META-ANALYSIS

An Analysis of Infection Prevention and Control Practices in Designated Hospitals that Treat COVID-19: A Systematic Review and Meta-Analysis

Yi Zhu, MD; Xia Zhao, MD; Ying Guo, BD; Wei Li, BD; Yingying Pan, BD; Jianwen Zhuang, BD; Jun Zhou, MD; Yurong Huang, MD

ABSTRACT

Objective • The present investigation aims to conduct a comprehensive examination of the infection prevention and control efforts in hospitals of Xinjiang Production and Construction Corps designated for COVID-19 treatment.

Methods • By searching the Cochrane Library, PubMed, Embase, Chinese Academic Journal, Full Text Database, Chinese Biomedical Literature Database (CBM), VIP Chinese Scientific, Web of Science, Chinese National Knowledge Infrastructure (CNKI), Wanfang Database (CECDB), and using Review Manager 5.2 software, the quality assessment, data extraction, and meta-analysis were carried out for the included literature.

Results • Between both the experimental and the control groups, there was a statistically significant difference in the level of public awareness of COVID-19 prevention and control [OR = 1.61, 95% confidence interval (CI) (1.31, 1.99), $P < .00001$, $I^2 = 32\%$, $Z = 4$]; public concern about COVID-19 prevention and control [OR = 1.56, 95% CI (1.28, 1.90), $P < .0001$, $I^2 = 0\%$, $Z = 4.35$]; public anxiety on COVID-19 prevention and control [OR = 1.67, 95% CI (1.37, 2.03), $P < .00001$, $I^2 = 32\%$, $Z = 5.13$].

Conclusion • Chinese prophylaxis and controlling measures for COVID-19 are mainly to protect vulnerable populations, cut off transmission routes, and control the source of infection. Therefore, we must also do our best to prevent and control novel coronavirus pneumonia to protect our health and reduce the burden on our country. (*Altern Ther Health Med.* 2023;29(8):699-703).

Yi Zhu, MD, Department of Office of hospital infection management and control; **Xia Zhao**, MD, Department of Medical Management; **Ying Guo**, BD, Department of Administration; **Wei Li**, BD, Department of Ministry of Economic Operations; **Yingying Pan**, BD, Department of Office of Hospital Infection Management and Control; **Jianwen Zhuang**, BD, Department of Office of Hospital Infection Management and Control; **Jun Zhou**, MD, Department of Medical Management; **Yurong Huang**, MD, Department of Respiratory and Critical Care Medicine; The Hospital of Xinjiang Production and Construction Corps, Urumqi, Xinjiang.

Corresponding author: Yurong Huang, MD
E-mail: hyr0919@sina.com

INTRODUCTION

Emerging coronavirus pneumonia is a dangerous infection that is spreading quickly.[1-3] Nosocomial infection prevention and control procedures must be put into place to respond to outbreaks, which will effectively prevent nosocomial transmission in the foreseeable.[4] Novel coronavirus outbreak is highly uncertain. Although the spread of the epidemic has been brought under control to a certain extent and the prevention and control situation is getting better, the experience in the fight against the epidemic in the previous period can be summarized.[5] It is of great significance, to sum up, the experience of crisis management and risk management and accumulated valuable wealth for improving the governance system and enhancing the governance capacity.[6]

Use of hardware facilities, especially after the negative pressure ward is put into use, it is necessary to strictly implement the management process of the ward area for new emerging infectious diseases, to effectively cope with the quality of emergency treatment for new emerging infectious diseases, save human effort, material resources, time costs, and reduce consumption. The room is quiet and relatively independent, which is convenient for patients to arrive and goods to be transferred. The ward is set up temporarily, but the management of the department is constantly improved. In the bedside practice, we constantly summarize and discuss the specific situation, supervise and remind each other in multiple shifts, and repeatedly discuss cases with the expert group during the diagnosis and treatment. This provides a strong assurance for bedside diagnosis, treatment, and infection prevention and control in hospitals.[7-9]

The relevant procedures are constantly adjusted following the National protection guidelines and the wearing of BWT-B5 bioprotective suits and layer 3 surgical gloves is eliminated.

