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Effectiveness of PPE in Preventing Transmission of COVID-19 in Healthcare Workers

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Background

- Human-to-human transmission of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) occurs during exposure to infectious respiratory droplets or aerosols (1).
- Aerosolizing events (AE) create a controversy on optimal personal protective equipment (PPE) utilization to prevent transmission of SARS-CoV-2 to healthcare workers (HCW) (2).

Methods

- Retrospective cohort study at Kaiser Permanente Southern California (KPSC) comprising of 13 service areas, identifying all HCW who underwent testing for COVID-19 by a polymerase chain reaction test during March 13-August 3, 2020.
- HCW were identified for testing either through 1) contact tracing of exposed HCW to positive COVID-19 patients or 2) symptomatology of potential COVID-19 as defined by CDC criteria (3).
- PPE policy at our medical centers consists of gowns, gloves, eye protection, and appropriate masks during patient contact.
- Local PPE shortages during March 13-April 23, 2020 diverted respirator masks (RM) defined as N95 or higher-level respirators to the following high-risk departments with risk for AE (Table 1a):
  - Emergency and Urgent Care (ERUC), Medical/Surgical (MSU), and Intensive Care (ICU) units.
- Medical masks (MM) defined as surgical or procedural masks were freely available to low-risk, outpatient departments.
- One service area provided complete contact tracing reports with individual HCW PPE and testing data by the end of the study period (Table 1b).

Results

Figure 1: HCW and General Patient Population Positivity Rate by Service Area at KPSC

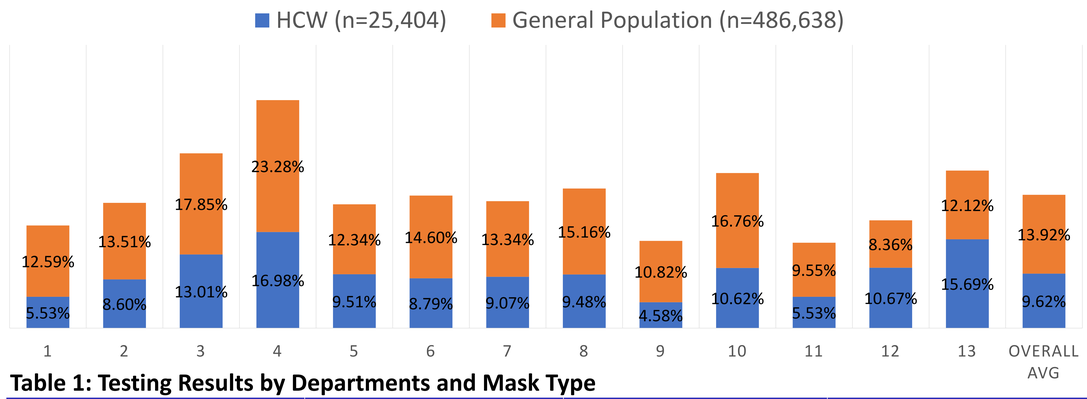
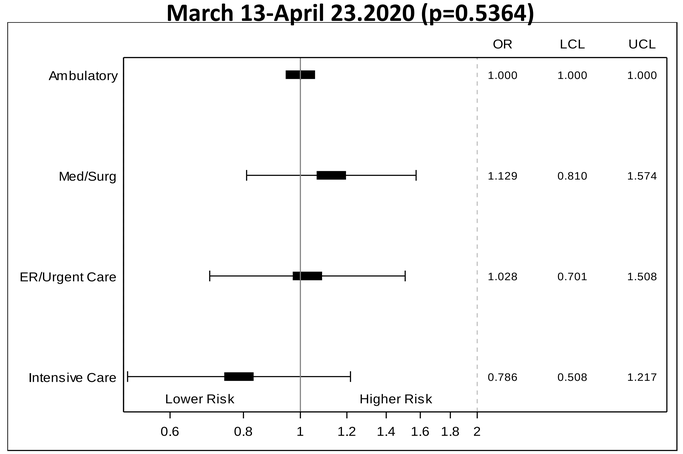


Table 1: Testing Results by Departments and Mask Type

	SARS-CoV-2 Positive (%)	SARS-CoV-2 Negative (%)	Total
a. Departments by Risk During PPE Shortage Period March 13-April 23, 2020			
Low-Risk Departments (All Outpatient Clinics)	124 (7.9)	1454 (92.1)	1578
High-Risk Departments	118 (7.9)	1381 (92.1)	1499
MSU	55 (8.8)	571 (91.2)	626
ERUC	37 (8.1)	422 (91.9)	459
ICU	26 (6.3)	388 (93.7)	41
b. Individual HCW Mask Data from Single Medical Center Period March 13-August 3, 2020			
Respirator	18 (3.5)	488 (96.5)	506
Medical	44 (3.5)	1201 (96.5)	1245
No mask	46 (7.6)	560 (92.4)	606

Figure 2: HCW Risk by Departments During PPE Shortage Period March 13-April 23.2020 (p=0.5364)



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Conclusions

- Our study found HCW had a lower average SARS-CoV-2 positivity rate than the general patient population within KPSC (Figure 1).
- Lower positivity rate among our HCW supports a recent study finding lower-risk of COVID-19 transmission in HCW within the medical workplace compared to outside the workplace (4).
- Providers in low-risk settings who mostly used MM had a similar positivity rate compared with providers in high-risk departments who mostly used RM (7.9% vs 7.9%, OR= 1.002, 95% confidence interval = 0.771-1.303, p=0.9886), supporting the level of mask used was equally appropriate across all risk level care settings.
  - The slightly lower test-positive rate in ICU providers may suggest RM are beneficial in settings with higher risk of AE, or it may be related to training and familiarity with infection-control measures (Figure 2).
- We found no difference in HCW SARS-CoV-2 positivity rates between HCW wearing RM compared to MM (OR 1.006, p=0.981, Table 1b), supporting findings from an earlier case report showing MM protected HCW from acquiring COVID-19 (5)
  - We found a statistically significant decrease in positivity rates when HCW wore RM compared to NM (OR 0.449, p=0.005) and MM compared to NM (OR 0.446, p=0.0002).
- Our study supports optimization of PPE stewardship based on WHO guidance (6) to protect HCW during the COVID-19 pandemic.
- Limitations of our study include potential for recall bias during contact tracing interviews and only one medical center had completed contact tracing for analysis by end of study.

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