SARS-CoV-2 Seroprevalence among Healthcare, First Response, and Public Safety Personnel (article review)

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Game plan

- Review a recent article on SARS-CoV-2 seroprevalence in a Midwestern hospital system, including pre-hospital care personnel
- Touch on findings from some other serostudies

objectives

- Recite statistics for seropositivity among pre- and post-hospitalization personnel in a large healthcare system

- List strengths and weaknesses of this study

- Suggest other study design options to more carefully measure the association between health care occupation (exposure) and seroprevalence (outcome) to SARS-CoV-2

- Pass a quiz at the end (scores to be sent to your supervisors. What, no supervisor? Then to your mothers).

Take home messages

- Seroprevalence varied substantially by health care occupation
- Seroprevalence varied substantially by location of conducting one's professional activities (ex: doctor in ER vs. OR)
- Distance from inner city Detroit was associated with serologic status
- Having a household member with Covid-19 was a strong risk for HCW seropositivity
- As with most other studies, only a small proportion of seropositives reported Covid-19 symptoms/signs

Introduction

- ▶ Various occupations and health care-related responsibilities are associated with different risk levels for infection among health care workers

- ▶ Most studies to date have been small to medium sized and have not spanned a complete spectrum of HCW's and their risks, within a large and representative health care system

- ▶ Antibody studies, although not with perfect sensitivity and specificity, offer options to further investigate factors associated with seropositivity to SARS-CoV-2 (paired with findings from questionnaires)

Design of Akinbami SARS-CoV-2 seroprevalence study in HCWs (EID, 2020)

- ► Cross sectional study, n=16,357 in Detroit metro area, May and June
- ► 27 hospitals included, and 7 Medical Control Authorities
- ► Convenience sample, subjects 18 years and over
- ► Blood drawn from each participant, cell phone or tablet responses to questionnaires
- ► Multiple work locations collected (thus, not mutually exclusive)
- ► Calculated % seropositive by categories, and ORs associating exposures with seropositivity to IgG antibody
- ► No attempt to validate questionnaire responses

- Most of the next slides will show participant numbers (%) in the first column, and % seropositive with 95% CI in the second column
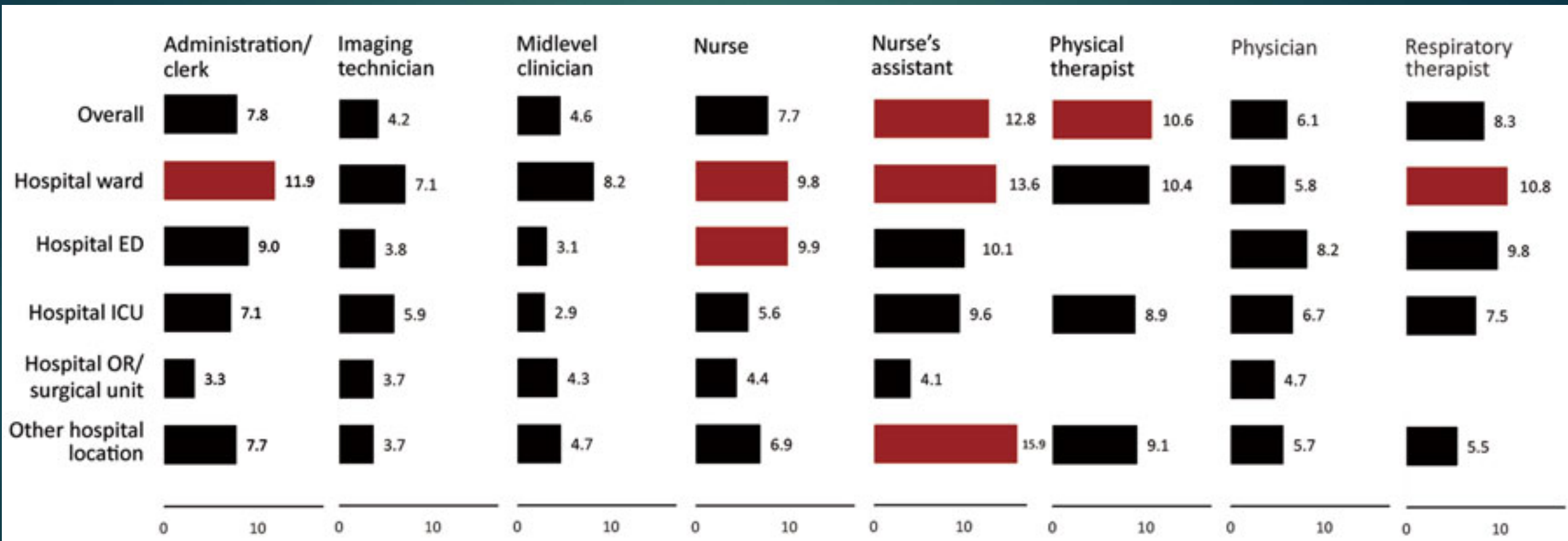
A few key findings related to seroprevalence:

- Over all participants, seroprevalence was 6.9%

- African Americans/Blacks: seroprevalence was 16.3%

- Older participants (>65 years) had lower seroprevalence

- Prevalence varied greatly by facility, 0.5% to 18%

- Aerosol-generating procedures correlated with seropositivity (9%)

Characteristic	No. (%)	% Seropositive (95% CI
Work location		
Hospital emergency department	3,614 (22.0)	8.1 (7.2–9.0)
Hospital ward	4,766 (29.1)	8.8 (8.0–9.7)
Hospital intensive care unit	3,973 (24.2)	6.1 (5.3–6.9)
Hospital operating room/surgical	2,661 (16.2)	4.5 (3.7–5.3)
Other hospital location	3,260 (19.9)	6.1 (5.3–7.0)
Emergency medical services	550 (3.4)	5.3 (3.6–7.5)
Fire services	1,008 (6.2)	5.0 (3.7–6.5)
Police department	615 (3.8)	3.9 (2.5–5.8)

Occupation		
Administration/clerk	964 (5.9)	8.0 (6.4–9.9)
Clinical technician†	365 (2.2)	5.5 (3.4–8.3)
EMT/medical first responder/paramedic‡	1,158 (7.1)	5.2 (4.0–6.6)
Firefighter§	330 (2.0)	6.7 (4.2–9.9)
Imaging technician	719 (4.4)	4.2 (2.8–5.9)
Laboratory technician	293 (1.8)	3.4 (1.7–6.2)
Midlevel clinician	566 (3.5)	4.6 (3.0–6.7)
Nurse	6,426 (39.2)	7.7 (7.1–8.4)
Nurse assistant	641 (3.9)	12.8 (10.3–15.6)
Other¶	688 (4.2)	6.8 (5.1–9.0)
Other health#	200 (4.6)	7.5 (4.3–12.1)
Pharmacist	321 (2.0)	4.4 (2.4–7.2)
Physical therapist	235 (1.4)	10.6 (7.0–15.3)
Physician	2,297 (14.0)	6.1 (5.1–7.1)

	Administration/ clerk	Imaging technician	Midlevel clinician	Nurse	Nurse's assistant	Physical therapist	Physician	Respiratory therapist
Overall	7.8	4.2	4.6	7.7	12.8	10.6	6.1	8.3
Hospital ward	11.9	7.1	8.2	9.8	13.6	10.4	5.8	10.8
Hospital ED	9.0	3.8	3.1	9.9	10.1		8.2	9.8
Hospital ICU	7.1	5.9	2.9	5.6	9.6	8.9	6.7	7.5
Hospital OR/ surgical unit	3.3	3.7	4.3	4.4	4.1		4.7	
Other hospital location	7.7	3.7	4.7	6.9	15.9	9.1	5.7	5.5

Distance of work agency/facility from Detroit centroid		
<15 km	7,194 (43.9)	11.0 (10.3–11.7)
15–30 km	4,677 (28.5)	5.5 (4.9–6.2)
31–55 km	4,526 (27.6)	1.8 (1.4–2.2)

