Supplementary Material*

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* This supplementary material was provided by the authors to give readers further details on their article. The material was reviewed but not copyedited.

Supplement Table 1. Burden of SARS-CoV-2, SARS-CoV-1, and MERS-CoV*

Study, Year (Reference) **Study Design** **Setting and Study Dates**	**Population Characteristics**	**Outcomes**	**Limitations**
SARS-CoV-2			
Mutambudzi et al, 2020 (22) Prospective cohort United Kingdom; HCWs throughout the United Kingdom; 16 March to 3 May 2020 **Added for June 1, 2020 update**	11,353 HCWs participating in UK Biobank • Age, sex of HCWs not reported 16% healthcare professionals, 12% medical support staff, 71% health associate professionals	Incidence of SARS-CoV-2 infection: 0.7% (76/10,718) Healthcare worker vs. non-essential worker: OR 7.59 (95% CI 5.43-10.62)	***Not peer reviewed*** Selection for testing unclear; limited information on clinical and demographic characteristics of HCWs; no information on clinical outcomes of infections; 5.5% participation rate
Nguyen et al, 2020 (23) Prospective cohort United Kingdom and United States; start March 24 or 29, 2020, end date not reported **Added for June 1, 2020 update**	99,795 frontline HCWs • Mean age, 42 y • 83% female HCW role/position not reported	30-day incidence of SARS-CoV-2 infection: 4.0% (1,922/1,454,701 person-days)	No information on clinical outcomes of SARS-CoV-2 infection; selection of HCWs for testing unclear; diagnosis based on self-report
Bai et al, 2020 (2) Retrospective cohort China (Wuhan); 1 hospital (neurosurgery department) prior to recognition of outbreak; December 25, 2019 to February 15, 2020 **Added for June 1, 2020 update**	118 HCWs with potential exposure to COVID-19 patient • Mean age, 31 years • 64% female • 25% physician, 75% nurse	Incidence of COVID-19: 10.2% (12/118)	Not peer reviewed; no information on clinical outcomes of COVID-19; criteria for COVID-19 diagnosis not reported; selection of HCWs for testing unclear

Study, Year (Reference) Study Design Setting and Study Dates	**Population Characteristics**	**Outcomes**	**Limitations**
Folgueira et al, 2020 (6) Retrospective cohort Spain (Madrid); 1 hospital; 1 to 29 March 2020 **Added for June 1, 2020 update**	2085 HCWs tested for SARS-CoV-2 infection • Age, sex, HCW role/position not reported	Incidence of SARS-CoV-2 infection: 37.9% (791/2,085) • Hospitalized: 2.7% (21/791) • Mechanical ventilation: 0.3% (2/791)	Not peer reviewed; no information on demographic or clinical characteristics of HCWs; selection of HCWs for testing unclear
Heinzerling et al, 2020 (8) Retrospective cohort United States (California); 1 hospital with unsuspected COVID-19 case; February 2020 **Added for June 1, 2020 update**	37 HCWs with exposure to COVID-19 patient and at least one aerosol-generating procedure • Median age, 39 years • 84% female • 7% physician, 51% nurse, 9% respiratory therapist, 9% phlebotomist, 7% certified nursing assistant, 7% environmental services worker, 5% nutrition services worker, 2% pharmacist, 2% other • No use of N95 respirators, eye protection, gowns, or PAPR	Incidence of COVID-19 (PCR): 5.4% (2/37)	No information on clinical outcomes of COVID-19; only 2 cases; 6 tested HCWs were not interviewed and excluded from analysis
Khalil et al, 2020 (11) Retrospective cohort United Kingdom (London); 1 maternity hospital; testing end date 16 April 2020 **Added for June 1, 2020 update**	266 HCWs • Age, sex, HCW/role/position not reported	Incidence of SARS-CoV-2 infection (PCR): 17.7% (47/266) • Asymptomatic: 8.4% (16/190) • Symptomatic: 40.8% (31/76)	Selection of HCWs for testing unclear; no information demographic and clinical characteristics of HCWs; no information on clinical outcomes of infections

Study, Year (Reference) Study Design Setting and Study Dates	**Population Characteristics**	**Outcomes**	**Limitations**
Lai et al, 2020 (14) Retrospective cohort China (Wuhan); 1 hospital; 1 January-9 February 2020 **Added for June 1, 2020 update**	9,648 HCWs • 12% ≥45 y, 88% <45 y • 74% female • 22% physician, 46% nurse, 32% health care assistant	Incidence of COVID-19: 1.1% (110/9658) Prevalence of asymptomatic SARS-CoV-2 infection: 0.9% (3/335) (random sample)	No information on clinical outcomes of COVID-19; criteria for COVID-19 diagnosis not reported; selection of HCWs for testing unclear
Liu J. et al, 2020 (39) Retrospective cohort China (Wuhan); 1 hospital; 16 January to 25 February 2020	101 HCWs with SARS-CoV-2 infection • Median age, 33 y • 68% female • 26% physician, 74% nurse	• Disease severity: 6% (6/101) severe, 94% (95/101) non-severe • Mortality: 0% (0/101) • Length of hospital stay (median, days): 17.0 (IQR 11.0-21.0)	Proportion meeting criteria for COVID-19 unclear; limited information on clinical outcomes of SARS-CoV-2 infection
Luigi et al, 2020 (18) Retrospective cohort Italy (Bari); 1 hospital; 21 February to 22 March 2020 **Added for June 1, 2020 update**	5,750 HCWs • Mean age, 49 y (HCWs) • Sex, HCW role/position not reported 70% physician, 22% nurse, 8.7% social health assistants	Prevalence of SARS-CoV-2 infection: 0.4% (23/5,750)	Clinical outcomes of infections not reported; limited information on demographic or clinical characteristics of HCWs

Study, Year (Reference) **Study Design** **Setting and Study Dates**	**Population Characteristics**	**Outcomes**	**Limitations**
Murphy et al, 2020 (21) Retrospective cohort United States (Washington state); emergency medical services providers in King County; through 9 April 2020 **Added for June 1, 2020 update**	700 emergency medical services providers with encounters with COVID-19 patients • Age, sex not reported	Incidence of SARS-CoV-2 infection: 0.4% (3/700) • Incidence among those with symptoms and tested: 7.0% (3/43)	***Not peer reviewed*** No information on clinical outcomes of SARS-CoV-2 infection; only 40 symptomatic HCWs underwent testing; no information on demographic and clinical characteristics of HCWs
Ran et al, 2020 (40) Retrospective cohort China (Wuhan); 1 hospital serving outbreak; follow-up through 28 January 2020	72 HCWs with acute symptoms • Median age, 31 y • 69% female • 53% clinicians and 47% nurses	Incidence of COVID-19: 38.9% (28/72)	No information on clinical outcomes of COVID-19; selection of HCWs for testing unclear
Treibel et al, 2020 (32) Retrospective cohort United Kingdom (London); 1 hospital; recruitment 23 to 31 March 2020 **Added for June 1, 2020 update**	400 asymptomatic HCWs • Age, sex, HCW role/position not reported	Incidence of SARS-CoV-2 infection • Week 1: 7.1% (28/396) • Week 2: 4.9% (14/284) • Week 3: 1.5% (4/263) • Week 4: 1.5% (4/267) • Week 5: 1.1% (3/269) No symptoms in week before or after positivity: 27% (12/44)	No information on clinical outcomes of COVID-19; no information on HCW demographics or clinical characteristics

Study, Year (Reference) Study Design Setting and Study Dates	**Population Characteristics**	**Outcomes**	**Limitations**
Wang Q. et al, 2020 (35) Retrospective cohort China (Hubei province); 107 hospital neurosurgery departments; January 20 to March 1, 2020 **Added for June 1, 2020 update**	5,322 HCWs • Mean age, 34 years • 50% female • 45% surgeon, 55% nurse	Incidence of COVID-19: 2.2% (120/5,442)	***Not peer reviewed*** Selection of HCWs for testing unclear; limited information on clinical outcomes of COVID-19
Clemency et al, 2020 (3) Cross-sectional United States (New York); regional health care system; 26 March to 16 April 2020 **Added for June 1, 2020 update**	961 HCWs with symptoms of COVID-19, presenting for outpatient testing • Age, sex, and role/position of HCWs not reported	Incidence of COVID-19: 23.3% (225/961)	No information on clinical outcomes of COVID-19; no information on HCW demographics or clinical characteristics
Dai et al, 2020 (41) Cross-sectional China (Hubei province); HCWs from throughout province; 3–11 February 2020	4357 HCWs • Mean age, 35 y • 76.5% female • 32.6% physicians, 53.8% nurses, 10.0% technicians, 3.6% support staff • 0.9% diagnosed with COVID-19	Incidence of COVID-19: 0.9% (40/4357)	***Not peer reviewed*** No control for baseline symptoms; no non-HCW controls; no control for work exposures
Felice, 2020 (5) Cross-sectional	388 HCWs (98 underwent testing)	Prevalence of SARS-CoV-2 infection among HCWs who underwent testing: 18.4% (18/98) • Received medical therapy: 61.1% (11/18) • Hospital admission: 5.6% (1/18)	Selection of HCWs for testing unclear

