Translational Perioperative and Pain Medicine

ISSN: 2330-4871

Research Article | Open Access Volume 8 | Issue 3

Management of Personal Protective Equipment Shortage and Other Medical Resources during the COVID-19 Pandemic

Chunhua Xi, MD, PhD[1,2], Yue Chang, MS[1], Peng Xian, MD, MS[1], John Grothusen, PhD[3], Changfeng Lu, MD[1] and Guyan Wang, MD, PhD[2*]

[1]Department of Hospital Infection Management & Disease Control and Prevention, Beijing Tongren Hospital, Capital Medical University, Beijing, China

[2]Department of Anesthesiology, Beijing Tongren Hospital, Capital Medical University, Beijing, China

[3]Department of Anesthesiology and Critical Care, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA, USA

Abstract

At the beginning of the COVID-19 pandemic, there had been a profound shortage of personal protective equipment (PPE) and other medical resources over the world, leaving healthcare personnel (HCP) in danger. The medical supply crisis, including oxygen shortage, still exists in some low-income countries. The article describes the experience in the management of PPE and rescheduling medical procedures in a hospital while battling COVID-19 and also maintaining necessary medical care, including training and guiding PPE use, triaging patients, and rescheduling daily services in ophthalmology and ENT department with high-risk exposure. We believe that in cases of medical resource shortage during the COVID-19 pandemic, strict guidelines with coordinated multi-department teamwork and meticulous management, along with a well-defined training-evaluation-supervision strategy for PPE use, appropriate risk assessment and rescheduling medical procedures can play a major role in the prevention of transmission of COVID-19 to healthcare personnel and patients. We also highlight the importance of governments and industry to be responsive to the lack of medical resources, especially oxygen supply.

Keywords

Coronavirus disease 2019, COVID-19, Personal protective equipment, Risk assessment, Ophthalmology, ENT

Introduction

As of June 9 2021, there have been 173,674,509 confirmed cases of COVID-19, including 3,744,408 deaths globally, reported to WHO [1]. Although the number of cases and deaths continued to decrease, case and death incidences remain at high levels and significant increases have been reported in many countries, especially in the South-East Asia Region [2]. The current surge of COVID-19 cases has put immense pressure on health systems, including personal protective equipment (PPE), daily medical service and medical oxygen production and delivery [3,4].

Health care workers play a vital role in keeping others safe, relieving suffering and saving lives. No country, hospital or clinic can keep patients safe unless its health care workers are safe. Infections among health care workers can lead to a depleted workforce at a time when they are most needed [5]. Oxygen therapy is recommended for all severe and critical COVID-19 patients. Oxygen supply involves oxygen production, storage and transportation. Only high quality, medical-grade oxygen should be given to patients [6]. Our hospital, Beijing Tongren Hospital affiliated to Capital Medical University in Beijing, China, is a large tertiary care hospital; with a medical care staff of more than 3600, with 1800 beds, and annual outpatient and emergency visits of 2.754 million. As a hospital both battling COVID-19 and maintaining necessary medical care, we experienced a shortage of medical supplies and obstacles in medical care. We set up fever clinics to manage potential COVID-19 patients, triaged regular patients in open-air environments and rescheduled medical procedures. No nosocomial infections have occurred in our hospital. We share our experience in the management of PPE, daily medical care during the pandemic and also discuss the medical oxygen supply in China and other countries during the most critical period.

Training, guidelines, the privileges of PPE usage and management

When the outbreak that began in Wuhan in early January was officially announced, our purchasing department responded immediately and tried to order

Table 1: Guidelines for personal protection and personal protective equipment (PPE) use.

Protection Level	Types of PPE Needed	Application Fields
Protection I	Working clothes, paper cap and medical surgical mask	HCP of general outpatient clinics and inpatient ward, specimen carrier
Protection II	Working clothes, paper cap, medical protective mask or N95 respirator. Isolation gown, goggles or face shields, and latex gloves if necessary	HCP of emergency dept, pediatric dept, respiratory dept, stomatological dept, ENT dept working for potentially infected patients, lab staffs for screening cases
Protection III	Working clothes, paper cap, medical protective mask or N95 respirator, medical protective clothing, double latex gloves, goggles or face shields. When performing tracheal intubation, tracheotomy, or other operations at high risk of spraying droplets, waterproof isolation gown, medical protective headgear, and shoecover or boots cover is needed.	HCP of fever clinic, isolation units and ICU, environmental disinfection personnel, lab staff for nucleic acid testing of COVID-19

