CADTH Evidence Driven.
ACMTS Preuves à l'appui.

Public Health Agency of Canada | Agence de la santé publique du Canada

CIHR IRSC
Canadian Institutes of Health Research | Instituts de recherche en santé du Canada

Discoveries for life / Découvertes pour la vie

"The science is in" – what next?

Mitigating the Proportional Risk of the Transmission of COVID-19: Perspectives from Across Infection Prevention & Control Contexts

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Best Brains EXCHANGE

The Current State – The Evidence & the Opinion

This NASEM workshop has addressed the main questions with the best available evidence.

https://www.nationalacademies.org/event/08-26-2020/airborne-transmission-of-sars-cov-2-a-virtual-workshop#sl-three-columns-c67bece1-4b4d-470f-8e0d-dbf76a481682

The Current State – The Evidence & the Opinion

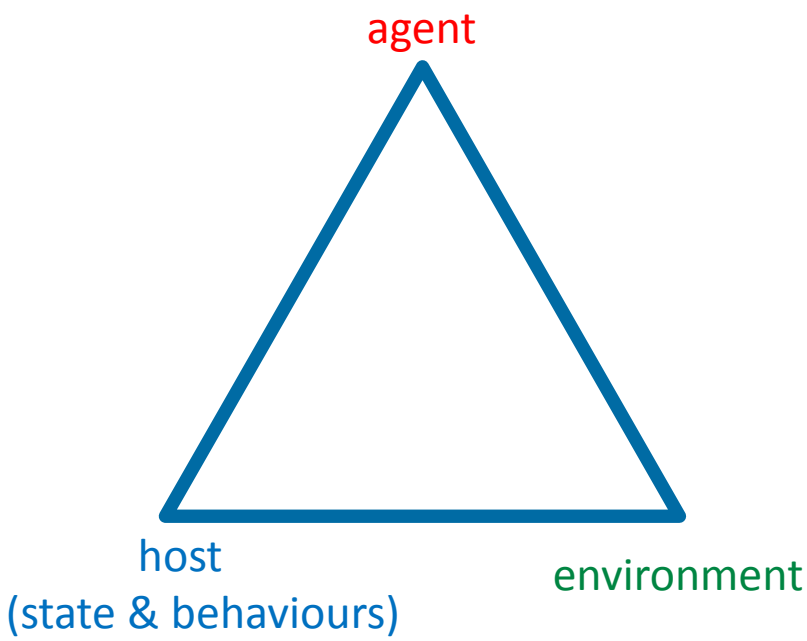
- new proposed definition of **droplet** >100 µm (**ballistic** trajectory dispersion, versus turbulent/laminar flow dispersion for smaller particles)
- differentiation between "**plume"** and "**room"** dispersion aerodynamics ("plume" independent of room air flow patterns)
- "**close-range" airborne transmission** probably the dominant mode of transmission (i.e. "close contact" airborne)
- differentiating between "**obligate**" (measles, TB), "**preferential**" (smallpox, anthrax), and "**opportunistic**" (influenza, SARS) airborne paths of transmission

https://www.nationalacademies.org/event/08-26-2020/airborne-transmission-of-sars-cov-2-a-virtual-workshop#sl-three-columns-c67bece1-4b4d-470f-8e0d-dbf76a481682

The Current State – The Evidence & the Opinion

The reproduction number (R_0)

- The reproductive number is not a property of the disease but the product of the interaction between disease, host (including susceptibilities & behaviours) and environmental conditions
- The R_{eff} for the Skagit choir outbreak was between **32 – 52**; the initial R_{eff} on the Diamond Princess was **14.8** *(Rocklöv et al., 2020)*
- If the infected choir member had stayed home the R_{eff} may only have been **1, 2 or 3** additional cases? after the protective measures were implemented, the Diamond Princess R_{eff} fell to **1.78**



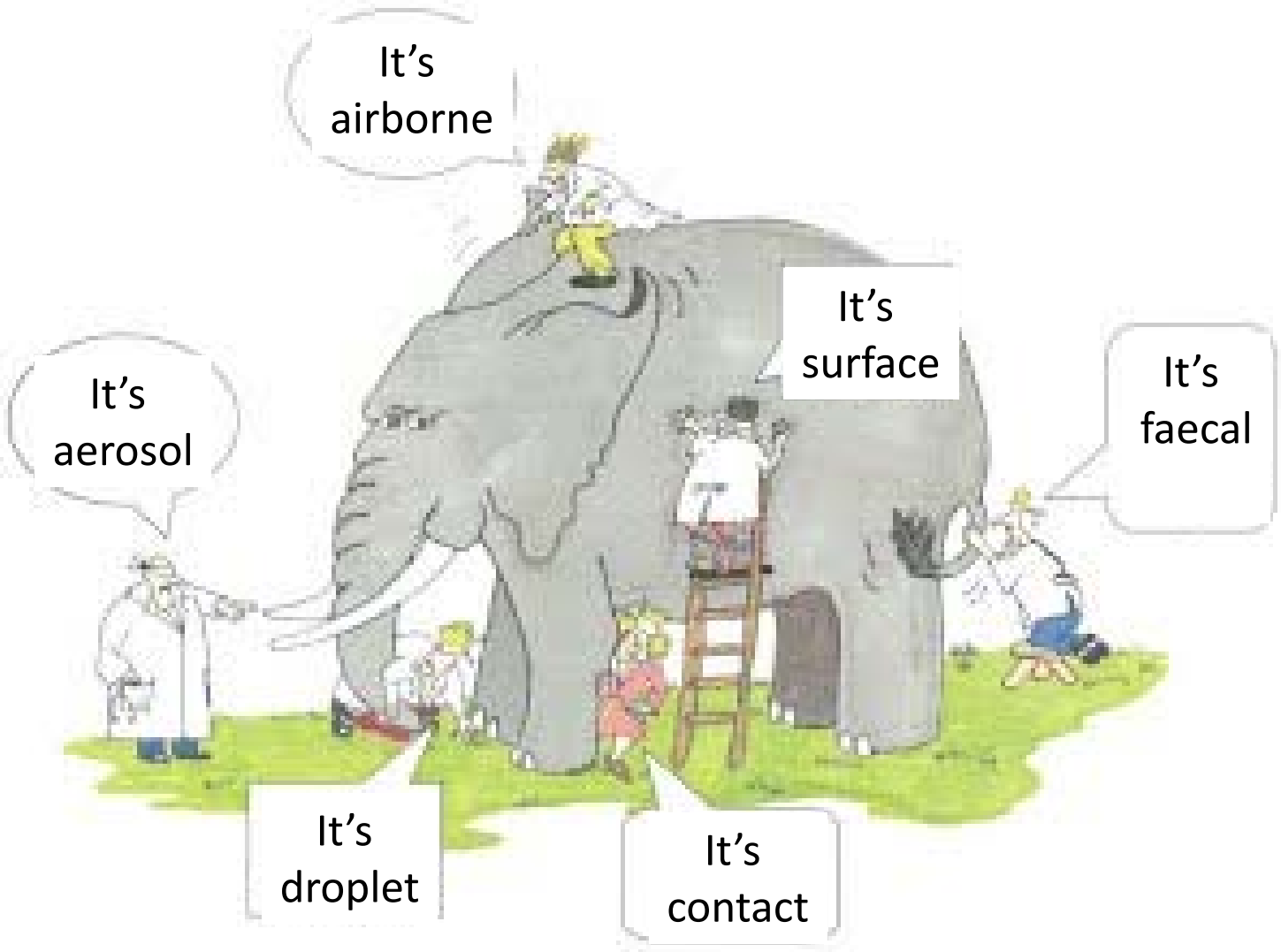
The Current State – The Evidence & the Opinion

