



Northeastern University Bouvé College of Health Sciences School of Nursing, School Health Academy



COVID-19 Masks as PPE: Stories from the hospital and community

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As a result of this webinar, participants will be able to describe:

how COVID19 is spread,

Outcomes

- how to limit COVID spread with focus on mask use,
- types of masks used in health care and other settings,
- challenges in using masks identified by individuals working in health care, work and school settings,
- potential solutions to some of the mask use challenges.

I can recognize challenges in using masks identified by individuals working in health care, work and school settings.



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Agenda

Introduction

COVID-19 Overview & transmission

Experiences of hospital & community workers

Testing & Making Masks

Closing



Loretta Fernandez, PhD, SM Civil & Environmental Engineering Northeastern University



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Presenters

EMS PARAMEDICS AND PANDEMIC PPE

Benjamin Podsiadlo, EMT-PDirector, Clinical IntegrationArmstrong Ambulance Service

PPE Shortages for EMS

Is a "JIT" Preparedness and Surge Supply Chain Effective?



EMS PPE Needs In the Field Are Unique

Don PPE =>Entry

Post-Contact => Doff



Massive EMS Surge in NYC

Catastrophic spike and scale of NYC surge disaster



EMT trains on nasal swab specimen collection



EMS Support to Public Health Mission

EMS Trained to Provide COVID-19 Swab Testing for DPH Surveillance



Trained Mobile EMS Strike Teams Assigned By DPH To Target Test Locations



EMS PPE Doffing

Paramedics field doff after attempted ACLS resuscitation



Emergency Preparedness "E-Prep" Achilles Heel for Emergency Medical Services

- Declining + Non-Sustained Public \$ for E-Prep
- "Lean Forward" vs. "Wait and See".....
- E-Prep based on global economy and margins
- Flex capacity and reserve in Ems and health care?
- EMS system concept vs. "Ambulance Industry"

Decon Fogger



EMS PPE Needs

Value the EMS Mission, Resource the EMS System, Respect the EMS Workforce

- Support regional and publicly funded career EMS system.
- Recognize EMS as a distinct response discipline.
- PPE outfitting and training for all EMS responders.
- Sustain public funding for surge capacity with stockpiles, replenishment and training to use it for EMS responders.





To Mask or Not to Mask? Preparing for Reopening Schools

Karen Rufo, MS, PPCNP-BC

CONFUSED?

"Seriously people," he began, and though it's a tweet, you can almost hear the exasperation in his plea. "STOP BUYING MASKS!"

Dr Jerome Adams March 2, 2020 CNN

US Surgeon General

On April 4, 2020, Dr Adams changed his stance on masks, and tweeted out how to make your own mask.

Dr Jerome Adams April 1, 2020 CNN

US Surgeon General



Why wear a mask?

Protect community

CHILDREN UNDER 2 YO

WHO SHOULD NOT WEAR MASKS

PEOPLE WHO ARE:

- UNCONSCIOUS
- INCAPACITATED
- UNABLE TO REMOVE THE MASK THEMSELVES

MULTIFACTORIAL

MASKS MAY PLAY A PART

PREVENTING

THE SPREAD

OF COVID-19

STILL NEED TO:

- WEAR THE MASK PROPERLY
- CLEAN IT OFTEN
- WASH YOUR HANDS
- DON'T TOUCH YOUR FACE
- PRACTICE PHYSICAL DISTANCING





AREAS TO EXPLORE

- 1. STUDENT COMFORT/SAFETY
- 2. IMPACT ON STUDENTS
- 3. LOGISTICS
- 4. ENFORCEMENT
- 5. ECONOMIC

CONCERNS ABOUT WEARING MASKS



CONCERNS ABOUT WEARING MASKS

MEDICAL

- **RESPIRATORY**
- STRUCTURAL ANOMALIES
- NEUROLOGICAL
- HEARING
- VISION

COGNITIVE

DEVELOPMENTAL

• AUTISM

CHALLENGES OF WEARING A MASK

SENSORY

- CONFINING
- ITCHY
- HOT
- DIFFICULT TO BREATHE
- DISTRACTING

TOUCH FACE MORE

CHALLENGE TO WEAR FOR THE ENTIRE DAY

COMMUNICATION

BAD BREATH

MISPLACED/LOST



SAFE N CLEAR MASKS

Students wearing Masks? Availability and Cost? How many?



ECONOMIC IMPACT

WHO PROVIDES THE MASKS?

SUPPLY ISSUES: SCARCITY AND QUALITY

WHO MAKES SURE THEY FIT CORRECTLY?

WHO ENSURES THEY ARE WORN CORRECTLY?