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Italy; HCWs throughout country; 25 March to 4 April 2020 **Added for June 1, 2020 update**	• 11% <30 y, 52% aged 30-39 y, 21% 40-49, 13% 50-59 y, 3.3% ≥60 y • 61% female • 74% physician, 26% other HCW	• Asymptomatic: 33.3% (6/18)	
Gheysarzadeh et al, 2020 (7) Cross-sectional Iran (Ilam); single hospital; February to April 2020 **Added for June 1, 2020 update**	125 nurses • Mean age not reported; range 33-39 y (cases) • % female not reported • 100% nurses • All reported to have been "equipped" with eye protection, masks (type not reported), face shield, gloves and shoe covers	Incidence of SARS-CoV-2 infection (PCR): 4.0% (5/125)	Limited information on clinical outcomes of COVID-19; limitation information on HCW demographics or clinical characteristics; selection of HCWs for testing unclear
Kang, 2020 (42) Cross-sectional China (Wuhan); HCWs from hospitals in Wuhan; 29 January to 4 February 2020	994 HCWs • 63.4% aged 25–40 y • 85% female • 31.1% high-risk department • 18.4% physicians; 81.6% nurses	Incidence of SARS-CoV-2 infection: 1.9% (19/994)	Participation rate not reported; no control for baseline symptoms; no non-HCW controls
Kluytmans-van den Berg et al, 2020 (43) Cross-sectional The Netherlands; 2 hospitals; 7–12 March 2020	1853 HCWs with fever or mild respiratory symptoms in past 10 d • Median age, 49 y (cases) • 83% female (cases) • HCW role/position not reported	Prevalence of SARS-CoV-2 infection (PCR): 6.4% (86/1353) • Met case definition (fever and/or coughing and/or shortness of breath): 91.9% (79/86) • Recovery (by day of interview): 23.3% (20/86), median duration of illness 8 days • Admitted to hospital (not critical): 3.7% (2/86)	77% not recovered at time of interview

Study, Year (Reference) **Study Design** **Setting and Study Dates**	**Population Characteristics**	**Outcomes**	**Limitations**
Korth et al, 2020 (13) Cross-sectional German (Essen); 1 hospital; 25 March to April 21 2020 **Added for June 1, 2020 update**	317 HCWs • Mean age, 37 y in high-risk group, 42.3 y in low-risk group • 100% female • 25% physician, 66% nurse, 6% lab assistant, 3% other	Prevalence of SARS-CoV-2 IgG positivity: 1.6% (5/316) • High-risk (daily contact with COVID-19 patients on designated wards and intensive care units): 1.2% (3/244) • Intermediate-risk (daily non-COVID-19 patient contact): 5.4% (2/36) • Low-risk (no daily patient contact): 0% (0/35) • Hospitalization: 0% (0/5)	No major limitations noted
Liu C. et al, 2020 (44) Cross-sectional China; HCWs from multiple urban and rural hospitals; 10–20 February 2020	512 HCWs • 75.4% aged 18–39 y • 85% female • 32.0% direct treatment contact of COVID-19–infected patient	Incidence of suspected COVID-19: 8.0% (41/512)	85% response rate; sample limited to HCWs utilizing WeChat app; no control for baseline symptoms
Lombardi et al, 2020 (17) Cross-sectional Italy (Milan); 1 hospital; 24 February to 31 March 31 2020 **Added for June 1, 2020 update**	1,573 HCWs • Mean age, 44 y • 64% female • 37% physician, 33% nurse/midwife, 10% healthcare assistant, 11% health technician, 9% clerical workers/technician • 30% at least 1 symptom	Prevalence of SARS-CoV-2 infection (PCR): 8.8% (138/1573) • ≥1 symptom vs. no symptoms: 20.2% (97/480) vs. 3.7% (41/1093), OR 7.55 (95% CI 5.07-11.2)	***Not peer reviewed*** Selection of HCWs for testing unclear; clinical outcomes of infections not reported

Study, Year (Reference) **Study Design** **Setting and Study Dates**	**Population Characteristics**	**Outcomes**	**Limitations**
Maida et al, 2020 (19) Cross-sectional Italy; HCWs in gastroenterology departments throughout Italy; 30 March to 7 April 2020 **Added for June 1, 2020 update**	266 HCWs in gastroenterology departments • Age, sex, HCW role/position not reported	Prevalence of SARS-CoV-2 infection: 49.6% (132/266)	Participation rate 36%, selection of HCWs for testing unclear; diagnosis of SARS-CoV-2 infection based on self-report; clinical outcomes of infections not reported; no information on demographic or clinical characteristics of HCWs
Manzoni et a, 2020 (20) Cross-sectional Italy; HCWs with data in national database; date not reported **Added for June 1, 2020 update**	291,500 HCWs (physicians or dentists) • Age, sex, and other demographic data not reported	COVID-19 mortality rate: 0.046% (133/291500)	Data obtained from publicly accessible epidemiological databases and other websites (e.g., Medscape) with uncertain reliability; no information on demographic or clinical characteristics of HCWs
Rivett et al, 2020 (25) Cross-sectional United Kingdom (Cambridge); 1 hospital; April 2020 **Added for June 1, 2020 update**	1,268 HCWs • Median age, 34 y • 71% female • HCW role/position: Not reported	Prevalence of SARS-CoV-2 infection (PCR): 4.8% (61/1,270) • Asymptomatic HCWs: 3.0% (31/1,032); 12 had experienced symptoms >7 days prior to testing • Symptomatic HCWs: 15.4% (26/169) • HCWs with symptomatic household contacts: 7.7% (4/52)	Limited information on demographic or clinical characteristics of HCWs; selection of HCWs for testing unclear
Romero et al, 2020 (26) Cross-sectional Spain; national survey; 9-19 2020 April	3,109 HCWs • Mean age 45 y • % female not reported • 56.6% medical staff; 26.5% nursing staff; 7.7% nurse assistants; 9.2%	Incidence of SARS-CoV-2 seropositivity: 2.9% (90/3,109)	Participation rate unclear; no control for baseline symptoms; no non-HCW controls; no control for work exposures

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Added for June 1, 2020 update	other staff (ancillary, administrative, laboratory technicians, research/faculty, management, hospital pharmacist) • 25.2% anaesthesia and critical care; 10.5% pathology; 5.2% intensivist and critical care; other specialties (<5% each)		
Roxby et al, 2020 (27) Cross-sectional United States (Washington); single assisted-living facility; March 2020 **Added for June 1, 2020 update**	62 HCWs (staff at independent and assisted living community) • Mean age 40 y • 68% female • 72% asymptomatic; 28% symptoms within 14 days	Prevalence of SARS-CoV-2 infection: 3.2% (2/62) (both symptomatic)	Limited information on clinical outcomes of SARS-CoV-2 infection
Shields et al, 2020 (28) Cross-sectional United Kingdom (Birmingham, England); four urban hospitals; 25 April 2020 **Added for June 1, 2020 update**	554 asymptomatic HCWs • Age, sex, HCW role/position not reported	Prevalence of SARS-CoV-2 (PCR): 2.4% (13/554) Prevalence of SARS-CoV-2 seroconversion (IgG, IgM, IgA): 24.4% (126/516)	***Not peer reviewed*** No information on clinical characteristics of HCWs; no information on clinical outcomes of SARS-CoV-2 infection; participation rate not reported; 7% of patients who underwent PCR testing did not undergo antibody testing
Sikkema et al, 2020 (29) Cross-sectional	1796 HCWs with fever or mild respiratory symptoms • Mean age 49 (cases) • 17% male	Prevalence of SARS-CoV-2 infection: 5.3% (96/1796)	***Not peer reviewed*** Demographic information reported for cases only; participation rate among