Figure 1. Literature Screening Flow Chart

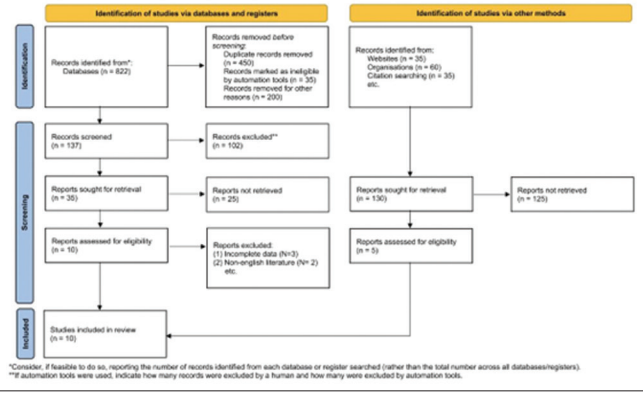
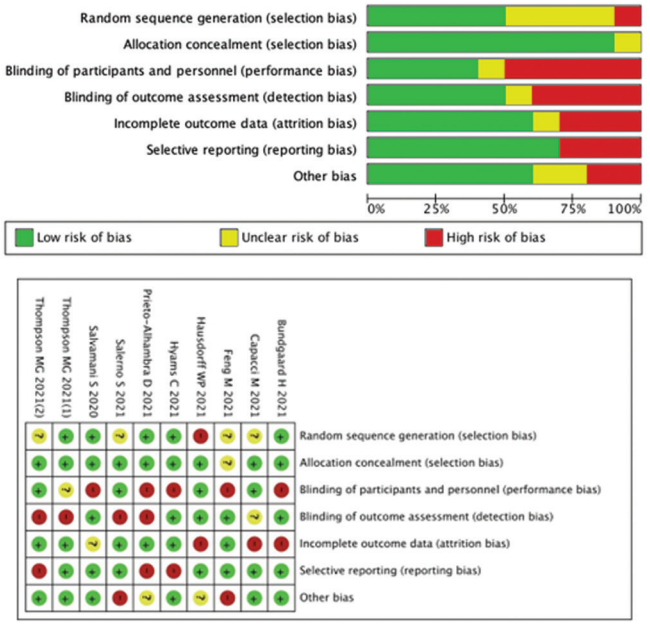


Figure 2. Chart for Rating the Quality of Literature and an Overview of Bias Risk



Four "positive" words reach the limit to reduce the waste of medical protective equipment and ensure the protection function. Because preventing nosocomial cross-infection in new coronavirus pneumonia carries several unknown dangers, standardized procedures will guide the reduction of infection among healthcare workers and the standardized management of similar diseases in the future.[10]

The transmission of the COVID-19 virus in and out of wards, hospitals, between doctors and patients, and among medical staff has been avoided, and zero infection has been achieved among the receiving medical staff. The number of both medical staff and patients included in the study is insufficient. Therefore, this process may be in work and needs to be further improved and adjusted according to the actual situation.

MATERIALS AND METHODS

Strategy of Search

Cochrane Library, Web of Science, CBM, CQVIP, & Wanfang, PubMed, Embase, and CNKI among other databases and affiliated research organizations, were searched for this study. Subject terms and free words, such as "COVID-19," "Nosocomial infection," "Prevention and control," and associated names, were retrieved. This study looked at both Chinese and English literature to prevent bias brought on by linguistic restrictions. Relevant references provided in the paper and conference abstracts obtained throughout the search were tracked down to avoid omitting pertinent studies (Figure 1).