Person-to-person infectious disease transmission is a **"wicked" problem**:

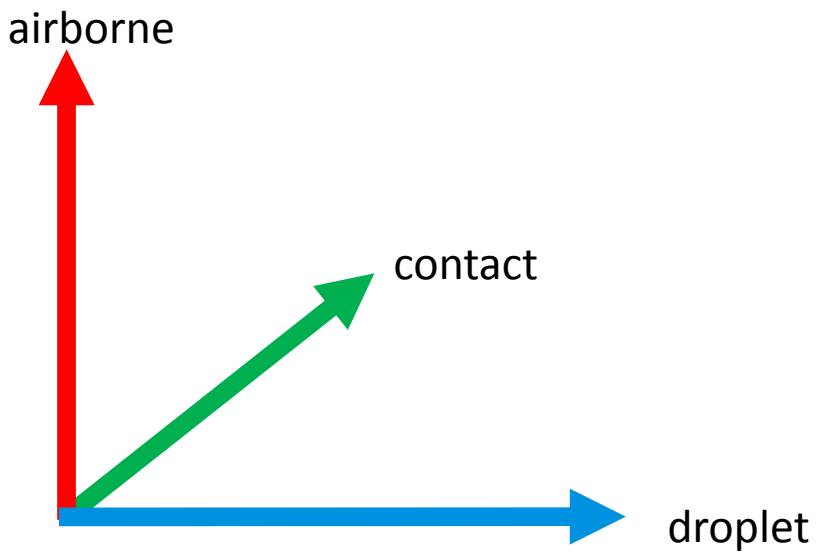
- "Wicked problems were first described by Rittel and Webber as a category of public policy problems that, in contrast to 'tame problems', are difficult to be clearly defined, are influenced by complex social and political factors, and are never solved" *[van Woezik et al (2016) "Tackling wicked problems in infection prevention and control - a guideline for co-creation with stakeholders"]*

- "Wicked" problems require a **multi-disciplinary** approach:
  1. "No consensus regarding the problem definition
  2. Involvement of multiple, often independent stakeholders.
  3. No clear cut "stopping rule"." *[van Woezik et al (2016)]*

Reminds me of the Indian folk story: the 6 blind people and the elephant

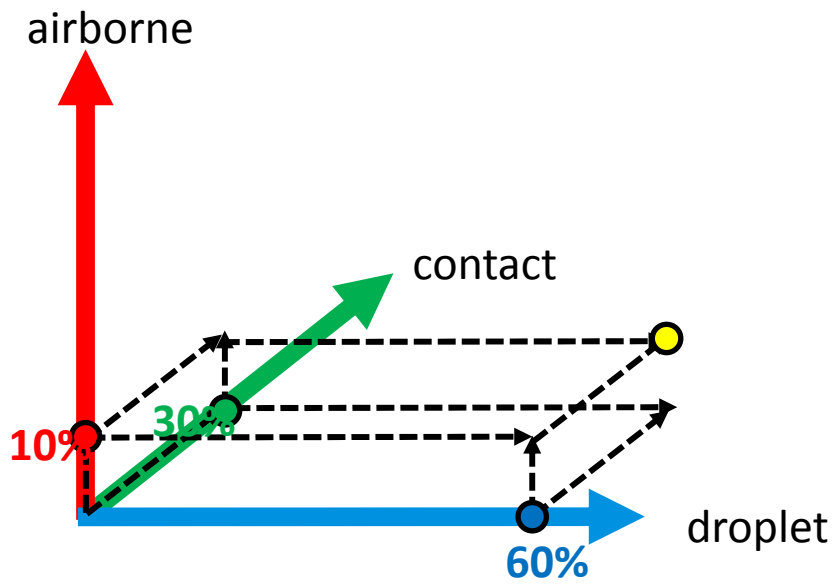


What if it's a 3(+) dimensional problem?

