UPDATE ALERTS

Update Alert 9: Epidemiology of and Risk Factors for Coronavirus Infection in Health Care Workers

This is the ninth update alert for a living rapid review on the epidemiology of and risk factors for coronavirus infection in health care workers (HCWs) (1). Updates were done monthly through update alert 7 (2), at which time the interval was switched to bimonthly. Update searches from 25 February 2021 to 24 April 2021 were done using the same search strategies as the original review. The update searches identified 3518 citations. We applied the same inclusion criteria used for prior updates, with previously described protocol modifications (3) to focus on higher-quality evidence and risk factors for coronavirus infections. Twenty-one studies on risk factors for SARS-CoV-2 infection were added for this update (**Supplement Tables 1-6**) (4–24).

The original rapid review included 34 studies on risk factors for coronavirus infections (3 studies on SARS-CoV-2 infection, 29 studies on SARS-CoV-1 infection, and 2 studies on Middle East respiratory syndrome–CoV infection) (1); 84 studies (82 studies on SARS-CoV-2 infection and 2 studies on Middle East respiratory syndrome–CoV infection) were added in prior updates (2, 3, 25–29). For this update, 4 cohort studies (9, 11, 15, 22) and 17 cross-sectional studies (4–8, 10, 12–14, 16–21, 23, 24) were added (**Supplement Table 1**). Eight studies were done in Europe (2 in the United Kingdom [15, 22]; 2 in France [7, 10]; and 1 each in Belgium [11], Italy [9], Spain [21], and Sweden [20]), and 6 were done in the United States (5, 8, 12, 16, 18, 23). The remaining studies were done in Egypt (17), Pakistan (4), Turkey (6), India (14), Malaysia (24), Thailand (19), and Japan (13). As in prior updates, the studies had methodological limitations, including potential recall bias, low or unclear participation rates, small sample sizes, and potential collinearity. Some studies did not control for confounders; those that did report adjusted estimates were limited in their ability to control for exposures and personal protective equipment (PPE) use.

Similar to prior updates, new studies did not indicate an association between sex (16 studies [4–10, 12–17, 19, 21, 24]) and risk for SARS-CoV-2 infection or seropositivity. Twelve new studies (5, 9–11, 13, 14, 16, 18, 21–24) found no consistent association between age and risk for SARS-CoV-2 infection, and 12 new studies (5–8, 10, 13–16, 21, 23, 24) found no consistent association between health worker role (nurse vs. physician) and risk for SARS-CoV-2 infection. Consistent with prior updates, 3 new studies (5, 16, 22) done in the United States or United Kingdom found that Black race compared with White race was associated with a statistically significant increased risk for SARS-CoV-2 infection (adjusted odds ratio, 2.83 [95% CI, 1.77 to 4.51]; 2.1 [CI, 1.8 to 2.4]; and 2.08 [CI, 1.25 to 3.45]), and Hispanic ethnicity compared with White race was associated with an increased risk for SARS-CoV-2 infection (adjusted odds ratio, 1.70 [CI, 1.35 to 2.13]) (5). Results of new studies were generally consistent with prior updates on the association between demographic or clinical characteristics and risk for SARS-CoV-2 infection in HCWs (**Supplement Table 2**).

One new study found that incidence of reinfection in HCWs who were seropositive at baseline was lower than the incidence of new infection in HCWs who were seronegative at baseline (incidence per 1000 participants, 18.7 vs. 98.0 for any infection and 6.0 vs. 64.8 for symptomatic infections) (15). This evidence was consistent with a study included in the previous update (30) that found a decreased risk for new infection in seropositive HCWs (**Supplement Table 2**).

Fifteen new studies that reported on the association between exposures indicated that more direct or more prolonged contact was associated with increased risk, although some findings were mixed or imprecise (5, 6, 8–10, 12–20, 24). In 3 studies that reported adjusted risk estimates, 2 found that working in a COVID-19 unit was associated with increased risk for SARS-CoV-2 infection versus not working in a COVID-19 unit (5, 20), and 1 study found decreased risk for infection (15). Three new studies found that direct contact with a COVID-19–infected coworker or patient was associated with an increased risk for infection versus no or limited contact (5, 16, 20), although differences were not all statistically significant (**Supplement Table 3**).

One new study reported imprecise estimates for the association between training for PPE donning and doffing or implementation of PPE shortage protocols versus no training and risk for infection (**Supplement Table 4**) (5). Regarding mask and PPE use, 1 new study (15) found that consistent mask use versus inconsistent use was associated with lower risk for SARS-CoV-2 infection (**Supplement Table 5**), and 1 study (5) reported no significant decrease in risk for infection with exposure to a COVID-19–infected patient while wearing PPE (**Supplement Table 6**). Overall, results regarding training and PPE were judged to be consistent with prior updates (**Supplement Tables 4-6**).