Collection and collation of data

In the whole process of literature screening, NoteExpress software and EndNote X9 software were used to manage the retrieved literature for Chinese literature and English literature respectively, and the flow chart of the whole literature was drawn for inclusion and discharge. In the preliminary screening of literature, a set of screening procedures and instructions were developed. The software was used to detect and exclude duplicate literature automatically. The literature was then evaluated independently and concurrently by two people using the following inclusion and exclusion criteria. After completion, the inconsistent literature was checked. For articles with inconsistent opinions, the judgment was made after mutual consultation.

Criteria for Inclusion

(1) Studies related to asymptomatic INFECTION of COVID-19; (2) Studies providing information related to age, sex, viral RNA shedding time, and viral load.

Exclusion criteria

(1) The research object is a special population; (2) the definition does not conform; (3) duplicate literature; (4) literature in languages other than English and Chinese.

Literature quality evaluation

To assess the caliber of the literature utilized in the meta-analysis, two researchers employed the Agency for Healthcare Research and Quality (AHRQ) Quality rating scales. A third researcher checked and discussed the differences and reached an agreement. The AHRQ scale consists of 11 items. One point is scored for "Yes", and zero point is scored for "No" or "Unclear". For example, a total score of 0 to 3 indicates low quality, 4 to 7 indicates medium quality, and 8 to 11 indicates good quality, and thus reliability.

Bias analysis

I^2 statistics were used to measure study heterogeneity, with 25%, 50%, and 75% representing low, medium, and high levels of heterogeneity, respectively. If I^2 was greater than 50 percent and P was greater than 0.1 among research using fixed effect models, and if I^2 was greater than 50 percent and P was greater than 0.1 from chi-square analysis, then meta-analysis using random effects models was used to identify potential sources of heterogeneity in the study. To determine if the pooled effect values were stable and dependable, the sensitivity analysis gradually removed each piece of the contained literature (Figures 2 and 3).

Statistical analysis

Review Manager 5.2 software (Cochrane Information Management System [IMS]), given by the Cochrane Collaboration Center, was used for statistical analysis, and the Risk ratio of dichotic variables was used. In the meta-analysis, the statistics for analyzing the efficacy and side effects were the RR and the 95% CI (Confidence interval, 95% CI). Chi-square (χ^2) test ($P < .05$ as the test level) and the Mann–Whitney U test (expressed by Z value) were used to test the hypothesis. When $P < .05$, a difference is deemed to be statistically significant. The results of the hypothesis test are listed in the forest map. Heterogeneity was analyzed by χ^2 test. $P < .10$, r = 25, 50, and 75 percent were regarded as low, medium, and high levels of heterogeneity, respectively, and publication bias was examined using an inverted funnel plot.

RESULT

Literature retrieval results and included research characteristics

Searches were conducted in the following databases: Cochrane, CBM, CNKI, CECDB, PubMed, Web of Science, Embase, and CQVIP. From the initial screening, literature sources were obtained. By reviewing the titles and abstracts, repeated publications were eliminated, leaving 19 literature studies. To avoid literature omission, references to relevant literature were searched, 19 full papers were evaluated, and reports of the same clinical trial and literature incompatible with the subject of this research were removed. Finally, the study consisted of 10 studies.[11-20] Two evaluators independently completed all the retrieval and screening procedures, and any divergent views were reconciled through internal discussion (Table 1).

Search results

Based on the search strategy, 952 studies were identified, 822 studies were separately retrieved from the database, and 130 studies were obtained from other sources and were considered for inclusion in this study summary. After excluding 450 duplicate studies, 452 studies were scanned according to abstract and title. Then, a full-text evaluation was performed on 15 articles. After full-text evaluation, 5 records were excluded. Finally, this meta-analysis included 10 studies.

