

SKILLS TO OBSTRUCT PANDEMICS

ADVANCE PRAISE

Get the simple things right first. Low-cost public health interventions have the potential to stop this pandemic in its tracks. While these measures may seem like common sense, in fact, they have to be learned. This text is a great place to start that learning.

High tech, scientific advances in therapeutics, and vaccines will come. In the meantime, the main things are the plain things, simple day-to-day modifications in lifestyle can stop contagion and save lives. This text details these, with practicalities and rationales for their implementation.

Dr. John Campbell, PhD RN, retired nursing professor, YouTube channel with 737k subscribers

What a great game plan to help us navigate through this pandemic. I'll run with this!

Franco Harris, former NFL player, NFL Hall of Fame member

Medical concepts, like Rocket Science, are always hard to translate into understandable and actionable terms. As my fellow epidemiologists—disease detectives—struggle to uncover the secrets of COVID19, *Skills* offers an approachable blueprint for action that all of us on the planet should heed. An equivalent of a naval aviator or astronaut's checklist for understanding the critical steps necessary to combat COVID.

Captain J.M. Linenger, Medical Corps, U.S. Navy (ret.) NASA astronaut/Mir Cosmonaut STS-64, STS-81, Mir 23, STS 84 physician (MD), epidemiologist (PhD), and author of *Off the Planet*

This book not only gave me the information I needed to understand our role in responding to the pandemic, but it is a practical tool to, "Love your neighbor as you love yourself." I appreciate the expertise and the care that went into this valuable work!

Rev. Dr. Joel C. Hunter, faith-based community organizer, retired pastor, and chairman, Community Resource Network

As health care professionals explaining the complexities of the pandemic to non-medical professionals can be daunting especially because of the complexity and the changing nature of the virus. Citizens continue to question the policies and guidelines that are being put in place because

they seriously affect our everyday lives. This book does an excellent job in taking the mystery out of COVID -19 for non-health professionals by putting the virus and the science in terms people can understand. I encourage anyone who has questions about this pandemic and those that are even a little bit skeptical about the seriousness of the virus spend some time with this valuable educational tool.

Deborah L. Arms PhD RN, Ohio Nurses Association

It's much more detailed than the safety information from corporate or the CDC. The question-and-answer sections are particularly useful for testing our understanding of how this pandemic spreads.

Joe Beddal, sandwich shop owner in State College, PA

Nature will have its way, with storms, floods, and disease. That does not mean it has to win. The key is to have a plan. This book offers a roadmap for the COVID-19 pandemic and for future outbreaks; events that disproportionately impact communities of color and the disadvantaged.

Lt. Gen. Russel Honoré, USA (ret.), author of *Survival: How Being Prepared Can Keep You and Your Family Safe*

SKILLS TO OBSTRUCT PANDEMICS

***How to protect yourself and your community
from COVID-19 and similar infections***

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Continue the Enlightenment!

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IN MEMORY OF FREDRICK RYANS who helped on this project while doing his PhD, and dedicated to all those who have had their lives turned upside-down yet cheerfully provide healthcare to the public, working from home while providing daycare, and those hard-working folks continuing to make products, stock shelves, take orders, drive trucks, and make deliveries.

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Introduction

This book teaches knowledge and skills to help interrupt the transmission of COVID-19 caused by the SARS-CoV-2 virus. These skills are also applicable to other respiratory pathogens and will also generally help decrease the spread of most infections.

This book is based on a comprehensive online tutor to educate the community about the science and steps we can all take to help reduce the pandemic (StopTheSpread.health). We started to create the tutor in early March 2020 when we saw that there was going to be a pandemic. The coming storm was visible in foreign news reports and first-person videos on Reddit and other news sources.

We are a team based at Penn State who work on computer-based tutoring and theories of learning. We have been joined by two medical doctors, a virologist, a nurse, a bioterrorism expert, and a public health doctor who have contributed prose, comments, and general advice. We have had the contents checked by another doctor, two nurses, a nutritionist, and a clinical psychologist.

The learning theory we use is based on learning declarative information (facts) and then proceduralizing it (turning the facts into skills). The declarative information needed to fight this pandemic is more complex than can be fully covered in a 2-minute TV interview or a single poster. The book thus covers extensive declarative information and then gives readers questions and exercises to help make the knowledge more proceduralized.

