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Just Warming Up or Cooling Down? Review of Pediatric Cold Related Injuries and CoVID Current State Update

Project ECHO

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Medical Director, Pediatric Emergency Medicine

UW Health

Project Echo for Pediatric Care 2018-2020
Just Warming Up or Cooling Down? Review of Pediatric Cold Related Injuries and CoVID Current State Update
March 19, 2020
Nicholas Kuehnel, MD
Provided by the University of Wisconsin–Madison Interprofessional Continuing Education Partnership (ICEP)

Intended Audience:
Pediatric emergency care professionals

Objectives:
As a result of this educational regularly scheduled series, learners will be able to:

1. Utilize new skills and guidelines determined to be safe for children when accessing pediatric trauma.
2. Identify proper tools and standardized practices in order to improve the diagnosis and treatment of pediatric patients.
3. Define roles and responsibilities of team members who triage pediatric emergencies in order to identify communication strategies that result in effective patient care.

Policy on Disclosure
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Benjamin Eithun, MSN, RN, Coordinator	No relevant financial relationships to disclose	No
Kim Sprecker, OCPD Staff	No relevant financial relationships to disclose	No
Nicholas Kuehnel, MD, Presenter	No relevant financial relationships to disclose	No

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https://ce.icep.wisc.edu

2. During the live presentation, and in the follow-up email, you will be provided a code. Text that code to a number we provide you, using a cell phone associated with your account.

Text **MANGUQ** to 608-260-7097

(save this number as **ECHO Credit**, it will never change)

3. All done!! Log onto ICEP to view or print your credit letter.

Disclosures

I have no disclosures to report

Outline

- Pediatric Physiology
- Common Cold Related Injuries
- Treatment of Cold Related Injuries

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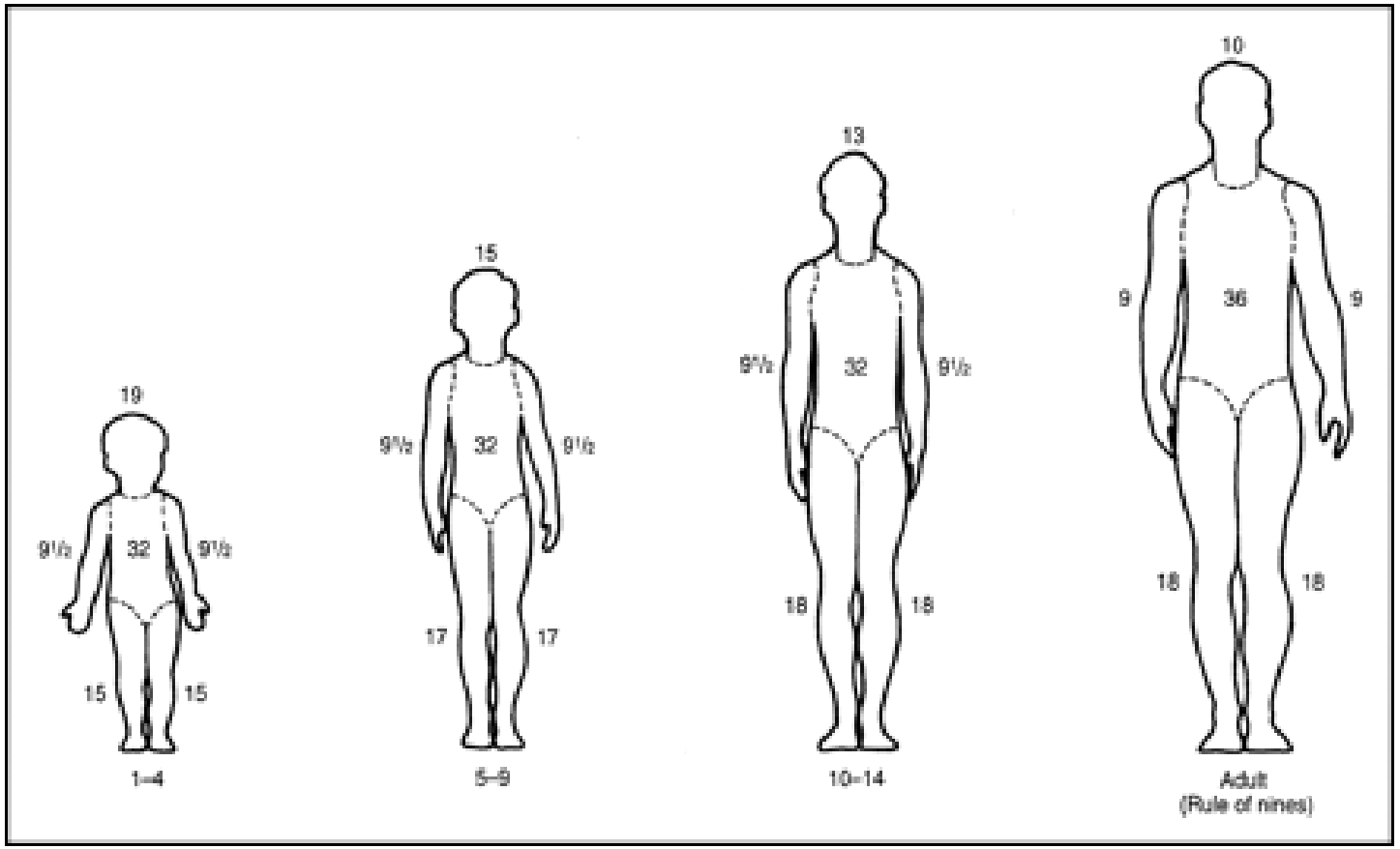
Why Are Kids At Higher Risk of Cold Injuries?

External Reasons



The "rule of nines" altered for the anthropomorphic differences of infancy and childhood. Reprinted with permission from Herndon DN, ed. *Total Burn Care*. 2nd ed. London, England: Saunders: 2002.

Internal Reasons

Less Subcutaneous Fat

Decreased Ability to Shiver

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Hypothermia

CDC

- Why should you care?

What to do: Call 911 at once.

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Degrees of Hypothermia

Mild	32–35	Few if any: • Shivering • Subjective awareness of cold • Apathy
Moderate	28–32	Unusual behaviors: • Disorientation (e.g., swimming off course) • Increasing confusion Altered conscious level: • Stupor • Coma
Severe	<28	Profound central changes: • Loss of consciousness • Coma • Respiratory depression • Myocardial irritability: Ventricular arrhythmias Cardiac arrest Death

Data from Butcher JD, Gambrell RC: Hypothermia. *In* Fields KB, Fitch PA (eds): Medical Problems in Athletes. Malden, MA, Blackwell Science, 1997, pp 285–292; and Kellett JJ: Medical considerations in aquatic sports. *In* Bloomfield, Fricker PA, Fitch K (eds): Medicine and Science in Sports and Exercise, ed 2. Melbourne, Blackwell Science, 1995, pp 576–589.

Signs & Symptoms

Adults:
- shivering
- exhaustion
- confusion
- fumbling hands
- memory loss
- slurred speech
- drowsiness

Infants:
- bright red, cold skin
- very low energy

CDC

Treatment

- Mild
  - Blankets
  - Warm Room Air
- Moderate
  - Heating Pad
  - Heated NC Oxygen
- Severe
  - Heated IVFs
  - NG lavage
  - Bladder irrigation

- Tips:
  - IV Fluids – WARM (goal 40-44C)
  - Focus on central re-warming
  - Continuous/frequent Temperature monitoring
  - Afterdrop

Last Ditch

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Frostbite
Have We Learned?

