

Received April 20, 2020, accepted April 21, 2020, date of publication April 22, 2020

THE CHINESE EXPERIENCE - FIGHTING AGAINST COVID-19, SHANXI MEDICAL ENGINEERS

By Jin Zhang, Jiansheng Li, Zhiyong Wu

¹ Shanxi Bethune Hospital, China.

² Shanxi, taiyuan, Shanxi Provincial People's Hospital, China.

ABSTRACT

The world has witnessed as the COVID-19 pandemic has been raging wildly across China and the world. Although it is a war without gunpowder smoke, it is nevertheless extremely fierce. Countless medical and other front-line staff are fighting under grave conditions while facing the death of their patients and the need to protect themselves against the virus. However, against these gigantic challenges, the healthcare team stays firm in their beliefs and with the long-term vision of winning the war for their patients and families. In order to win this battle faster, in addition to the doctors, there are also a large number of clinical/medical engineers fighting on the front line! This group of unsung heroes wrote application letters asking to join the battle and take on assignments at the front line early on. They have kept working at their assignments 7 × 24. These clinical engineers appreciate the urgency of racing against time to expedite the commissioning and installation of new and relocated medical equipment at their hospitals. In the face of the epidemic, as always, they have remained at their stations in hospitals and have become the "patron saints" of medical equipment. Although there is a risk of infection, they do not hesitate. It is their commitment in the face of exhaustion that ensures the normal and safe operation of the equipment. It is their untiring belief that together we will wipe out this disease, unite as one, and overcome any challenges. In the end, victory will belong to us all!

Copyright © 2021. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY): *Creative Commons - Attribution 4.0 International - CC BY 4.0*. The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

SHANXI BETHUNE HOSPITAL

Faced with the severe situation of a pneumonia epidemic from the novel coronavirus, it has become very important to triage tasks and employ workarounds to deal with the limited supply of protective gear with priority given to medical personnel and ensure that rescue and resuscitation equipment is in place and ready when critically needed. All the staff of the Medical Equipment and Materials Management (CE) program of Bethune Hospital

in Shanxi province held fast to their posts and mobilized to search for resources and solutions day and night.

"We have only one idea, no matter how great the pressure, we must do our best to ensure that protective and disinfection materials are kept in stock and all diagnosis and treatment equipment operates normally," said their manager.



In order to prevent the spread of the epidemic and ensure the safe use of available and much needed medical equipment, relevant resources were consulted and new protocols were organized. This included the "Guidelines for Disinfection of Medical Equipment (I) and (II)" links that were developed to guide clinical and medical departments (CE personnel) on how to clean and disinfect medical equipment scientifically and reasonably.



This epidemic knows no boundaries, is merciless, and everyone is impacted to some degree. The Hubei Medical Aid Team from Bethune Hospital in Shanxi has continuously rushed to help meet the CE needs at the front lines in Hubei. Members play a vanguard and exemplary role. Our Chinese CEs, like Jin Yue actively practice at the front

line of this war. On February 4, he went with the Shanxi Provincial Emergency Medical Rescue Team to the epicenter of the virus in Wuhan. This is an example of a dedicated medical worker and a model for all healthcare workers.

Our office has prepared a travel inventory for the team members going to Hubei many times. This includes protective clothing, head covers, various masks, goggles, and other decontamination products, to ensure the safety of the medical team members as they work.

SHANXI PROVINCIAL PEOPLE'S HOSPITAL

To establish an isolation ward as soon as possible, it was vital to speed up the progress and shorten construction time. This required the general staff of the engineering department of Shanxi People's Hospital to work overtime dismantling the old DR and install the new computed tomography (CT) scanner for testing for novel coronavirus. This is shown in the following photos.



In order to cope with the new coronavirus pneumonia epidemic, Shanxi Provincial People's Hospital used a GE 16-slice CT for the examination of patients showing symptoms such as fever. However, the CT had to be set up and operated by trained personnel who must enter the computer room. This led to close contact between

the operator and the patient and increased the possibility of operator infection. To solve this problem, the engineers of Shanxi People's Hospital carefully studied the environment and equipment structure, reviewed the operating circuits, jointly brainstormed ideas, designed the required additional interconnecting circuits, searched for and purchased the materials needed, and came up with a custom-built built it in-house solution.