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
The Netherlands; two teaching and one regional hospital; 2 to 12 March 2020 **Added for June 1, 2020 update**	• 79% medical department, 21% staff without direct patient contact • 32% close contact of individual with confirmed COVID-19 within 14 days		persons meeting inclusion criteria not reported; no information about clinical outcomes of infection
Sikora et al, 2020 (30) Cross sectional United Kingdom (four cancer centers); 14 to 24 April 2020 **Added for June 1, 2020 update**	161 HCWs • Mean age 43 • Other demographic data not reported	Prevalence of SARS-CoV-2 IgG or IgM: 7.5% (12/161)	***Not peer reviewed*** No information on clinical outcomes of infection; limited information on demographic characteristics and no information on clinical characteristics of HCWs; participation rate not reported
Tang et al, 2020 (31) Cross-sectional United Kingdom (East Midlands); throughout region (tested in home: 3 March to 29 April 2020 **Added for June 1, 2020 update**	523 HCWs who were self-isolating or performing non-patient-facing duties and called for testing due to symptoms of suspected COVID-19 • Age, sex, HCW role/position not reported	Prevalence of SARS-CoV-2 infection (PCR): 29.1% (152/523)	No information on clinical outcomes of infection; no information on demographic or clinical characteristics of HCWs
von Freyburg et al, 2020 (33) Cross-sectional Germany (Dachau); single hospital; 3-5 and April 2020	1170 HCWs in hospital with outbreak • Age, sex not reported • 17.8% physician, 35.3% nurse, 43.1% nonmedical staff; 3.8% other	Incidence of SARS-CoV-2 infection (PCR): 5.0% (58/1170)	No information on clinical outcomes of infection; limited information on demographic and no information on clinical characteristics of HCWs

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Added for June 1, 2020 update			
Zhang S. et al, 2020 (36) Cross-sectional Iran; public and private hospitals (number not reported); 5-20 April 2020 **Added for June 1, 2020 update**	304 HCWs • Mean age 35 y • 58.6% female • HCW role not reported	Incidence of COVID-19: 2.3% (7/304)	***Not peer reviewed*** Recruitment method not reported; participation rate not reported; no control for baseline symptoms; no non-HCW controls; no control for work exposures
Zheng et al, 2020 (37) Cross-sectional China (Wuhan); throughout Wuhan area; from March 26, 2020 **Added for June 1, 2020 update**	117,100 HCWs • Age not reported • 72% female • 37% physician, 49% nurse, 14% medical staff	Incidence of COVID-19: 2.1% (2,457/117,100) • HCW vs. non-HCW: 2.1% vs. 0.4%, p<0.001 Case fatality rate: 0.69% (17/2,440) • HCW vs. non-HCW: 0.69% vs. 5.30%, p<0.001	COVID-19 cases based on requests for financial assistance; denominators based on epidemiological data; limited information on clinical outcomes of COVID-19 infections
Zhu et al, 2020 (45) Cross-sectional Wuhan, China; tertiary hospital; 8–10 February 2020	5,062 HCWs • 96.5% aged 19–49 y • 85% female • 20% physicians, 68% nurses, and 13% medical technicians • 3.1% with suspected or confirmed COVID-19	Incidence of suspected or confirmed COVID-19: 3.1% (157/5,062)	***Not peer reviewed*** Response rate 77%; did not control for baseline symptoms; no non-HCW controls

Study, Year (Reference) **Study Design** **Setting and Study Dates**	**Population Characteristics**	**Outcomes**	**Limitations**
Lapolla et al, 2020 (15) Case series (descriptive study) Italy (throughout); 21 February to 17 April 2020 **Added for June 1, 2020 update**	16,991 HCWs with SARS-CoV-2 infection • Median age, 48 y • 68% female	Incidence of SARS-CoV-2 in HCWs: 10.7% (16,991/168,941) • Nurse/midwife: 43.2% (6988/16,991) • Doctor: 22% (3574/16,911) Mortality in HCWs: 1.2% (206/16,991)	No denominator for the total number of exposed HCWs; proportion recovered unclear; estimates based on epidemiological data
Liu J. et al, 2020 (46) Case series China (Wuhan); single hospital; diagnosed 16 January–15 February 2020	64 HCWs with COVID-19 (PCR-positive) • Median age, 35 y • 64% female • 33% doctors; 67% nurses	• Mortality: 0% • ICU admission for mechanical ventilation: 0% • Severe illness: 1.6% (1/64) • Discharge (as of 24 February): 53% (34/64) • Discharge time (median): 20 days • Nondischarge: larger BMI (≥24 kg/m^2) ***(HR, 0.14 [95% CI, 0.03–0.73])***, fever ***(HR, 0.24, [95% CI, 0.09–0.60])***, increased IL-6 (>2.9 pg/mL) ***(HR, 0.31 [95% CI, 0.11–0.87])***	Small sample; 47% of patients still hospitalized at time outcomes reported
Liu M. et al, 2020 (47) Case series China (Wuhan); single hospital; diagnosed 10–31 January 2020	30 HCWs with COVID-19 (7 confirmed with PCR) • Mean age, 35 y • 66.7% female • 73.3% doctors; 26.7% nurses	• Mortality: 0% • Noninvasive ventilation or nasal high-flow oxygen: 13.3% (4/30) • Severe pneumonia (respiratory rate ≥30 breaths/min, resting oxygen saturation ≤93%; Pao_2/Fio_2 ≤300 mm Hg): 13.3% (4/30); severe pneumonia associated with higher BMI, greater number of exposures, and longer exposure times, and infections before use of PPE (10–20 January)	Small sample; 20% of patients still hospitalized at time outcomes reported; most cases not confirmed with PCR
McMichael et al, 2020 (48) Case series United States (Washington); 1 long-term care facility; initial	50 HCWs with COVID-19 (PCR-positive) • Median age, 43.5 y • 76% female • Various (numbers not reported)	29.9% (50/167) of cases were in HCWs • Hospitalized: 6.0% (3/50) • Mortality: 0% (0/50)	No denominator for the total number of exposed HCWs; proportion recovered at time of study not reported

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resident case diagnosed 28 February 2020			
Novel Coronavirus Pneumonia Emergency Response Epidemiology Team, 2020 (49) Case series (descriptive study) China (throughout); through 11 February 2020	44 672 patients with COVID-19 (PCR-positive) • Age, sex, and role/position of infected HCWs not reported (not restricted to physicians and nurses)	• 3.8% (1716/44 672) of cases were in HCWs o Before 31 December: 0% (0/104) o 1–10 January: 3.1% (20/653) o 11–20 January: 5.7% (310/5417) o 21–31 January: 3.9% (1036/26 468) • Case-fatality rate: 0.3% (5/1716) • Mortality per 10 patient days: 0.002 • Proportion severe or critical: 14.6% (247/1608) o 1–10 January: 45.0% (9/20) o 11–20 January: 19.7% (61/310) o 21–31 January: 14.4% (149/1,036) o After 1 February: 8.7% (28/322) o Wuhan: 17.7% (191/1,080) o Hubei (outside Wuhan): 10.4% (41/394) o Outside Hubei: 7.0% (15/214)	No denominator for the total number of exposed HCWs; proportion recovered unclear; estimates based on epidemiological data
Wang X. et al, 2020 (50) Case series China (Wuhan); through 18 February 2020	25 961 patients with COVID-19 (PCR-positive) • Age, sex, and role/position of infected HCWs not reported	5.1% (1316/25,961) of cases were in HCWs • Estimated attack rate in HCWs vs. general population: 144.7 (95% CI, 137.0 to 152.8) vs. 41.7 (95% CI, 41.2 to 42.2) per 10^6 people o Before 11 January: 6.1 vs. 2.2 per 10^6 people o 11–22 January: 275 vs. 44.9 per 10^6 people o 23 January–1 February: 507.4 vs. 150.9 per 10^6 people o 2–18 February: 116.6 vs. 54.1 per 10^6 people	***Not peer-reviewed*** Attack rate in general population and HCWs estimated using the Wuhan Statistical Yearbook 2018; denominator for potentially exposed HCWs not provided
SARS-CoV-1			