Figure 1: Personal protective equipment (PPE) use indifferent protection level. (A) Level I protection; (B) Level II protection; (C) Level III protection.

more medical surgical masks, medical protective masks, and protective clothing, however the purchase was very difficult due to very limited market availability. The Hospital Infection Management & Disease Control and Prevention department (HIM & DCP) and the warehouse checked the detailed inventory of all PPE in our hospital, then developed personal protection guidelines for hospital care professionals (HCP) and the paramedical staff in the hospitals and also strengthened the training of all staff in the use of hand hygiene and PPE. The guidelines for personal protection and use of PPE in our hospital was based on technical guidelines for quarantine and protection against infectious diseases among medical personnel (2018 version) by Beijing Municipal Health Commission [7], and updated with guidance of the proper use of PPE from the National Health Commission of the People's Republic of China [8-11], which are shown with detail in Table 1 and Figure 1. Medical personnel and paramedical staff were required to strictly abide by the guidelines, and excessive protection was forbidden. Medical protective masks, N95 respirators, and protective clothing were under strict control. During the surge period of COVID-19 cases, more than a dozen doctors and nurses were recruited to the HIM & DCP for training, evaluation, and supervision of PPE use.

We appointed specific personnel to manage the process of PPE distribution based on the guidelines. At times of critical shortage, we verified the usage and inventory of PPE on a daily basis, predicted the usage time of the remaining supply, and communicated tothe purchasing department how many PPE items were needed for the next week. The Centers for Disease Control and Prevention (CDC) website provides a PPE Burn Rate Calculator for healthcare facilities to plan and optimize the use of PPE for COVID-19 [12].

We implemented a hierarchical management of PPE distribution according to the risk level of HCP exposure to COVID-19. For instance, we ensured an adequate supply of PPE in the fever clinic, isolation unit, intensive care units (ICU), emergency department, respiratory department, and pediatric department. We distributed PPE to clinical and medical technology departments based on the number of staff on duty. We reduced the regular consumption of PPE for non-emergent use. For example, 80-90% of scheduled elective surgeries were postponed and PPE for administrative staff was limited. We were aware that in some hospitals once PPE was obtained all departments sought to get it, but the high-risk departments were not allocated enough. This is not appropriate allocation of limited PPE and should not happen.

As more PPE became available, we predicted the amount of PPE required for each department for each week. All departments received PPE once a week, and registration of usage was required and checked. If there was more demand, an appropriate application was needed and evaluated by HIM & DCP. The emergency room and the medical office each had five sets of protection level III PPE for clinical emergency use.

We received donations of PPE from many caring people and companies. An expert was appointed in the warehouse to evaluate the quality and quantity of the donations, keep the records, and manage the distribution of these donations. For instance, European-standard protective clothing is suitable for fever clinic and isolation units; those items that meet national standards can be used in ICUs. Protective clothing that does not meet national or European standards is distributed to non-medical areas. Donated medical protective masks or N95 respirators meeting national standards or European standards, and those that are NIOSH - approved, can be used in medical facilities except for fever clinics, isolation units, or ICUs. Fever clinics, isolation areas, and ICUs are given priority for access to goggles, protective headgear, and waterproof boot covers. Goggles can be reused after strict disinfection.

As the beginning and epicenter of the COVID-19 outbreak in China, 1809 cases of HCP infection has been identified in Hubei Province, accounting for 88% (2055 cases) of all HCPs infection nationwide [13]. The Chinese central government attached great importance to protecting the health of HCP and then took a number of immediate actions, including dispatching medical assistance teams from all over the country. In all, over 300 medical teams had rushed to the rescue of Hubei province, with over 38,000 medical workers going to Wuhan [14]. Each medical team took PPE with them from their original working place to Hubei province, and began their work there after strict training about PPE usage according to the guidance on the proper use of PPE from the National Health Commission of the People's Republic of China [8-11], which was also followed by our hospital. Until May 5, 2020, none of the medical members among the 42000 going to Hubei province had been infected with SARS-CoV-2 [15]. Meanwhile, a total of 152,888 HCP infections and 1413 deaths were reported globally during the early phases of the pandemic until May 8, 2020 [16]. Ñamendys-Silva reported that there had been a total of 46013 Mexican HCPs infected with SARS-CoV-2, with afatality rate of 1.48% (683 cases) [17]. The author thought that PPE alone did not effectively protect patients and healthcare personnel. The way to ensure safe PPE use should be reinforced by repeated training and practice. We believe that our training, guidelines and management of PPE usage plays an important role in preventing nosocomial infections from occurring in our hospital.