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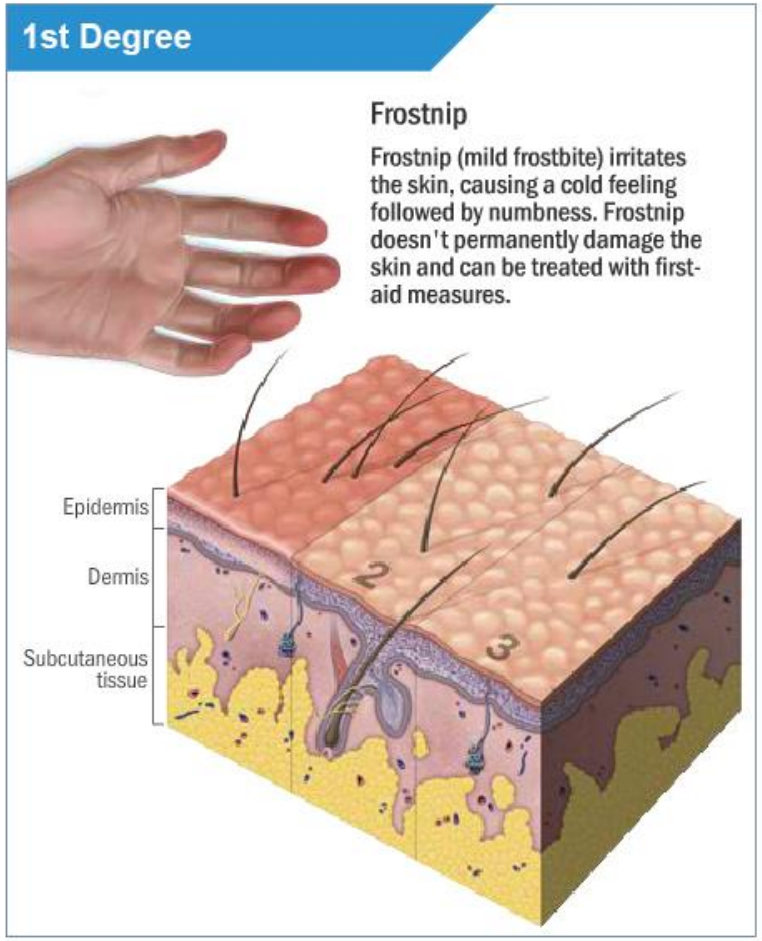
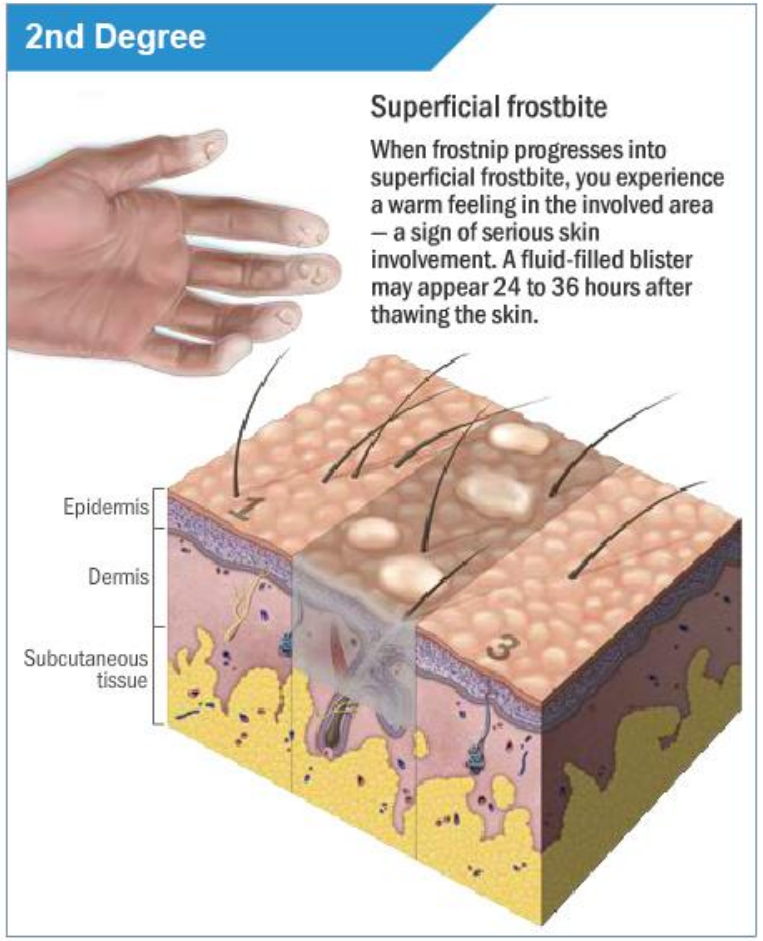
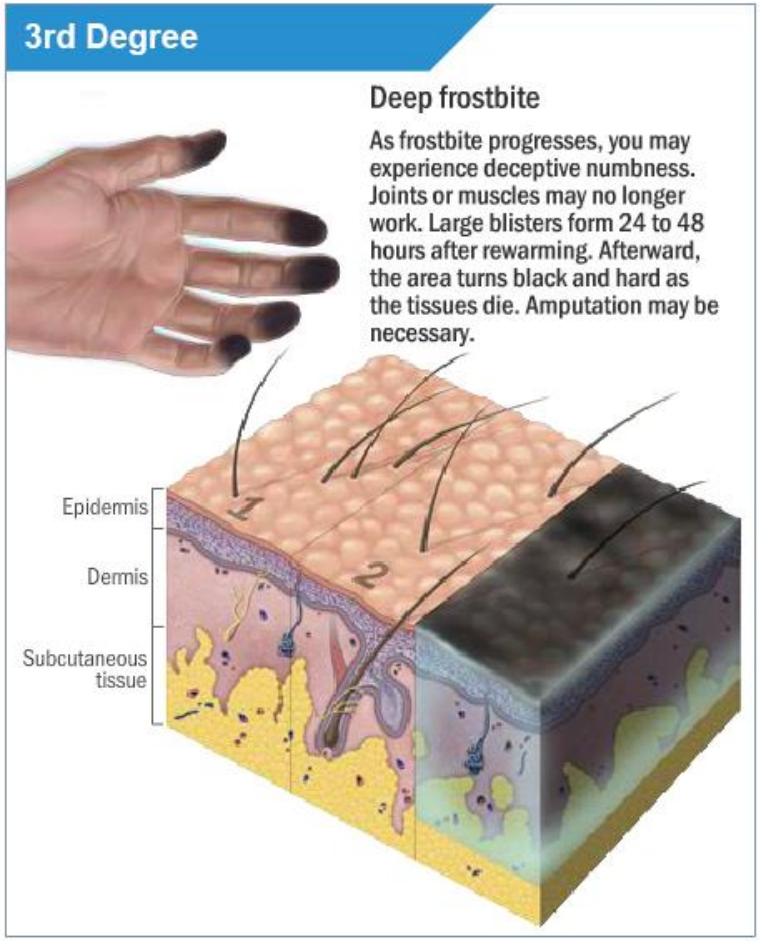
Frostbite







Mayo Clinic

Treatment

- Remove any wet clothing
- Do not rub or disturb the tissue
- Re-warm in warm water bath
- Narcotic pain medications may be needed

Safety with Cold Prevention

One ice angler dead, four hospitalized after being overcome by carbon monoxide poisoning

January 18, 2017 by Associated Press

Report: CO caused woman's death in ice shanty

Authorities don't suspect foul play

Posted: February 5, 2013 2:29 AM

Updated: December 28, 2019 10:02 AM by Site staff

Four Teens Killed By Carbon Monoxide In Ice-Fishing Shanty

MARYANN MROWCA February 5, 1989

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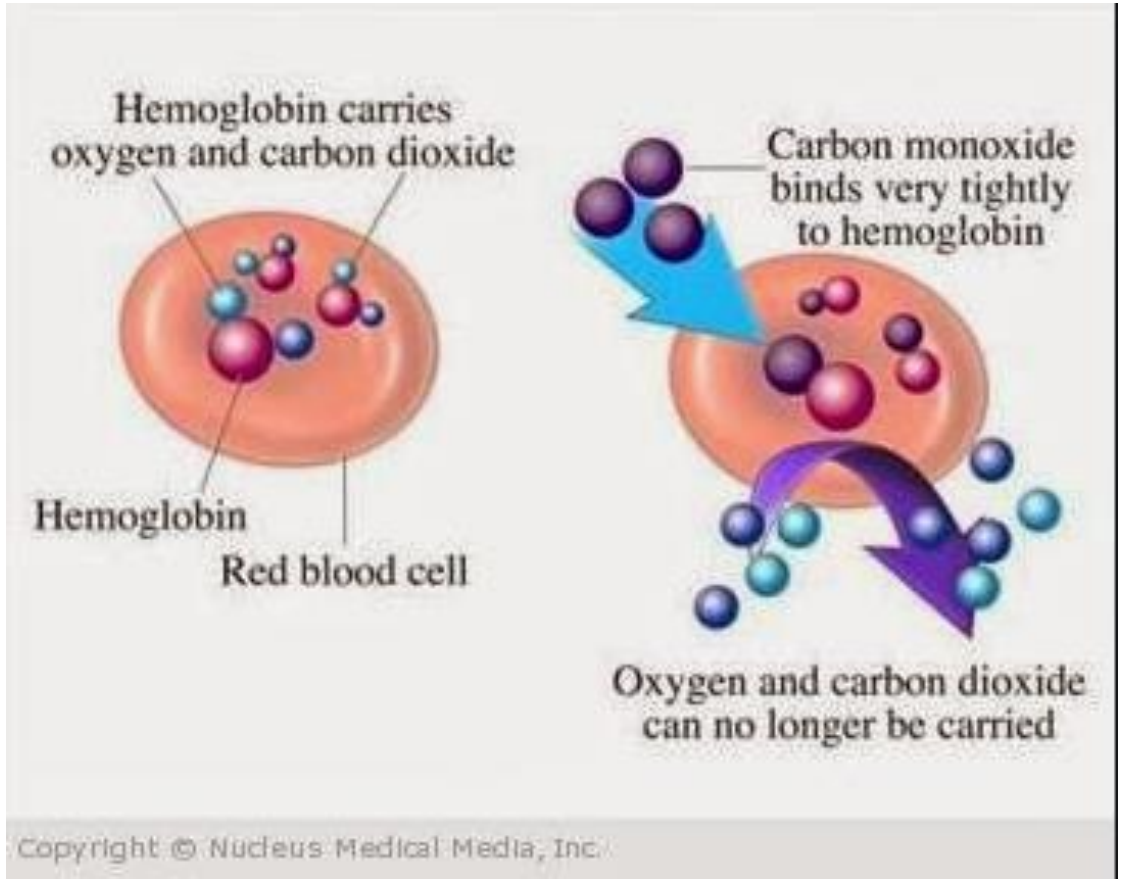
Carbon Monoxide Poisoning