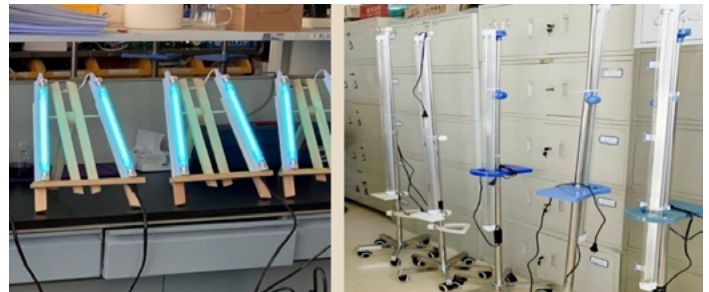
With the aim of not affecting the function of the CT equipment, the rack control panel was moved to the external operation room so that the operators could safely position themselves outside the CT room and avoid close contact with patients. This greatly reduced the risk of infection.

SHANXI CHILDREN'S HOSPITAL

With the continuous spread of the virus, the demand for disinfection equipment in hospitals has increased greatly. In order to meet this demand, the medical engineering (CE) team of Shanxi Children's Hospital designed and manufactured 60 sets of ultraviolet disinfection lamps of differing specifications using existing materials in combination with professional characteristics and first-line operation specifications. This will better meet the needs of clinical departments during the epidemic and is shown in the photos below.

At present, the first batch of disinfection lamps have been distributed to dozens of key prevention and control departments such as emergency and respiration

departments and comprehensive and clinical examination areas. After they are built and installed, the hospital will be better prepared to carry out disinfection work in a 3000² medical area space while simultaneously providing strong assurance against possible coronavirus infection and strengthening the fight against the epidemic. Ultraviolet lamps can effectively disinfect the surface of objects by exposing them to light radiation. They can be reused and can be mobilized and moved between rooms and patient consultation areas.



This is the disinfection method recommended by the prevention and control guidelines issued by the National Health and Safety Commission. Engineers carried out ultraviolet intensity testing in strict accordance with medical ultraviolet disinfection requirements and formulated usage specifications to more comprehensively ensure the protection and safety of patients, family members, and medical personnel.

SHANXI COAL CENTRAL HOSPITAL

The epidemic situation is merciless, people everywhere are impacted, and sadly some succumb to the disease. In the face of this grave situation, Shanxi Coal Central Hospital, as the protection department during the epidemic, has volunteered to safeguard the hospital's protection gear and materials. For many years CEs have been making continuous and silent contributions to improve patient care. In order to ensure that temporarily assigned on-the-job front-line medical personnel are protected in place, the material support department checked inventory and issued protective gear and materials in a fixed amount every day. It also allocated the necessary equipment for the fever clinic and emergency department in the hospital. In addition to moving needed equipment

between locations, the medical maintenance department also serves as the competent on-site technical service support staff as shown in the photos below. They are at the dangerous forefront of transportation, installation, commissioning, and training of air purification disinfectors that are urgently needed in fever clinics, respiratory medicine departments, emergency departments, clinical departments, and CT rooms.



The Clinical/Medical Engineering Committee of Shanxi Medical Association issued a "Proposal for Donations to Fight Novel Coronavirus Pneumonia Together" which received a positive response from Shanxi medical workers. Everyone actively participated in the charity fundraising activities and have made a modest contribution to the final victory in the fight against this disease.



Medical equipment plays an important role in the diagnosis and treatment processes. In order to strengthen the prevention and control work of medical institutions

throughout the province, the management and the use of medical equipment must be more efficient during the prevention and control of a pneumonia epidemic from the novel coronavirus. This especially applies to the safe use, cleaning, and disinfection and control of large medical, first aid, and life support equipment. The Medical Engineering Branch of Shanxi Medical Association referred to the cleaning and disinfection plans of Philips, GE, and Murray for medical equipment during the epidemic. The Organization of Shanxi Province Medical Equipment Management Quality Control Center, Shanxi Medical Association Medical Engineering Professional Committee and Hospital Infection Experts conducted research, formulated, and demonstrated various cleaning and disinfection work plans (trial runs) to guide medical facilities in the diagnosis and treatment safety of medical equipment throughout the province and ensure the safety of medical personnel, patients and their families. Examples of protocols are attached below.



At present, director Zhang Jin leads all clinical/medical engineers in Shanxi in collaboration to help concentrate manpower, perform their extraordinary duties, provide solid backing for front-line clinical medical personnel, build up the cornerstone of epidemic prevention, and improve the required logistics support during these abnormal times. Under the guidance of medical engineers, we firmly believe that in the face of the epidemic, we will be able to overcome this difficulty through concerted and collaborative efforts. Come on, Wuhan! Come on, Shanxi! Come on, China!