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**Pharmacy services at a temporary COVID-19 hospital in Wuhan, China**

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As the coronavirus disease 2019 (COVID-19) epidemic in Wuhan, China, worsened in late 2019 and early 2020, a number of patients with mild symptoms of COVID-19 were admitted to COVID-19 “ark hospitals” (ie, temporary makeshift hospitals housed in preexisting nonmedical buildings).<sup>3</sup> To ensure effective treatment of patients with COVID-19 admitted to these COVID-19 ark hospitals, a range of pharmacy services had to be provided, including formulation of a catalog of required drugs, medication supply chain management, storage of drugs, medication dispensing, and evaluation of the effectiveness and safety of drug therapy. Pharmacy services provided in ark hospitals played an important role in controlling the COVID-19 epidemic in Wuhan.

The outbreak of COVID-19, which is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2),<sup>1</sup> emerged in Wuhan, the capital of Hubei Province, in December 2019.<sup>2</sup> SARS-CoV-2 is highly infectious and is spread rapidly by human-to-human transmission via respiratory droplets or direct contact.<sup>3</sup> The main clinical symptoms of SARS-CoV-2 infection include respiratory symptoms, fever, cough, shortness of breath, and breathing difficulties.<sup>4</sup> Genomic analysis showed that SARS-CoV-2 differs from SARS-associated coronavirus (SARS-CoV) or the coronavirus that causes Middle Eastern respiratory syndrome (ie, MERS-CoV).<sup>5</sup>

As the local epidemic was getting worse, health officials recognized a problem: the growing number of patients with mild COVID-19, whose initial symptoms did not require admission to one of the city’s established acute care hospitals but who might spread the illness among family members if they continued to reside in the community.<sup>6</sup> To address this problem, gymnasiums, exhibition centers, and other large buildings in Wuhan were

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converted to COVID-19 ark hospitals. Diagnosed patients exhibiting milder symptoms were admitted to COVID-19 ark hospitals so that patient care—usually only oral pharmacotherapy but also higher-level treatment if necessary—could be provided in a concentrated way.<sup>7</sup> The COVID-19 ark hospitals, typically housing a medical function unit, ward unit, and technical support unit, provided services ranging from clinical examination to emergency treatment and surgical intervention.<sup>8</sup> Each ark hospital was typically staffed by 10 doctors, 40 nurses, and 1 pharmacist caring for about 100 patients. Within the COVID-19 ark hospitals, medical facilities and medicines were allocated to a “treatment district” and a “rescue district.”

A pharmacy emergency leadership team consisting of a drug supply group, drug dispensing group, quality control group, and clinical pharmaceutical services group was designated to be responsible for providing pharmacy services to COVID-19 ark hospitals.

A drug catalog was formulated according to guidance documents issued by the Chinese government, including the document “Diagnosis and Treatment for COVID-19 (Trial Version 6),”<sup>9</sup> as well as the National Essential Drugs List and National Formulary. These sources mainly list drugs for symptomatic treatment, prevention of complications, treatment of underlying diseases, and salvage drugs, comprising antiviral drugs, liver-protective drugs, antibiotics, antipyretic analgesics, glucocorticoids, microecological regulators, and drugs for respiratory system diseases, digestive system diseases, diseases of the psychoneurotic system, cardiovascular system diseases, metabolic diseases, and endocrine system diseases, as well as antianaphylaxis drugs, vitamins and electrolyte drugs, traditional Chinese medicines, and first-aid medicines.

The permanent hospital responsible for supplying medications to COVID-19 ark

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hospitals has a mature purchasing system, which helped to ensure that drugs were supplied in a timely manner and of reliable quality. The drug supplies reserved by the responsible hospital were helpful in establishing a drug supply system for COVID-19 ark hospitals in a short time.

The pharmacy of each COVID-19 ark hospital was set up in a space that was suitable for the scope of diagnosis and treatment and the quantities of drugs needed, relatively independent, and convenient for management purposes. The pharmacy was either located in a separate office or compartment or housed in a large, secure container outside. Medicine cabinets, refrigerated cabinets, backing plates, and other required equipment were installed.

Pharmacists at COVID-19 ark hospitals dispensed prescription drugs according to prescription administrative policy using the following procedures and workflow: (1) review prescription to determine whether the indication is suitable or not, the drugs selected are suitable or not, the routes of administration are suitable or not, the usage and dosage are suitable or not, the drug combination is suitable or not, and there is repeated administration or not; (2) dispense drugs on a first-in/first-out basis by batch number; (3) check the name, specification, and quantity of each drug; and (4) deliver the drugs to the nurse.

Since specific drug therapies and vaccines for COVID-19 are still not available, antiviral drugs commonly used in clinical practice, especially broad-spectrum antiviral drugs and traditional Chinese medicines, were chosen to treat patients with COVID-19.

Pharmacists in COVID-19 ark hospitals focused on the therapeutic and adverse effects of antiviral drugs through the following steps: (1) evaluate disease progression after treatment to confirm the effectiveness of drugs administered; (2) monitor adverse drug reactions,

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especially in the aged, children, and patients with underlying diseases, and report adverse drug reactions; and (3) timely adjust the treatment plan to ensure the safety of medication use.

In summary, implementation of COVID-19 ark hospitals helped to relieve the severe shortage of hospital beds, isolate sources of infection, and restrain the local epidemic in Wuhan while also helping to ensure that diagnosed patients with milder symptoms were treated as early as possible.<sup>7</sup> Diagnosed patients in COVID-19 ark hospitals mainly received oral medications. Pharmacy services personnel ensured that all patients received time and appropriate pharmacotherapy while assisting in evaluating the effectiveness and safety of medication use, monitoring adverse drug reactions, and recommending available drugs and appropriate dosing based on patient condition. Pharmacy services within COVID-19 ark hospitals played an important role in controlling the COVID-19 epidemic. On March 10, 2020, with better control of the COVID-19 epidemic in the city achieved, 16 COVID-19 ark hospitals were closed.

<sup>a</sup>Editor's note: The term "ark hospital" appears to have been derived from a Mandarin Chinese term also used to describe a makeshift temporary hospital, "Fangcang" (literally, "square cabin"), which when spoken is said to sound like the Chinese term for "Noah's Ark."

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