Mechanism



Symptoms

Clinical severity: *(Ernst et al 2008)*

Mild **< 15 - 20%**	**Headache** **Nausea, Vomiting** **Dizziness, Blurred vision**
Moderate **21 - 40%**	**Confusion, Syncope** **Chest pain, Dyspnea** **Weakness** **Tachycardia, Tachypnea** **Rhabdomyolysis**
Severe **41 - 59%**	**Palpitations, Dysrhythmias** **Hypotension** **Myocardial ischemia, Cardiac arrest** **Respiratory arrest** **Noncardiogenic pulmonary edema** **Seizures, Coma**
FATAL >60%	**Death**

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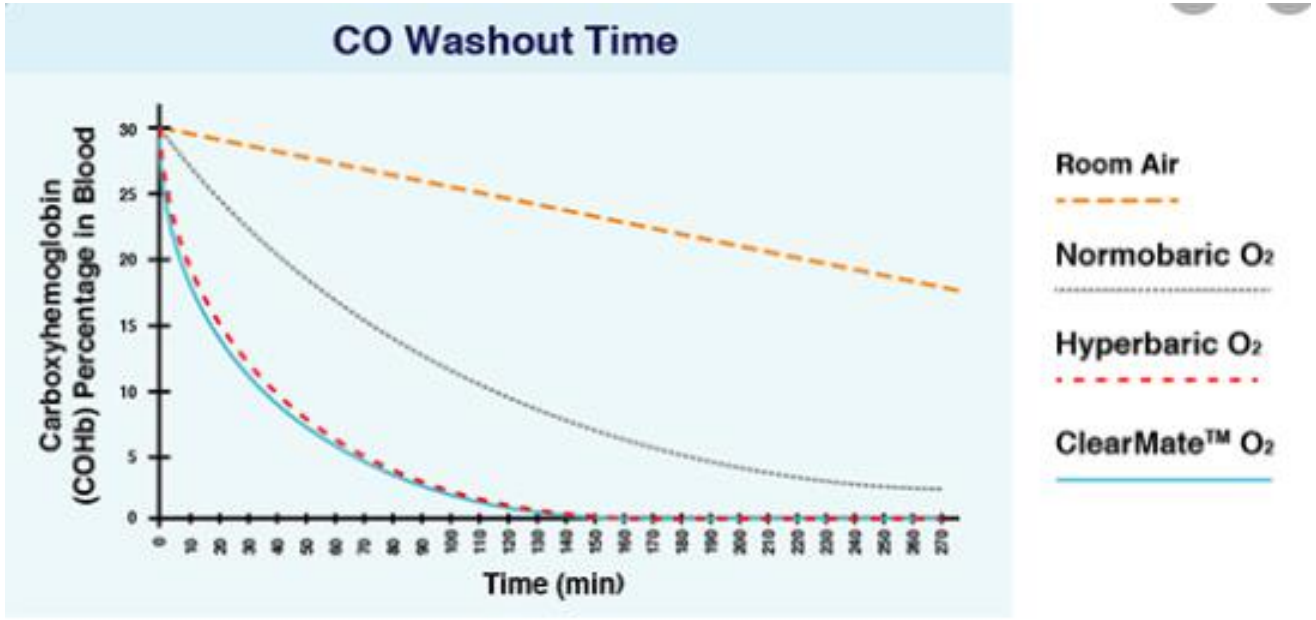
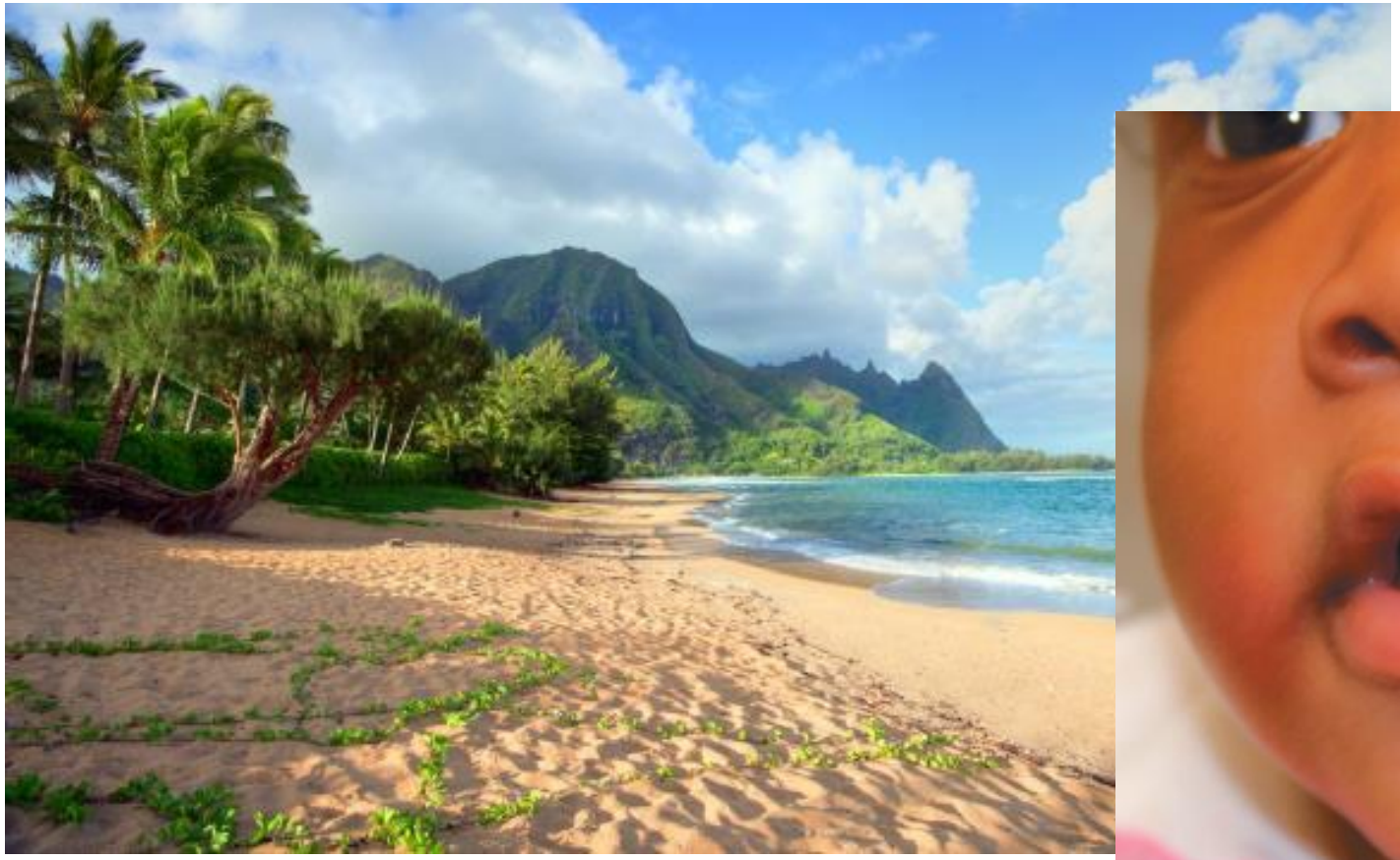
Treatment

- Carbon Monoxide
  - Oxygen is Key!
  - Hyperbaric?
    - Loss of consciousness
    - Carboxyhemoglobin level >25%
    - Cerebellar or Cardiac Dysfunction



Adapted from: Fisher JA, Sommer LZ, Rucker J, Vesely A, Lavine A, Greenwald, Y, Volgyesi G, Fedorko L, Iscoe S (1999) Isocapnic hyperpnea accelerates carbon monoxide elimination. Am J Respir Crit Care Med 159:1289–1292.