Educating the public about preventing and controlling COVID-19

The heterogeneity test of the 10 RCTs literature incorporated in the awareness creation of COVID-19 prophylaxis and management analysis revealed that the heterogeneity of the eligible papers was minimal, allowing for the execution of a meta-analysis with fixed models. The results of the meta-analysis revealed that there was a statistical difference between the experimental group and the control group in terms of public awareness of COVID-19 prevention and control [OR = 1.61, 95% CI (1.31, 1.99), $P < .00001$, $I^2 = 32\%$, $Z = 4.45$]. This was because the rhombus plot and vertical line did not intersect in the forest map of awareness creation for COVID-19 prevention and control for the 4 included literature.

Figure 3. A-B: Literature Publishing Bias Plot

A **B**

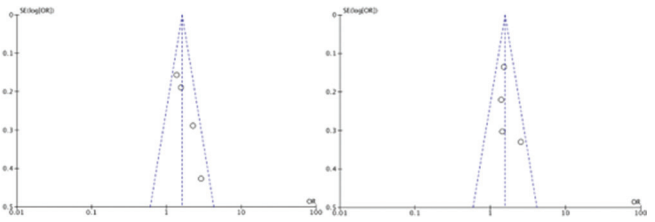
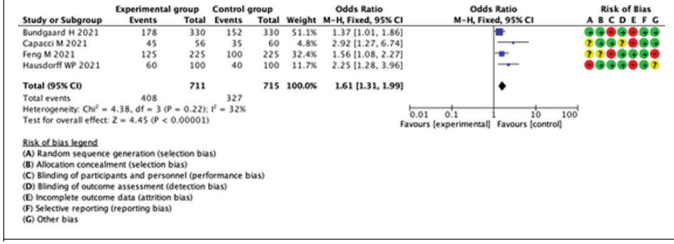


Table 1. Ten Literature Articles Used in Our Analysis and Their Basic Clinical Characteristics

Study	Age	Gender (Man)	Experimental group	Control group	NOS score
Thompson MG 2021[11]	55.71 ± 1.2	41.25%	124/204	80/204	7
Bundgaard H 2021[12]	57.65 ± 3.4	59.12%	178/330	152/330	9
Thompson MG 2021[13]	43.12 ± 4.5	45.72%	121/221	100/221	8
Hyams C 2021[14]	47.15 ± 4.5	44.12%	246/446	200/446	8
Capacci M 2021[15]	42.85 ± 8.4	51.89%	45/56	35/60	8
Hausdorff WP 2021[16]	44.36 ± 1.2	53.45%	60/100	40/100	7
Salerno S 2021[17]	54.36 ± 1.2	56.35%	90/166	76/166	8
Salvamani S 2020[18]	34.45 ± 1.5	62.45%	48/78	30/78	8
Prieto-Alhambra D 2021[19]	57.35 ± 1.2	55.66%	48/88	40/88	7
Feng M 2021[20]	44.36 ± 1.4	58.84%	125/225	100/225	8

Abbreviations: NOS: The Newcastle-Ottawa Scale

Figure 4. Meta-Analysis of Public Awareness of COVID-19 Prevention and Control



Public anxiety on the prevention and management of COVID-19

The heterogeneity test of the 10 RCTs included in the concern about COVID-19 prophylaxis and containment analysis revealed that the heterogeneity of the studies reviewed was low, allowing for the execution of a meta-analysis with a fixed model. Upon analysis, it was found that the rhombus plot and vertical line did not intersect in the forest map of public concern about COVID-19 prevention and control for the four included literature. As a result, there was a statistically significant difference between the experimental group and the control group when comparing public concern about COVID-19 prevention and control [OR = 1.56, 95% CI (1.28, 1.90), $P < .0001$] $I^2 = 0\%$, $Z = 4.35$].

