese specific requirements in medical college education, so creating a specific VCoP for medical education is necessary. However, it is still a long way to go.

Regarding the sense of belonging or the trust of VCoPs, facial expressions and body language influence the section of VCoP problems. VCoPs offer videos and live-streaming classes for students to learn, but there is no access for teachers to observe these factors of students. Therefore, it only depends on the students themselves. Meanwhile, according to Chinese students' performance in online courses during the Covid-19 pandemic, most students closed their cameras and microphones, further increasing the difficulty. Nevertheless, the most challenging issue is motivating students to participate in learning activities in VCoPs. According to the 90-9-1 rule for participation inequality in social media and online communities (2006), which collected the participants' responses to VCoPs' activities, it is surprising that only ten per cent of the participants were willing to actively in these learning activities. It is common for users to keep silent in using VCoPs, just searching for information and reading (39). Still, it is impossible to determine whether users actively participate (17).

Limitations and Suggestions

Unlike most previous research, which focuses on one specific aspect of VCoPs

based on their research objective, one of the strengths of this study is that it overviews research VCoPs in medical fields as comprehensively as possible. This systemic review provides a comprehensive, unbiased review of many relevant types of research in a single document (40). It is adequate to ensure accurate analysis of VCoP functions in medicine, which resulted from different research objectives. In other words, a systemic review is a method which minimizes the risk of error and bias in research (41). Based on the systemic review, this paper overviews the situation of Chinese medical education and VCoPs in medicine to provide evidence for the feasibility of implementing VCoPs.

At the same time, we conducted a literature review to explore previous research through several steps: identification, screening, and eligibility, making searching for relevant articles easier. Reviewing systemically addresses a particular question or issue of importance to the field (41), and some articles, books, reports, and websites in systemic reviewing guides for authors to search (42).

There are also some limitations in this paper. On the one hand, even though this paper uses systemic review, it still has the limitation of other literature review articles; that is, the data analyzed come from previous research of other scholars, lacking relevance on the subject of this paper. Meanwhile, the accuracy of most previous research is limited by its sample size and fixed region. However, due to the different levels of participants in competencies, such as sophistication, commitment, expertise, experience, and collaboration (9, 28), it is hard to come to a general conclusion with a sample size ranging from 50 to 150 people. The fixed regions influence the accuracy of the research, just like the Miners' Wellness TeleECHO, which was limited to specific areas in the USA and did not focus on the whole of America to receive a general conclusion (9). In systemic review, there is no way to get new information not mentioned before.

On the other hand, a review article cannot avoid such a problem that has widely appeared

in previous research: the trust problem. This problem is shown in two aspects. One is that the participants have their own biases. Because the research objective is VCoP, a kind of practice online, participants are more likely to be those who are willing to accept it (43), bringing inaccurate conclusions. This paper is limited by the inaccurate findings from these reviewed articles because of bias. Another aspect is technology. Some scholars pointed out that technology restricts the usage of VCoPs (26). In previous research, many scholars pointed out that the online environment makes it hard to build a trusting relationship (17, 26, 28). In the review, the authors can realize the limitation but need help finding solutions from previous studies.

The final limitation of this paper is that it only focused on articles published in Google Scholar, PubMed, and the online library of the University of Manchester databases, excluding the China National Knowledge Infrastructure (CNKI) database, so more detailed information about the Chinese situation is overlooked, which is possible to bring potential barriers in implementing VCoPs in Chinese medical education.

Conclusion

Although many studies have focused on using the virtual community of practice in medical education, particularly in America, only some studies have explored its feasibility in the Chinese medical education context. In this context, to fill a gap in the field of medical education research in China, this article utilizes a literature review to identify the potential benefits and challenges of implementing a virtual community of practice in the Chinese context and to provide insights into how such an initiative can be designed and implemented effectively. The scope of the present review spanned the 2013-2023 period. The existing literature indicates that if the virtual community of practice is applied correctly, it can positively teach students better. For example, virtual communities of practice can provide opportunities for meaningful student-faculty interaction

through forums and video conferencing and allow medical students to hone their skills operating on virtual patients. In this way, virtual communities of practice are likely to reduce the budget for building realistic scenarios significantly.

Of course, it is necessary to recognize the challenges and barriers to implementing a virtual community of practice, including technological barriers, privacy concerns, and the need for student training and support. For instance, whenever difficulties are encountered, students need to communicate with instructors or peers repeatedly, and sometimes comprehension of meaning requires facial expressions and body language. However, in virtual scenarios, medical students do not necessarily recognize the instructor's medical gestures, such as head nods, shoulder shrugs, and shakes. In this context, virtual devices have the potential to be rigid, narrow, and indifferent to the problem of students' inability to recognize medical gestures. Thus, we believe that replacing traditional face-to-face teaching may hinder rather than support medical students' learning.

For our third research question, given the high cost of implementing virtual community of practices and the expensive equipment, the idea of schools providing technical support for all students might be impractical, especially those in less economically developed regions. However, the high cost of virtual devices is only a problem with a solution. For example, we could call on Chinese medical education researchers to establish a particular Chinese medical education volunteer association (non-governmental organization), which might include virtual equipment suppliers, top medical education experts, and student teams as members. The organization can raise money through financial contributions and tax-efficient donations if registered as a charity. The proceeds can help pay for equipment (provided free access to students), teacher training fees, and scholarships.

Given the space limitation, this review only focused on peer-reviewed articles

published from PubMed, Google Scholar, and the Online Library of the University of Manchester databases rather than including the China National Knowledge Infrastructure (CNKI) database. A potential consequence of not including articles from the CNKI database is that we might overlook unknown barriers to implementing virtual communities of practice in the Chinese medical education context. Despite its limitations, this study has undoubtedly increased our understanding of the advantages and disadvantages of implementing virtual communities of practice. Future research is recommended to use empirical data to design a formative or summative assessment tool to help faculty measure medical students' learning progress. The tool will include assessment criteria, level maps, and assessment items.

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Authors' Contribution

YS performed a Literature review, methodology, data analysis, writing-original draft, writing review, and editing; YZ performed validation, writing-original draft, writing-review, and editing; Li N also performed supervision, funding acquisition, writing-review and editing, project administration.

Conflict of Interest: None declared.

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