**Decreasing High Risk Exposures for Healthcare-workers through Universal Masking and Universal SARS-CoV-2 Testing upon entry to a Tertiary Care Facility**

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**Abstract**

We describe the impact of universal masking and universal testing at admission on high risk exposures to SARS-CoV-2 for healthcare workers. Universal masking decreased the rate per patient day of high risk exposures by 68%, and universal testing further decreased those exposures by 77%.

**Introduction:**

The coronavirus disease 2019 (COVID-19) pandemic has challenged our healthcare system through rapid spread within healthcare facilities [(1)], pre-symptomatic transmission [(2)], and the disproportionate burden of disease upon health care workers (HCWs)[(3-5)]. To address this, the Centers for Disease Control and Prevention (CDC) recommends healthcare facilities employ universal screening for COVID-19 symptoms, universal masking, and consideration of targeted asymptomatic SARS-COV-2 testing. [(6)] Our institution implemented universal masking on March 24, 2020 and on April 6, 2020, began universal SARS-CoV-2 nasopharyngeal polymerase chain reaction (PCR) testing of all patients on admission, utilizing an electronic medical record (EMR) based clinical decision support tool (CDST) to ensure appropriate definition and cohorting of Patients Under Investigation (PUI). We hypothesized that implementation of universal masking and testing of all admissions would decrease the number of high risk exposures (HRE) to COVID-19 for HCWs.

**Methods:**

We designed a retrospective quasi-experimental study of all patients admitted April 6, 2020 -May 18, 2020 to a large academic referral center in the Southeastern U.S. at the beginning of the COVID-19 pandemic. Our study was approved by the Institutional Review Board at the University of Alabama in Birmingham.

Universal Masking: Beginning March 22, we cohorted COVID-19 positive cases and PUIs and HCWs received appropriate PPE including N-95 respirators. Universal masking with ASTN level-1 procedural masks for all other healthcare workers and masking of all patients, began March 24. Visitors were restricted to the facility for the duration of this study.

Universal Testing: Our CDST designated positive screening symptoms as unresponsive, fever, cough, or dyspnea. The CDST required provider completion of a dual-response screening form including symptoms and reason for testing (clinical concern, universal testing). If a patient was documented

to have no COVID-19 symptoms, and no clinical concern prompting testing, the screening's embedded algorithm designated the patient as non-PUI. All other response combinations resulted in a PUI designation, and the CDST automatically ordered appropriate isolation precautions.

Healthcare Worker Exposure: Employee health created an electronic form for self-report of exposures to COVID-19. Information included symptoms, whether source or HCW was wearing mask, participation in an aerosolizing procedure, and whether exposure source was a patient, employee, or community member. All responses were stored outside of the EMR in a secure database and responses were sorted based on epidemiologic risk factors. HRE were defined as exposure with both source and HCW not wearing a mask or being present in aerosol generating procedure without appropriate PPE.

Statistical analysis: Exposure counts were standardized per 100 patient days given fluctuations of hospitalizations. A negative binomial regression model (to account for overdispersion of count data) was used to estimate rate ratios (RRs) and 95% confidence intervals (CIs) for the association between intervention period and exposure rate. Rate ratios for a given intervention period were relative to the prior period (i.e., universal masking only vs no intervention and universal masking and testing vs universal masking only). For all analyses, $P < .05$ was considered statistically significant, and SAS 9.4 (SAS Institute, Cary, NC) was used.

**Results:**

4,891 unique patients were tested for SARS-CoV-2, of whom 1,502 were designated as PUI and 3,389 as non-PUI (Table 1). Among PUIs, 114 patients were positive (7.6%), and among non-PUIs, 26 were positive (0.77%). Of these 26 positive non-PUI cases, four had atypical symptoms consistent with COVID-19 on presentation, nine subsequently developed symptoms during hospitalization, and thirteen patients remained asymptomatic throughout their stay.

Following implementation of our interventions we saw a decline in self-reported HRE for HCWs (Figure 1).Institution of universal masking decreased the reported rate per patient-day of exposure without any mask by 73%, (RR 0.27, 95% CI 0.14-0.55), but was not associated with a significant change in exposure rates during aerosolizing procedure (RR 0.59, 95% CI 0.31 – 1.14). Addition of universal testing of patients to universal masking further decreased exposures without a mask by 86%, (RR 0.14, 95% CI 0.07-0.27), and decreased the rate of exposures from aerosolizing procedures by 56% (RR 0.44, 95% CI 0.23-0.81).