Vacation



Emedicinehealth.com

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The Bomb Pop

Popsicle Panniculitis

Reasoning:

- Higher Percentage of Saturated Fatty Acids
- Cold temperature causes local injury

Consultant 360

Symptoms:

- Erythema
- Warmth
- Induration

Treatment:

Supportive Care

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Resources

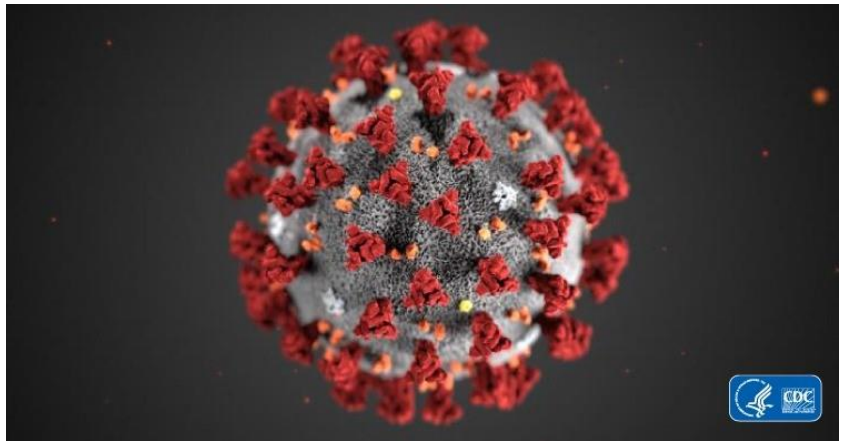
- www.healthychildren.org
- www.aap.org
- www.cdc.gov

Review

- Dress appropriately
- Tiredness can be first sign of hypothermia in kids
- Warm the core and don’t rub!
- Keep area well ventilated
- Beware the Bomb Pop

CoVID-19
(special thanks to Mike Pulia, MD, MS)

- What is it:
  - Severe Acute Respiratory Syndrome Coronavirus 19 (SARS-CoV-19)
  - Coronavirus are large, enveloped, single stranded RNA molecules that can rapidly mutate when transmitted between animals and humans



- Causes:
  - Coronavirus Disease-19 (CoVID-19)

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What's New

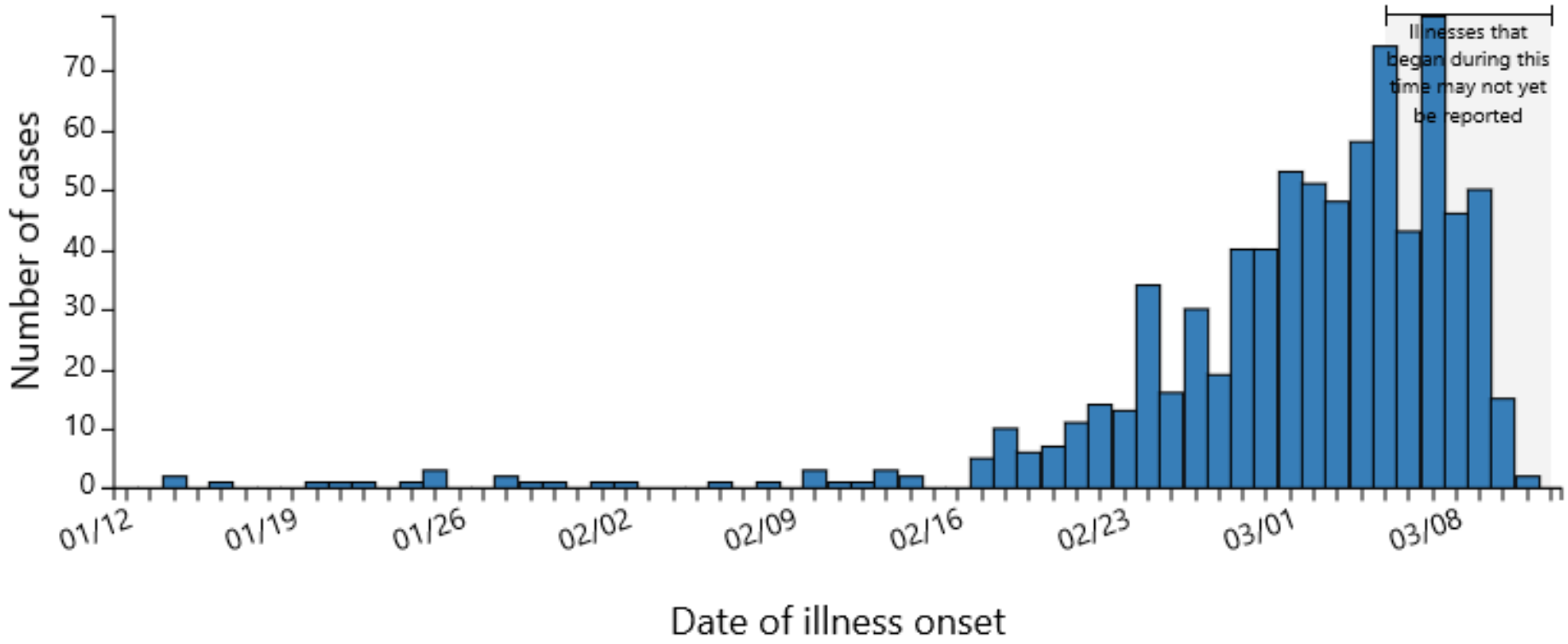
- Diagnostic testing
- Transmission data
  - Asymptomatic
  - Close contacts
  - Healthcare workers
  - R_0
- Pathophysiology update
  - Incubation period
  - Severity of illness

Los Angeles, Mar 9, 2020

Study Estimates COVID-19 May Have Infected Over 9,000 in U.S.

Cedars-Sinai researchers estimate that by the start of March, up to 9,000 in the U.S. may have been infected by COVID-19. Photo by Getty.

COVID-19 cases in the United States by date of illness onset, January 12, 2020, to March 12, 2020, at 4pm ET (n=792)**



Transmission Dynamics

- Asymptomatic spread
  - Serial interval<incubation period
  - However, may have comparatively low R_0 (2.2)
- No evidence to suggest airborne
  - Stool shedding
- Standard cleaning measures effective
  - Healthcare workers at low risk standard precautions

Serial interval of novel coronavirus (COVID-19) infections

Hiroshi Nishiura, Natalie M. Linton, Andrei R. Akhmetzhanov

PII: S1201-9712(20)30119-3
DOI: https://doi.org/10.1016/j.ijid.2020.02.060
Reference: IJID 4006

To appear in: *International Journal of Infectious Diseases*

Received Date: 14 February 2020
Revised Date: 25 February 2020
Accepted Date: 27 February 2020

Research Letter

March 4, 2020

Air, Surface Environmental, and Personal Protective Equipment Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) From a Symptomatic Patient

Sean Wei Xiang Ong, MBBS[1]; Yian Kim Tan, PhD[2]; Po Ying Chia, MBBS[1]; et al

Author Affiliations | Article Information

JAMA. Published online March 4, 2020. doi:10.1001/jama.2020.3227

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Basic reproductive number, R_0

