THE CORONAVIRUS PREVENTION HANDBOOK

101 SCIENCE-BASED TIPS THAT COULD SAVE YOUR LIFE

Chief Editor **Wang Zhou, MD**
Chief Physician of Wuhan Center for Disease Control and Prevention
Foreword by **Nanshan Zhong**, Translated by **Shan Zhu, Qing Chen, Jun Li**

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Chief Editor: Wang Zhou
Reviewed by Yongjian Xu
Foreword by Nanshan Zhong
Translated by Shan Zhu, Qing Chen, Jun Li

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Words from the Translators

In this era of globalization, non-stop movements of humans and goods make no country immune to the potential threat of epidemics. Since 2003, emergent contagious diseases such as the avian influenza, Middle East respiratory syndrome, SARS, and Ebola reminded us human beings once and again of the grave threat that they pose to the human health and the economic and social security.

While the spread of COVID-19 is gradually being contained in China, the world is facing several new hot spots such as Japan, South Korea, Iran, and Italy. So, dissemination of the knowledge and know-hows of the prevention and control of the epidemic is urgent and essential not only for China but also for the world.

In the early days of the outbreak, China promptly shared its understanding of the virus with the world through the World Health Organization. Tested and tempered by the viral epidemic such as SARS epidemic, the frontline professionals and experts at the “epicenter”—Wuhan, decided to share their invaluable experiences and lessons drawn from the current outbreak as well as during their careers in China and various countries in the form of the Handbook of Prevention and Control of COVID-19 in Chinese.

To prepare non-Chinese speakers for personal protection, contain the global spread of 2019-nCoV, and share Chinese solutions to the epidemic with the world, the publishing house invited

the Translators Association of China to promote the translation program. Under their guidance, the Center for Medical Language Service of Guangdong University of Foreign Languages was nominated for this mission and, shortly recruited the volunteers who worked with an all-out effort and completed the work in time.

This book, especially the measures that individuals and communities can adopt at the time of an outbreak, might serve as an important source of information on the prevention and control of both the present and future epidemics. Even if China’s experiences do not apply to all countries in the same manner, they should serve as valuable references.

The intended readership of this book includes health professionals and the public, and archiving of the book may be suggested for public and professional, academic libraries. Readers can find topics of their interest in the contents page and jump directly to the relevant pages without finishing the preceding ones.

Despite our best efforts to review and proofread, unintended errors may remain in the book. The responsibility lies with all of us, and comments and suggestions for the improvement of translation are much appreciated.

Translation Team
February 2020

Those who contribute to the English version are as follows.

Translation Counselors

Dr. Ping Yang, Translators Association of China

Ruilin Li, School of Interpreting and Translation Studies, Guangdong University of Foreign Studies

Translators

Shan Zhu, School of Foreign Studies, China University of Petroleum(Huadong)

Dr. Qing Chen, Center for Medical Language Service, Guangdong University of Foreign Studies

Dr. Jun Li, School of Medical Humanities, Peking University

Gao Chen, Guangzhou Bon-lion Tech Co., Ltd.

Kuan-Hung Chen, First-Affiliated Hospital, Sun Yat-Sen University

Shane Lau, Chinese University of Hong Kong

Fengyuan Yang, State Key Laboratory of Respiratory Disease, Guangzhou Medical University

Li Li, Nanjing University of Chinese Medicine

Lin Shen, Guangdong university of Foreign Studies

Bilingual Proofreader

Dr. Jongdae Lee, State Key Laboratory of Respiratory Disease, Guangzhou Medical University

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Editorial Board

Xiafen Hu (School of Medicine, Wuhan University of Science and Technology)
Kaiwen Guo (School of Medicine, Wuhan University of Science and Technology)
Na Zhan (Renmin Hospital of Wuhan University)

Introduction to Editors-in-Chief

Wang Zhou, MD, Chief Physician (Level 2) of Wuhan Center for Disease Control and Prevention. Senior Visiting Scholar, University of Pennsylvania, 2005 to 2006.

Funded by the “213 Talent Project” by Wuhan Municipal People’s Government in 2003;

Funded by “Huanghe Talent Program” by Wuhan Municipal Committee of the Communist Party of China in 2015;

Professor, Huazhong University of Science and Technology and Wuhan University

Director, Chinese Association for STD and AIDS Prevention and Control;

Executive director, Hubei Preventive Medicine Association,

Vice chairman and secretary-general, Wuhan Branch, Chinese Preventive Medicine Association;

Director, Wuhan Association for STD/AIDS Prevention and Treatment;

Member of editorial board, Chinese Journal of Preventive Medicine and Chinese Journal of Viral Diseases.