WHO MAKES SURE THEY ARE CLEAN?

WHO REPLACES THE MASKS?

QUALITY OF MASK

STATUS SYMBOL

SIMPLE MATH

- DISTRICT 5000 STUDENTS
- PROVIDE <u>ONE MASK PER WEEK</u>
- LOWEST PRICE 87 CENTS/MASK

87 X 5,000 = \$4,350.00/WEEK \$4,350 X 36 WEEKS = **\$156,600/DISTRICT**

IN MASSACHUSETTS, BASED ON 1 MILLION STUDENTS \$870,000/WEEK **OVER \$31 MILLION** FOR THE YEAR



Do we explore students wearing home made masks?

DESIGN OF MASKS FOR CHILDREN

SOFT, SENSORY FRIENDLY FABRIC

ELASTIC LOOPS OR VELCRO

POCKET FOR INTERCHANGABLE TISSUE?

KID FRIENDLY DESIGNS/COLORS





Do we rely on individuals to sew masks?
COVID-19's Staggering Impact On Global Education

Number of learners impacted by national school closures worldwide



Figures refer to learners enrolled at pre-primary, primary, lower-secondary, and upper-secondary levels of education, as well as at tertiary education levels. Source: UNESCO

https://www.statista.com/chart/21224/learners-impacted-by-



national-school-closures/



To get a sense of the magnitude...

47 schools closed through rest of school year

- Montana (May 7 reopen possible)
- Wyoming (May 15)
- Nebraska (May 31)
- <u>https://thejournal.com/articles/2020/</u> 03/17/list-of-states-shutting-down-alltheir-schools-grows-to-36.aspx</u>



Adults in schools wearing masks

Examples

 Quebec not requiring students to wear masks, though might slow virus spread. The real challenge is maintaining physical distancing.

https://www.ctvnews.ca/health/coronavir us/should-your-child-wear-a-face-mask-1.4931370

 In France, "People are required to wear masks in high schools and on public transportation — or risk being fined." (burqas still banned) <u>https://www.washingtonpost.com/world/</u> <u>europe/france-face-masks-</u> <u>coronavirus/2020/05/09/6fbd50fc-8ae6-</u> <u>11ea-80df-d24b35a568ae_story.html</u> What school reopening looks like around the world Images from 9 countries reopening schools as of May 7, 2020: Belarus, China, Denmark, France, Germany, Madagascar, Norway, Vietnam, and Montana in the United States

http://fullframe.edweek.org/2020/05/07/school-reopening/

Guidelines from American Federation Teachers

- Personal protective equipment and sanitization—Providing medical-grade masks for health professionals and nonmedical-grade masks for all others, and disinfecting schools on a regular basis, in addition to providing handwashing and sanitizing stations.
- A PLAN TO SAFELY REOPEN AMERICA'S SCHOOLS AND COMMUNITIES
- April 29,2020
- <u>https://www.aft.org/press-release/aft-launches-landmark-plan-safely-reopen-americas-schools-and-communities</u>

How can we quantitatively test efficacy of cloth/non-medical masks for protection to the wearer?







Amy Mueller

Dept. of Civil & Environmental Engineering, Northeastern University

Mask-making projects are popping all over as crafters mobilize against coronavirus

By Victoria McGrane Globe Staff, Updated March 22, 2020, 3:05 p.m.



the Boston Globe, March 22, 2020

HEALTH NEWS MARCH 19, 2020 / 10:59 PM / 2 MONTHS AGO



Faced with a shortage of face masks, some U.S. doctors make their own

Volunteers sew masks for health workers facing shortages



March 24, 2020

Homemade face masks may not block coronavirus like N95: CDC says make them your last resort

N95 masks adhere to strict protocols to block out airborne particles, including viruses, in ways that cotton and elastic just can't.



P 43



CNET.com March 20, 2020

Existing standard methods answer different needs

N95 masks & respirators

- Materials tested for filtration capacity before manufacture
- "Fit Test" measures leakage around the mask on the person







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Existing standard methods answer different needs

Surgical masks (for medical use)

<u>Materials</u> tested for filtration capacity before manufacture



Designation: F2101 – 19

Standard Test Method for Evaluating the Bacterial Filtration Efficiency (BFE) of Medical Face Mask Materials, Using a Biological Aerosol of *Staphylococcus aureus*¹



Designation: F2299/F2299M – 03 (Reapproved 2017)



Designation: F1862/F1862M - 17

Standard Test Method for Determining the Initial Efficiency of Materials Used in

Medical Face Masks to Penetration by Particulates Usin Latex Spheres¹ Standard Test Method for Resistance of Medical Face Masks to Penetration by Synthetic Blood (Horizontal Projection of Fixed Volume at a Known Velocity)¹

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Resistance of Medical Face Masks to Penetration by Synthetic Blood (Horizontal Projection of Fixed Volume at a Known Velocity)¹

What does a "Fit Test" actually measure?