The expected tutor and book time is one to three hours. There are many quizzes for practice and mastery learning. If you follow the **Read/Learn More:** notes, you can learn even more. These are available as an online set at <http://StopTheSpread.health/URLs>, which hosts all the links in this book. You can also choose instead to look at single sections and skip around. This time may seem like a long time. This length is required because the material is comprehensive and because the knowledge requires practice and thought. If the content is too long for you, try breaking it up into smaller chunks,

looking at single sections, and feeling free to jump around. Many topics are self-contained. You can also skim or skip the quizzes, but you will not learn the material as well. The book assumes you want to learn a lot. Information can change rapidly in this area. We will put updates and errata on the StopTheSpread.health site You can also use the online tutor if you wish—logins are free!

The book and online tutor are designed for non-medical professionals, for example, Penn State students and the people in their community. The tutorial encompasses multiple types of skills. The scenarios reflect everyday life and strategies that can be used by almost everyone.

The goal of this material is for you to understand how viruses spread and to know what you can do to stop the spread of COVID-19 and similar diseases by protecting yourself and others. You will learn basic microbiology concepts. You will learn strategies to reduce the chance of being infected, and that will help “flatten the curve” by reducing or delaying infections. A one-page summary of the skills to obstruct pandemics is available in Figs. 2.2 and 3.1, as a quiz in Appendix 1, and on the tutor’s homepage.

The knowledge and skills in this book should also help stop the spread of other infections, including the flu. And these skills will be useful in the next flu season and the next pandemic if there is one (and they are expected).

Stopping the spread is not political, but rather practical. No one likes to become ill. Changing our behavior to reduce infection and the spread should be seen as practicing the Golden Rule, do unto others as you would have them do on to you. Being a good neighbor has many benefits.

We do not present material on why the pandemic is leading to a considerable amount of suffering and how it could rapidly get even worse if not addressed. Information in this area is readily available. We have curated a website containing descriptions of why this is a serious pandemic; if you have any questions—we do not. This disease has not only mortality (death) but also morbidity (long-lasting damage). [<https://stopthespread.health/taking-covid-seriously/>]

For learners, the disease is COVID or COVID-19 (COroNaVIrus Disease [20]19). The disease is caused by the SARS-CoV-2 virus, which is a type of coronavirus. The book uses these terms somewhat interchangeably, but they are technically different things.

All content and media in this book are created and published for informational purposes only. They are not intended to be a substitute for professional medical or healthcare advice and should not be relied on as health or personal advice.

Acknowledgments

We need to thank many people and organizations who helped create this book. Dan Kirkpatrick provided numerous comments on style and correctness and provided the idea for this project years before this pandemic. Chris Garrison provided advice on numerous occasions. Prof. William Bahnfleth suggested the material about the virus's life in the air and gave a 20 minute interview to provide initial material. Our panel of experts gave suggestions and helped improve the presentation and correctness. We need to thank the Applied Cognitive Science Lab members for comments, assistance, and numerous discussions on this project. Garrett Barch did an internship working on the tutor and book, including writing a paragraph in Section 4, which helped a lot. Matthew J. Norris did part of his required internship with us. He started out helping run a psychology study and ended up helping prepare this material. Darlene Chassé Ash, Father Richard Baker, Paul Clifford, Catherine Copetas, Steve Croker (several times), Don Donahue, Patrick Dudas, Cara Exten, David Hozza, William Kennedy, Jong Kim, Edward Mays, Trisha McKee, Stellan Ohlsson, Colleen Ritter, Joseph Ritter, Jack Sparks, Sarah Stager, Yvette and Richard Tenney, and Sue Van Vactor provided comments and advice. The College of IST at Penn State, the Applied Research Lab, The Office of Naval Research, and the Defense Health program provided support for the tutor, and ONR and DHP provided support for the D2P tutoring architecture (N00014-15-1-2275; W81XWH-17-C-0002). iStock.com provided some images under their "Support for Covid" campaign, as did some other resource sites noted in the figure sources. Materials, including pictures and text, are generally drawn from creative commons and US Government websites. We would like to thank Korey MacDougall, former ACS Lab member and consultant, for helping maintain the tutoring system. Myeongcheol Hong and Jacob Oury also helped with this maintenance. And thanks go to Abigail Henson, Crystal Devine, and Lawrence Knorr at Sunbury Press for helping turn this into a book.

A portion of the proceeds (12%) of the book will go to the Society for Disaster Medicine and Public Health, where it will help with information dissemination about disaster preparedness. The online tutor is free to use.

1

What Does Flatten the Curve Mean?