Rich experience in epidemiology and control of contagious diseases;

Principal investigator, research projects funded by the National Institutes of Health (US), the Bill & Melinda Gates Foundation, the National Health Commission of China, and the Hubei Health Commission

Winner of four Science and Technology Progress Awards of Hubei Province or Wuhan City;

First/corresponding author of more than 50 academic journal articles (over 20 in SCI/SSCI journals).

Qiang Wang, MD, professor of the School of Medicine of the Wuhan University of Science and Technology;

Visiting scholar of MD Anderson Cancer Center, the University of Texas (2015-2016);

Standing committee member and secretary-general, Committee of Cancer and Microecology, China Anti-Cancer Association;

Deputy chairman, Blood Section, Rehabilitation Branch, Chinese Anti-Cancer Association;

Standing committee member, Immunology Branch, China Association of Chinese Medicine;

Deputy director, Youth Committee, China Association of Chinese Medicine;

Standing committee member, Tenth Council, Hubei Society for Immunology;

Member, Sixth Committee, Microbiology and Immunology Branch, Hubei Medical Association.

Rich experience in the immunology of infectious diseases, tumor microenvironment, and preventive interventions on AIDS among college students in China;

Principal investigator of research projects funded by the Ministry of Education of China, and the Departments of Science and

Technology, and of Education of Hubei province;

Winner of a Science and Technology Progress Award of Hubei province;

First/corresponding author of more than 20 academic journal articles (10 in SCI/SSCI journals); editor-in-chief of three textbooks.

Ke Hu Professor and Director of the Second Department of Respiratory and Critical Care Medicine of Renmin Hospital of Wuhan University (Hubei Renmin Hospital), chief physician, and doctoral supervisor.

Principal investigator of four projects funded by the National Natural Science Foundation of China and one sub-project of the National Key Research and Development Project “Research on diagnosis and treatment of COPD complications and comorbidities”. First or corresponding author of over 100 academic journal papers.

Has participated in the clinical treatment of many public health emergencies in Hubei Province since the SARS outbreak in 2003.

Zaiqi Zhang, doctor of internal medicine, postdoctor of emergency medicine, MBA, chief physician, professor, doctoral supervisor, and member of the CPC Committee and vice president of Hunan University of Medicine.

Deputy director, Committee of Health Emergency, Chinese Research Hospital Association

Deputy director, Committee of Emergency Resuscitation, Chinese Medical Doctor Association

Deputy director and deputy manager, Committee of Disaster Medicine and Committee of Chemical Injury Treatment, Chinese Association of Integrative Medicine

Vice director and vice chairman, Committee of Modernization of Medicine and Clinical Translation, China National Medical Association, and director, Committee of Disaster Medicine, Hunan Association of Chinese and Integrative Medicine.

Principal investigator of over 32 national and local research projects,

Author of 82 academic journal articles in Chinese and English;

Winner of 12 provincial and local research awards;

Editor-in-chief of *Diagnosis and Treatment in Clinical Emergency*, *Clinical Treatment of Critical Conditions*, *Disaster and First Aid*, *Formulary of Practical Therapy*, among others.

Foreword

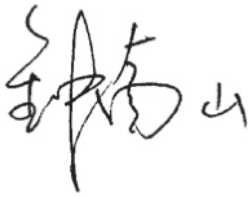
The novel coronavirus pneumonia (COVID-19) that was first reported from Wuhan, China has spread all around China and even to other countries in the world. Confirmed cases of COVID-19 have mounted to a number far exceeding that of SARS in 2003, and its mortality is not negligible. Realizing its “human-to-human” transmission capability, the World Health Organization identified it as a Public Health Emergency of International Concern on January 31, 2020. These facts are enough to illustrate the severity and complexity of the outbreak.

Given the fact that no effective medicine is available for viral infectious diseases, the preventive measures including control of the source of infection, early detection of patients, cutting off transmission, and protecting susceptible population are paramount. Although medical institutions and workers are the main force fighting the disease, public participation is also indispensable for a rapid epidemic control. Therefore, it is extremely important to disseminate the relevant information to the public.