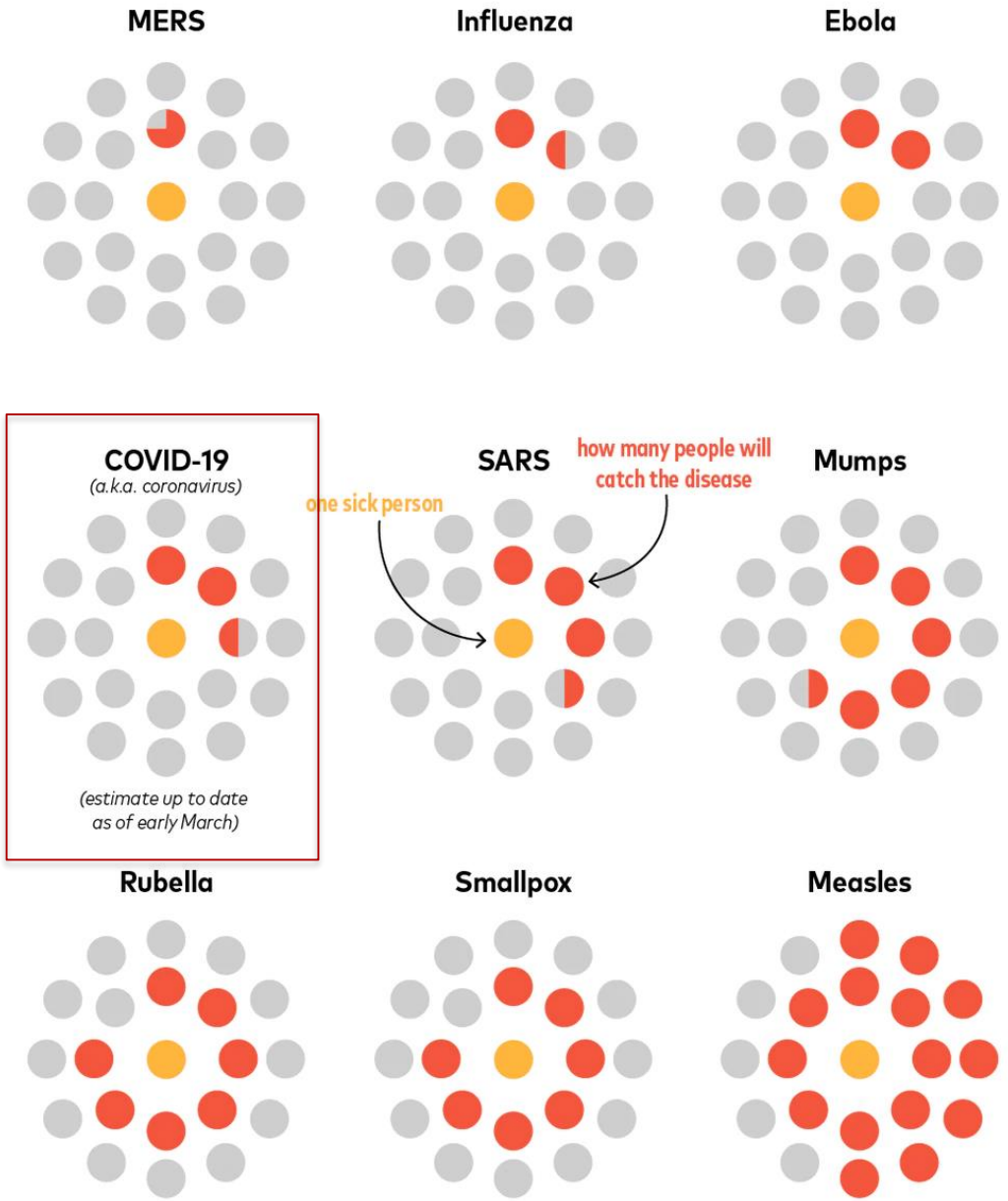
Expected number of cases caused by a typical infectious individual in a susceptible population.

$R_0 \leq 1$ → disease dies out

$R_0 > 1$ → disease can invade

Outbreak dynamics
- probability of fade-out
- epidemic growth rate

Disease control
- threshold targets
- vaccination levels



Transmission Dynamics

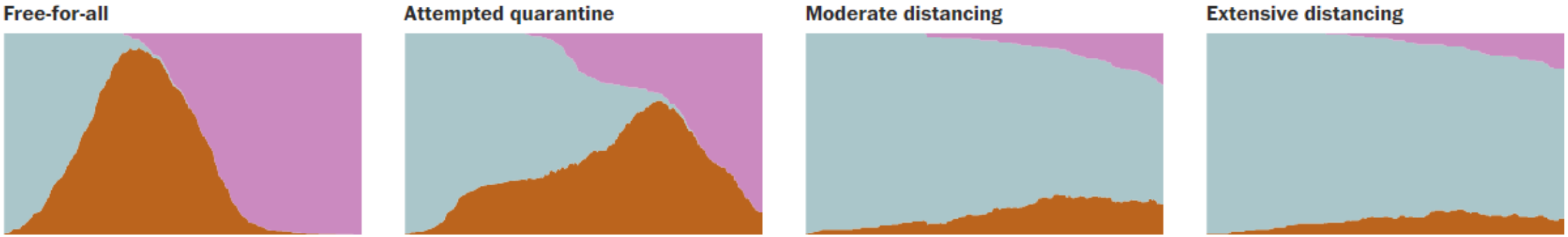
- 445 close contacts with first cases in US
  - 19 household, 5 had ongoing exposure
- Daily follow up for 14 days
- 0.45% secondary attack rate overall
- 10.5% among household members

Active Monitoring of Persons Exposed to Patients with Confirmed COVID-19 — United States, January–February 2020

Early Release / March 3, 2020 / 69

Rachel M. Burke, PhD[1]; Claire M. Midgley, PhD[1]; Alissa Dratch, MPH[2]; Marty Fenstersheib, MD[3]; Thomas Haupt, MS[4]; Michelle Holshue, MPH[5,6]; Isaac Ghinai, MBBS[6,7]; M. Claire Jarashow, PhD[8]; Jennifer Lo, MD[9]; Tristan D. McPherson, MD[6,10]; Sara Rudman, MD[11]; Sarah Scott, MD[6,12]; Aron J. Hall, DVM[1]; Alicia M. Fry, MD[1]; Melissa A. Rolfes, PhD[1]

How Viral Illness Are Spread



https://www.washingtonpost.com/graphics/2020/world/corona-simulator/

Contact Tracing and Case Isolation

- Mathematical model based on #cases, R_0 and clinical factors (e.g. asymptomatic transmission, time to isolation, etc.)
- Once R_0 reaches 2.5, this does not work unless <1% transmission before symptom onset
- Appears unlikely we can control at this point