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Chang et al, 2004 (51) Retrospective cohort Taiwan; 1 hospital ED; 30 March–30 June 2003	193 HCWs • Mean age, 32.7 y • 72% female • 17% physician, 49% nurse, 8.8% radiology technician, 8.3% clerk, 6.7% sanitation worker, 6.7% administration personnel, 3.1% ambulance drivers	Prevalence of SARS-CoV-1 seropositivity: 4.7% (9/193) Incidence of SARS-1: 4.1% (8/193)	No major limitations noted
Fowler et al, 2004 (52) Retrospective cohort Toronto; 1 hospital intensive care unit; 1–22 April 2003	122 intensive care unit HCWs • Mean age, 35.1 y (cases) • Sex not reported • 54% nurse, 15% nursing aid/patient assistant, 12% physician, 15% respiratory therapist, 2.5% physiotherapist, 1.6% other HCW	Incidence of SARS-1: 8.2% (10/122)	No major limitations noted
Ho et al, 2003 (53) Retrospective cohort Hong Kong; 1 hospital; 25 March to 5 May, 2003	1,053 HCWs • Mean age (cases) 36 y • 78% female (cases) • 13% physician, 47% nurse, 8.4% health care assistant, 10.5% cleaner, 12.4% clerical staff	Incidence of SARS-1: 3.8% (40/1053)	No major limitations noted
Ho et al, 2004 (54) Prospective cohort Singapore; 1 hospital; 18 March –29 April 2003	372 HCWs • Mean age, 34.2 y • 77% female • 27.7% physician, 55.1% nurse, 17.2% allied health and clerical	Prevalence of SARS-CoV-1 seropositivity: 2.2% (8/372) Incidence of SARS-1: 1.6% (6/372)	No major limitations noted
Ip et al, 2004 (55)	742 HCWs	Incidence of SARS-1: 7.1% (53/742)	No major limitations noted

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Retrospective cohort Hong Kong; 1 hospital; blood samples obtained after 21 May 2003	• Mean age, 36.2 y (HCWs with serologic testing) • 79% female (HCWs with serologic testing) • 9.0% doctor, 3% nurse, 23% allied health, 14% health care/general service assistant, 13% ancillary, 3.7% other		
Jiang et al, 2003 (56) Retrospective cohort China (Guangzhou); 1 hospital; 30 January–March 2003	431 HCWs • Age, sex, role/type of HCW not reported	Incidence of SARS-1: 17.9% (77/431)	No major limitations noted
Lau J. et al, 2004 (57) Retrospective cohort Hong Kong; 16 hospitals; 4 March to 31 May 2003	~28 000 HCWs • Age, sex, and HCW role/position not reported	Incidence of SARS-1: 1.2% (339/~28,000)	SARS-1 criteria not reported
Li et al, 2003 (58) Retrospective cohort China (Beijing); 1 hospital; 24 March–13 May 2003	770 HCWs • Age, sex and health care role/position not reported	Incidence of SARS-1: 2.43% (18/770)	No major limitations noted

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Loeb et al, 2004 (59) Retrospective cohort Canada (Toronto); 1 hospital critical care units; 8–16 March 2003	43 nurses • Mean age, 41 y • 100% female	Incidence of SARS-1: 18.6% (8/50)	No major limitations noted
Nishiyama et al, 2008 (60) Retrospective cohort Vietnam (Hanoi); two hospitals; exposure 3–17 March 2003	146 HCWs • Age, sex, and HCW role/position not reported	Prevalence of SARS-CoV-1 seropositivity: 40.4% (59/146) Incidence of SARS-1: 29.4% (43/146)	No major limitations noted
Raboud et al, 2010 (61) Retrospective cohort Canada (Toronto); 20 hospitals; 5 March–12 June 2003	624 HCWs provided care to intubated SARS-1 patients • Mean age 38.5 y (cases) • 75.2% female • 12.3% staff physician, 2.6% medical resident/intern, 45.4% registered nurse, 14.3% respiratory therapist, 10.7% radiology technologist, 6.1% housekeeper, 4.2% personal service assistant, 2.2% laboratory technician/technologist, 0.5% EMT; 1.8% other	Prevalence of SARS-CoV-1 seropositivity: 4.2% (26/624)	SARS-1 diagnosis did not require laboratory confirmation

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Scales et al, 2003 (62) Retrospective cohort Canada (Toronto); single hospital intensive care unit; exposure occurred 23 March 2003	69 HCWs with brief, unexpected exposure to SARS-1–infected patient • Age, sex, HCW role/position not reported	Incidence of SARS-1: 10.1% (7/69)	No major limitations noted
Wang et al, 2007 (63) Retrospective cohort Taiwan; 4 hospitals; study began 1 July 2003	2512 HCWs • Mean age, 33.4 y • 88% female • 13% physician, 83% nurse • 0.36% (9/2512) seropositive for SARS-CoV-1; 1.0% (9/882) among those reporting contact with SARS-1 patients	Prevalence of seropositivity to SARS-CoV-1: 0.3% (9/2512); 1.0% (9/882) among those reporting contact with SARS-1 patients	No major limitations noted
Wong et al, 2004 (64) Retrospective cohort Hong Kong; 1 hospital; 4–10 March 2003	66 medical students • Mean age, 22.3 y (cases) • 50% female (cases) • 24% (16/66) diagnosed with SARS-1	Incidence of SARS-1: 24% (16/66)	No major limitations noted
Chen et al, 2005 (65) Cross-sectional China (Guangzhou); 3 hospitals; May 2003	1856 HCWs (1135 worked with SARS patients) • Mean age, 30.8 y • 71.6% female • 30.7% doctor, 48.3% nurse, 5.5% health attendant, 4.0% laboratory technician, 11.5% other	Prevalence of SARS-CoV-1 seropositivity among HCWs who worked with SARS patients: 8.3% (95/1147) Incidence of SARS-1: 7.8% (90/1147)	10 patients with SARS-1 were SARS-CoV-1 seronegative

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Leung et al, 2004 (66) Case series Hong Kong; All cases 2003 outbreak	1755 SARS-1 cases (405 HCWs) • 48% aged ≤39 y of age, 30% aged 40–59 y (all cases) • 55.7% female (all cases) • 15.8% physician, 51.9% nurse, 28.4% other, 4.0% medical students	23.1% (405/1755) of cases were in HCWs Mortality: 2.0% (8/405) • Physician: 6.2% (4/64) • Nurse: 0.5% (1/210) • Medical student: 0% (0/16) • Other HCW: 2.6% (3/115) Adjusted OR (95% CI) for mortality • HCW vs. non-HCW: ***0.30 (0.1–0.7)***	288 cases without laboratory confirmation; based on studies with laboratory confirmation, adjusted OR for mortality for HCW vs. non-HCW 0.6 (95% CI, 0.2–1.3)
MERS-CoV			
Al-Abdallat M et al, 2014 (67) Retrospective cohort Jordan; 3 hospitals; exposure 15 March–30 April 2012, study done May 2013	97 HCWs • Age, sex, HCW role/position not reported	Incidence of MERS-CoV seropositivity in HCWs overall: 6.2% (6/97) • Mortality: 16.7% (1/6) Outbreak hospital HCWs: 10% (6/57) Other HCWs (transfer hospital, outbreak investigators): 0% (0/40)	Small number of cases; clinical presentation of 5 nonfatal cases not described
Alraddadi et al, 2016 (68) Retrospective cohort Saudi Arabia; 1 hospital; May 2014–June 2014	283 HCWs • Mean age, 40 y (cases) • 64.4% female • 55% nurse, 16% physician, 12% respiratory therapist, 6.8% radiology technicians, 9.2% other (MICU and ED HCWs)	Incidence of MERS-Co seropositivity in HCWs: 7.1% (20/283); 8.0% (20/250) in units with direct contact • MICU: 11.7% (15/128) • ED: 4.1% (5/122) • Neurology unit (no direct contact): 0% (0/33) • Radiology technician (MICU and ED): 29.4% (5/17) • Nurses (MICU and ED): 9.4% (13/138) • Respiratory therapist (MICU and ED): 3.2% (1/31) • Physicians (MICU and ED): 2.4% (1/41) • Patient transport or clerical staff (MICU and ED): 0% (0/21) Mortality: 0% (0/20) Mechanical ventilation: 15% (3/20) Hospital admission without mechanical ventilation: 10% (2/20)	Potential recall bias

