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The Role Of Routine SARS-Cov-2 Screening Of Healthcare-Workers In Acute Care Hospitals: A Systematic Review

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Abstract:

Background: The risk of SARS-CoV-2 infection among healthcare workers (HCWs) remains a concern, particularly in safeguarding vulnerable patient populations and preventing clinics from becoming COVID-19 transmission hubs. Asymptomatic transmission underscores the importance of routine screening to detect infections early and break transmission chains.

Methods: A systematic review was conducted [1]using Cochrane COVID-19 Study Register, Web of Science, and WHO COVID-19 Global literature to assess non-incident related testing of HCWs with polymerase chain reaction (PCR) tests . Studies were included, with a focus on risk of bias and representativeness assessment.

Results: Thirty-nine studies with varied designs were identified, spanning data collection across different regions globally. The sample sizes ranged from 70 to 9449 HCWs, with 1.9% testing positive for SARS-CoV-2 out of 51,700 asymptomatic HCWs. Positive test rates ranged from 0% to 14.3%, and no studies reported reductions in infected person-days due to HCW screening.

Discussion and Conclusions: Heterogeneous positivity rates may stem from regional differences, lockdown measures, and limitations in swab sensitivity. High prevalence in certain studies suggests the importance of HCW screening in high-incidence areas and during pandemics. However, with low case numbers and increasing vaccination rates among HCWs, cost-benefit considerations are crucial, especially during low-incidence periods. Further evaluation is warranted as data on reductions in infected person-days from HCW screening become available.

***Keywords**: COVID-19, SARS-CoV-2, Coronavirus, Screening, Healthcare Workers, Infection Control, Prevention, PCR, Hospital.*

Introduction:

Various measures have been implemented globally to combat the SARS-CoV-2 pandemic, including personal protective equipment (PPE), disinfection protocols, ventilation strategies,

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public restrictions, vaccination campaigns, and more. However, the long-term impacts of these measures on social and economic aspects are challenging to gauge. Healthcare workers (HCWs) face an elevated risk of infection due to their frequent exposure and intensive contact with patients. Asymptomatic infections among HCWs pose a risk of nosocomial transmission to non-COVID patients and fellow HCWs. Such infections can lead to disruptions in HCW availability, exacerbating staff shortages in specialized services. Moreover, HCWs may experience fears of infection, isolation, and transmitting the virus to their families, especially during periods of PPE shortages. Nosocomial infections, accounting for a significant proportion of cases in HCWs, are known to have severe consequences. (Kramer et al., 2021)

Although hospitals often screen patients on admission irrespective of symptoms or contacts, HCWs are typically tested only when symptomatic, despite the potential for asymptomatic transmission. Nosocomial infections contribute substantially to overall infections, with similar viral durations observed in asymptomatic and symptomatic individuals. Given these risks, routine screening of HCWs could serve as a crucial strategy to curb the pandemic, safeguarding both HCWs and vulnerable patient populations from transmission. (Alhazzani et al., 2020)

Moreover, routine screening programs have historically boosted HCW morale and mental well-being during pandemics. Hospitals play a critical role in ensuring timely medical care for patients with comorbidities or new-onset conditions, as delays in seeking treatment due to COVID-19 fears can worsen outcomes. However, expanding screening programs to include asymptomatic HCWs presents challenges such as financial constraints, logistical issues, and the potential impact on workforce availability due to positive or false-positive results. Therefore, strategic planning is essential to implement effective and sustainable screening programs for HCWs. This systematic review aims to consolidate the existing literature on routine SARS-CoV-2 screening among HCWs in acute care settings using PCR testing, highlighting the benefits and challenges of such screening programs. (Abbas et al., 2021)

Methods:

Systematic Literature Search:

This systematic review adheres to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 guideline. A systematic literature search was conducted by an information specialist and peer-reviewed by another specialist.

we searched for studies involving PCR screening for SARS-CoV-2 among healthcare workers (HCWs). The search encompassed the Cochrane COVID-19 Study Register (including MEDLINE, Embase, CENTRAL ClinicalTrials.gov, WHO ICTRP, medRxiv, RetractionWatch), Web of Science (Science Citation Index Expanded and Emerging Sources Citation Index), and WHO COVID-19 Global literature on coronavirus. The search terms included various combinations of HCW, SARS-CoV-2, and PCR. Detailed search strategies are available as supplementary material (Additional file 1).