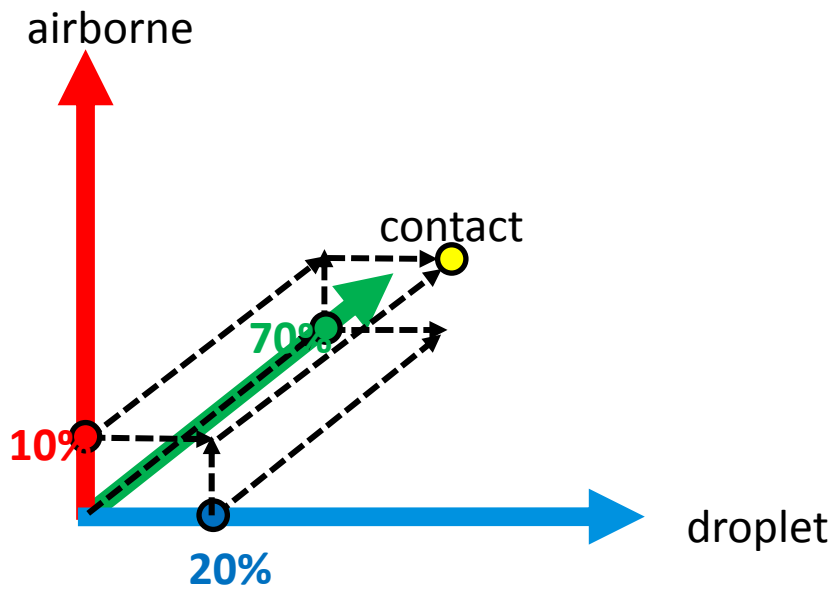


… a **continuous** set of variables rather than discreet or categorical ones

Different conditions different apportionments across the transmission paths

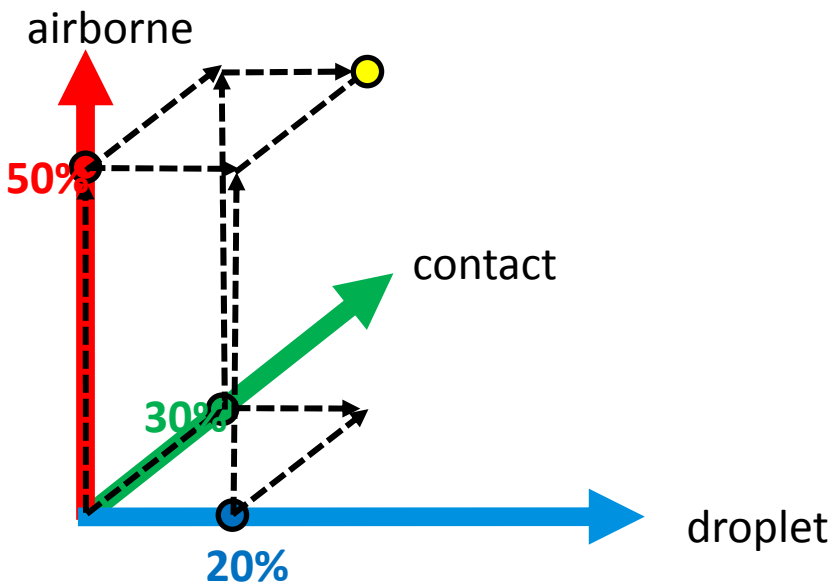


Applying controls changes the relative contributions



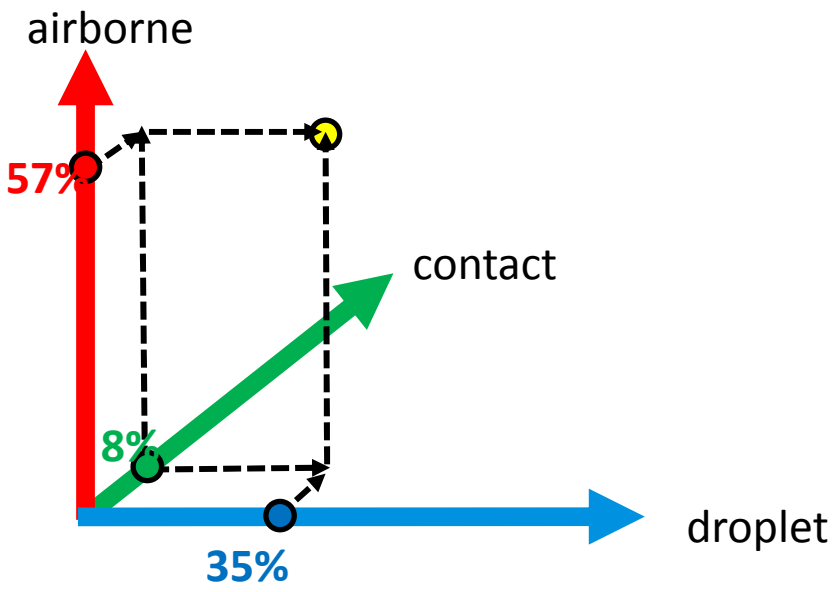
droplet precautions

Certain conditions are recognized as contributing to close range airborne transmission (3(4) C's)

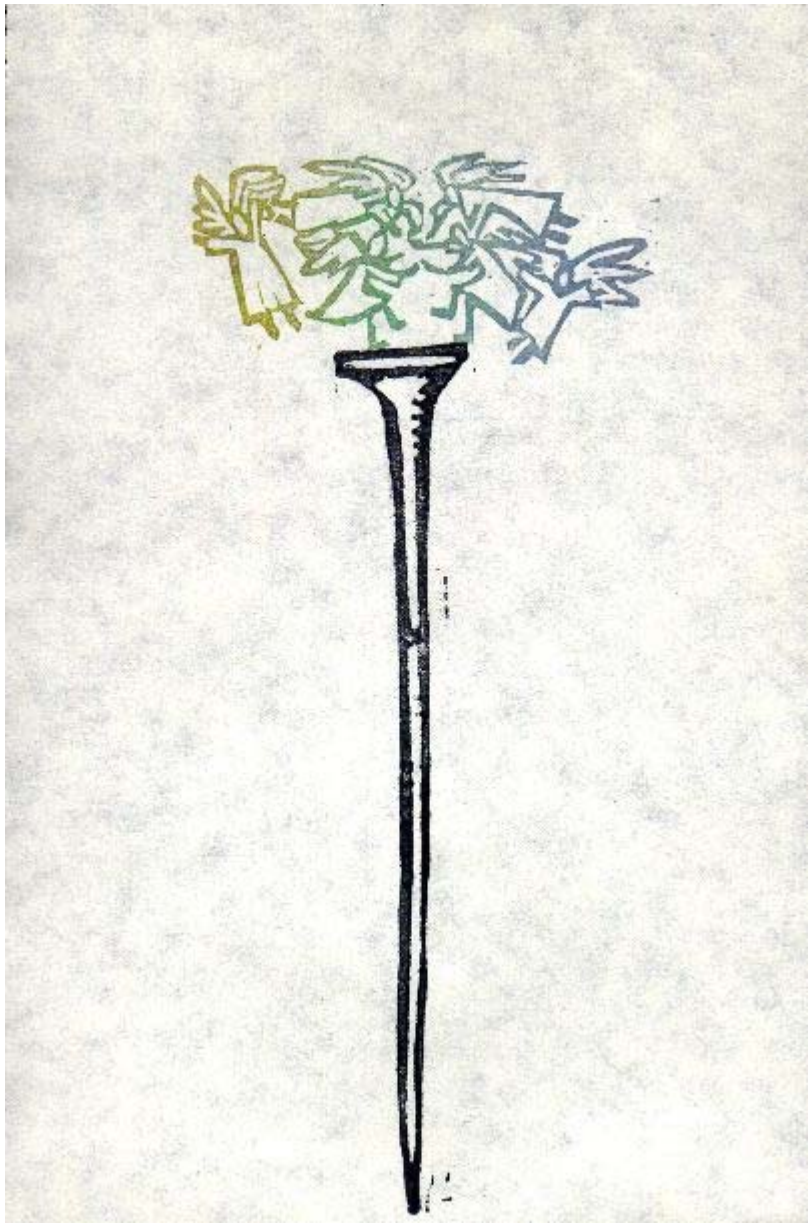


- super-spreader
- crowding
- patients not wearing mask the right way
- poor ventilation
- AGMP's

Rachael Jones (July 9, 2020): "Relative contributions of transmission routes for COVID 19 among healthcare personnel providing patient care"



“How many angels can dance on the head of a pin?”