Evidence across all risk factors for SARS-CoV-2 infection in HCWs is summarized in **Supplement Table 7**. Despite large numbers of studies and participants, most evidence remains low or moderate certainty because of methodological limitations, imprecision, and inconsistency. Given little change in conclusions after 1 year of monthly or bimonthly updates, we are extending the interval between updates to every 6 months.

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References

1. Chou R, Dana T, Buckley DI, et al. Epidemiology of and risk factors for coronavirus infection in health care workers. A living rapid review. Ann Intern Med. 2020;173:120-136. [PMID: 32369541]. doi:10.7326/M20-1632
2. Chou R, Dana T, Selph S, et al. Update alert 7: epidemiology of and risk factors for coronavirus infection in health care workers. Ann Intern Med. 2021;174:W45-W46. [PMID: 33556273]. doi:10.7326/L21-0034
3. Chou R, Dana T, Buckley DI, et al. Update alert 2: epidemiology of and risk factors for coronavirus infection in health care workers [Letter]. Ann Intern Med. 2020;173:W77. [PMID: 32663033]. doi:10.7326/M20-4806
4. Abbas S, Raza A, Iftikhar A, et al. Seroprevalence of SARS-CoV-2 antibodies among health care personnel at a health care system in Pakistan. Asia Pac J Public Health. 2021:10105395211011010. [PMID: 33880961] doi:10.1177/10105395211011010
5. Akinbami LJ, Chan PA, Vuong N, et al. Severe acute respiratory syndrome coronavirus 2 seropositivity among healthcare personnel in hospitals and nursing homes, Rhode Island, USA, July-August 2020. Emerg Infect Dis. 2021;27:823-834. [PMID: 33622481] doi:10.3201/eid2703.204508
6. Alkurt G, Murt A, Aydin Z, et al. Seroprevalence of coronavirus disease 2019 (COVID-19) among health care workers from three pandemic hospitals of Turkey. PLoS One. 2021;16:e0247865. [PMID: 33657142] doi:10.1371/journal.pone.0247865
7. Bayle C, Cantin D, Vidal JS, et al; APHP COVID 19 Research Collaboration. Asymptomatic SARS COV-2 carriers among nursing home staff: a source of contamination for residents. Infect Dis Now. 2021;51:197-200. [PMID: 33521774] doi:10.1016/j.idnow.2020.11.008
8. Clifton GT, Pati R, Krammer F, et al. SARS-CoV-2 infection risk among active duty military members deployed to a field hospital—New York City, April 2020. MMWR Morb Mortal Wkly Rep. 2021;70:308-311. [PMID: 33661864] doi:10.15585/mmwr.mm7009a3
9. Comelli A, Focà E, Sansone E, et al. Serological response to SARS-CoV-2 in health care workers employed in a large tertiary hospital in Lombardy, northern Italy. Microorganisms. 2021;9. [PMID: 33669151] doi:10.3390/microorganisms9030488
10. Davido B, Gautier S, Riom I, et al; Garches COVID-19 Collaborative Group. The first wave of COVID-19 in hospital staff members of a tertiary care hospital in the greater Paris area: a surveillance and risk factors study. Int J Infect Dis. 2021;105:172-179. [PMID: 33607301] doi:10.1016/j.ijid.2021.02.055
11. Dillner J, Elfström KM, Blomqvist J, et al. Antibodies to SARS-CoV-2 and risk of past or future sick leave. Sci Rep. 2021;11:5160. [PMID: 33664279] doi:10.1038/s41598-021-84356-w
12. Fletcher JJ, Feucht EC, Hahn PY, et al. Health care acquired COVID-19 is less symptomatic than community acquired disease among healthcare workers. Infect Control Hosp Epidemiol. 2021:1-28. [PMID: 33853694] doi:10.1017/ice.2021.167
13. Fukuda H, Seyama K, Ito K, et al. SARS-CoV-2 seroprevalence in healthcare workers at a frontline hospital in Tokyo. Sci Rep. 2021;11:8380. [PMID: 33863960] doi:10.1038/s41598-021-87688-9
14. Gupta R, Dwivedi T, Gajendra S, et al. Seroprevalence of antibodies to SARS-CoV-2 in healthcare workers & implications of infection control practice in India. Indian J Med Res. 2021 Jan & Feb;153:207-213. [PMID: 33642348] doi:10.4103/ijmr.IJMR_3911_20