Five reviewers conducted initial title and abstract screening, followed by full-text assessment for potentially eligible studies based on inclusion criteria.

Inclusion and Exclusion Criteria:

Included studies considered (i) asymptomatic HCWs in hospital settings, (ii) non-incident-related SARS-CoV-2 screening using reverse transcriptase polymerase chain reaction (RT-PCR) tests, with additional rapid tests or serology also allowed.

Excluded were studies focusing solely on non-medical staff, rapid tests/serology without PCR, cause-related screening, and modeling studies.

Data Extraction:

Key study details, participant demographics, testing outcomes (number tested, positives, reduction in infected person-days), and settings were extracted independently by reviewers.

Data Analysis: analysis utilized the R package meta (Version 4.18-0) to calculate proportions with 95% confidence intervals (CI) and Higgins' I2 to assess heterogeneity. Proportions were pooled using a random intercept logistic regression model when appropriate.

Results

The study selection process involved searching for relevant records, resulting in 5218 records. After screening, 39 studies comprising 51,700 healthcare workers (HCWs) met the inclusion criteria for non-cause-related screening of HCWs for SARS-CoV-2.

Additionally, eight studies on cause-related testing, involving 7,950 HCW samples, were identified and described separately.

The characteristics of the 39 included studies are detailed in Table 1. These studies were conducted between January 2020 and August 2020, with PCR sample sizes ranging from 70 to 9449 HCWs. The studies covered all six WHO-defined regions, with a significant number of samples from the USA.

Regarding demographics, 17 studies reported on the mean age of HCWs (ranging from 31.9 to 45.2 years), and 29 studies reported on gender distribution (ranging from 33% to 84.2% women). The participants included various healthcare roles across different hospital wards.

Most of the included studies utilized a cross-sectional design (24 studies), followed by cohort studies (15 studies) and one case series study. All studies used RT-PCR testing, primarily conducted in acute care hospitals.

The outcomes revealed that 1.9% of screened HCWs tested positive for SARS-CoV-2, with positivity rates varying widely among studies. No studies reported on reductions in infected person-days.

Additionally, cause-related testing studies showed a positivity rate ranging from 1.9% to 34%, while studies on asymptomatic HCWs in nursing homes and home care services reported a positivity rate of 0.5%.

Table 1 Study characteristics and results of included studies

First Author	Study Type	No. Positive Tested Asymptomatic/Sample Size	Setting (Level)	Ward	Period of Data Collection	Mean Age of HCW	Gender Distribution (Female in %)
Abdelmoniem et al.	Cross-sectional	29/203 (14.3%)	3	3	01.–14.06.2020	31.9	49

Al-Zoubi et al.	Cohort	0/370 (0%)	4	0	18.03.–29.04.2020	32.02	33
Armin et al.	Cross-sectional	25/475 (5.3%)	3	0	20.04.–05.05.2020	N.A.	80
Brown et al.	Cross-sectional	23/1152 (2.0%)	0	0	24.04.–07.05.2020	39 (median)	70
Campbell et al.	Cohort	16/525 (3%)	3	0	N.A.	N.A.	N.A.
Cavicchiolo et al.	Cohort	3/112 (2.7%)	4	1	21.02.–21.04.2020	N.A.	N.A.
Demmer et al.	Cohort	0/488 (0%)	3–4	6	20.04.–24.06.2020	41	84.2
Dillner et al.	Cohort	235/9449 (11.8%)	4	6	23.04.–24.06.2020	N.A.	79.3
Fakhim et al.	Cross-sectional	14/102 (13.7%)	3–4	0	20.02.–15.03.2020	N.A.	67.6
Favara et al.	Cohort	0/70 (0%)	3	2	01.–07.06.2020	42	56.6
Ferreira et al.	Cross-sectional	Cohort 1: 9/1669 (0.54%) Cohort 2: 20/4107 (0.49%)	3	0	17.04.–29.05.2020	N.A.	N.A.
Fusco et al.	Cross-sectional	2/115 (1.7%)	4	5	23.03.–02.04.2020	43	48.7
Guery et al.	Cross-sectional	3/136 (2.2%)	4	2	16.–19.04.2020	39 (median)	82
Halbrook et al.	Cohort	10/1787 (0.6%) of all 4/1108 (0.4%) of HCW	4	0	08.04.–31.08.2020	N.A.	64
Handal et al.	Cross-sectional	12/360 (3.3%)	4	4	11.05.–11.06.2020	N.A.	76.4
Hellewell et al.	Cohort	15/200 (7.5%)	4	0	26.03.–05.05.2020	N.A.	N.A.
Hidayat et al.	Cross-sectional	83/742 (11.1%)	4	6	19.–23.06.2020	N.A.	66.9
Horton et al.	Cross-sectional	4/5826 (0.09%)	4	0	22.04.–02.06.2020	N.A.	N.A.