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Amer et al, 2018 (69) Retrospective cohort Saudi Arabia; 1 hospital; June 2017	879 HCWs with unprotected exposure to MERS patient • Mean age, 32 y (15 cases) • 80.0% female (15 cases) • 80% nurse, 20% physician	Incidence of positivity for MERS-CoV PCR: 1.9% (17/879) • Mortality: 0% • Asymptomatic: 53% (8/15) • Mild symptoms: 47% (7/15)	Two patients with inadequate follow-up
Kim C. et al, 2016 (70) Retrospective cohort South Korea; 31 hospitals; dates not reported	737 HCWs with direct contact with MERS patient • Mean age, 33 y • 78% female • 19% physician; 69% nurse; 12% other	Incidence of MERS: 2.0% (15/737) Incidence of MERS-CoV seropositivity (ELISA and confirmatory IIFT) not meeting criteria for MERS: 0.27% (2/737)	No details on outcomes of MERS cases
Kim T. et al, 2016 (12) Retrospective cohort South Korea; 1 hospital ED; exposure May 26, 2015 with testing 3-6 weeks later	9 HCWs within 3–6 ft of MERS patient • 56% aged <30 y • 56% female • 33% doctor, 44% nurse, 11% nurse assistant, 11% security guard	Incidence of MERS in HCWS: 11% (1/9) • Case was a security guard with no PPE	Small cohort with single case
Park et al, 2016 (24) Retrospective cohort South Korea; 1 hospital; May to June 2015 **Added for June 1, 2020 update**	40 HCWs with exposure to MERS patient • Mean age, sex, HCW role/position not reported	Incidence of confirmed or probable MERS-CoV seropositivity: 12.5% (5/40) (1 confirmed, 4 probable)	Published as conference abstract only; criteria for confirmed or probable MERS-CoV infection not reported

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Ryu et al, 2019 (71) Retrospective cohort South Korea; public health center and EMS personnel; January 2016	34 HCWs with contact with MERS patient • Mean age, 44 y • 41.2% female • 32% general health care staff, 18% nurses; 12% doctors, 8.8% paramedics; 2.6% lab technician; 26.5% non–health-related workers	Incidence of MERS-CoV seropositivity: 0% (0/34)	No cases; small sample size
Wiboonchutikul et al, 2016 (72) Retrospective cohort Thailand; 1 hospital; exposure 18 June–3 July 2015	38 HCWs with exposure to MERS patient • Mean age, 38.1 y • 79% female • 7.9% physician, 21% nurse, 7.9% nursing or patient assistant, 21% radiology technician, 39.4% laboratory personnel, 2.6% housekeeping	Incidence of MERS-CoV seropositivity: 0% (0/38)	No cases
Memish et al, 2014 (73) Cross-sectional Saudi Arabia; hospitals throughout country; September 2012 to September 2013	1695 HCWs (contacts of MERS patients) • Age, sex, HCW role/position not reported	Prevalence of MERS-CoV PCR positivity: 1.12% (19/1695) • Female: 1.30% (15/1155) • Male: 0.74% (4/540)	No detail on clinical presentation, no information on HCW role/position

Study, Year (Reference) **Study Design** **Setting and Study Dates**	**Population Characteristics**	**Outcomes**	**Limitations**
Adegboye et al, 2019 (74) Case series Saudi Arabia; throughout Saudi Arabia; 2012–2016	787 cases of MERS (166 HCWs) • Mean age, 35 y (HCWs) • 37% female (HCWs) • HCW role/position not reported	Mortality in HCWs with MERS: 3.0% (5/166) Adjusted OR (95% CI) for mortality • HCW vs. non-HCW: ***0.08 (0.03 to 0.40)*** • Comorbidity vs. no comorbidity: ***2.43 (1.11–5.33)*** • Male vs. female: 1.41 (0.83–2.40) • Age (per year): ***1.03 (1.01–1.04)***	Potential residual confounding
Al-Tawfiq 2019 (75) Case series Lebanon, Malaysia, Oman, Qatar, Saudi Arabia, and United Arab Emirates (cases report to WHO) from December 2016 to January 2019	403 MERS cases (105 HCWs) • Mean age, 47.7 y (HCWs) • 25.6% female (all cases) • HCW role/position not reported	26.1% (105/403) of cases were in HCWs • Mortality: 16% (17/105)	Mortality in HCWs includes primary cases; no analysis of risk factors for mortality in HCWs
Bernard-Stoecklin et al, 2019 (76) Case series South Korea; 11 health care–associated outbreaks; 2015–2017	2260 cases with MERS (105 HCWs) • Age, sex, role/position of HCWs not reported	Adjusted OR (95% CI) for mortality in persons with MERS • HCW vs. not HCW: ***0.07 (0.001–0.35)*** • Age ≥65 y vs. <65 y: ***4.79 (2.60–8.64)*** • ≥1 underlying comorbid condition vs. no comorbid conditions: ***0.07 (0.001–0.35)***	Potential residual confounding

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Elkholy et al, 2020 (77) Case series Worldwide (all cases reported to WHO) from September 2012–2 June 2018	2223 MERS cases (415 HCWs) • Mean age, 39.3 y (HCWs) • Female: 54.9% (HCWs) • HCW role/position not reported	18.6% (415/2223) of cases were in HCWs • Mortality: 5.8% (24/415) • Secondary cases: 4.7% (16/338) • Diagnosis year: o 2013: 18.9% (7/30) o 2014: 8.0% (16/200) o 2015: 1.1% (1/95) o 2016: 0% (0/34) o 2017: 0% (0/45) o 2018: 0% (0/4) Adjusted OR (95% CI) for mortality in HCWs with secondary MERS (factors in backwards stepwise model) • Year of infection (2013–2018): ***0.17 (0.07–0.45)*** • Comorbidity (none vs. any): ***0.22 (0.05–0.92)*** • Factors not retained in model: sex, residency, symptomatic, age	No information on HCW role/position

CoV = coronavirus; COVID-19 = coronavirus disease 2019; ED = emergency department; EMT = emergency medical technician; HCW = health care worker; MERS = Middle East respiratory syndrome; MICU = medical intenvie care unit; PPE = personal protective equipment; SARS = severe acute respiratory syndrome

*Here and throughout the tables, boldface and italics indicate a statistically significant difference between groups.

Supplement Table 2. Mental health and sleep outcomes associated with SARS-CoV-2*

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
SARS-CoV-2			
Dai et al, 2020 (41) Cross-sectional China (Hubei province); HCWs from throughout province; 3–11 February 2020	4357 HCWs • Mean age, 35 y • 76.5% female • 32.6% physicians, 53.8% nurses, 10.0% technicians, 3.6% support staff • 0.9% diagnosed with COVID-19	GHQ-12 score ≥3: 39.1% (1704/4357) Adjusted OR (95% CI) for GHQ-12 score ≥ 3 • Female vs. male: ***1.53 (1.26–1.85)*** • Nurse vs. doctor: 0.97 (0.81–1.15) • Technician vs. doctor: ***0.73 (0.57–0.94)*** • Support staff vs. doctor: 0.80 (0.55–1.18) • Hospital type (reference ministerial/provincial) o Municipal: ***1.45 (1.17–1.81)*** o Country: ***1.71 (1.30–2.23)*** o Township/community: ***1.46 (1.08–1.98)***	***Not peer reviewed*** No control for baseline symptoms; no non-HCW controls; no control for work exposures
Du et al, 2020 (4) Cross-sectional China (Wuhan); HCWs from 2 hospitals in Wuhan; 13-17 February 2020 **Added for June 1, 2020 update**	134 frontline HCWs (60 local to Wuhan and 74 outreach workers relocated to Wuhan from other parts of China) • Mean age 36 years • 60.5% female • 35% physicians, 41% nurses, 23.9% support staff • Proportion diagnosed with COVID-19 not reported	Mean depression (BDI-II) score (score ≥14=mild depression): 5.76 (SD 7.04) Mean anxiety (BAI) score (score ≥8=mild anxiety): 4.96 (SD 8.13) Mean perceived stress (PSS) score (score ≥14=moderate to severe stress): 13.81 (SD 6.34) Adjusted OR (95% CI): • Depression (BDI-II ≥14) o Age 18-34 vs. age ≥35: 0.96 (0.90-1.03) o Women vs. men: 2.76 (0.73-10.43) o Physician or nurse vs. support staff: 2.45 (1.00-5.99) o Family/friend with virus, yes vs. no: 2.51 (0.49-12.82) o Low vs. high preparedness for material supplies: 1.18 (0.97-1.45) • Anxiety (BAI score ≥8): o Age 18-34 vs. age ≥35: 1.00 (0.94-1.05) o Women vs. men: 2.70 (0.99-7.37) o Physician or nurse vs. support staff: 1.63 (0.86-3.10) o Prior emergency response experience, yes vs. no: 2.13 (0.55-8.32)	Response rate 43%; no control for baseline symptoms; no non-HCW controls; no control for work exposures; proportion with COVID-19 infection not reported