Overview of Book

This book will help decrease your chances of catching infections based on understanding how they are transferred. There are relatively easy ways to decrease the spread of infections by interrupting every step of the process. The chain of infections are shown metaphorically in Fig. 1.1 and taught throughout this book.

This book helps by teaching you how to separate yourself from infectious material and how to protect people around you if you might be or are infectious. This includes how to cough, how to protect yourself from droplets and contaminated surfaces, and how to keep your hands clean.

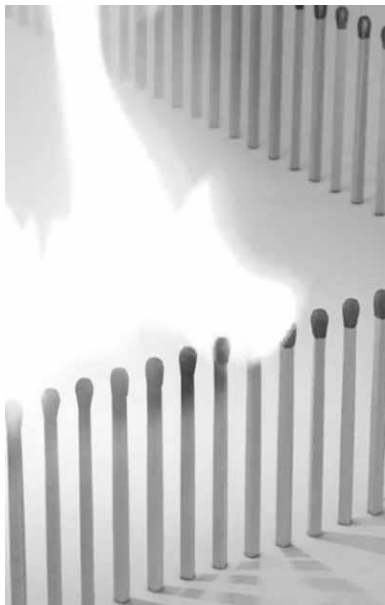


Fig. 1.1 [U1.1, U1.2] A row of safety matches shown catching fire, representing the spread of infection.

Infection, in many cases, is a probabilistic danger. Not every situation you run across will have infectious material. In the case of COVID-19, it is hard to tell when someone is infected and transmitting the virus. Not every precaution is necessary, but it is very difficult to know when the precaution is necessary. So, to help reduce the spread, you should apply as many of these skills as often as you can. Sometimes, nothing will have been prevented. Sometimes, you might save yourself, or you might stop yourself from getting infected and infecting someone else you do not know or someone you care about. The more we apply these skills, the sooner the disease rate decreases, and the sooner we can get back to normal. These skills make a real difference [U1.3].

You cannot see viruses. The people around you may be contagious without having obvious

or any symptoms, so you need to take these precautions even if you do not think you are at risk. You might also be infectious, spreading viruses, even if you do not feel sick.

Now is the time to practice. The military, medical personnel, driving instructors, skydivers, pilots, firefighters, and police all practice the skills they need to use before it counts. So, even if you think you are not at risk today, you still want these skills to be second nature. This book will teach you to identify situations that put you at risk, help you practice making the right decisions, equip you with the knowledge about when and how to wash, and many other related skills.



READ MORE*

- [U1.1] “Safety Match” by Juan Delcan & Valentina Izaguirre (@Juan_delcan) [https://www.youtube.com/watch?v=oHx_slAQfMM]
- [U1.2] Juan Delcan on YouTube [<https://www.youtube.com/channel/UCRjQVwyyBD2VpX2u5rFdHkw>]
- [U1.3] This is just one example showing that these skills work to fight infection. Additional references are in appropriate sections: Cowling, Benjamin J., Kwok-Hung Chan, Vicky J. Fang, Calvin KY Cheng, Rita OP Fung, Winnie Wai, Joey Sin et al. 2009. “Facemasks and hand hygiene to prevent influenza transmission in households: A cluster randomized trial.” *Annals of Internal Medicine* 151: 437-446. [https://www.researchgate.net/publication/26714438_Facemasks_and_Hand_Hygiene_to_Prevent_Influenza_Transmission_in_Households_A_Cluster_Randomized_Trial]

Flatten the Curve

Fig. 1.2 shows a match that did not catch the flame and protected the matches on the other side from igniting. You could be that match!

If you are concerned about the COVID-19 pandemic and would like to help on an individual level, you can use this material to practice the ways to protect yourself and thus protect others because you will learn how to stop the transmission.

Why are we making a big deal about this virus? The evidence so far suggests that perhaps 80% of the people who get the disease, COVID-19, will have a “mild” illness. But that does not mean people with mild symptoms have it easy. “Mild” includes everything up to pneumonia that does not require hospitalization. Approximately 14% will experience more severe illness, and approximately 6% will experience critical illness (i.e., will require an ICU bed). Of the infected, various estimates have put the death rate of infected cases between 0.2% and 2%—if they are treated. These numbers vary by population and are not yet well understood.

There are typically about 3 hospital beds per 1,000 people in the US, and not all of these are ICU beds. There are other people who would normally

* Resources with indicators like [U1.1] are available as a set at <http://StopTheSpread.health/URLs>.