----- Particle count (room) ----- Particle count (inside mask) ----- Particle removal %

Our goal: similar method for non-N95 masks

How can we help users evaluate efficacy of any type of mask?



Proposed testing method

- Generate virus-relevant sized particles in the lab (from NaCl, size range 5-300nm, mean ~ 40 nm)
- Particles (per cm³) are measured in air sampled inside and just outside of the mask as it is worn
- Time series collected over 3 one-minute runs per mask (not just "fit factor")



Officer John Dillon and Prof. Amy Mueller testing a candidate mask for the Northeastern Police Department

Learning about **both** fit and materials



- Masks are also tested in a "best achievable fit" configuration where a nylon layer is used to snug mask to the face¹
- Unlike for N95 masks, our tests are done in only one position, as previous work shows loose-fitting mask results are not strongly affected by position of the head²

 ¹Cooper, D. W., W. C. Hinds, J. M. Price, R. Weker and H. S. Yee (1983). Expedient Methods of Respiratory Protection. II. Leakage Tests. D. o. E. H. Sciences, Harvard School of Public Health, Boston, MA, pp.47.
²van der Sande, M., P. Teunis and R. Sabel (2008). "Professional and Home-Made Face Masks Reduce Exposure to Respiratory Infections among the General Population." PLoS ONE 3(7): 1-6

Caveats

- All masks have so far been tested against a single face
- Results measure *protective capacity for the wearer* (PPE) – not *protective capacity for others* (PHPE)
- We are testing masks provided by the general public, so the materials tested are what folks choose/have – not comprehensive coverage of all possible materials
- Other important factors like comfort and breathability not characterized

HOWEVER:

 The goal of preliminary data is to prove that this method could be useful and easily implemented at facilities nationwide



Data we collect for each mask test (x3)

--- Particle count (room) --- Particle count (inside mask) --- Particle removal %



Data we collect for each mask test (x3)

----- Particle count (room) ----- Particle count (inside mask) --- Particle removal %



Data we collect for each mask test (x3)

--- Particle count (room) --- Particle count (inside mask) --- Particle removal %



Preliminary results: commercial masks



- Surgical masks worn as designed filter 50-75% of particles (brand/face fit dependent)
- However, when snugged to the face filtration is close to 90%
- Material filtration is good – air leakage is the main culprit

Candidate materials

KC 500 and Halyard H600 **Sterilization wrap**











Preliminary results: cloth masks



- Results are highly variable based on mask fit & materials
- Cone-shaped masks appear to fit better
- Gray bars show material filtration potential: higher ones generally have multiple layers

How do cloth masks compare to surgical masks?



- Many cloth masks actually surpass results of a surgical mask worn as designed!
- Some even match results of the "snugged" surgical mask
- BUT: many do not

Take-home messages

- Because the efficacy of cloth masks is so variable, a quick quantitative way to compare them on site could be useful for facilities considering their use
- May provide comfort for the public in selecting masks for protecting themselves or family members who may be at high risk



Questions?



website with updated data: masktestingatNU.com a.mueller@northeastern.edu l.fernandez@northeastern.edu

PPE PROJECT

Stan (and Gabby) Helinski

March 22, 2020

Proud Parent





- 31 Printers
 - Weston High School
 - Wellesley High School
 - Waltham Public Library

Present Design

CFU REDUCTIO

500

450

' ANTIBACTERIAL ACTIVITY

x10000 400 the results of 2 studies conducted by microbiology 350 and Chile^{1,2}. Both studies confirm that the Colony 300 of Staphylococcus aureus MRSA and Escherichia coli during the first 6 hours of exposure to PLACTIVE ne elmination of exposure to PLACTIVE ne elmination of exposure to PLACTIVE rs and >99.99% elimination at 24 hours. Filament (Plastic)

>9





Standard Filter Holder for Anesthesia and Resuscitation lines

By Francesco Guarnieri

Viral Filter Prototype

Printed

Users

32-3
D-Printed Hospital PPE

Stay Safe and Thank you

https://www.gofundme.com/f/Hospital-and-First-Responder-PPE

\$4,200 raised of \$ 62 215 62 donors follo shares Do Laura Astorir 2 **\$100** 1d **Donald New** \$100

CNE online

https://neusha.org/visit-neusha/index.php/online-program-list/





Thank you

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