Triaging patients in open-air environments

COVID-19 is a highly contagious pathogen and is mainly transmitted through direct or indirect contact with infected people or contaminated surfaces. The World Health Organization (WHO) claims COVID-19 can be transmitted by symptomatic and asymptomatic people [18]. Both symptomatic and asymptomatic cases represent virus spreaders during clinic visits. It is difficult to identify patients with COVID-19 infection since early clinical presentation is minor or non-specific. Thus, it is necessary to do risk assessment to allow patients to visit hospitals for medical treatment and avoid COVID-19 outbreaks in hospitals.

The Chinese Ministry of Health implemented the internet-based disease reporting system, and the China Information System for Disease Control and Prevention (CISDCP) reports the real-time COVID-19 cases [19]. The community with newly confirmed COVID-19 cases is updated every day and the trajectories of the confirmed cases are quickly announced by local CDC. Due to the rapid growth of digital technology in China, each person has his/her Health Code shown on the smart phone. Health Codes are based on a 14-day history of daily self-reported health declarations, travel and exposure history and knowledge of local epidemic prevention information. Green means pass, while yellow and red

mean isolation and treatment. Anyone who is in the community with newly confirmed cases or has close contact with the confirmed or suspected cases has his/her Health Code turn to yellow or red [20]. Health Code is necessary information for triaging in public places, especially in hospitals.

In our hospital all patients were asked triage questions before they entered the outpatient clinic or emergency department by Wechat on their mobile phone. The triage questions included COVID-19 related symptoms such as fever, cough, dyspnea, myalgia, anosmia or fatigue. Any patients with COVID-19 related symptoms were sent to fever clinic. Patients were also required to show their Health Code. Only patients with a green code were allowed to enter the hospital. Patients with a yellow or red code would go to the designated hospital. Anyone who wanted to visit the hospital was required to wear a face mask. Visit time was arranged by computer to avoid crowding and visitors were informed to keep a distance of at least 1 meter from other people. At the main entrance of our hospital a tent was setup for temperature measurement and hand disinfection.

Details of daily services in ophthalmology and ENT department

As a hospital famous for ophthalmology and otorhinolaryngology there were many patients visiting our hospital for urgent or non-urgent eye or ENT problems. It is vital to determine safe and efficient procedures and management alignment.

During routine examinations otolaryngologists will inevitably come into direct contact with the upper respiratory tract, which may generate aerosol and is susceptible to viral dissemination. Considering that COVID-19 is an infectious respiratory disease, otolaryngologists know that their work is at high risk for exposure to SARS-CoV-2. With the decrease in clinic visits and surgery, non-medical staff in the ENT department were reallocated, as only otolaryngologists and professional nurses were needed for clinic care. All of the otolaryngologists and nurses were subject to level II protection. For operations with a risk of splashing, such as rhinopharyngeal laryngoscopy, management of nasal bleeding, or emergency tracheostomy, doctors and nurses wore level III protection. A green channel was opened to deal with patients with life-threatening diseases such as severe dyspnea, severe head and neck trauma, persistent nasal bleeding with hemorrhagic shock, and tracheal foreign body whenever COVID-19 was confirmed or excluded, and all medical staff should keep level III protection in this situation. After the patients were stabilized, a PCR test was performed to rule out COVID-19. One should never delay the rescue time due to the epidemic, otherwise it will increase the risk of death of ENT patients. We recommend that only senior and experienced surgeons participate in the rescue of critically ill patients, thereby reducing operation time, reducing exposure risks and improving rescue efficiency. In addition, otolaryngologists need to be allocated the limited medical resources to care for patients in urgent need of surgery as soon as possible, such as patients with malignant tumors, benign tumors of the throat causing poor breathing, and nasopharyngeal fibrovascular tumors that cause anemia due to repeated bleeding.