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		o Family/friend with virus, yes vs. no: ***4.66 (1.01-21.43)*** o Low vs. high preparedness for material supplies: 1.09 (0.91-1.30)	
Huang F. et al, 2020 (9) Cross-sectional China (29 provinces); 13-17 February 2020 **Added for June 1, 2020 update**	2,970 HCWs in pediatric settings • Mean age not reported; 27.1% <30 y; 43% 30-39 y; 18.2% 40-49 y; 11.7% ≥50 y • 89% female • 52.4% physician; 47.6% nurses • 61.8% internal medicine; 6.5% respiratory medicine; 2.7% infection medicine; 9.2% critical medicine; 19.8% other • Proportion diagnosed with COVID-19 not reported	HRQOL summary score (SD) (summary score includes physical function, emotional functioning, social functioning cognitive functioning and worry; scale 0-100; higher score=better QoL): 69.7 (15.9) • Male vs. female: 69.3 (16.7) vs 69.8 (15.8); p=0.60 • <30 y vs. 30-39 y vs. 40-49 y vs. ≥50 y: 73.7 (15.6) vs. ***69.0 (16.0) vs. 66.2 (15.0) vs. 68.7 (15.7); p<0.001*** • Physician vs. nurse: ***67.1 (15.4) vs. 72.6 (15.9); p<0.001*** • Internal medicine vs. respiratory medicine vs. infection medicine vs. critical medicine: 69.6 (15.8) vs. 70.2 (16.8) vs. 71.8 (15.7) vs. 70.2 (16.2); p=0.73 • Independent fever/isolation clinic, no vs. yes: ***67.4 (16.0) vs. 70.8 (15.7); p<0.001*** • Previous treatment of COVID-19 patients, no vs. yes: ***70.7 (15.7) vs. 64.6 (15.7); p<0.001*** • Family or colleague with past or present COVID-19, no vs. yes: ***63.8 (15.3) vs. 70.0 (SD 15.9); p<0.001*** • Family or colleague contact with COVID-19, no vs. yes: ***70.5 (16.0) vs. 65.6 (14.4); p<0.001*** Adjusted OR (95% CI) for individual HRQOL domains or summary score (score converted to dichotomous outcome, ≤25 percentile vs. >25th percentile): • Female vs. male, emotional functioning: ***1.6 (1.2-2.1)***; cognitive functioning: ***1.4 (1.1-1.8)*** • 30-39 y vs. <30 y, summary score: ***1.8 (1.4-2.2)***; 40-49 y vs. <30 y: ***2.0 (1.5-2.6)***; ≥50 y vs. <30 y: 1.3 (0.9-1.8) • Nurse vs physician, physical functioning: ***0.8 (0.6-0.9)***; emotional functioning: ***0.8 (0.7-0.99)***; social functioning: ***0.6 (0.5-0.7)***; cognitive functioning: ***0.7 (0.6-0.9)*** • Independent fever/isolation clinic, no vs. yes, summary score: ***1.5 (1.3-1.8)***	***Not peer reviewed*** Unclear recruitment method for participants; participation rate not reported; no control for baseline symptoms; no non-HCW controls; no control for work exposures; proportion diagnosed with COVID-19 not reported

Study, Year (Reference) Study Design Setting and Study Dates	**Population Characteristics**	**Outcomes**	**Limitations**
		• Previous treatment of COVID-19 patients, yes vs. no, summary score: ***1.7 (1.4-2.1)***	
Huang, J. et al, 2020 (10) Cross-sectional China (Fuyang City); single hospital frontline-staff; 7-14 February 2020 **Added for June 1, 2020 update**	230 HCWs • Mean age 32.6 y • 81.3% female • 30.4% physicians; 69.6% nurses • 35.7% internal medicine; 42.6% surgical system; 21.7% infectious disease • Proportion diagnosed with COVID-19 not reported	Anxiety, mean SAS score (SD) (score <50=normal; score 50-60=mild anxiety; score 61-70=moderate anxiety; score >70=severe anxiety): 42.9 (10.9) • Male vs. female: 39.1 (9.0) vs. 43.8 (11.1); p=0.01 • <30 y vs. 30-<40 y vs. ≥40 y: 44.2 (11.0) vs. 41.8 (11.0) vs. 44.3 (10.0); p=0.24 • Doctor vs. nurse: 38.5 (10.7) vs. 44.8 (10.4); p<0.001 • Internal medicine vs. surgical system vs. infectious disease: 42.3 (11.5) vs. 43.6 (10.2) vs. 42.4 (11.2); p=0.67 Proportion with mild, moderate or severe anxiety: • Male vs. female: 11.6% vs. 25.7%; p=0.045 • <30 y vs. 30-40 y vs. >40 y: 23.1% vs. 24.4% vs. 17.2%; p=0.76 • Physician vs. nurse: ***14.3% vs. 26.9%; p=0.04*** • Internal medicine vs. surgical system vs. infectious disease: 20.7% vs. 24.5% vs. 24.0%; p=0.86 Stress, mean PTSD-SS score (SD) (score ≥50=positive score for stress): 42.9 (17.9) • Male vs. female: 36.9 (14.0) vs. 44.3 (18.4); p=0.01 • <30 y vs 30-<40 y vs ≥40 y: 42.7 (18.0) vs. 43.8 (17.9) vs. 40.0 (17.8); p=0.38 • Physician vs. nurse: 41.5 (18.1) vs. 43.5 (18.3); p=0.42 • Internal medicine vs. surgical system vs. infectious disease: 43.1 (18.1) vs. 43.5 (17.2) vs. 41.6 (18.5); p=0.83 Proportion with score PTSD-SS score ≥50: • Male vs. female: 18.6% vs. 29.4%; p=0.15 • <30 y vs. 30-<40 y vs. ≥40 y: 24.3% vs. 30.1% vs. 24.1%; p=0.62 • Physician vs. nurse: 24.3% vs. 28.8%; p=0.48 Internal medicine vs. surgical system vs. infections disease: 28.0% vs. 29.6% vs. 22.0%; p=0.61	Participant selection method unclear; no control for baseline symptoms; no non-HCW controls; no control for work exposures; proportion diagnosed with COVID-19 not reported

Study, Year (Reference) Study Design Setting and Study Dates	**Population Characteristics**	**Outcomes**	**Limitations**
Kang, 2020 (42) Cross-sectional China (Wuhan); HCWs from hospitals in Wuhan; 29 January to 4 February 2020	994 HCWs • 63.4% aged 25–40 y • 85% female • 31.1% high-risk department • 18.4% physicians; 81.6% nurses • 1.9% (19/994) positive for SARS-CoV-2 infection	Proportion classified into moderate or severe mental health disturbance clusters: • Moderate: 22.4% (223/994) o Mean depression (PHQ-9) score: 9.0 (SD, 3.9) o Mean anxiety (GAD-7) score: 8.2 (SD, 3.6) o Mean insomnia (ISI) score: 10.4 (SD, 4.8) o Mean distress (IES-R) score: 39.9 (SD, 5.4) • Severe: 6.2% (62/994) o Mean depression (PHQ-9) score: 15.1 (SD, 5.2) o Mean anxiety (GAD-7) score: 15.1 (SD, 4.3) o Mean insomnia (ISI) score: 15.6 (SD, 5.2) o Mean distress (IES-R) score: 60.0 (SD, 9.8) No association between increased risk for moderate or severe mental health disturbance and age, sex, type of HCW or department	Participation rate not reported; no control for baseline symptoms; no non-HCW controls
Lai et al, 2020 (78) Cross-sectional China; HCWs from hospitals with COVID-19 fever clinics or wards for COVID-19; 29 January–3 February 2020	1257 HCWs • 65% aged 26–40 y • 77% female • 39% physicians and 61% nurses • Proportion diagnosed with COVID-19 not reported	Depression symptoms (PHQ-9), moderate or severe: 14.7% (186/1257) Anxiety symptoms (GAD-7), moderate or severe: 12.3% (154/1257) Insomnia symptoms (ISI), moderate or severe: 7.7% (97/1257) Distress symptoms (IES-R), moderate or severe: 35.0% (440/1257) Adjusted OR (95% CI): • Depression symptoms (PHQ-9) o Women vs. men: ***1.94 (1.26–2.98)*** o Secondary vs. tertiary hospital: ***1.65 (1.17–2.34)*** o Technical title: ▪ Intermediate vs. junior: ***1.77 (1.25–2.49)*** ▪ Senior vs. junior: 1.21 (0.72–2.03) o Frontline vs. second-line HCV: ***1.52 (1.11–2.09)*** • Anxiety symptoms (GAD-7) o Women vs. men: ***1.69 (1.23–2.33)*** o Secondary vs. tertiary hospital: ***1.43 (1.08–1.90)*** o Technical title: ▪ Intermediate vs. junior: ***1.82 (1.38–2.39)***	Response rate 69%; no control for baseline symptoms; no non-HCW controls; no control for work exposures