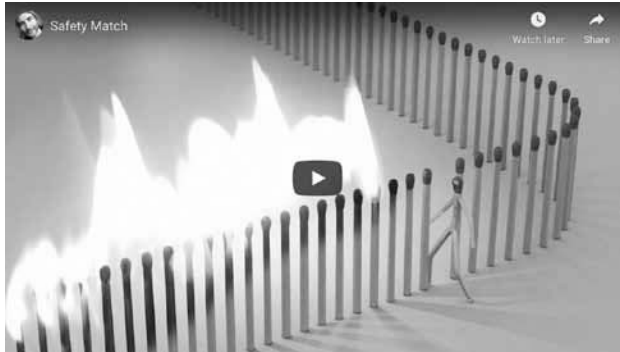


Fig. 1.2 [U1.1] A row of safety matches illustrating how physical distance can put an end to the flame igniting all the matches when one match steps out of line and stops the spread.

need those beds. If more than 1.5% get COVID-19 at any point in time, then the hospitals can be overwhelmed (unless we get more beds, and we are getting more beds).

The virus spreads exponentially, so the growth rate for infections can be very fast, doubling every few days or every week. As Dr. Fauci, Director of the National Institute of Allergy and Infectious Diseases (NIAID), said, “if it

looks like you’re overreacting, you’re probably doing the right thing.” Thus, we need to be very concerned but not unduly afraid.



READ MORE

- [U1.4] America’s COVID-19 warning system
[<https://covidactnow.org/>]
- [U1.5] Fauci: “If it looks like you’re overreacting, you’re probably doing the right thing”
[<https://thehill.com/homenews/sunday-talk-shows/487639-fauci-if-it-looks-like-youre-overreacting-youre-probably-doing-the>]
- [U1.6] Predictions for COVID-19 infections
[<https://projects.fivethirtyeight.com/covid-forecasts/>]

Summary of Flatten the Curve: The Curve Itself

Hospitals and health care facilities usually have capacity. We have seen through numerous reports on TV and the Internet that this is not the case with COVID-19 when it gets out of control.

If enough people are infected at the same time, there will be a peak of sickness that will overwhelm our healthcare resources and perhaps breaking the healthcare workers too. This peak is illustrated in Fig. 1.3.

Flattening the curve, in summary, is doing all that you can at an individual level to slow the spread of infection so that the healthcare system does not become overwhelmed. This flattens the curve of cases, spreading out and reducing the load on the healthcare system at any single point in time.

The higher the exposure rate to an infectious agent, the greater the chance for infection. The less contact and the fewer number of contacts you have, the less likely you are to catch a disease.

Practicing the social distancing and personal hygiene techniques provided in this book can reduce your chances of becoming infected with

FLATTEN THE CURVE

Proactively control timing of number of sick, so health care system can take care of all.

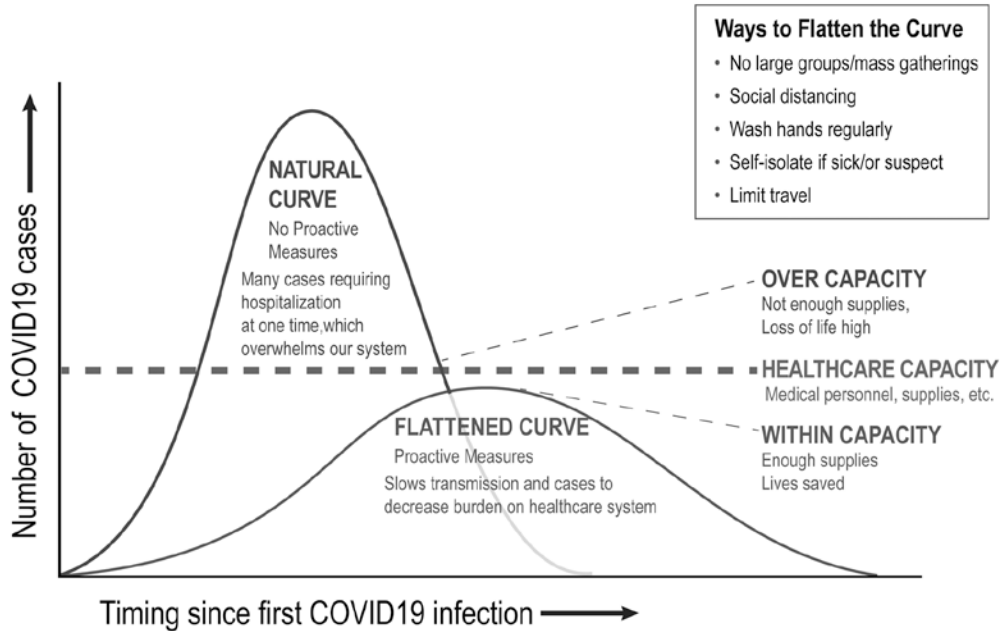


Fig. 1.3 Reducing the spread of infection also helps stays within healthcare capacity.