We have to be prepared for all possible combinations, rather than wait till we can determine which happens, when, with an unreasonable degree of precision

https://armedlaughing.files.wordpress.com/2014/01/angels.jpeg

The Current State – The Circumstance & the Context

Again from the NASEM workshop – the **6 C's**:

Crowded places

Close contact

Continuous exposures

Coverings

Cold air temperature (high humidity?)

Closed space

Circulation (outdoor air supply)

Short Term Action – Prioritizing Interventions

Coverings/Masking in Public

NOTE: The public's compliance with **distancing (isolation, shutdown) orders** is what leveled the curve

- At low community risk, it is **symbolic** (solidarity – something everyone can do – "we're all in this together")
- At medium risk it becomes **etiquette & source control** (keep your oral & nasal emissions to yourself)
- At high risk when combined with 6 C's in can be both **source control** and **protection at the worker** (e.g. Montréal: in the last 14 days case count of 11.9 per 10,000 i.e. red zone; so my daughter wears an N95 with valve (for **inhalation protection**) with a procedural mask over top (for **emission etiquette**))

Looking to the Future – The Evidence & The Implications

HCWs as the "canaries in the coalmine":

- An early case series report of the first 138 patients with COVID from one of the hospitals in Wuhan indicated that 40 (**29%**) of the patients were HCWs which caused China to admit human-to-human transmission

https://www.researchgate.net/figure/The-allergy-epidemic-as-a-canary-in-the-coal-mine-An-early-indicator-of-the-impact-of_fig2_259882432

WHO (Sept 17 2020) : "While health workers represent less than 3% of the population in the large majority of countries and less than 2% in almost all low- and middle-income countries, around **14% of COVID-19 cases** reported to WHO are among health workers." (14% of 29.7 millions confirmed COVID-19 cases = **4.16 million HCWs infected**) …

"Thousands of health workers infected with COVID-19 have lost their lives worldwide."

https://www.who.int/news-room/detail/17-09-2020-keep-health-workers-safe-to-keep-patients-safe-who

Looking to the Future – The Evidence & The Implications

Chinese response

- Jan 20th after saying that there wasn't enough evidence to support human-to-human transmission, the Chinese government classified the new disease as a Class B infectious disease (similar to SARS1 & MERS), however they prescribe Class A infectious disease (cholera, plague) protective measures (similar to Ebola precautions)
- Two hospitals (the first with 1000 beds, the other 1500 beds), the first being built within 10 days (Jan 24 – Feb 3)
- In Wuhan, the demand for HCWs was so great that 42,600 additional HCWs were recruited to help the existing 110,000+ HCWs.
- Between May 15 and June 1, tested over 90% of Wuhan residents (over 9,000,000 swab tests)

https://www.cbc.ca/news/world/coronavirus-china-huoshenshan-hospital-photos-1.5450026

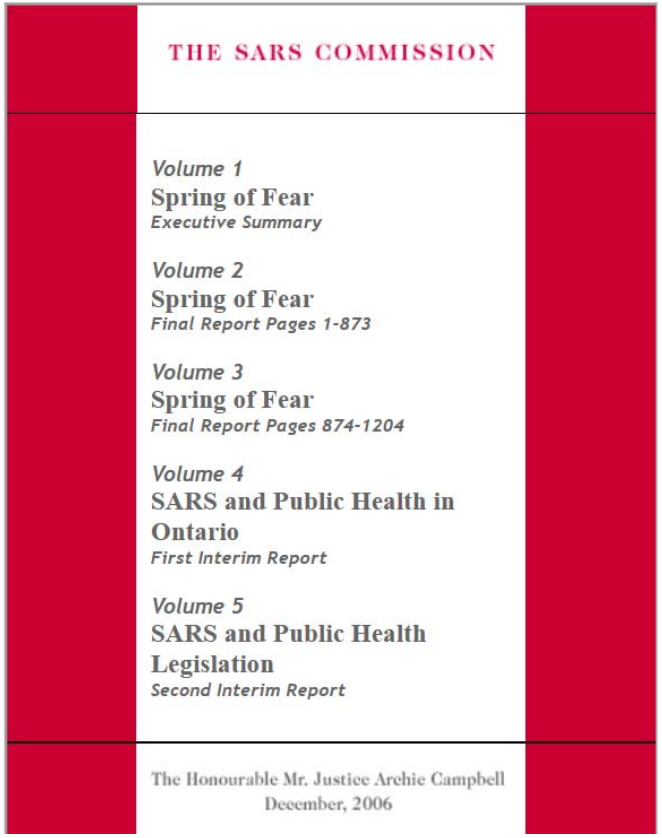
The response to scientific uncertainty

THE SARS COMMISSION
THE HONOURABLE ARCHIE CAMPBELL, COMMISSIONER

This website was transferred to the Archives of Ontario in October of 2008. It is no longer being updated so forms, search boxes, and external links may not function

Home | About | Commission Staff | Hearings | Mandate | Transcripts | Media | FAQs | Feedback | Report

http://www.archives.gov.on.ca/en/e_records/sars/report/index.html


THE SARS COMMISSION

Volume 1
Spring of Fear
Executive Summary

Volume 2
Spring of Fear
Final Report Pages 1-873

Volume 3
Spring of Fear
Final Report Pages 874-1204

Volume 4
SARS and Public Health in Ontario
First Interim Report

Volume 5
SARS and Public Health Legislation
Second Interim Report

The Honourable Mr. Justice Archie Campbell
December, 2006

- The Campbell Commission dealt with this very issue of what to do about scientific **uncertainty** (confusion)
- Recognized the **conflict** in *modus operandi* of the two disciplines (H&S and IPAC)
- Recommended the "**precautionary principle**" (H&S *modus operandi*) should prevail
- While originally the Campbell Commission recommendations were implemented, the changes were gradually eroded and H&S was put back into the "back seat" (where we are now)

"Those who cannot remember the past are condemned to repeat it" (George Santayana, The Life of Reason: Reason in Common Sense. Scribner's, 1905: 284)