Huang et al.	Cross-sectional	0/1394 (0%)	4	0	01.04.–15.06.2020	N.A.	N.A.
Jameson et al.	Cohort	0/121 (0%)	3–4	6	N.A.	N.A.	N.A.
Johnson et al.	Cohort	1/439 (0.2%)	3–4	6	21.05.–16.07.2020	N.A.	N.A.
Kantele et al.	Cross-sectional	36/1095 (3.3%)	4	6	22.04.2020	38 (median)	82.7
Kassem et al.	Cross-sectional	9/74 (12.2%)	4	2	01.–14.04.2020	N.A.	59.5
Lahner et al.	Cross-sectional	58/2057 (2.7%)	3	0	18.03.–27.04.2020	45.2	60.2
Lai et al.	Case series	3/335 (0.9%)	4	6	01.01.–09.02.2020	N.A.	73.6
Lombardi et al.	Cross-sectional	41/1093 (3.7%)	4	6	24.02.–31.03.2020	44.5	64.2
Martin et al.	Cross-sectional	31/270 (11.5%)	4	4	N.A.	37	73
Mohanty et al.	Cross-sectional	64/1670 (3.8%) in total; 33/912 HCW	0	0	02.04.–30.06.2020	42.5	48.6
Moncunill et al.	Cohort	25/501 (5.0%)	3–4	6	27.04.–06.05.2020	42	71.7
Moolla et al.	Cohort	12/799 (8.3%)	0	0	01.05.–31.05.2020	39.7	77.4
Olalla et al.	Cross-sectional	2/498 (0.4%)	3	6	15.–25.04.2020	41.5	80
Olmos et al.	Cross-sectional	14/414 (3.4%)	3	6	01.05.–01.07.2020	33	76
Oster et al.	Cohort	5/4897 (0.1%)	4	6	23.03.–11.05.2020	N.A.	N.A.
Rivett et al.	Cross-sectional	31/1032 (3%)	4	6	06.–24.04.2020	34	71
Stock et al.	Cross-sectional	8/98 (8.2%)	4	6	04.–20.04.2020	37.6	50

Temkin	Cross-sectional	1/522 (0.2%)	3	4	30.04.–07.05.2020	39.33	63.98
Treibel et al.	Cohort	53/1479 (3.6%)	3	0	23.–31.03.2020	N.A.	N.A.
Vahidy et al.	Cross-sectional	112/2787 (4%)	3–4	0	N.A.	40.68	73
Zhou et al.	Cross-sectional	28/3674 (0.76%)	4	0	16.–25.03.2020	N.A.	67.7

Table 2: Study characteristics and results of studies on nursing homes

First Author	Study Type	No. Positive Tested Asymptomatic/Sample Size	Setting (Level)	Ward	Period of Data Collection	Mean Age of HCW	Gender Distribution (Female in %)
Bayle et al.	Cohort	32/241 (13.3%)	8	8	16.–29.04.2020	39.9	83.8
Hassan et al.	Cohort	13/387 (3.3%)	8	9	11.05.–17.06.2020	43	52.6
McBee et al.	Cross-sectional	31/13687 (0.2%) and 35/1,639 (2.1%)	8	0	21.04.–08.05.2020	N.A.	N.A.
Van Buul et al.	Cross-sectional	1/542 (0.002%)	8	0	04.–10.05.2020	45.7	91.3