COVID-19 and help flatten the curve. This can reduce the risk of our health-care system becoming overwhelmed and, quite likely, fewer people will die.

We do not all inevitably get food poisoning, SARS, norovirus, and Ebola. These viral diseases that do not have vaccines are avoided for the most part by behavioral changes. So, it is not the case that we must all now get COVID-19.



READ MORE

- [U1.7]** Site where you can find the COVID-19 status for where you are and other geographical locations [<https://healthblog.uofmhealth.org/wellness-prevention/flattening-curve-for-covid-19-what-does-it-mean-and-how-can-you-help>]
- [U1.8]** Article with interactive infection spread simulations [<https://www.washingtonpost.com/graphics/2020/world/corona-simulator/>]

Quiz 1: Flattening the Curve

Here is a short quiz about flattening the curve. There are many quizzes throughout the book. Please think about each question and mark your answer with a pen or pencil before turning the page to look at the answer. The questions are another way to get the material to sink in and to practice applying the knowledge. Answering quiz questions is a way of practicing retrieval of declarative information from your memory, which increases the strength of that memory, thus making it easier to turn your declarative knowledge (facts) into procedures (skills). Through practice and proactive behavior, you can help break the chain of infection like the match in Fig. 1.4.



Fig. 1.4 A row of matches showing how distancing can help stop the spread.

- Question 1.1** Does flattening the curve mean fewer deaths in general?
A) Yes B) No C) Maybe
- Question 1.2** Does flattening the curve mean less COVID-19 infections overall?
A) Yes B) No C) Maybe
- Question 1.3** Do your personal actions help flatten the curve?
A) Yes B) No C) Maybe
- Question 1.4** I am just one person, and I do not have any symptoms, and no one I know does. Will my actions really matter?
A) Yes B) No C) Maybe
- Question 1.5** What is the main purpose of helping to flatten the curve?
A) Alert people to when they can stop sheltering in place
B) To give companies time to make more toilet paper and hand sanitizer
C) Reduce the infection rate of senior citizens
D) Increase healthcare capacity
E) Prevent overwhelming the health care system and reduce deaths

.....

Answers to Quiz 1

Question 1.1: C, Maybe

Feedback: Maybe. Flattening the curve does not necessarily prevent deaths; it defers deaths in the absence of a vaccine. If a death rate reduction occurs, it will come from two sources where healthcare facilities are not overwhelmed, and thus resources are available:

1. Ventilators and other healthcare resources may now be used in more cases where needed, reducing death.
2. Facilities and resources are available to treat non-COVID-19 cases.

Question 1.2: C, Maybe

Feedback: Maybe. It depends. With a mild outbreak, flattening the curve can mean less infection, and that the healthcare system will not be overwhelmed. For a particularly dangerous infection, flattening the curve might only mean that the healthcare system is not overwhelmed, which would lead to less suffering and fewer deaths.

Question 1.3: A, Yes

Feedback: Yes, each person who helps themselves also helps others. The flattening is the addition of everyone who contributes. It requires enough of us. Right now, all of us. We have developed this material to help flatten the curve and save lives. David Quammen, in *Spillover*, notes that individual actions can help stop pandemics in humans, and humans are uniquely able to stop pandemics with their individual actions.

Question 1.4: A, Yes

Feedback: Yes, because those infected with the coronavirus can infect others possibly days before they feel any effects, if they ever do. That means that someone can spread it to you, and you can spread it to others before you even suspect you are ill.

Question 1.5: E, prevent overwhelming the health care system and reduce deaths

Feedback: Preventing the healthcare system from being overwhelmed is the main purpose of flattening the curve. Keeping the caseload within the capabilities of the healthcare might also lower the overall death rate and permit vaccine interventions.

About the Authors

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JAMES J. JAMES, MD DrPH MHA, is the Executive Director of the Society for Disaster Medicine and Public Health. His doctorate is in public health from UCLA. He is the former Director of the American Medical Association (AMA) Center for Public Health Preparedness and Disaster Response. He is the former Director of the Miami-Dade County Health Department and a retired General, US Army, Medical Corps.