Looking to the Future – The Evidence & The Implications

Chinese COVID-19 PPE

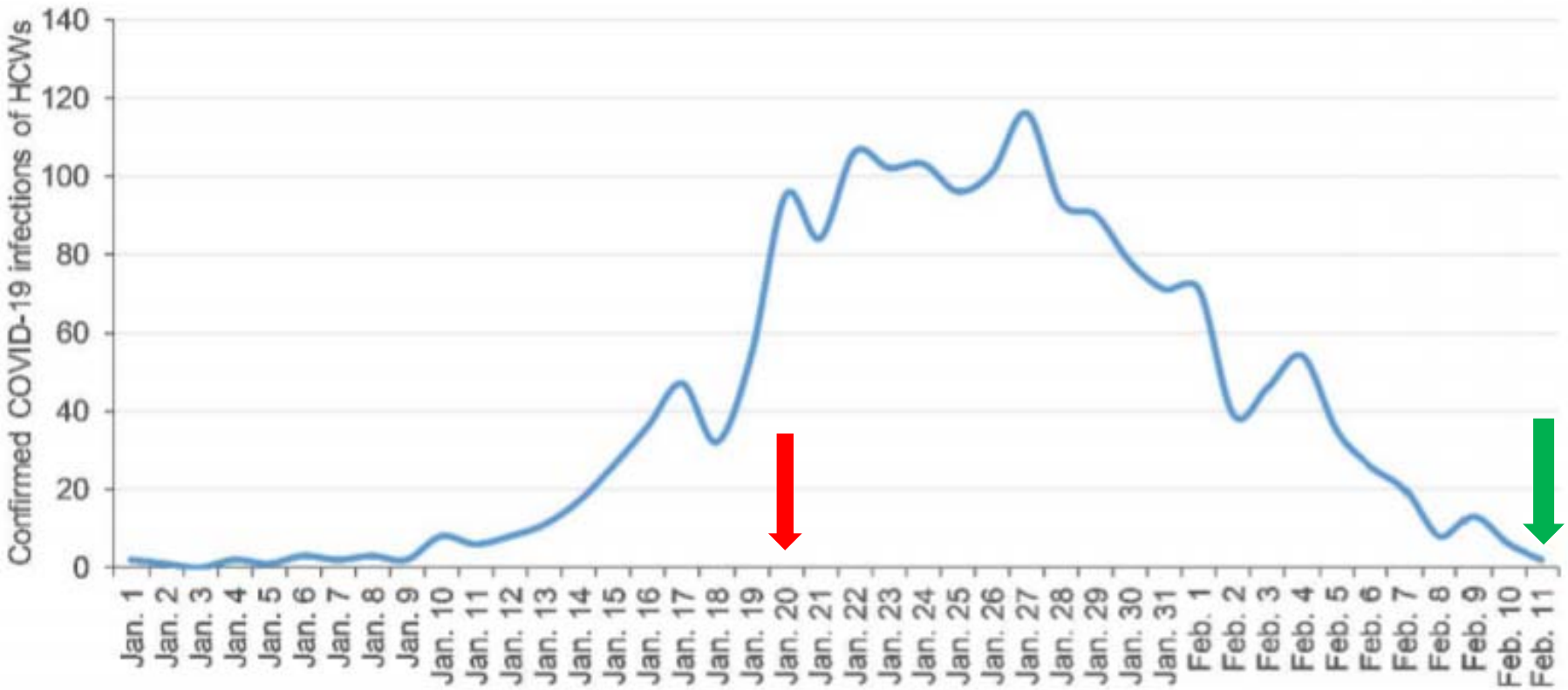
"The adopted COVID-19 protocol included a hospital-provided scrub suit, complete covering of dorsum of the foot and ankles with socks covered by plastic wrap and closed shoes with two layers of boot covers …, three layers of gloves, a coverall, N95 face mask, surgical mask, face shield/goggles, hood with two layers of head covering, and a disposable waterproof surgical gown."

Zhan et al (Aug 10 2020) "Lesson Learned from China Regarding Use of Personal Protective Equipment"

An example of what such protective measures implies can be seen at: https://www.youtube.com/watch?v=9HsGqQCLzLU

Looking to the Future – The Evidence & The Implications

Incidence of Chinese HCWs' infections:

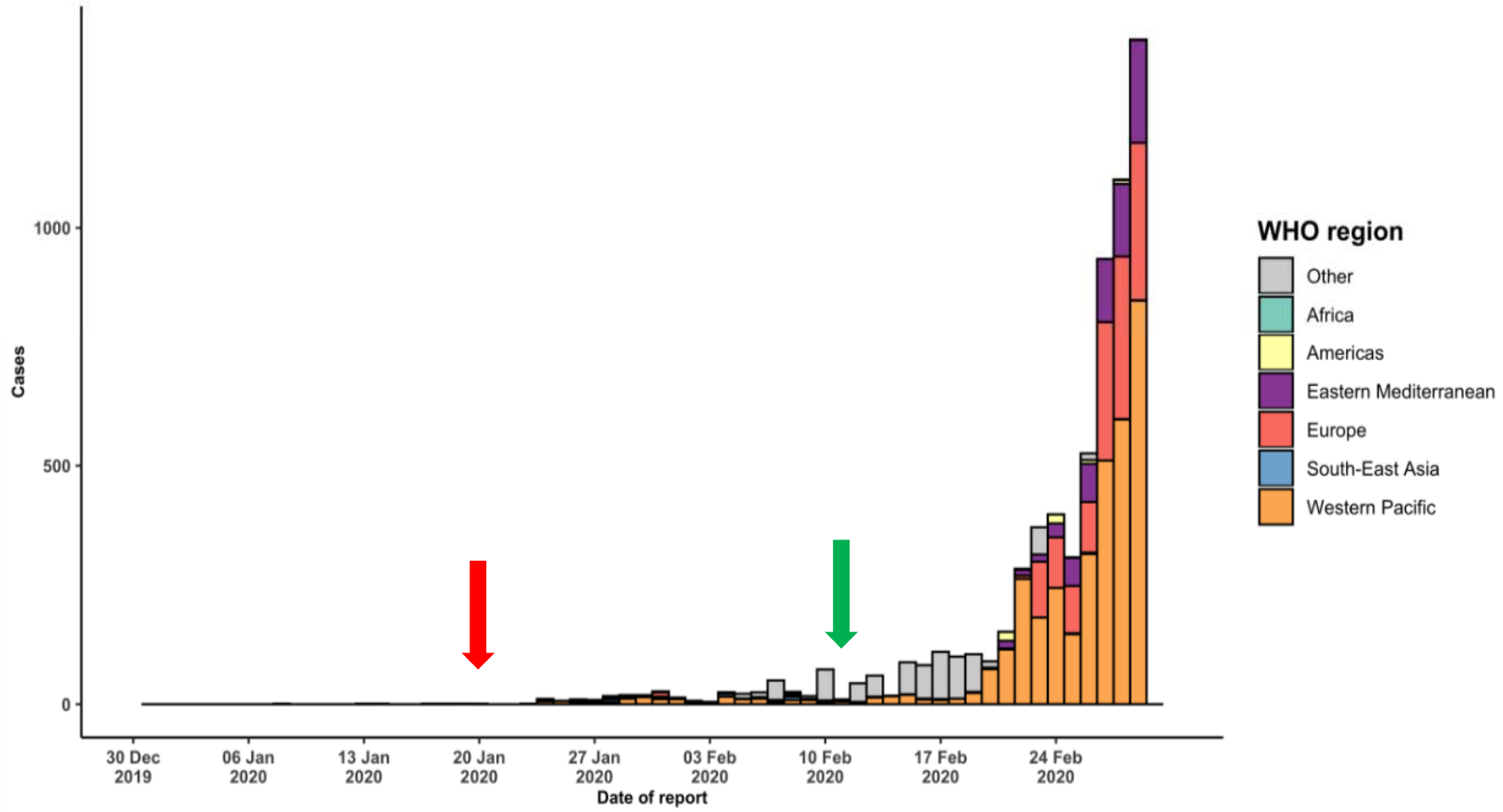


Wang et al (Apr 28, 2020) "Association of Personal Protective Equipment Use with Successful Protection Against COVID-19 Infection Among Health Care Workers"

Looking to the Future – The Evidence & The Implications

Incidence of Chinese HCWs' infections:

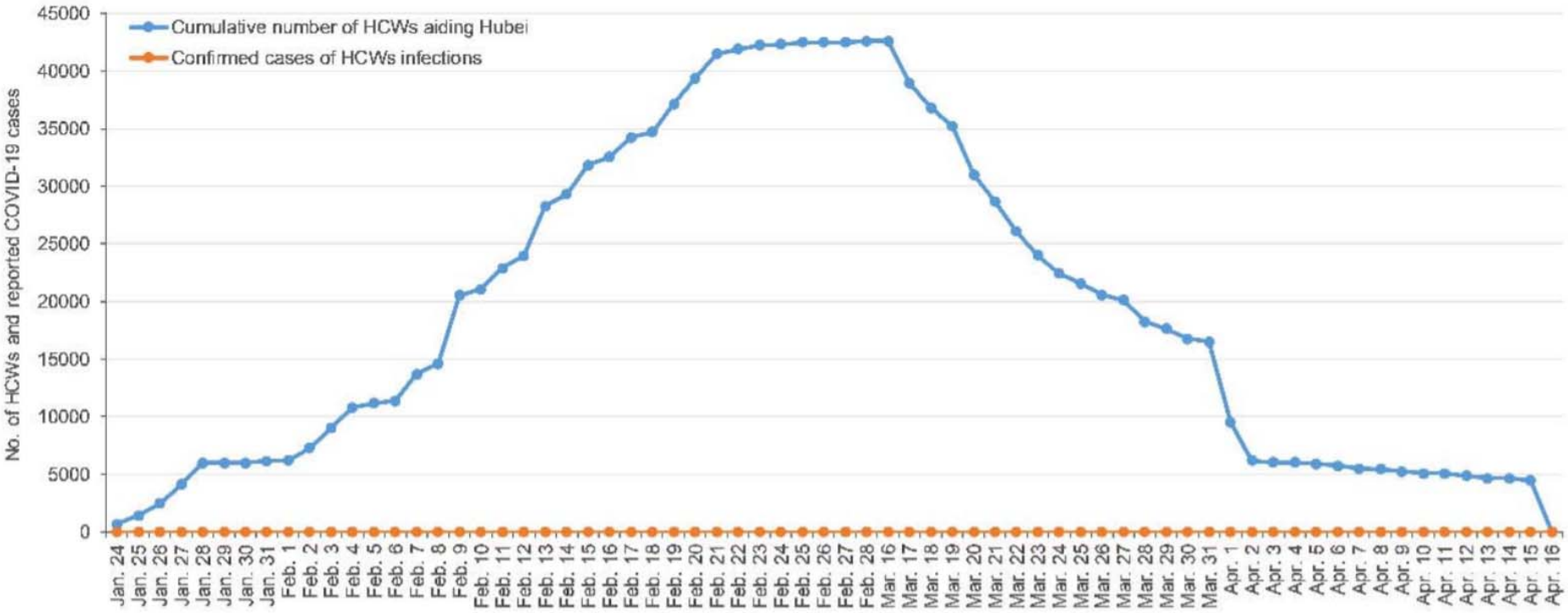
Figure 2. Epidemic curve of confirmed COVID-19 cases (n=6567) reported outside of China, by date of report and WHO region with complete days of reporting through 29 February 2020



https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200301-sitrep-41-covid-19.pdf?sfvrsn=6768306d_2