Table 3: Study characteristics and results of studies on cause-relating tests

First Author	Study Type	No. Positive Tested Asymptomatic/Sample Size	Setting (Level)	Ward	Period of Data Collection	Mean Age of HCW	Gender Distribution (Female in %)
Borras-Bermejo et al.	Cohort Study	Staff: 403/2655 tested positive for COVID-19 (144/403 asymptomatic)	Nursing homes	Previous laboratory-confirmed cases	10.04.–24.04.2020	N.A.	N.A.

				of COVID-19			
Harada et al.	Cross-sectional Design	52/697 (7.5%)	Level 3	N.A.	24.03.–24.04.2020	N.A.	N.A.
Khalil et al.	Cohort Study	47/266 (18%), 16/47 (34%) asymptomatic	Level 3	N.A.	17.03.–16.04.2020	N.A.	N.A.
Rajme-López et al.	Cross-sectional Design	111/2000 (5.5%)	N.A.	N.A.	28.04.–08.07.2020	34	57.5/42.5 %
Rasmussen et al.	Cohort Study	7/347 (1.9%)	Level 4	N.A.	27.05.–03.06.2020	N.A.	N.A.
Sebastian et al.	Cross-sectional Design	8/204 (4%)	Dental hospital	N.A.	03/–10/2020	38	64/36%
Soltani-Zangbar et al.	Cross-sectional Design	66/609 (10.8%)	Level 3	N.A.	04/–06/2020	41.9	38.75/61.25%
Zhao et al.	Retrospective Cohort Study	88/1172 (9.7%) of HCW with close contact to confirmed cases of COVID-19	Level 4	N.A.	14.01.–21.02.2020	N.A.	N.A.

Discussion

This systematic review aimed to summarize the existing literature on routine screening of healthcare workers (HCW) for SARS-CoV-2 in acute care hospitals. We identified 39 studies conducted between January and August 2020, covering the first and second waves of the pandemic. Among 51,700 asymptomatic HCW tested, 1000 (1.9%) were positive for SARS-CoV-2. Detection rates varied widely, ranging from 0% to 14.3%. (Evans et al., 2020)

The data from these studies showed considerable heterogeneity and ambiguity, as depicted in the forest plot (Fig. 2). Factors contributing to this variability may include regional differences in infection rates and pandemic management strategies across countries. It's important to note that these studies were conducted before the widespread availability of vaccines, so the impact of vaccination on these results was not considered. (Iacobucci, 2020)

In areas with higher overall infection rates, such as regions experiencing surges in cases, we might expect to see higher rates of positive cases among asymptomatic HCW due to increased exposure outside of the hospital environment. Conversely, in areas with lower virus circulation, screening asymptomatic HCW may be less effective in identifying those spreading the virus. (McMichael et al., 2020)

Some studies indicated that screening asymptomatic HCW in high-prevalence regions could potentially reduce transmissions. However, the effectiveness of such screening strategies varied based on the local context and the level of adherence to preventive measures like personal protective equipment (PPE). (Wang et al., 2020)

Regarding the risk of bias assessment, all studies used RT-PCR, the gold standard for diagnosing SARS-CoV-2 infections. However, details about preanalytical factors that could affect test sensitivity were often lacking. Moreover, most studies focused on higher-level healthcare facilities, limiting the generalizability of the findings to other settings like primary care or specialist clinics. (Zhou et al., 2020)

We also briefly touched on studies that examined cause-related testing of HCW, which showed higher detection rates, likely due to the higher pre-test probability in these populations. However, our review primarily focused on routine screening of asymptomatic HCW in acute care hospitals. (Lazzerini et al., 2020)

As vaccination rates among HCW increase and new variants of the virus emerge, the benefits and challenges of routine screening strategies may evolve. Future research should continue to assess the impact of screening on reducing transmission rates and improving patient safety, especially in the context of changing epidemiological dynamics and healthcare practices. (Rivett et al., 2020)

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