With that in mind, Professor Wang Zhou of the Wuhan Center for Disease Control and Prevention organized a panel of experts to compile this Handbook about the overview of the coronaviruses and its transmission, detection and treatment of the disease, precautions for individuals and public places, and basics about contagious

diseases. With graphic illustrations and plain language, this book is intended to serve as a systematic introduction to the scientific knowledge on COVID-19.

The speed and scope of spread of COVID-19 makes the publication of this book urgent. I believe it will play an essential role in popularizing relevant knowledge, raising awareness of disease prevention and control, and preventing social panic. I am more than delighted to write the preface.



Nanshan Zhong
January 2020

Preface

In December 2019, scores of pneumonia cases with unknown causes presenting with fever, fatigue, coughing, and breathing difficulties as the main symptoms occurred in Wuhan within a short period of time. The Chinese governments and health departments at all levels placed great importance on the disease and immediately enacted measures for disease control and medical care, and directed research institutions to initiate investigations, treatments and collaborative research. The pathogen of the disease was quickly identified as a novel coronavirus, which was subsequently confirmed by the World Health Organization (WHO). The WHO named the virus 2019-nCoV while the International Committee on Taxonomy of Viruses (ICTV) coined it SARS-Cov-2; and the pneumonia caused by the viral infection was called novel coronavirus pneumonia (COVID-19) by WHO.

This handbook aims to improve the understanding of the disease among the public as well as people in relevant professions, and to provide a guidance on personal preventive measured to reduce the transmission risks. For these purposes, the Wuhan Center for Disease Control & Prevention promptly organized specialists in contagious disease control, researchers in pathogenic organisms and immunology, and front-line clinical experts at tertiary hospitals to compile *THE CORONAVIRUS PREVENTION HANDBOOK*. The

book consists of six parts: 1) overview of the coronaviruses, 2) transmission of coronaviruses, 3) COVID-19 detection, diagnosis and treatment, 4) personal precautions, 5) precautions in public places, and 6) basics on contagious diseases. It addresses the concerns of the public on COVID-19. If we are united in the face of adversities and execute epidemic prevention measures based on scientific evidence, we will undoubtedly win this battle.

In the compilation of the handbook, we referred to relevant published literature and official reports. The editorial board sincerely apologizes for the absence of citation trails or references due to the time constraint. If there are any problems or errors with the content, please feel free to contact us. Your comments and suggestions would be much appreciated.

Editorial Board
January 2020

I. Overview of Coronaviruses

1. What are viruses associated with respiratory infections?

"Viruses associated with respiratory infections" refer to the viruses that invade and proliferate in the epithelial cells of the respiratory tracts that could cause respiratory and systemic symptoms.

2. What are the common viruses associated with respiratory infections?

Viruses from the family Orthomyxoviridae (influenza viruses), the family Paramyxoviridae (paramyxoviruses, respiratory syncytial virus, measles virus, mumps virus, Hendra virus, Nipah virus and human metapneumovirus), the family Togaviridae (Rubella virus), the family Picornaviridae (rhinovirus), and the family Coronaviridae (SARS coronavirus) are the common respiratory viruses. In addition, adenovirus, reovirus, coxsackie virus, ECHO virus, herpes virus, etc. can also cause infectious respiratory diseases.

3. What are coronaviruses?

Coronavirus are unsegmented single-stranded positive-strand RNA viruses. They belong to the order Nidovirales, the family Coronaviridae, and the subfamily Orthocoronavirinae, which is divided into α, β, γ, and δ genera according to their serotypic and genomic characteristics. Coronaviruses belong to the genus Coronavirus of the family Coronaviridae. It is named after the wreath-shaped protrusions on the envelope of the virus.

4. What are the shape and structure of coronaviruses?

Coronaviruses have an envelope encasing the RNA genome), and the virions (the whole viruses) are round or oval, often polymorphic, with a diameter of 50 to 200 nm. The novel coronavirus is 60 to 140 nm in diameter. The spike protein is located on the surface of the virus and forms a rod-like structure. As one of the main antigenic proteins of the virus, the spike protein is the main structure used for typing. The nucleocapsid protein encapsulates the viral genome and can be used as a diagnostic antigen.