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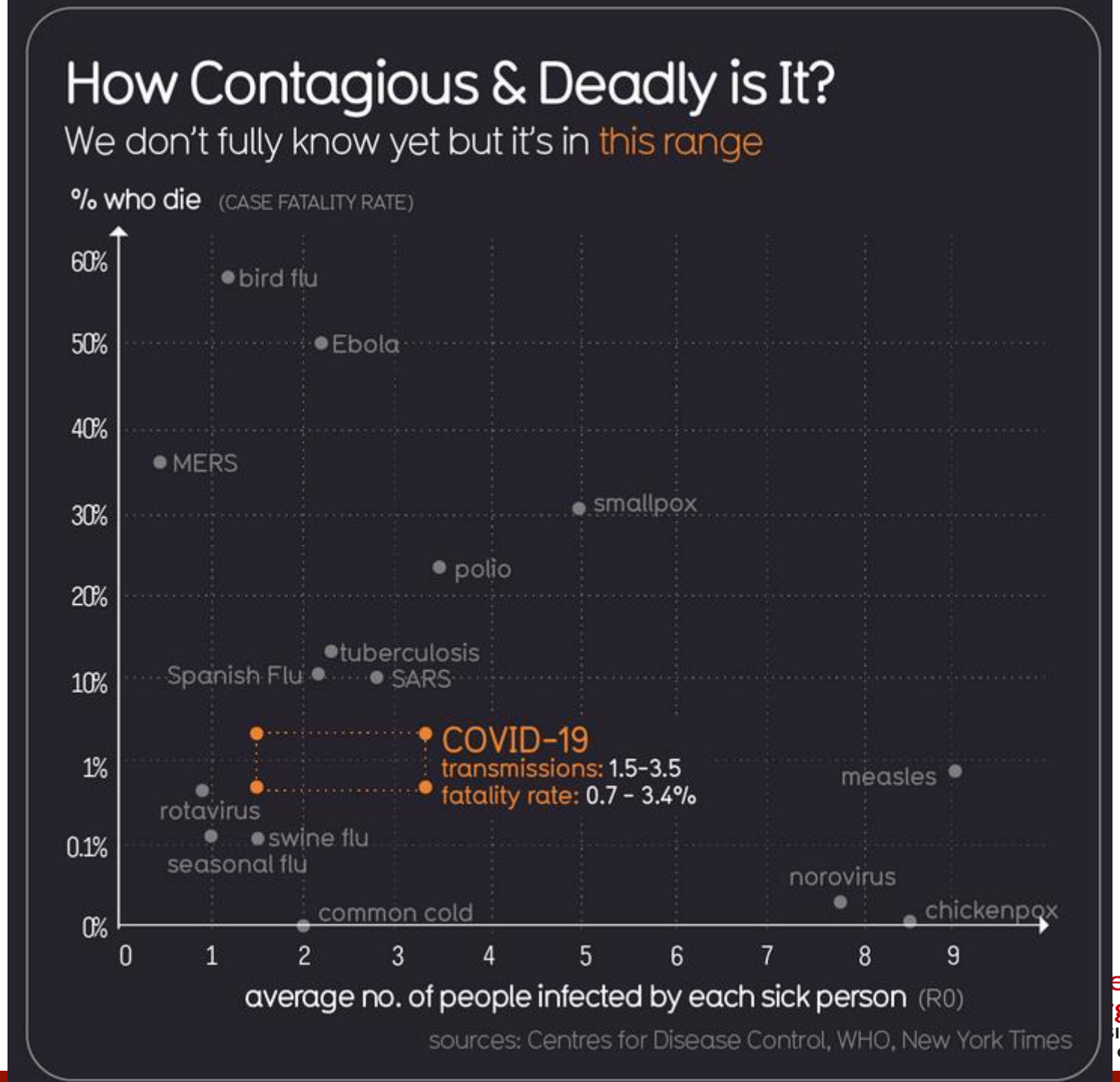
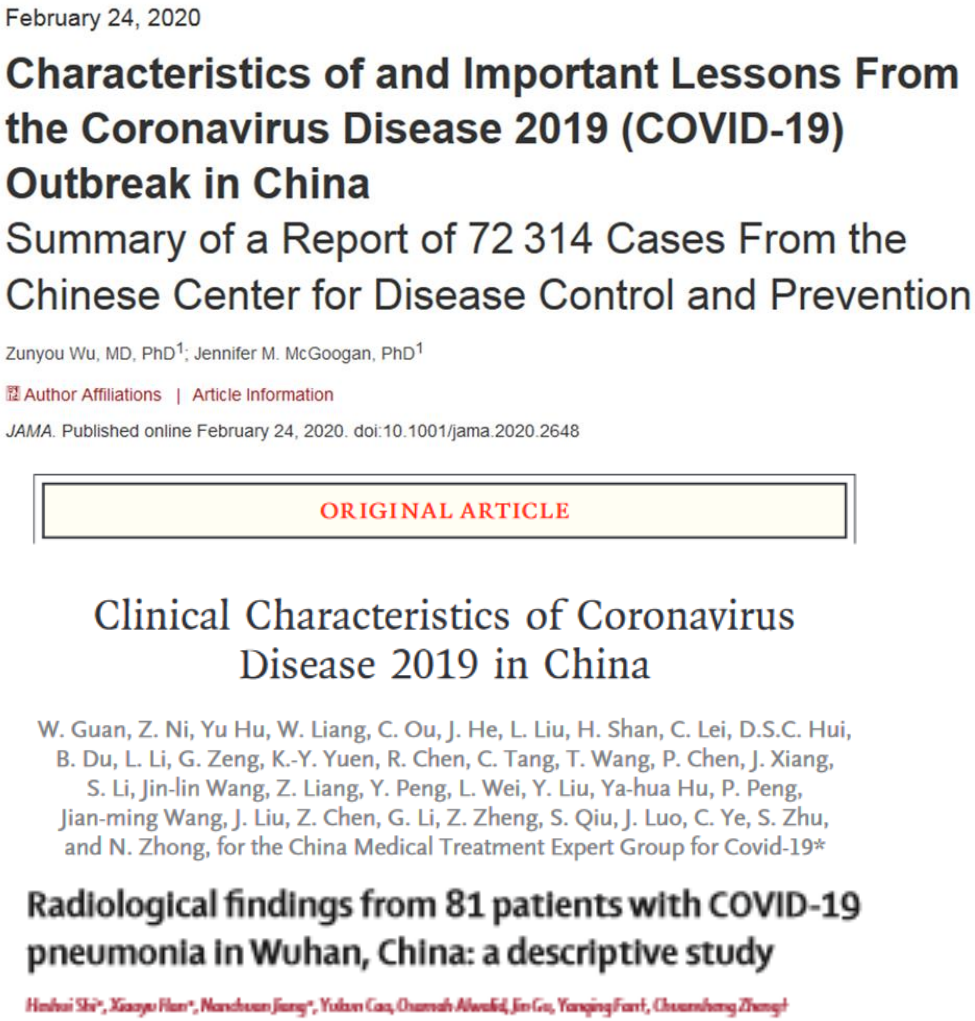

How Contagious & Deadly is It?
We don't fully know yet but it's in this range
% who die (CASE FATALITY RATE)
60%
50%
40%
30%
20%
10%
1%
0.1%
0%
bird flu
Ebola
MERS
smallpox
polio
tuberculosis
Spanish Flu
SARS
COVID-19
transmissions: 1.5-3.5
fatality rate: 0.7 - 3.4%
measles
rotavirus
swine flu
seasonal flu
norovirus
chickenpox
common cold
0 1 2 3 4 5 6 7 8 9
average no. of people infected by each sick person (R0)
sources: Centres for Disease Control, WHO, New York Times

Clinical Features

- Confirmed cases
  - Fever 44% on admission,
    - 89% during stay
  - Cough 68%, diarrhea 3%
  - Lymphocytopenia 83%
  - Procalcitonin nml 95%
  - Thrombocytopenia common, though <100K rare
  - CRP Elevation seems to correlate with need for O2 supplementation and likely mortality
  - CXR typically shows bibasilar patchy opacities
- 5% ICU, 1.4% mortality
- CXR/CT negative: 18% with mild, 3% severe



February 24, 2020

Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China

Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention

Zunyou Wu, MD, PhD[1]; Jennifer M. McGoogan, PhD[1]

Author Affiliations | Article Information

JAMA. Published online February 24, 2020. doi:10.1001/jama.2020.2648

ORIGINAL ARTICLE

Clinical Characteristics of Coronavirus Disease 2019 in China

W. Guan, Z. Ni, Yu Hu, W. Liang, C. Ou, J. He, L. Liu, H. Shan, C. Lei, D.S.C. Hui, B. Du, L. Li, G. Zeng, K.-Y. Yuen, R. Chen, C. Tang, T. Wang, P. Chen, J. Xiang, S. Li, Jin-lin Wang, Z. Liang, Y. Peng, L. Wei, Y. Liu, Ya-hua Hu, P. Peng, Jian-ming Wang, J. Liu, Z. Chen, G. Li, Z. Zheng, S. Qiu, J. Luo, C. Ye, S. Zhu, and N. Zhong, for the China Medical Treatment Expert Group for Covid-19*

Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study

This article was published on February 28, 2020, and last updated on March 6, 2020, at NEJM.org.

The NEW ENGLAND JOURNAL of MEDICINE

CORRESPONDENCE

Detection of Covid-19 in Children in Early January 2020 in Wuhan, China

- Case study with 6 children
  - Fever 100% (6/6)
  - Cough 100% (6/6)
  - Vomiting 67% (4/6)
  - Lymphocytopenia 100% (6/6)
  - One required ICU level care

ORIGINAL ARTICLE: INFECTION AND IMMUNITY

Clinical and CT features in pediatric patients with COVID-19 infection: Different points from adults