**Discussion:**

As the COVID-19 pandemic has progressed there has been increasing consensus, supported by evidence that universal masking within healthcare settings mitigates spread. (7-9) Universal testing has been described in targeted groups such as labor and delivery with rates of 4-13% [10, 11] and some have supported enhanced HCW testing including those who are asymptomatic to minimize nosocomial transmission. (12) However, to our knowledge, we are the first to describe universal testing for all inpatients and the effect on HCW exposures.

Based off the CDC definition of high risk exposures at the time strict adherence to universal masking would have prevented HRE except in the case of aerosolizing procedures. Interestingly we found universal testing further decreased exposures in which HCW were without masks by 82%. This was early in masking protocols and prior to community mask mandates, thus the reasons for lapse in PPE were numerous, but our findings suggest increased attention to appropriate PPE use when a patient is known or suspected to have COVID-19 significantly decreases exposures. Recent CDC guidance includes the importance of face-shields and further study is warranted to see if a similar effect would be seen using this updated definition of HRE. Our findings that universal testing further decreased exposures related to aerosolizing procedures is expected but further emphasizes the importance of testing prior to higher risk interactions.

We acknowledge several limitations to our data. Our experience as incidence was increasing in the community and universal masking guidance was changing may not be transferrable to other institutions or points in time. Our surveillance of exposures relied upon self-report, although from a more health conscious population than the general community. We chose an end-point of exposures rather than HCW testing positive to increase our number of events and due to the presence of community spread. Although using exposures did increase our total events we still have relatively few exposures documented over our intervention time periods. Though a more appropriate measure for our exposure rate denominators would be the number of days an employee worked or the number of patients the employee contacted, we did not have access to these data. Our use of patient days is the next best measure for time at risk for the hospital's faculty and staff, and it additionally accounts for fewer risk of exposures due to the decreased patient volumes from our institution's COVID-19 response.

As testing availability increases targeting populations at high risk for spread is important. Many professional societies have called for pre-procedural screening, but the burden of asymptomatic disease within hospitals is unknown. We implemented universal testing at a tertiary referral center in the Southeastern United States. Our experience suggests this approach is feasible and protective to HCWs when expedited testing is available.

NOTES

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J.A. reports that Cerner Corporation is the vendor for the EHR referenced in this manuscript. J.A. reports stocks in Cerner Corporation. All other authors have no conflicts of interest to disclose