5. How are coronaviruses classified?

Most coronaviruses infect animals. Currently, three types of coronaviruses have been isolated from humans: Human Coronaviruses 229E, OC43, and SARS coronavirus (SARS-CoV). There are 6 types of coronaviruses previously known to infect humans. 229E and NL63 (of alphacoronaviruses), OC43 (of betacoronaviruses), HKU1, Middle East Respiratory Syndrome Coronavirus (MERS-CoV), and Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV).

Recently, a novel coronavirus was isolated from the lower respiratory tract of patients in Wuhan, who were suffering from

Different environments	Temperature	Survival time
Air	50 ~ 59°F	4 hours
	77°F	2 ~ 3 minutes
Droplets	<77°F	24 hours
Nasal mucus	132.8°F	30 minutes
Liquid	167°F	15 minutes
Hands	68 ~ 86°F	<5 minutes
Non-woven fabric	50 ~ 59°F	<8 hours
Wood	50 ~ 59°F	48 hours
Stainless steel	50 ~ 59°F	24 hours
75% alcohol	Any temperature	<5 minutes
Bleach	Any temperature	<5 minutes

9. How virulent is the 2019-nCoV?

Common coronaviruses mainly infect adults or older children, causing the common cold. Some strains can cause diarrhea in adults. These viruses are mainly transmitted by droplets, and can also be spread via the fecal-oral route. The incidence of corona virus infection is prevalent in winter and spring. The incubation period for coronaviruses is usually 3 to 7 days.

2019-nCoV is a coronavirus that underwent antigenic mutations. The incubation period of the virus is as short as 1 day but generally

II. Transmission of 2019-nCoV

14. What is community-acquired pneumonia?

Community-acquired pneumonia (CAP) refers to infectious pulmonary parenchymal pneumonia (including in the alveolar wall, which belongs to the lung interstitium in a broad sense) contracted outside the hospital setting, including pneumonia from known pathogens presenting after admission within its average incubation period.

15. What are the diagnostic criteria for community-acquired pneumonia?

The diagnostic criteria for community-acquired pneumonia are:

(1) Onset in community.

(2) The clinical manifestations of pneumonia are as follows.

- New presentation of cough, sputum, or exacerbation of existing respiratory diseases, with or without purulent sputum/chest pain/dyspnea/hemoptysis.
- Fever.
- Pulmonary consolidation and/or presence of wet rales.
- WBC (white blood cells) counts higher than 10×10^9/L or lower than 4×10^9/L, with or without a left shift of neutrophil nucleus

(a sign of immature neutrophils).

(3) Imaging characteristics. Radiographic examination revealing patchy infiltrates, lobular/segmental consolidation, or interstitial changes with or without pleural effusion.

If any items in (2) is positive and the imaging results support, a diagnosis of community-acquired pneumonia could be made after ruling out non-infectious diseases.

16. Which pathogens cause community-acquired pneumonia?

The most common pathogens that cause acute respiratory diseases include bacteria, viruses, or a combination of bacteria and virus. New pathogens, such as the novel coronavirus, can cause an epidemic or pandemic of an acute respiratory disease.

Bacteria are the main cause of community-acquired pneumonia. Streptococcus pneumonia is one of the most common bacterial pneumonia. Other bacterial pathogens include Mycoplasma, Chlamydia, Klebsiella pneumoniae, Escherichia coli, and Staphylococcus aureus; pneumonia caused by Pseudomonas aeruginosa and Acinetobacter baumannii have also been reported.

The virus detection rate for adult CAP patients in China is 15% to 34.9%, with influenza viruses including Haemophilus influenzae occupying the top spot. Other viral pathogens include parainfluenza virus, rhinovirus, adenovirus, human metapneumovirus, respiratory syncytial virus, and coronavirus. 5.8% to 65.7% of patients with positive virus test results are coinfected with bacteria or atypical pathogens.

17. How is community-acquired pneumonia transmitted?

IV. Personal Precautions

42. How to prevent respiratory infections in spring and winter?

Wash hands frequently with plain or antimicrobial soap and rinse with running water. Be sure to dry hands with clean towels. Wash hands immediately after contact with respiratory secretions (for example after sneezing).

Practice good respiratory hygiene/cough practices. Cover mouth and nose while coughing/sneezing with tissue, towel etc. and avoid touching eyes, nose or mouth afterwards before thoroughly washing hands.

Strengthen overall health and immunity. Keep a balanced diet, get enough sleep and regular exercise, and also avoid overworking.