Public anxiety on COVID-19 prevention and control

The heterogeneity test of the 10 RCTs included in the public concern about COVID-19 prevention and control analysis revealed that the heterogeneity of the studies reviewed was minimal, allowing for the execution of a meta-analysis with a fixed model. The results of the meta-analysis showed

Figure 5. Meta-Analysis of Public Concern About COVID-19 Prevention and Control

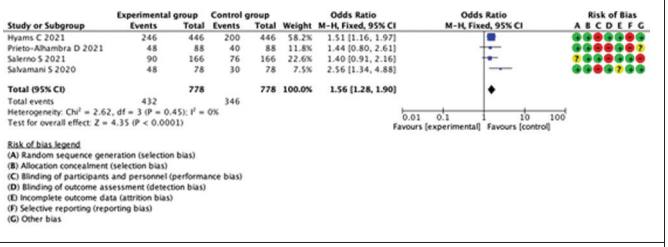
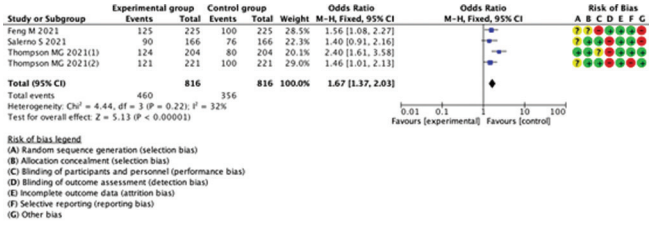


Figure 6. Public Angst Over COVID-19 Prevention and Control: A Meta-Analysis



that there was a statistical difference between the experimental group and the control group in the comparison of public anxiety on COVID-19 prevention and control [OR = 1.67, 95% CI (1.37, 2.03), $P < .00001$, $I^2 = 32\%$, $Z = 5.13$]. This was because the rhombus plot and vertical line did not intersect in the forest map of public anxiety on COVID-19 prevention and management for the 4 included works of literature.

DISCUSSION

Travel restrictions, designated isolation of sick individuals, and home isolation are some of the general strategies to stop the spread of COVID-19.[21-24] This review analysis found that asymptomatic infections were majorly reported in younger population, had a shorter viral duration, and had a lower viral load than asymptomatic infections.[25] For young asymptomatic patients with lower viral load, the shorter duration of the virus mechanism is unclear, it may be associated with young people's immunity. Possibly in young people with strong immunity, the virus is cleared soon after its invasion by the body's non-specific immune system and hence the inflammatory reaction is weak with low levels of virus replication.[26] On the contrary, the elderly population has weak immunity and is more prone to clinical symptoms.[27]

The number of COVID-19 cases has escalated since the first SARS-CoV2 pneumonia patient was discovered in Wuhan, Hubei Province, in mid-December 2019. In less than two months, COVID-19 has swept through Hubei and spread to 37 other countries overseas.[28] Most COVID-19 sufferers experience shortness of breath one week after the start of their illness, while a small proportion of participants will experience upper respiratory symptoms like nasal congestion and runny nose. Severe and critical patients may experience symptoms ranging from mild to reduced fever as the illness advances, while some may experience no substantial pyrexia at all.[29] Some individuals experience minimal clinical symptoms during the early stages of the illness without a temperature, and they often recover within a week. After symptomatic therapy, the majority of patients have a favorable prognosis, while only a few patients develop critical conditions or even die.[30-32] Cutting off the route of transmission, isolating suspected cases immediately, and carrying out infection control according to standard precautionary principles are the key infection control strategies for COVID-19.[33]

This study still has some limitations: in the process of data extraction, part of the data is obtained by the formula or image transformation, which could be biased in its selection. Furthermore, the included literature has poor quality and was highly heterogeneous. Despite being used, in the random effect model, some deviations were still inevitable. Furthermore, there was strong invisibility of clinical symptoms in asymptomatic people in the early stage of the epidemic and asymptomatic case reports related to big data are lacking.[34]

Asymptomatic infections are relatively common in young and highly active individuals. They have a low viral load and the virus begins to excrete before the onset of the initial symptoms. There is evidence that the COVID-19 outbreak is largely a result of asymptomatic transmission.[35] We must acknowledge the important role of community-level medical and health institutions in preventing the epidemic, expanding epidemiological screening, treating patients, enforcing strict quarantine management, conducting regular sexual publicity and education, and providing people with necessary psychological support. To further understand the role of asymptomatic transmission in the COVID-19 outbreak and to establish a solid scientific foundation for the prevention and management of similar outbreaks in the future, extensive epidemiological research is required.