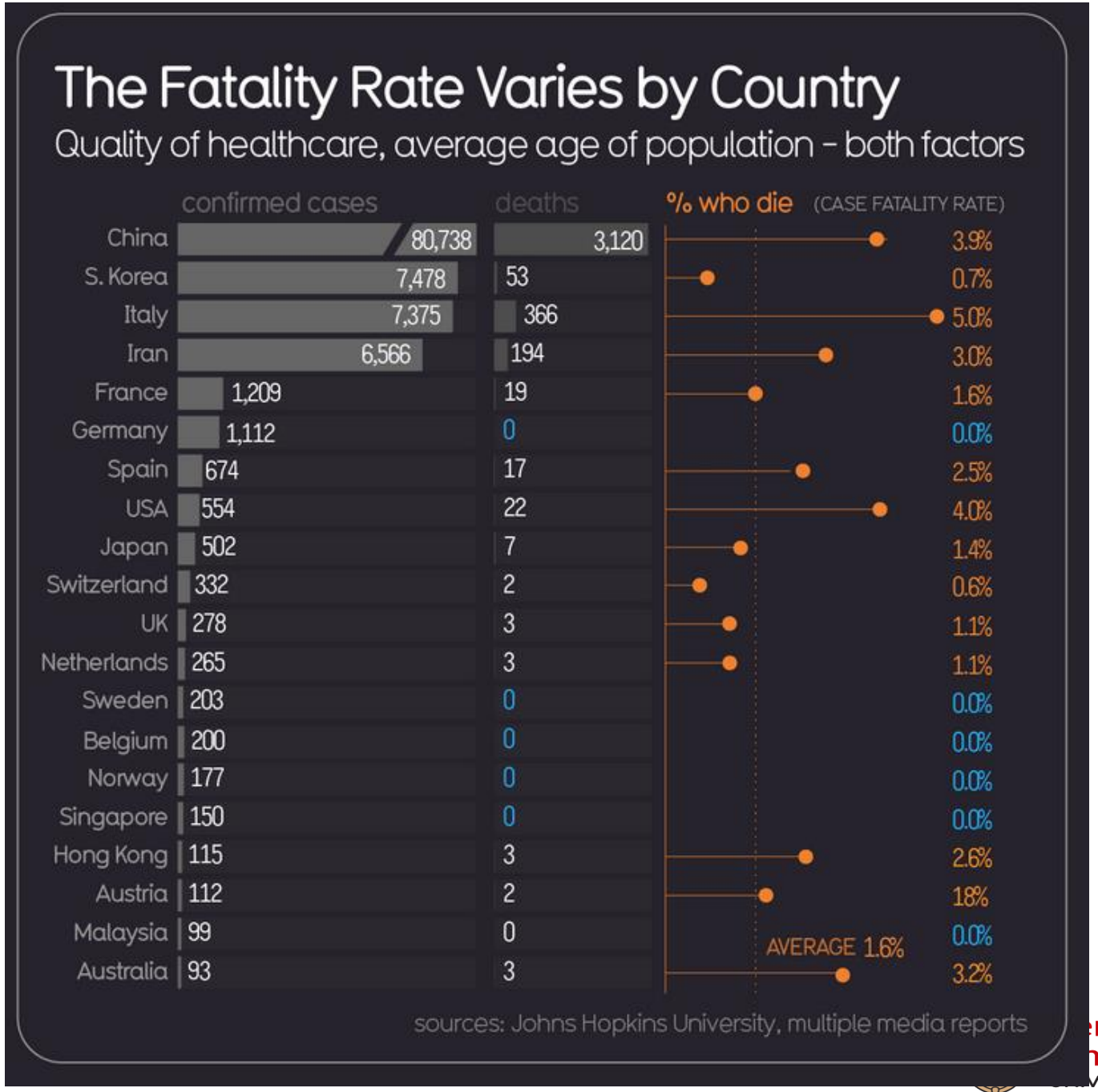
Wei Xia MD[1] | Jianbo Shao MD[1] | Yu Guo MD[1] | Xuehua Peng MD[1] | Zhen Li MD[2] | Daoyu Hu MD[2]

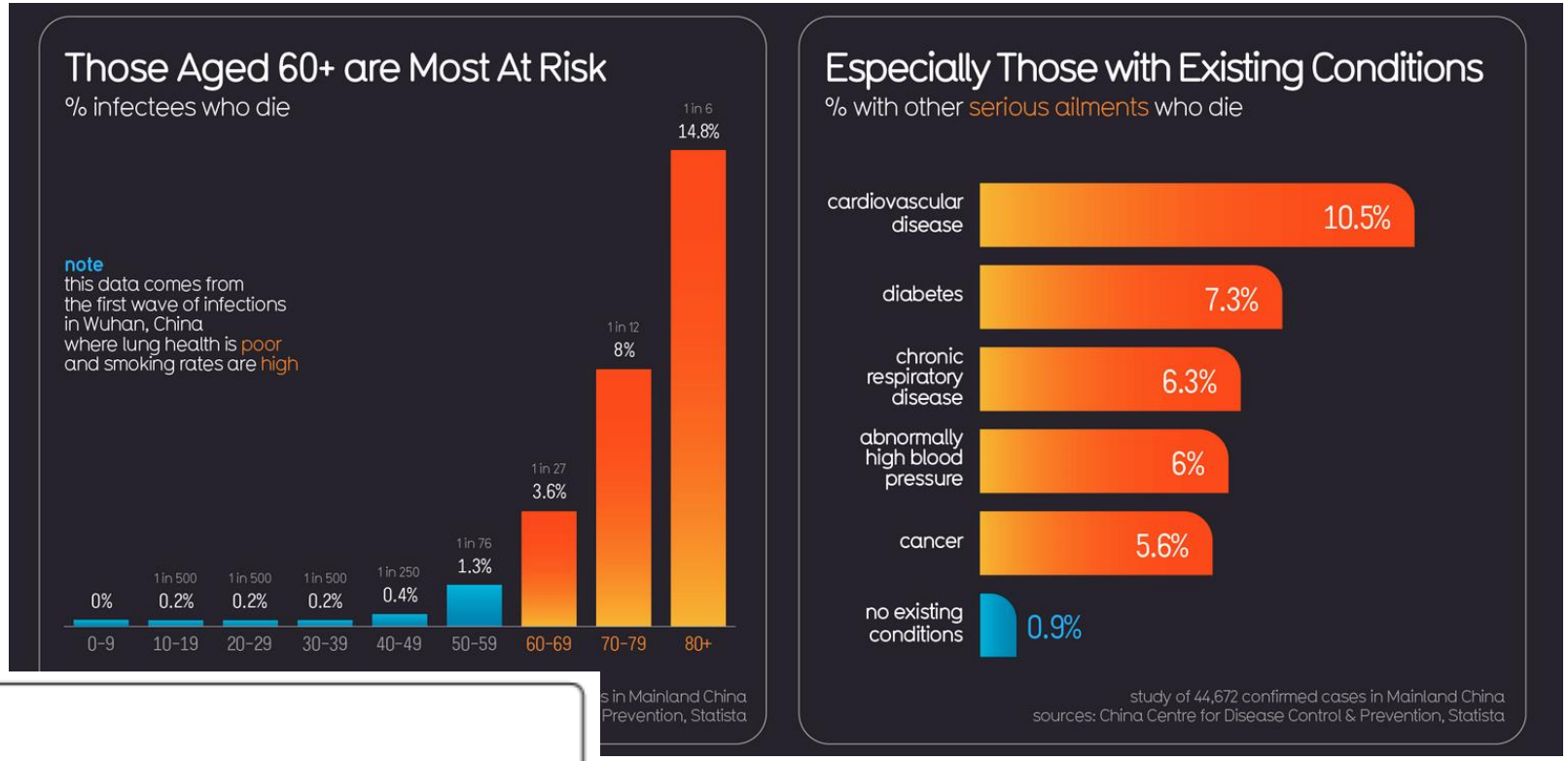
- Case series with 20 children
  - Fever 60% (12/20)
  - Cough 65% (13/20)
  - Elevated Procalcitonon 80% (16/20)
  - Co-infection 40% (8/20)

Coronavirus Infections in Children Including COVID-19

An Overview of the Epidemiology, Clinical Features, Diagnosis, Treatment and Prevention Options in Children