Maintain good hygiene and proper ventilation. Open windows regularly throughout the day to let in fresh air.

Avoid crowded places or contact with persons with respiratory infections.

Seek a medical attention if fever, cough, sneezing, runny nose or other respiratory symptoms appear.

43. Why does flu caused by viruses become pandemic?

Influenza is mainly transmitted through respiratory droplets and contact from infected to susceptible people, or through contact with contaminated items. In general, its incidence peaks in autumn and winter. Human influenza is mainly caused by influenza A virus and influenza B virus. Influenza A viruses often undergo antigen mutations and can be further classified into subtypes such as H1N1, H3N2, H5N1, and H7N9. When new influenza virus subtypes appear, they easily become a pandemic because the population generally lacks immunity against them.

44. How to keep yourself away from the novel coronavirus?

(1) 2019-nCoV is mainly transmitted by droplets and contacts, therefore medical surgical masks must be worn properly.

(2) When sneezing or coughing, do not cover nose and mouth with bare hands but use a tissue or a mask instead.

(3) Wash hands properly and frequently. Even if there are viruses present on hands, washing hands can block the viruses from entering respiratory tract through nose or mouth.

(4) Boost your immunity, and avoid going to crowded and enclosed places. Exercise more and have a regular sleep schedule. Boosting your immunity is the most important way to avoid being infected.

(5) Be sure to wear the mask always! Just in case you come in contact with an infected person, wearing a mask can prevent you from inhaling virus-carrying droplets directly.

45. Can a mask block such small coronaviruses?

The masks are effective. Because the purpose of wearing the mask is to block the ‘carrier’ by which the virus is transmitted, rather

than directly blocking the viruses. Common routes for transmission of respiratory viruses include close contact over a short distance and aerosol transmission over a long distance. Aerosols which people usually come in contact with refer to respiratory droplets from patients. Wearing a mask properly can effectively block respiratory droplets and therefore prevent the virus from directly entering the body.

Please be reminded that it is not necessary to wear a KN95 or N95 respirator. Regular surgical masks can block most virus-carrying droplets from entering the respiratory tract.

46. What are the features of masks for different purposes?

Major types of masks: N95/KN95 respirators, surgical face masks, and cotton face masks.

N95/KN95 respirators can filter 95% of particles with an aerodynamic diameter greater than or equal to 0.3 μm, and block viruses. They can help prevent airborne diseases.

Disposable surgical face masks have 3 layers. The outer layer is hydrophobic non-woven layer which prevents droplets from entering the mask; the middle layer has a filter to block 90% of particles with a diameter greater than 5μm; and the inner layer in contact with the nose and mouth absorbs moisture. They are typically for sterile medical operations and be used to prevent airborne diseases.

Cotton face masks are heavy, stuffy, and do not fit closely to the face, and thus not effective against viruses.

The characteristics of the commonly-used masks are shown in the table on page 24.

47. Any difference between KN95 respirator and N95 respirator?

Respirators are a kind of respiratory protective gear. It’s designed to more closely fit on the face than regular masks, and effectively filter particles in the air. “N” indicates “non-oil-based uses” and a N95 mask can be used to protect against non-oil-based suspended particles; “95” means that the filtration efficiency is no less than 95%, indicating that this respirator, as proved by careful testing, can block at least 95% of very small (0.3 μm in size) tested particles.

If worn correctly, N95’s filtration efficiency is superior to regular and surgical masks. However, even if you wear it as required, it does not 100% eliminate the risks of infection.

KN95 is one of the ratings specified in the Chinese standard (GB 2626—2006) while N95 is one of the ratings specified in the American standard (42 CFR 84). The technical requirements and testing methods of these two ratings are basically the same, and they both have a filtration efficiency of 95% by their respective standards.