15. Hall VJ, Foulkes S, Charlett A, et al; SIREN Study Group. SARS-CoV-2 infection rates of antibody-positive compared with antibody-negative healthcare workers in England: a large, multicentre, prospective cohort study (SIREN). Lancet. 2021;397:1459-1469. [PMID: 33844963] doi:10.1016/S0140-6736(21)00675-9
16. Jacob JT, Baker JM, Fridkin SK, et al. Risk factors associated with SARS-CoV-2 seropositivity among US health care personnel. JAMA Netw Open. 2021;4:e211283. [PMID: 33688967] doi:10.1001/jamanetworkopen.2021.1283
17. Mukhtar A, Afishawy M, Alkhatib E, et al. Asymptomatic SARS-CoV-2 infection among healthcare workers in a non-COVID-19 teaching university hospital. J Public Health Res. 2021. [PMID: 33794599] doi:10.4081/jphr.2021.2102
18. Newberry JA, Gautreau M, Staats K, et al. SARS-CoV-2 IgG seropositivity and acute asymptomatic infection rate among firefighter first responders in an early outbreak county in California. Prehosp Emerg Care. 2021:1-10. [PMID: 33819128] doi:10.1080/10903127.2021.1912227
19. Nopsopon T, Pongpirul K, Chotirosniramit K, et al. Seroprevalence of hospital staff in a province with zero COVID-19 cases. PLoS One. 2021;16:e0238088. [PMID: 33793556] doi:10.1371/journal.pone.0238088
20. Nygren D, Norén J, De Marinis Y, et al. Association between SARS-CoV-2 and exposure risks in health care workers and university employees—a cross-sectional study. Infect Dis (Lond). 2021;53:460-468. [PMID: 33689558] doi:10.1080/23744235.2021.1892819
21. Rodriguez A, Arrizabalaga-Asenjo M, Fernandez-Baca V, et al. Seroprevalence of SARS-CoV-2 antibody among healthcare workers in a university hospital in Mallorca, Spain, during the first wave of the COVID-19 pandemic. Int J Infect Dis. 2021;105:482-486. [PMID: 33647507] doi:10.1016/j.ijid.2021.02.104
22. Shorten RJ, Haslam S, Hurley MA, et al. Seroprevalence of SARS-CoV-2 infection in healthcare workers in a large teaching hospital in the north west of England: a period prevalence survey. BMJ Open. 2021;11:e045384. [PMID: 33727275] doi:10.1136/bmjopen-2020-045384
23. Talbot LR, Romeiser JL, Spitzer ED, et al. Prevalence of IgM and IgG antibodies to SARS-CoV-2 in health care workers at a tertiary care New York hospital during the spring COVID-19 surge. Perioper Med (Lond). 2021;10:7. [PMID: 33648573] doi:10.1186/s13741-021-00177-5
24. Wan KS, Tok PSK, Yoga Ratnam KK, et al. Implementation of a COVID-19 surveillance programme for healthcare workers in a teaching hospital in an upper-middle-income country. PLoS One. 2021;16:e0249394. [PMID: 33852588] doi:10.1371/journal.pone.0249394
25. Chou R, Dana T, Buckley DI, et al. Update alert: epidemiology of and risk factors for coronavirus infection in health care workers [Letter]. Ann Intern Med. 2020;173:W46-W47. [PMID: 32515983]. doi:10.7326/L20-0768
26. Chou R, Dana T, Buckley DI, et al. Update alert 3: epidemiology of and risk factors for coronavirus infection in health care workers [Letter]. Ann Intern Med. 2020;173:W123-W124. [PMID: 32744870]. doi:10.7326/L20-1005
27. Chou R, Dana T, Buckley DI, et al. Update alert 4: epidemiology of and risk factors for coronavirus infection in health care workers [Letter]. Ann Intern Med. 2020;173:143-144. [PMID: 32915642]. doi:10.7326/L20-1134
28. Chou R, Dana T, Buckley DI, et al. Update alert 5: epidemiology of and risk factors for coronavirus infection in health care workers [Letter]. Ann Intern Med. 2020;173:W154-W55. [PMID: 33076695]. doi:10.7326/L20-1227
29. Chou R, Dana T, Selph S, et al. Update alert 6: epidemiology of and risk factors for coronavirus infection in health care workers [Letter]. Ann Intern Med. 2021;174:W18-W19. [PMID: 33226856]. doi:10.7326/L20-1323
30. Chou R, Dana T, Buckley DI, et al. Update alert 8: epidemiology of and risk factors for coronavirus infection in health care workers. Ann Intern Med. 2021;174:W48-W49. [PMID: 33780293]. doi:10.7326/L21-0143