Ophthalmologists also have close contact with patients during diagnosis and treatment. Compared with physicians in fever clinics, respiratory departments and ENT departments, ophthalmologists may face potential problems caused by lack of adequate awareness of prevention and inadequate protective measures. From the ocular perspective, there have been reports that Severe Acute Respiratory Syndrome Coronavirus (SARS-CoVs) can be present in tears [21,22]. Thus, there should be appropriate precautions to prevent transmission through ocular tissues and secretions. Recently ophthalmologists, along with dentists and ENT specialists, have been infected during routine visits [23,24]. In our hospital HIM & DCP staff trained medical workers in the ophthalmology department about precautions in the diagnosis and treatment process, and to increase their vigilance and strengthen prevention in daily care, such as special examinations (slit lamp, direct ophthalmoscopy, etc.), ocular procedures (subconjunctival injection, lacrimal duct flushing, etc.) and various ophthalmic surgeries. We set up slit lamp barriers to prevent patient secretions from splashing in the clinic room. And when barriers were in short supply, X-ray or other imaging film was used as a substitute. To avoid close contact, indirect ophthalmoscopy or fundus photography was used to replace direct ophthalmoscopy. During the peak of the epidemic, patients with elective surgery such as cataract and myopia surgery were temporarily postponed to reduce the possibility of nosocomial infection similar to that which was reported [25]. Main conditions that required emergency treatment included moderate to severe ocular trauma, endophthalmitis, glaucoma requiring emergency surgery, and rhegmatogenous retinal detachment.

Oxygen supply

Most pure oxygen is produced on a large commercial scale by cooling air to very low temperatures so that the oxygen and nitrogen become liquid. The difference in boiling temperature allows for the distillation of pure oxygen from the other atmospheric gasses. Both medical and industrial oxygen (used primarily for welding) are produced in the same manner, the only differences are in the testing and certification of purity of the gas, and the certification of cleanliness of the storage tanks and valves used to deliver the gas.

The COVID-19 pandemic has accelerated global demand for oxygen and made the delivery of oxygen supplies more urgent than ever [26]. Without oxygen therapy, COVID-19 can be fatal. However, many hospitals in vulnerable countries lack reliable oxygen access. The oxygen consumption of hospitals reached a peak of more than 10 times the daily use during the worst period of the epidemic in Wuhan, China. As the largest medical oxygen production base in central China, Wuhan Iron Steel (Group) Corporation was involved with oxygen production, bottling, transportation, oxygen supply system maintenance, transportation and other work [27]. Cases of COVID-19 were originally concentrated only in Wuhan, China, so the oxygen consumption did not produce shortages in Wuhan or in other Chinese cities. An imbalance of oxygen consumption and oxygen production happened in the United States in 2020, as there are plenty of oxygen producers along the East Coast, but few exist on the West Coast, adding to the difficulties of increasing oxygen supply in places like Los Angeles. The American medical oxygen industry now tries to anticipate the virus's path, moving resources to where medical oxygen is needed [28].

National Public Radio (NPR) has reported that India has run out of oxygen with the country confirming more than 300,000 coronavirus cases a day in April, 2021 [4]. In response to the crisis of availability of medical grade oxygen, most of India's industrial oxygen production has had an extra purification step added and been diverted to medical use [29]. It has been stated that India never really had an oxygen shortage, but that the crisis occurred due to lack of preparedness for the unexpected second wave of COVID-19 that struck India. It has been estimated that at the height of this second wave crisis 9000-11000 tons of liquid oxygen were needed per day, and India produces 9000 tons of liquid oxygen daily under normal circumstances [30]. The problem is that 90% of this oxygen is produced for industrial use, such as steelmaking. It unfortunately took weeks for the Indian government to divert all production to medical use. A major issue is transportation of the liquid oxygen (the usual form for transport) to where it's needed, as most oxygen production is done in eastern India where steelmaking industries are located.

Information from various sources has identified a number of countries which are at greatest risk of suffering oxygen shortages in the near future. These countries, besides India, include Argentina, Iran, Nepal, the Philippines, Malaysia, Pakistan, Costa Rica, Equador, South Africa are most at risk, but other countries such as Laos, Nigeria, Ethiopia, and Malawi are also at high risk [31].

Further challenges

At present, the pandemic in China has been well controlled. As of June 19, 2021, the number of doses of COVID-19 vaccine in China has reached 1 billion [32]. Work production, social activity and medical service have resumed for a year. Although there is no current shortage of PPE or oxygen supply, we need to continue using them appropriately and avoid waste. Sporadic COVID-19 cases continue to occur in China. Patients from communities with confirmed cases are subject to rigorous screening and COVID-19 nucleic acid testing to receive medical care. We have gained much experience from this pandemic; however, more precise management algorithms are needed to balance timely medical resource supply, medical care and epidemic prevention and control.