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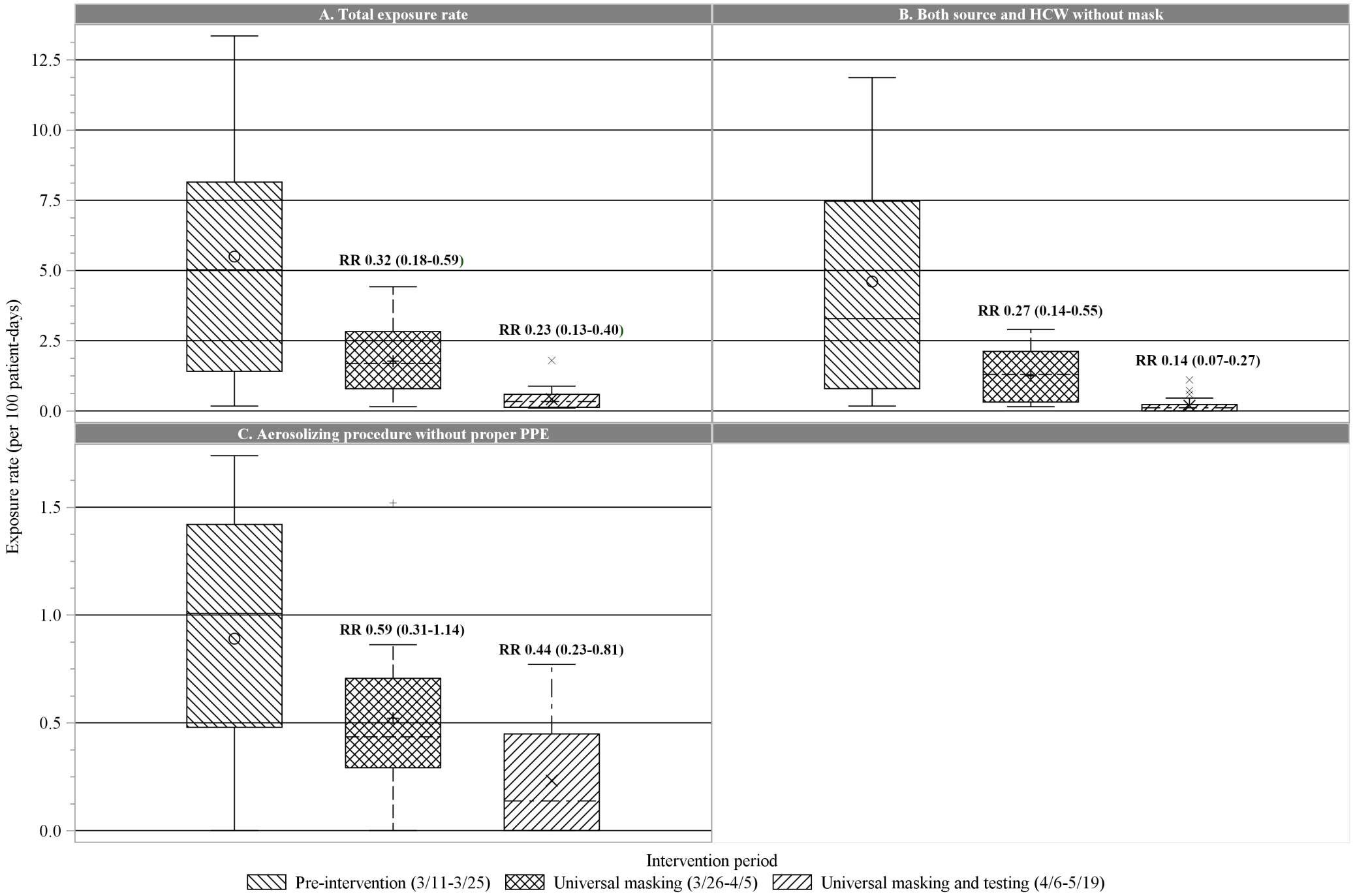
Table 1. Testing Results by Documentation of PUI status Using Clinical Decision Tool

| | | PUI Designation | | |
|---|---|---|---|---|
| | **Total (n =4891)** | **PUI (n=1502)** | **Non-PUI (n=3389)** | **Positive Cases (n=140)** |
| Screening Symptoms | | | | |
| Presence of fever, cough or dyspnea, No. (%) | 1233 (25) | 1233 (82) | 0 | 106 (76) |
| Unknown history or Unresponsive, No. (%) | 244 (5) | 244 (16) | 0 | 5 (3) |
| None, No. (%) | 3414 (70) | 25 (2) | 3389 (100) | 29 (21) |
| Reason for testing | | | | |
| Clinical symptoms concerning for COVID, No. (%) | 1244 (25) | 1244 (73) | 0 | 114 (81) |
| Universal testing only, No. (%) | 3647 (75) | 258 (17) | 3389 (100) | 26 (19) |
| Testing Result | | | | |
| Positive by SARS-COV-2 RNA PCR, No. (%) | 140 (2.9) | 114 (7.6) | 26 (0.77) | |

Figure 1. Rate Ratios (RRs) and associated 95% Confidence Intervals for the Comparison of the Rate, for Healthcare Workers of High-risk Exposures among Intervention Time Periods Overall and by Type of Exposure.

Footnote: Rate ratios estimated from negative binomial regression and in comparison to the directly prior intervention time period.


A. Total exposure rate
B. Both source and HCW without mask
C. Aerosolizing procedure without proper PPE
Exposure rate (per 100 patient-days)
12.5
10.0
7.5
5.0
2.5
0.0
1.5
1.0
0.5
0.0
RR 0.32 (0.18-0.59)
RR 0.23 (0.13-0.40)
RR 0.27 (0.14-0.55)
RR 0.14 (0.07-0.27)
RR 0.59 (0.31-1.14)
RR 0.44 (0.23-0.81)
Intervention period
Pre-intervention (3/11-3/25)
Universal masking (3/26-4/5)
Universal masking and testing (4/6-5/19)