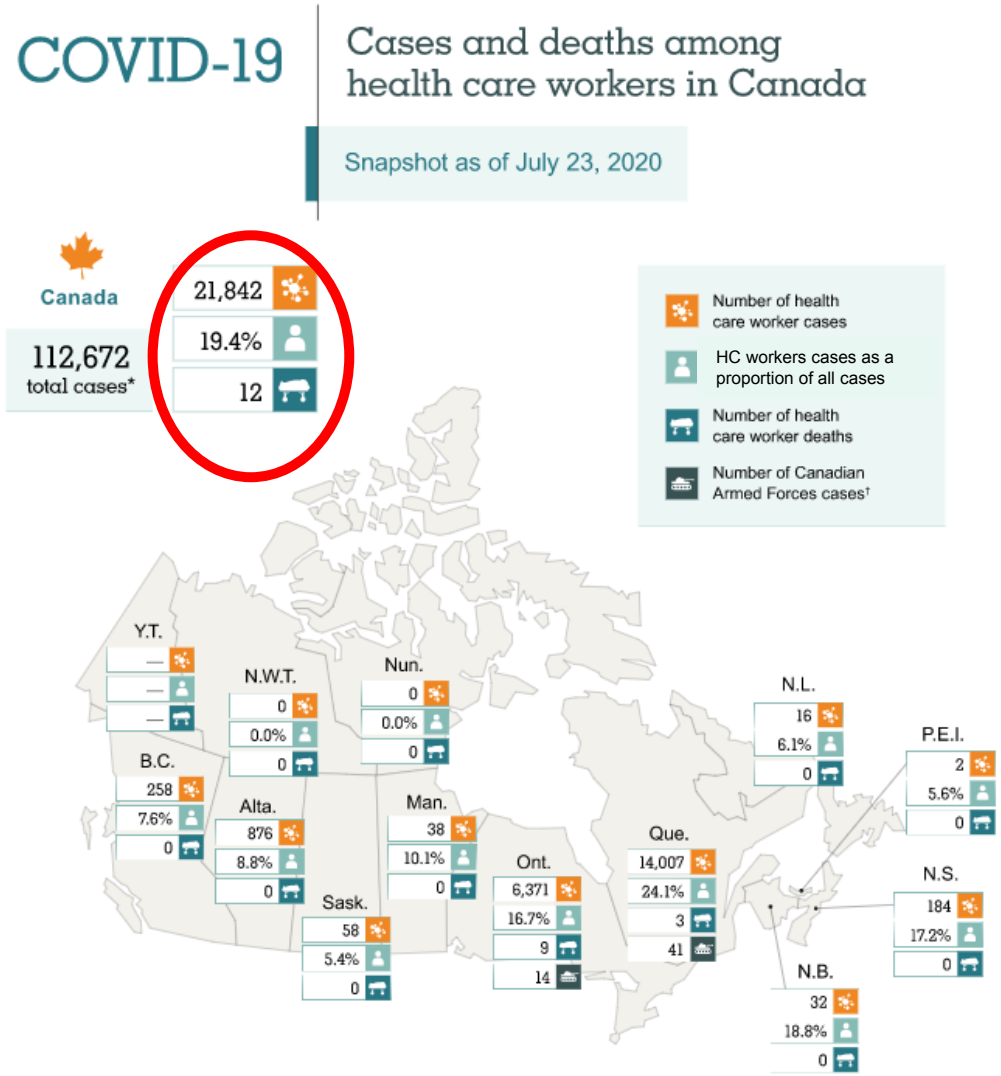
Looking to the Future – The Evidence & The Implications

- of the 42,600 recruited HCWs, none got infected using the prescribed protections:



Wang et al (Apr 28, 2020) "Association of Personal Protective Equipment Use with Successful Protection Against COVID-19 Infection Among Health Care Workers"

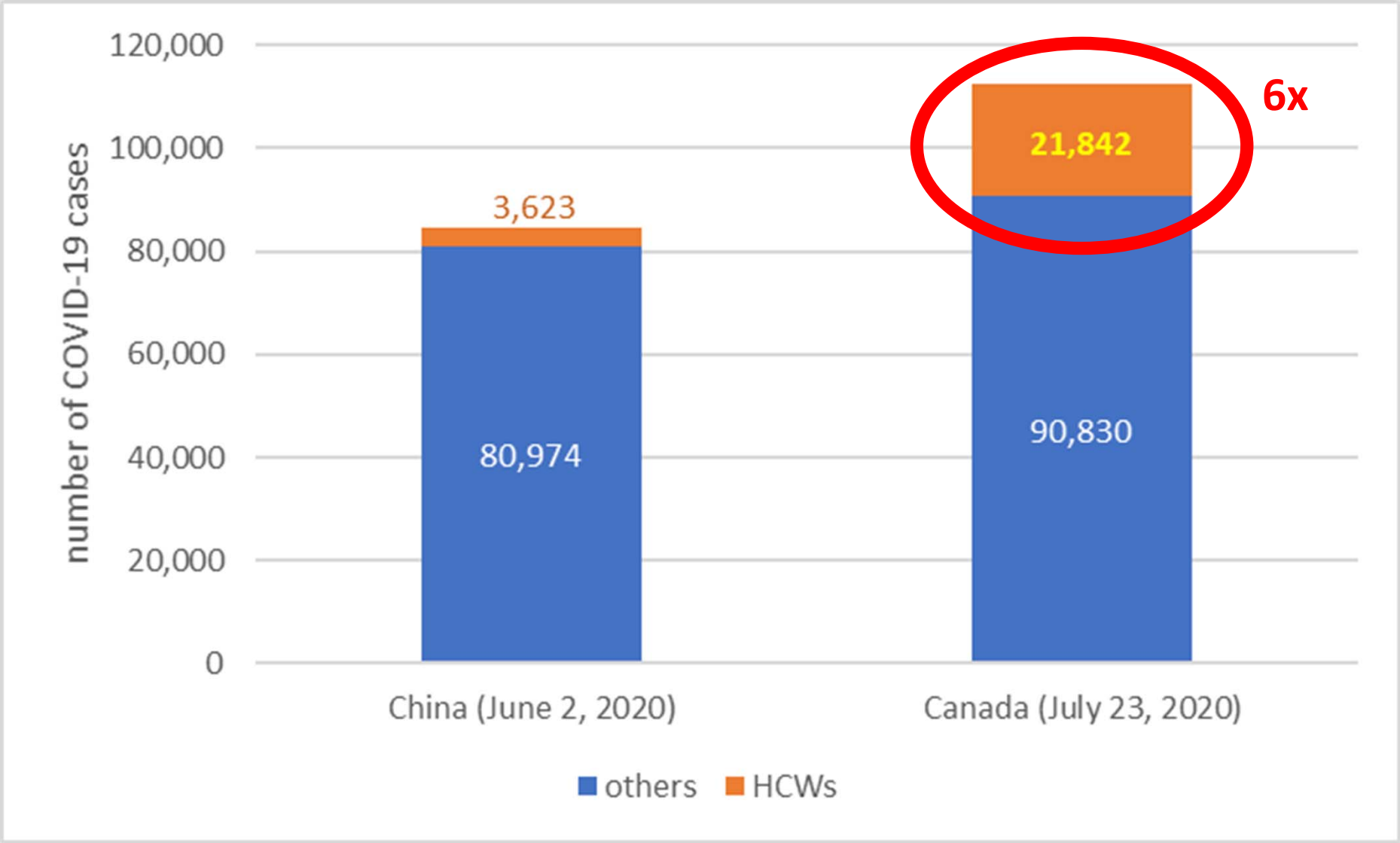
Looking to the Future – The Evidence & The Implications



In China HCWs made up 4.3% of all COVID-19 cases (as of June 2nd: 3,623 HCWs infected and 31 deaths).

https://www.cihi.ca/en/covid-19-cases-and-deaths-among-health-care-workers-in-canada#map