MASK TYPES	INTENDED USE	FILTRATION EFFICIENCY	NUMBER OF USES
N95 masks (Without a breathing valve) 	Also known as N95 respirators. A type of respiratory protective gear that can effectively filter particulates in the air and is suitable for protecting against airborne respiratory infectious diseases.	Blocks at least 95% of very small particles (approximately 0.3 μm in size)	Can be reused or used extendedly. Discard the masks when they get damaged, deformed, wet or dirty.
N95 masks (With a breathing valve) 	Same as N95 masks without a breathing valve. The breathing valve has a delicate design with several flaps. It allows the exhaled air to escape without letting small particles enter. This design makes exhaling easier and helps reduce the accumulation of moisture and heat.	Same as N95 masks without an exhalation valve. It blocks at least 95% of very small particles (approximately 0.3 μm in size)	Same as N95 masks without a breathing valve.
Surgical masks 	Used as basic protective gear for medical professionals or related personnel. It protects the wearer from splashes and droplets that may contain germs.	The filtration efficiency of surgical masks is not uniform. Some might perform worse than required of surgical masks or medical protective masks. In general, particles that are roughly 5 μm in size can be filtered out. There is a water-repelling outer layer which blocks droplets from entering the mask; the middle layer is a filter layer.	Single use
General medical masks 	Single-use protection masks for medical procedures. Generally used in ordinary environments to block particles (such as pollen) other than pathogenic microorganisms.	Does not fulfill the filtration efficiency requirements for particles and bacteria, or has lower requirements than surgical masks and medical protective masks.	Single use
Cotton face masks 	Used to keep warm and block larger particles such as dust.	Can only filter larger particles, such as soot or dust.	Washable and reusable

48. How to choose a mask?

The capability of masks to protect a wearer is ranked as follows: N95 respirators > surgical face masks > general medical masks > cotton masks.

N95 respirators come in two types, with or without breathing valves. While N95 respirators may make breathing more difficult for people with chronic respiratory diseases, heart disease, or other diseases with breathing difficulty, N95 respirators with breathing valves can make breathing easier and help reduce heat build-up.

N95 respirators with or without breathing valves have the same protection capability for the wearer. However, N95 respirators with breathing valves cannot protect people nearby an infected wearer. Therefore, carriers of the virus should wear N95 respirators without breathing valves to prevent spreading the virus. To keep the sterility of an environment, N95 respirators with breathing valves are not suggested because the wearer may exhale bacteria or viruses.

49. How to put on, use and take off a mask?

(1) After identifying the front, back, top, and bottom of the mask, wash your hands before wearing it. Make sure that the mask covers your nose and mouth, fits closely around the face to form a closed environment, so air passes through the mask, but not the gaps around it. Then, place the ear loops around each the ears.

(2) Besides the front and back side, the surgical mask also has a stiff bendable strip on top. When wearing it, with the front side facing outwards, you also need to make sure the stiff bendable strip is on top, molded around the nose.

(3) Wash hands thoroughly before taking off your mask. Push the front side of mask with one hand while holding the ear loops and

remove them from around each ear with the other. Fold the mask with the back side in. If the back side is not contaminated, a limited reuse is allowed.

50. How often should a mask be replaced? Can N95 respirators be extendedly used or reused?

All masks have a limited protective effect and need to be replaced regularly in the following cases:

- when it is difficult to breath though the mask;
- when the mask is damaged;
- when the mask cannot fit snugly to the contour of the face;
- when the mask is contaminated with blood or respiratory droplets etc.;
- after contact with, or exit from, an isolation ward of any patient infected with an infectious disease requiring contact precautions (the mask has been contaminated).

At present, international organizations including the World Health Organization, have no definitive guidelines as to the optimal wearing time of N95 respirators. China has not yet introduced the relevant guidelines regarding the time of use of masks, either. Researches on the protective capability and wearing time of N95 respirators show that the filtration capability stays at 95% or above after 2 days of use, while the respiratory impedance has not changed much; the filtration capability is reduced to 94.7% after 3 days of use. The U.S. Centers for Disease Control and Prevention recommends that when N95 respirators are in short supply, N95 respirators can be extendedly used or reused unless they are visibly dirty or damaged (such as creased or torn).

Resources

CDC Coronavirus Disease 2019 (COVID-19) Situation Summary: https://www.cdc.gov/coronavirus/2019-ncov/summary.html

Interim Guidance for Administrators of US Childcare Programs and K-12 Schools to Plan, Prepare, and Respond to Coronavirus Disease 2019 (COVID-19): https://www.cdc.gov/mmwr/volumes/66/rr/rr6601a1.htm#T1_down

Interim Guidance for Businesses and Employers to Plan and Respond to Coronavirus Disease 2019 (COVID-19): https://www.cdc.gov/coronavirus/2019-ncov/specific-groups/guidance-business-response.html

CDC in Action: Preparing Communities for Potential Spread of COVID-19 https://www.cdc.gov/coronavirus/2019-ncov/php/preparing-communities.html