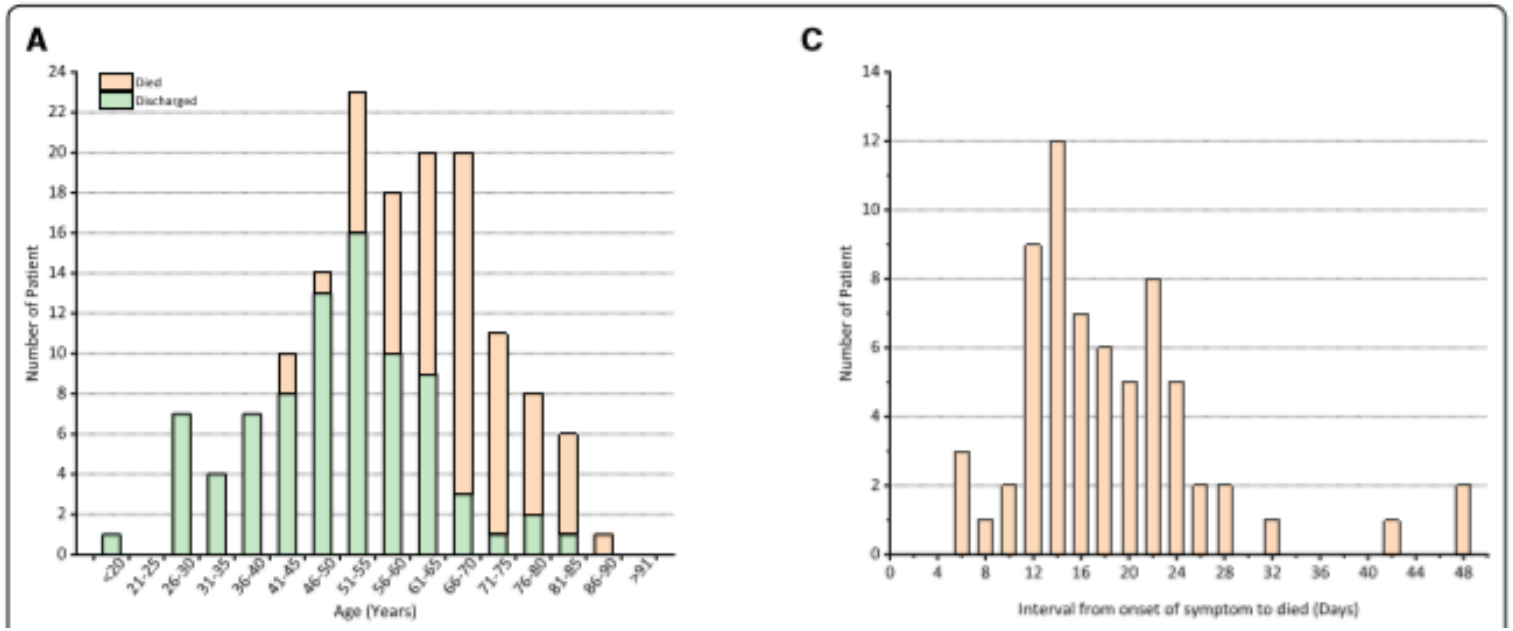
Petra Zimmermann, MD, PhD,†,‡ and Nigel Curtis, FRCPCH, PhD†,‡,§*


The Fatality Rate Varies by Country
Quality of healthcare, average age of population - both factors
confirmed cases
deaths
% who die (CASE FATALITY RATE)
China 80,738 3,120 3.9%
S. Korea 7,478 53 0.7%
Italy 7,375 366 5.0%
Iran 6,566 194 3.0%
France 1,209 19 1.6%
Germany 1,112 0 0.0%
Spain 674 17 2.5%
USA 554 22 4.0%
Japan 502 7 1.4%
Switzerland 332 2 0.6%
UK 278 3 1.1%
Netherlands 265 3 1.1%
Sweden 203 0 0.0%
Belgium 200 0 0.0%
Norway 177 0 0.0%
Singapore 150 0 0.0%
Hong Kong 115 3 2.6%
Austria 112 2 1.8%
Malaysia 99 0 0.0%
Australia 93 3 3.2%
AVERAGE 1.6%
sources: Johns Hopkins University, multiple media reports



Clinical predictors of mortality due to COVID-19 based on an analysis of data of 150 patients from Wuhan, China

Qiurong Ruan[1,2], Kun Yang[3], Wenxia Wang[4], Lingyu Jiang[5] and Jianxin Song[4*]



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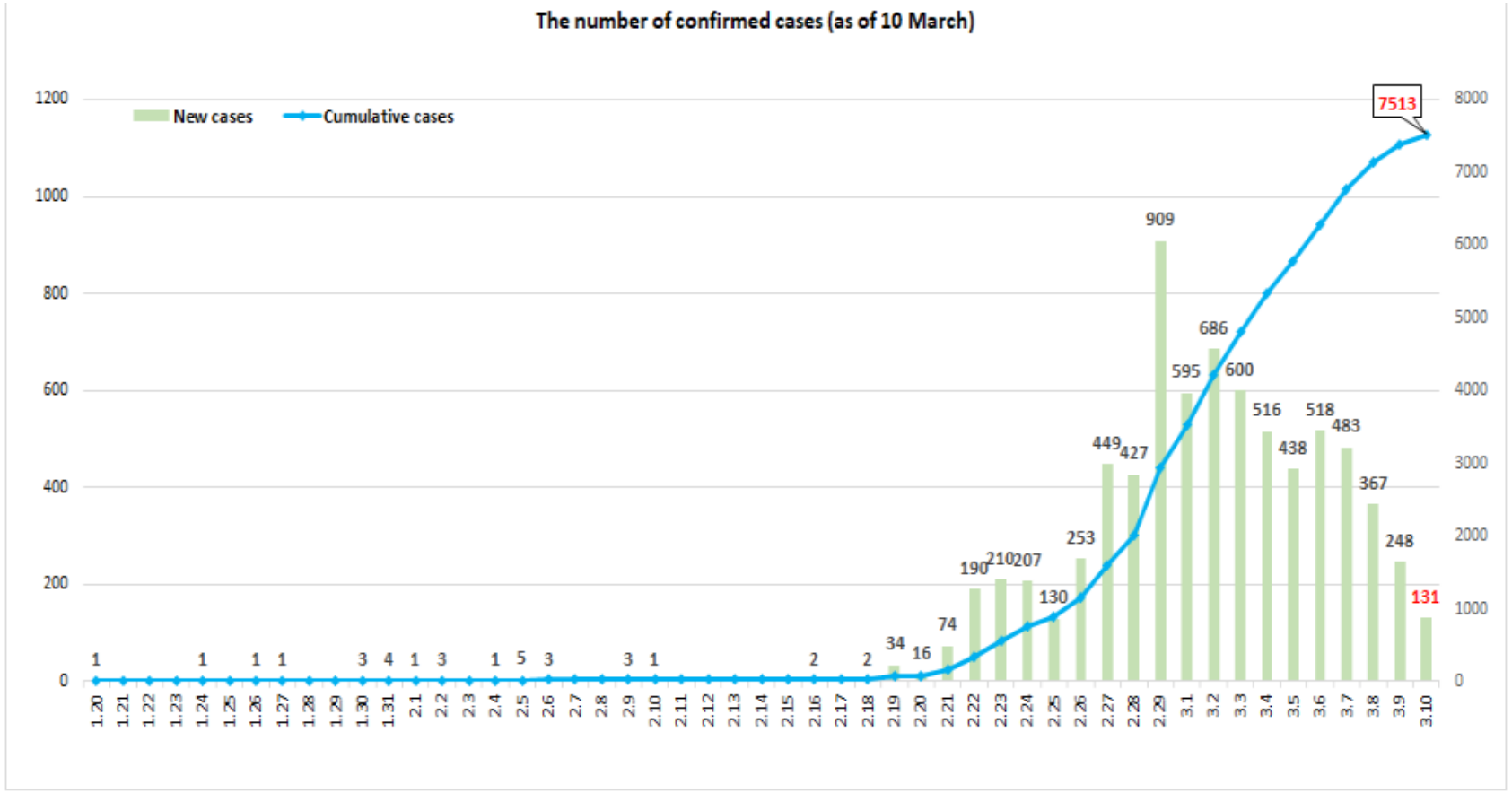
The South Korean Experience



Drop in new cases!!

COVID-19: Lessons from South Korea

America can learn from what South Korea is doing right.

by ADAM BECKMAN, MARY ZHAO, AND DR. HOWARD FORMAN · MARCH 10, 2020 10:57 AM

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The Korean Experience

○ Cases Distribution by gender and age

Classification		Cases (%)	Death cases (%)	Fatality rate (%)
Total		7,513 (100.0)	54 (100.0)	0.7
Sex	Male	2,852 (38.0)	33 (61.1)	1.2
	Female	4,661 (62.0)	21 (38.9)	0.5
Age	above 80	222 (3.0)	15 (27.8)	6.8
	70-79	454 (6.0)	19 (35.2)	4.2
	60-69	929 (12.4)	13 (24.1)	1.4
	50-59	1,416 (18.8)	5 (9.3)	0.4
	40-49	1,030 (13.7)	1 (1.9)	0.1
	30-39	789 (10.5)	1 (1.9)	0.1
	20-29	2,213 (29.5)	0 (0.0)	-
	10-19	393 (5.2)	0 (0.0)	-
	0-9	67 (0.9)	0 (0.0)	-

- <1% overall mortality rate
- NIAID, CDC agree (NEJM)

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Key EMS Takeaways

- Proper PPE is Important
  - Gloves
  - Mask
    - Low Risk patient – Surgical Mask is sufficient
    - High Risk patient (intubating, on CPAP/BiPAP, Nebulizer) – N95 recommended
  - Gown Protection if available
  - Eye Protection

Further Information

www.uwhealth.org/covid19

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Additional References

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- *Emerg Med Clin N Am*, 2004;22:281–298
- Nagpal B, Sharma R. Cold Injuries: The Chill Within. *Med J of Armed Forces India.* 2004 Apr ; 60(2) 165-171.