Looking to the Future – The Evidence & The Implications



Looking to the Future – The Evidence & The Implications

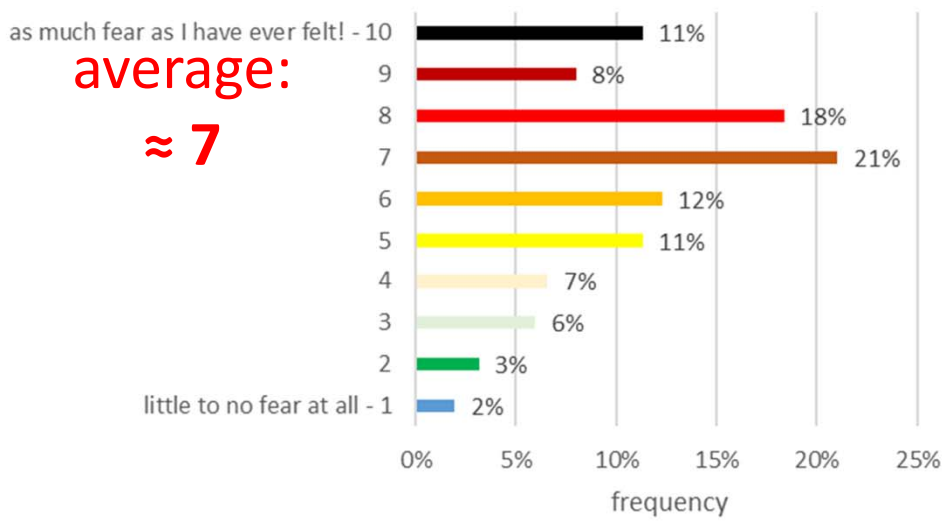
"paper napkin" epidemiology

- With the help of Peter Smith (IWH) we estimated the number of HCWs in Ontario from the 2016 census data and recent Labour Force Surveys: 482,000 HCWs in ON (3.3%)
- With 7044 Ontario HCWs infected (Sept 29) among a total of about 51,710 confirmed cases (ON pop. ≈14.745 million), HCWs are **more than 4 times more likely** to be infected than the general population (at least 75% of HCW infections are work-related: sufficient grounds for presumptive recognition for compensation purposes)
- From legal proceedings: Toronto hospital with 10,000 workers had roughly 4% infection rate (≈400 HCWs) in May when Toronto rates were 0.285%. Even using seroprevalence data for that time, Toronto's infection rate was 1.5%, still **almost 2/3rds (≈63%) of HCW infections are work-related, probably higher**, maybe even as high as over 90% (c.f. PHO estimate 3% based on contact tracing data)

Looking to the Future – The Evidence & The Implications

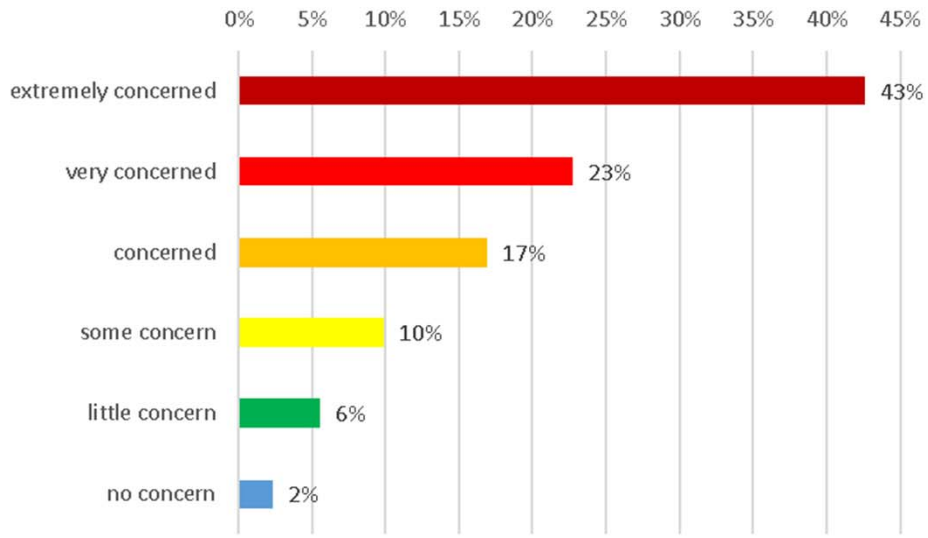
Cross Canada HCW survey (Apr-May/20, n≈6000)

On a scale from **1 to 10**, how would you rate your **current level of fear** about this whole **pandemic** situation:



average:
≈ 7

How **concerned** are you about **bringing the virus home** to those with whom you live and/or friends?



Generalized Anxiety Disorder screen (GAD-2): 55%

Patient Health Questionnaire screen (PHQ-2): 42%

https://journals.sagepub.com/doi/pdf/10.1177/0706743720961729

Looking to the Future – The Evidence & The Implications

Failures of the "scientific reviews"

- A lack of sound scientific reasoning – falling prey to logical fallacies – "absence of evidence", verification bias, lack of falsifiability
- Selection bias, misinterpretation (e.g. lack of understanding of air sampling limitations; lack of multi-disciplinary approach)
- Biased standards of evidence ("droplet" needs no evidence, "airborne" needs RCTs and meta-analyses)
- Citing papers as evidence for positions which the papers actually contradict
- Misrepresenting/ignoring the IPAC successes in other countries (China, Taiwan, Hong Kong, South Korea, Singapore) – in particular the Chinese-WHO Joint report
- Not recognizing our own IPAC failures when they occur (blaming victims, passing off responsibility)

Looking to the Future – The Evidence & The Implications

Now What?

1. "The science is in" so recognize the airborne component of the complex SARS-CoV-2 transmission picture; **change the guidelines** now!
2. Follow the SARS Commission (also following John Snow & Sir Bradford Hill) recommendations for dealing with uncertainty (i.e. **precautionary principle**)
3. Ensure adequate PPE (supply) and IPAC procedures to prevent all workplace infections (**as other countries have done** – learn from their examples) – monitor our progress by **counting & publishing HCW infections** (count the canaries – provide presumptive recognition of work-relatedness)
4. Review where the "scientific reviews" went wrong and respond accordingly (need **multi-disciplinary approach**, esp. H&S)
5. Expand our **tool box** (e.g. combine genetic sequencing with contract tracing, take exposure measurements, use quick antibody tests, etc.)
6. Layer the public responses to the regional risk using a **graduated continuum/hierarchy (spectrum) of controls**
7. Have politicians and responsible bureaucrats offer to attend the funerals of infected HCWs to **apologize** and **promise to do better** – mind you, there is enough blame to go around for everyone, so **we all need to accept responsibility** and do something **quick!**