Exposure to persons testing positive for COVID-19§		
Co-worker	6,799 (41.5)	10.0 (9.3–10.8)
Household member	519 (3.2)	34.3 (30.2–38.6)
Patient	10,389 (63.4)	7.8 (7.3–8.3)
Other person	2,709 (16.5)	11.5 (10.3–12.7)

Figure 1. Seropositivity for SARS-CoV-2 among healthcare, first response, and public safety personnel, by hospital and Medical Control Authority agency location, Detroit metropolitan area, Michigan, USA, May–June 2020. Centroid: Detroit city center. Mean SARS-CoV-2 seroprevalence within 15 km was 11.0% (red), 15–30 km, 5.5% (orange), and 31–55 km, 1.8% (yellow). Base map source: ESRI ArcGIS map for Province of Ontario and Oakland County, Michigan (https://www.esri.com). SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

<15 km Detroit Center (ref. >30 km)
15–<30 km Detroit Center

Exposed to co-worker (ref. not)
Exposed to HH member
Exposed to patient
Exposed to other person

Characteristic	No. (%)	% Seropositive (95% CI)
PPE		
Gown use all the time	9,316 (56.8)	6.9 (6.4–7.5)
Glove use all the time	11,887 (72.5)	7.0 (6.5–7.5)
N95 respirator use all the time	7,316 (44.6)	6.9 (6.3–7.5)
PAPR use all the time	695 (4.2)	7.6 (5.8–9.9)
Goggles/face shield all the time	6,581 (40.1)	6.5 (5.9–7.1)
Surgical facemask all the time	9,452 (57.6)	6.6 (6.1–7.1)

Adjusted analyses considering multiple factors—key messages

- Household + contact: OR 6.2 (4.8-7.9)
- Home proximity to city center: OR 5.6 (4.0-8.0)
- Occupation Nurse assistant: OR 1.9 (1.2-3.0)
- Occupation Nurse: OR 1.5 (1.2-2.0)

Strengths and weaknesses of this study

strengths

- Relatively easy to understand and to implement

- Relatively cheap

- Can calculate measures of association (Odds ratios)

- Provided important information on role of community of origin of the HCWs

- Web based survey—large!

weaknesses

- compliance with study entry invitation

- Hard to measure and consider cross over in exposure (job) category

- Test sensitivity 90%,so some seropositives will be missed

- Healthy worker effect

- While not exactly a weakness, data from the study were collected in May and June…the same study now would likely show higher antibody prevalences

- We are missing info on use of PPE at home and info about quarantine of household members

Other design options

▶ Retrospective cohort, though unlikely to find serum bank that is adequate and may be difficult to account for hybrid jobs

▶ Cohort study, with considerations of cross-over of exposure categories (ICU nurse who also works on wards). Allows calculation of incidence rates of conversion…and, cumulative incidence

▶ Case-crossover studies (designed to answer the question, 'what were you doing right before you seroconverted?). These studies are good for assessing the relation of discrete (usually short duration) exposures with easily-measured or easily-observed outcomes.

▶ Case control study, starting with seropositives/seronegatives in a care system and assessing job-related exposures

Quiz. (please email Eric the name and address for your supervisor, and, your score. honor system in effect.)

▶ Within the parameters of this study, does seropositivity have a stronger association with healthcare position or with community/household factors among health care workers?

▶ Which <u>in-hospital</u> job location is associated with highest SARS-CoV-2 seropositivity, all occupations combined?

▶ What is the sensitivity of the antibody test used in the study?

▶ What are the strengths and limitations of a cohort study to investigate the relation between occupation and serostatus?

references

- Akinbami et al. SARS-CoV-2 Seroprevalence among Healthcare, First Response, and Public Safety Personnel, Detroit Metropolitan Area, Michigan, USA, May–June 2020, Emerging Infectious Diseases, 2020

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