Conclusion

We believe that in cases of limited medical resources during the COVID-19 pandemic, strict guidelines with coordinated multi-department teamwork and meticulous management, along with a well-defined training-evaluation-supervision strategy for PPE use and patient triaging, can play a major role in the prevention of transmission of COVID-19 to healthcare personnel and patients in the hospital. Also, it is necessary for governments and industry to be responsive to the lack of medical resources.

References

1. World Health Organization (2021). WHO Coronavirus (COVID-19) dashboard. Available online: https://covid19.who.int Last accessed June 12, 2021
2. World Health Organization (2021). Weekly epidemiological update on COVID-19 - 8 June 2021. Available online: https://www.who.int/publications/m/item/weekly-epidemiological-update-on-covid-19---8-june-2021Last accessed June 12, 2021
3. COVID 19 and the oxygen bottleneck (2020). Bull World Health Organ. 2020; 98(9):586-587.
4. National Public Radio (2020). Why is India running out of oxygen? Available online: https://www.npr.org/sections/goatsandsoda/2021/05/05/989461528/why-is-india-running-out-of-oxygenLast accessed June 12, 2021
5. World Health Organization (2020). Shortage of personal protective equipment endangering health workers worldwide. Updated March 3, 2020. Available online: https://www.who.int/news-room/detail/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwideLast accessed June 12, 2021
6. GrahamHR, Bagayana SM, Bakare AA, et al (2020). Improving hospital oxygen systems for COVID-19 in low-resource settings: Lessons from the field. Glob Health Sci Pract. 2020; 8(4):858-862
7. Beijing Municipal Health Commission (2018). Technical guidelines for quarantine and protection against infectious diseases among medical personnel. Available online: http://wjw.beijing.gov.cn/zwgk_20040/fgwj/bz/201912/t20191216_1239865.html
8. National Health Commission of the People's Repub-

lic of China (2020). Novel coronavirus pneumonia prevention and control program (third edition). Available online: http://www.nhc.gov.cn/jkj/s7923/202001/470b128513fe46f086d79667db9f76a5.shtml