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		▪ Senior vs. junior: 1.01 (0.67–1.51) o Frontline vs. second-line HCW: ***1.57 (1.22–2.02)*** • Insomnia symptoms (ISI) o Frontline vs. second-line: ***2.97 (1.92–4.60)*** • Distress symptoms (IES-R) o Women vs. men: ***1.45 (1.08–1.96)*** o Technical title: ▪ Intermediate vs. junior: ***1.94 (1.48–2.55)*** ▪ Senior vs. junior: 1.03 (0.69–1.55) o Frontline vs. second-line HCW: ***1.60 (1.25–2.04)*** o Location: Hubei outside Wuhan vs. Wuhan: 0.77 (0.57–1.06) o Outside Hubei vs. Wuhan: ***0.62 (0.43–0.88)***	
Liu C. et al, 2020 (44) Cross-sectional China; HCWs from multiple urban and rural hospitals; 10–20 February 2020	512 HCWs • 75.4% aged 18–39 y • 85% female • 32.0% direct treatment contact of COVID-19–infected patient • 8.0% suspected COVID-19 case	Anxiety score (scale 20–80; higher score = more anxiety), direct treatment contact vs. nondirect treatment contact: ***38.8 (SD, 8.4) vs. 41.1 (SD, 9.8); P = 0.007*** Adjusted beta (95% CI) for anxiety score: • Direct contact vs. nondirect contact: 2.33 (0.65–4.00) • Contact with suspect cases vs. no suspect cases: ***4.44 (1.55–7.33)*** • Hubei province vs. other: ***3.67 (1.44–5.89)***	85% response rate; sample limited to HCWs utilizing WeChat app; no control for baseline symptoms
Liu Y. et al, 2020 (16) Cross-sectional China (excluding Wuhan and Hubei Province); setting not report, study focused on frontline workers; 11-14 February 2020 **Added for June 1, 2020 update**	1,315 HCWs • Median age 37 y • 76% female • 38.9% physician; 43.9% nurse; 9.1% technician; 8.1% hygiene • 32.4% fever clinic; 12.8% ED; 16.6% isolation ward; 38.3% laboratory or radiology • Proportion diagnosed with COVID-19 not reported	Stress, proportion with moderate to severe stress (C-PSS-10 score ≥14): 49.1% (646/1315) • Male vs. female: ***40.5% vs. 51.9%; p<0.01*** • ≤30 vs. 30~40 vs. 40~50 vs. ≥50: ***54.5% vs. 51.7% vs. 41.0% vs. 46.7%; p<0.01*** • Physician vs. nurse vs. technician vs. hygiene: ***44.7% vs. 51.1% vs. 51.7% vs. 54.7%; p=0.03*** • Isolation ward vs. fever clinic vs. ED vs. laboratory or radiology: 46.3% vs. 45,3% vs. 56.0% vs. 51.3%; p=0.10 Anxiety, proportion with moderate to severe anxiety (GAD score ≥15): 10.7% (141/1315) • Male vs. female: ***8.5% vs. 11.4%; p=0.02*** • ≤30 vs. 30~40 vs. 40~50 vs. ≥50: ***6.8% vs. 12.3% vs. 11.8% vs. 15.1%; p=0.003***	Recruitment methods and participation rate unclear; no control for baseline symptoms; no non-HCW controls; no control for work exposures

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		• Physician vs. nurse vs. technician vs. hygiene: 11.1% vs. 11.3% vs. 5.8% vs. 11.3%; p=0.57 • Isolation ward vs. fever clinic vs. ED vs. laboratory or radiology: ***10.1% vs. 12.2% vs. 11.3% vs. 9.5%; p=0.03*** Depression, proportion with major depression (PHQ-9 score ≥10): 12.5% (164/1315) • Male vs. female: 10.4% vs. 13.1%; p=0.21 • ≤30 vs. 30~40 vs. 40~50 vs. ≥50: ***10.8% vs. 13.9% vs. 12.4% vs. 13.8%; p=0.04*** • Physician vs. nurse vs. technician vs. hygiene: 12.3% vs. 12.7% vs. 11.7% vs. 13.2%; p=0.91 • Isolation ward vs. fever clinic vs. ED vs. laboratory or radiology: 11.5% vs. 12.2% vs. 18.5% vs. 11.1%; p=0.18	
Lu et al, 2020 (79) Cross-sectional China (Fujian Province); single provincial hospital; 25–26 February 2020	2299 (2042 direct contact workers and 257 administrative staff) • 78% aged <30-40 y • 78% female • 22% high-risk department (respiratory, emergency, ICU or infectious disease) • Proportion diagnosed with COVID-19 not reported	Medical staff vs. administrative staff • Anxiety symptoms (HAMA), mild/moderate: 22.6% (462/2042) vs. 17.1% (44/257) • Anxiety symptoms (HAMA), severe/extreme: 2.9% (59/2042) vs. 1.6% (4/257) • Depression symptoms (HAMD), mild/moderate: 11.8% (241/2042) vs. 8.2% (21/257) • Depression symptoms (HAMD), severe/extreme: 0.3% (6/2042) vs. 0% (0/257) • Fear scale (0 to 10 NRS), moderate: 43.9% (896/2042) vs. 38.9% (100/257) • Fear symptoms (0 to 10 NRS), severe/extreme: 26.7% (545/2042) vs. 19.5% (50/257) Adjusted hazard ratio (95% CI), direct contact worker vs. nonclinical: Fear, high-risk worker: ***1.41 (1.02–1.93)***; low-risk worker: 1.30 (0.99–1.72) Anxiety (HAMA), high-risk worker: ***2.06 (1.35–3.15)***; low-risk: 1.31 (0.89–2.93) Depression (HADA), high-risk worker: ***2.02 (1.10–3.69)***; low-risk: 1.39 (0.80–2.43)	Response rate not reported; no non-HCW control; no control for baseline symptoms