The new crown pneumonia epidemic will not only lead to individual body dysfunction, and endanger life and health, but also bring huge challenges to economic development, political civilization, and public health governance, and also have a strong impact on the psychological well-being of people. At the same time, due to the sudden outbreak of the epidemic, little medical knowledge about the new crown pneumonia virus, untimely disclosure of epidemic-related information, and shortage of epidemic prevention materials, many people will experience negative emotions such as upset, irritability, sadness, pain, and anxiety to varying degrees. Therefore, when dealing with public health emergencies, we should not only pay attention to material supply and medical security, but also take certain precautions and diversions to the potential psychological risks of people, to avoid people's anxiety, pain, depression, mental breakdown, and even anti-social thoughts, etc., that are not conducive to social stability.

A total of 10 literature articles were included in this study, including 2283 patients in the experimental group and 853 in the control group, i.e., a total of 3136 patients. All studies included in this meta-analysis were published in 2020 and 2021. Among them, Thompson MG published two studies on infection prevention and control practices in designated hospitals that treated COVID-19 in 2021, both of which are included in this study. The age of the patients mainly ranged from 34.45 ± 1.5 to

57.65 ± 3.4 years. The ratio of males and females was relatively balanced, with the proportion of male patients ranging from 41.25% to 62.45% across studies. Meta-analysis showed that patients who received infection prevention and control measures in designated hospitals that treat COVID-19 had a higher level of public awareness of COVID-19 prevention and control. Meta-analysis showed the level of public awareness of COVID-19 prevention for the experimental group [OR = 1.61, 95% CI (1.31, 1.99), $P < .00001$, $I^2 = 32\%$, $Z = 4$]. Based on the results of the meta-analysis of the public concern about COVID-19 prevention and control, compared to the control group, patients who received infection prevention and control measures in designated hospitals that treat COVID-19 had a higher level of public concern about COVID-19 prevention and control. The meta-analysis result of public concern about COVID-19 prevention and control is [OR = 1.56, 95% CI (1.28, 1.90), $P < .0001$, $I^2 = 0\%$, $Z = 4.35$]. Based on the results of the meta-analysis of the public anxiety on COVID-19 prevention and control, compared to the control group, patients who received infection prevention and control measures in designated hospitals that treat COVID-19 had higher levels of public anxiety about COVID-19 prevention and control. The result of public anxiety on COVID-19 prevention and control is [OR = 1.67, 95% CI (1.37, 2.03), $P < .00001$, $I^2 = 32\%$, $Z = 5.13$]. The NOS scores of the included studies were relatively high, ranging from 7 to 9. NOS is a commonly used quality assessment tool for case-control studies and cohort studies. Therefore, the quality of the literature in this study is acceptable.

Limitations

The limitations of this systematic review and meta-analysis are: The overall sample size is not very large. All controlled trials or cohort trials were single-centered, and the lack of multi-center studies may have limited the generalizability of the conclusions to some extent. Therefore, we need to view the results of this meta-analysis objectively. Second, the small sample size is not sufficient to fully assess the standardization and safety of infection prevention and control practices in designated hospitals that treat COVID-19. Last, but not the least, only 4 studies performed a funnel plot analysis to check for publication bias, and although we searched extensively for studies and attempted to contact authors of identified studies for unpublished information and to confirm published data, no reply was received.

CONCLUSION

Chinese prophylaxis and controlling measures for COVID-19 are mainly to protect vulnerable populations, cut off transmission routes, and control the source of infection.

FUNDING

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DATA AVAILABILITY

The data used to support this study is available from the corresponding author upon request.

AUTHOR DISCLOSURE STATEMENT

The authors declare that they have no conflicts of interest.

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