9. National Health Commission of the People's Republic of China (2020). Novel coronavirus pneumonia prevention and control program (fourth edition). Available online: http://www.nhc.gov.cn/xcs/zhengcwj/202002/573340613ab243b3a7f61df260551dd4.shtml
10. National Health Commission of the People's Republic of China (2020). Strengthening the management of medical protective equipment during the epidemic.http://www.nhc.gov.cn/yzygj/s7659/202002/039b10b649c444d7b39ad8a8b62e1c60.shtmlLast accessed June 12, 2021
11. National Health Commission of the People's Republic of China (2020). Further strengthening the use and management of medical protective clothing in different levels and regions during the epidemic period. Available Online: http://www.nhc.gov.cn/yzygj/s3594/202002/7cdc86b3bb81401c96482797f3ee364d.shtmlLast accessed June 12, 2021
12. Centers for Disease Control and Prevention (2020). Personal protective equipment (PPE) burn rate calculator. Available online: https://www.cdc.gov/coronavirus/2019ncov/hcp/ppe-strategy/burn-calculator.htmlLast accessed June 12, 2021
13. Zhang Z, Liu S, Xiang M, et al (2020). Protecting healthcare personnel from 2019-nCoV infection risks: lessons and suggestions. Front Med. 2020;14(2):229-231
14. National Health Commission of the People's Republic of China (2020). When Wuhan was in need, help came from close and afar. Available online: http://en.nhc.gov.cn/2020-03/20/c_78007.htmLast accessed June 12, 2021
15. People's Daily Online (2020). None of the 42,000 medical staff who supported Hubei Province was infected with COVID-19. Available online: http://health.people.com.cn/n1/2020/0505/c14739-31697344.htmlLast accessed June 12, 2021
16. Bandyopadhyay S, Baticulon RE, Kadhum M, et al (2020). Infection and mortality of healthcare workers worldwide from COVID-19: a systematic review. BMJ Glob Health. 2020;5(12)
17. Ñamendys-Silva SA (2020). Healthcare workers with COVID-19 in Mexico. Eur Respir J. 2020; 56(4)
18. World Health Organization (2020). Coronavirus disease 2019 (COVID-19): situation report, 73. Available online:https://apps.who.int/iris/handle/10665/331686Last accessed June 12, 2021
19. ZaninM, XiaoC, Liang T, et al. (2020). The public health response to the COVID-19 outbreak in mainland China: a narrative review. J Thorac Dis. 2020; 12(8):4434-4449
20. Xinhuanet (2020). Tencent takes the lead in drafting the first "epidemic prevention travel code" group standard to help prevent and control epidemics and resume production. Available online: http://www.xinhuanet.com/ tech/2020-03/06/c_1125674248.htm Last accessed June 12, 2021
21. Seah I, Agrawal R (2020). Can the Coronavirus Disease 2019 (COVID-19) Affect the eyes? A review of coronaviruses and ocular implications in humans and animals.Ocul Immunol Inflamm.2020; 28(3):391-395
22. Loon SC, Teoh SC, Oon LL, et al(2004). The severe acute respiratory syndrome coronavirus in tears. Br J Ophthalmol.2004; 88(7):861-863
23. Xia J, Tong J, Liu M, Shen Y, Guo D (2020). Evaluation of coronavirus in tears and conjunctival secretions of patients with SARS-CoV-2 infection. J Med Virol. 2020; 0–3.
24. Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B (2020). Transmission routes of 2019-nCoV and controls in dental practice. Int J Oral Sci. 2020;12(1):1–6.
25. Wu J, Yao S, Liu R. Towards a full capacity of anaesthesia and surgical services in the epicenter (Wuhan) of the COVID-19 epidemic (2020). Br J Surg. 2021; 108(1):e1-e2.
26. World Health Organization (2021). COVID-19 oxygen emergency impacting more than half a million people in low- and middle-income countries every day, as demand surges. Available online: https://www.who.int/news/item/25-02-2021-covid-19-oxygen-emergency-impacting-more-than-half-a-million-people-in-low--and-middle-income-countries-every-day-as-demand-surges Last accessed June 12, 2021
27. Sohu (2020). Wuhan Iron and Steel (Group) Corporation, an oxygen-supplying commandos. Available online: https://www.sohu.com/a/373750659_365977
28. National Public Radio (2021). Oxygen industry scrambles to keep U.S. patients with COVID-19 breathing. Available online: https://www.npr.org/sections/health-shots/2021/02/03/963537030/oxygen-industry-scrambles-to-keep-u-s-patients-with-covid-19-breathing Last accessed June 12, 2021
29. The vaccine Alliance (2021). Why Indian hospitals are running out of medical oxygen and how to fix it.2021. Available online: https://www.gavi.org/vaccineswork/why-indian-hospitals-are-running-out-medical-oxygen-and-how-fix-itLast accessed June 12, 2021
30. Fortune (2021). India has always had enough oxygen. 2021. Available online: https://fortune.com/2021/05/18/india-covid-cases-crisis-oxygen-shortage-supplyLast accessed June 12, 2021
31. The Guardian (2021). Oxygen shortages threaten 'total collapse' of dozens of health systems. 2021. Available online: https://www.theguardian.com/global-development/2021/may/25/oxygen-shortages-threaten-total-collapse-of-dozens-of-health-systemsLast accessed June 12, 2021
32. National Health Commission of the People's Republic of China (2021). Latest on the COVID-19 vaccine across China. 2021. Available online: http://www.nhc.gov.cn/xcs/yqfkdt/202106/a170c7ae7fda4809af3961dc6d79c2ff.shtmlLast accessed June 20, 2021

Citation: Xi C, Chang Y, Xian P, Grothusen J, Lu C, et al. Management of Personal Protective Equipment Shortage and Other Medical Resources during the COVID-19 Pandemic. Transl Perioper & Pain Med 2021; 8(3):365-371

Corresponding Authors: *Guyan Wang, MD, PhD, Department of Anesthesiology, Beijing Tongren Hospital, Capital Medical University, 1 Dongjiaominxiang Rd, Dongcheng District, Beijing, 100730, China, Tel: +86-10-58268101, E-mail: guyanwang2006@163.com*

Additional publication details

Journal short name: Transl Perioper & Pain Med

Received Date: November 28, 2020

Accepted Date: June 22, 2021

Published Date: June 23, 2021