Study, Year (Reference) Study Design Setting and Study Dates	**Population Characteristics**	**Outcomes**	**Limitations**
Qi et al, 2020 (80) Cross-sectional China (Hubei Province); HCWs from hospitals throughout province; dates not reported	1306 HCWs (persons with sleep disturbances and treated for psychiatric conditions excluded) • Mean age, 33.1 y • 80% female • 61% frontline HCW and 39% non-frontline • Proportion diagnosed with COVID-19 not reported	Pittsburgh Sleep Quality Index >7: 59.6% (779/1306) overall • 67.2% (538/801) frontline medical workers vs. 47.7% (241/505) non-frontline medical workers, *P* < 0.0001 Athens Insomnia Index >6: 45.5% (594/1306) overall • ***51.7% (414/801) frontline medical workers and 35.6% (180/505) non-frontline medical workers, P < 0.0001***	Response rate not reported; no non-HCW control
Romero et al, 2020 (26) Cross-sectional Spain; national survey; 9-19 2020 April **Added for June 1, 2020 update**	3,109 HCWs • Mean age 45 y • % female not reported • 56.6% medical staff; 26.5% nursing staff; 7.7% nurse assistants; 9.2% other staff (ancillary, administrative, laboratory technicians, research/faculty, management, hospital pharmacist) • 25.2% anaesthesia and critical care; 10.5% pathology; 5.2% intensivist and critical care; other specialties (<5% each) • 2.9% with SARS-CoV-2 seropositivity	Psychological Stress and Adaptation at Work Score (SD) (scale not reported; higher score=more psychological impact/stress): • 20-29 y vs 30-39 y vs. 40-49 y vs. 50-59 y vs. 60-69 y: ***46.7 (14.8) vs. 45.5 (15.9) vs. 42.1 (15.1) vs. 38.8 (14.5) vs. 37.6 (16); p<0.001*** • Work environment, ICU vs. surgery vs. hospital ward vs. consultation vs. ED vs. other: 44.3 (15.4) vs. 40.4 (15.3) vs. 43.3 (15.0) vs. 39.8 (15.6) vs. 45.1 (16.0) vs. 40.0 (15.2); p=0.12 • Personal exposure, asymptomatic vs. symptomatic vs. in isolation vs. positive test vs. hospitalization: 41.3 (15.4) vs. 43.2 (15.5) vs. 44.3 (15.1) vs 43.7 (16.1) vs 45.9 (10.0); p<0.001 No significant difference in scores when stratified according to medical profession or specialty	Participation rate unclear; no control for baseline symptoms; no non-HCW controls; no control for work exposures
Wang B. et al, 2020 (34) Cross-sectional China (Shanghai); single medical center; 8-10 February 2020	694 HCWs • Mean age not reported; 36.5% 18-30 y, 36.5% 31-40 y, 21.6% 41-50 y, 5.5% ≥51 y • 94.5% female • 22.3% physician, 45.1% nurse, 14.6%	Depression, severe depression (PQH-9 score ≥10) • Male vs. female: 5% (2/38) vs. 6% (37/656); p=0.92 • 31-40 y vs 18-30 y: 7% (18/253) vs. 7% (17/253); p=0.86 • 41-50 y vs 18-30 y: 3% (4/150) vs. 7% (17/253); p=0.09 • ≥51 y vs. 18-30 y: 0% (0.38) vs 7% (17/253); p=0.998 • Nurse vs. physician: 10% (32/313) vs. 3% (5/155); p=0.01	***Not peer reviewed*** No control for baseline symptoms; no non-HCW controls; no control for work exposures; some data (adjusted ORs) appear to be missing

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Added for June 1, 2020 update	technician/researcher, 10.1% administrator	• Technician/researcher vs. physician: 0% (0/101) vs. 3% (5/155); p=0.996 • Administrator vs. physician: 3% (2/70) vs. 3% (5/155); p=0.88 Anxiety, severe panic disorder (PDSS score ≥11) • Male vs. female: 3% (1/38) vs 7% (46/656); p=0.32 • 31-40 y vs 18-30 y: 7% (17/253) vs. 8% (20/253); p=0.61 • 41-50 y vs 18-30 y: 6% (9/150) vs. 8% (20/253); p=0.48 • ≥51 y vs. 18-30 y: 3% (1/38) vs. 8% (20/253); p=0.27 • Nurse vs. physician: ***12% (37/313) vs. 4% (6/155); p=0.008*** • Technician/researcher vs. physician: 0% (0/101) vs 4% (6/155); p=0.996 • Administrator vs. physician: 4% (3/70) vs 4% (6/155); p=0.88	

Ying et al, 2020 (81)
 	
Cross-sectional
 	
China (Ningbo); HCWs from 5 hospitals; February 2020
	843 family members of HCWs
	• Mean age, 38 y
	• 47.3% female
	• Relationship with HCW: 65.4% spouse, 4.7% child, 5.8% parent, 24.0% other
	• HCW had direct contact with confirmed or suspected COVID-19–infected patient: 48.0%
		Prevalence of GAD score ≥5 in family members of HCWs: 33.7%
		Proportion with PHQ score ≥5 in family members of HCWs: 29.4%
		
		Adjusted OR (95% CI) for GAD score ≥5 in family members of HCWs (significant variables in model)
		• Hours/day focusing on COVID-19: ***1.22 (1.06–1.39)***
		• HCW in direct contact with confirmed or suspected COVID-19 patients: ***1.48 (1.07–2.04)***
		• Family member's self-reported safety score for PPE of HCWs: ***0.81 (0.70–0.93)***
		
		Adjusted OR (95% CI) for PHQ-9 ≥5 in family members of HCWs (significant variables in model)
		• Occupation:
		  o Enterprise worker vs. HCW: ***1.75 (1.10–2.78)***
		  o Government employee vs. HCW: ***0.53 (0.29–0.98)***
		• Relationship:
		  o Parent vs. spouse: ***3.53 (1.61–7.73)***
		  o Other next of kin vs. spouse: ***1.64 (1.10–2.45)***
			Not peer reviewed
			Sample limited to family members using WeChat App; no control for baseline symptoms; no controls without HCW family members

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		• Hours/day focusing on COVID-19: ***1.20 (1.04–1.38)*** • Average working time per week for HCWs: ***1.02 (1.00–1.03)***	
Zhang S. et al, 2020 (36) Cross-sectional Iran; public and private hospitals (number not reported); 5-20 April 2020 **Added for June 1, 2020 update**	304 HCWs • Mean age 35 y • 58.6% female • HCW role not reported • 2.3% (7/304) infected with COVID-19	Mean mental health (SF-12) score (SD): 26.3 (7.5) Mean physical health (SF-12) score (SD) 40.7 (7.0) Proportion with depression (PHQ-2, cutoff not reported): 20.6% (63/304) Proportion with anxiety (GAD-2, cutoff not reported): 28.0% (85/304)	***Not peer reviewed*** Recruitment method not reported; participation rate not reported; no control for baseline symptoms; no non-HCW controls; no control for work exposures
Zhou et al, 2020 (38) Cross-sectional China (Wuhan); single hospital 2 February-30 March 2020 **Added for June 1, 2020 update**	1734 HCWs • Mean age 33 y • 75.3% female • 20.2% physicians, 79.8% nurses • Proportion diagnosed with COVID-19 not reported	ProQOL, mean burnout score (SD): 19.42 (5.73) • Proportion with low burnout score (≤22): 69.6% (1207/1734) • Proportion with average burnout score (23-41): 30.4% (527/1734) ProQOL, mean secondary traumatic stress score (SD): 24.8 (5.09) • Proportion with low traumatic stress score (≤22): 33.3% (578/1734) • Proportion with average traumatic stress score (23-41): 66.2% (1148/1734) • Proportion with high traumatic stress score (≥42): 0.46% (8/1734) ProQOL, mean compassion satisfaction (SD): 41.4 (6.49) • Proportion with low compassion score (≤22): 0.63% (11/1734) • Proportion with average compassion score (23-41): 49.7% (861/1734) • Proportion with high compassion score (≥42): 49.7% (862/1734)	***Not peer reviewed*** Participation rate not reported; no control for baseline symptoms; no non-HCW controls; no control for work exposures

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Zhu et al, 2020 (45) Cross-sectional Wuhan, China; tertiary hospital; 8–10 February 2020	5062 HCWs • 96.5% aged 19–49 y • 85% female • 20% physicians, 68% nurses, and 13% medical technicians • 3.1% with suspected or confirmed COVID-19	Depression symptoms (PHQ-9 ≥10): 13.5% (681/5062) Anxiety symptoms (GAD–7 ≥8): 24.0% (1218/5062) Distress symptoms (IES-R >33): 29.8% (1509/5062) Adjusted OR (95% CI) for psychological distress (selected factors) • Women vs. men: ***1.31 (1.02–1.66)*** • Nurse vs. doctor: ***2.24 (1.61–3.12)*** • Medical technician vs. doctor: ***1.57 (1.12–2.21)*** • Working >10 y vs. < 2 y: ***2.02 (1.47–2.79)*** • Work in isolation ward vs. nonisolation: ***1.32 (1.10–1.59)*** • Chronic noncommunicable disease vs. in good health: ***1.51 (1.27–1.80)***; history of mental disorders vs. in good health: ***3.27 (1.77–6.05)*** • Satisfied with coverage with protective measures vs. not satisfied: ***0.69 (0.53–0.89)*** • Satisfied with work shift arrangement vs. not satisfied: ***0.45 (0.33–0.63)*** • Satisfied with logistic support and accommodation arranged by hospital vs. not satisfied: not significant	***Not peer reviewed*** Response rate 77%; did not control for baseline symptoms; no non-HCW controls

CoV = coronavirus; COVID-19 = coronavirus disease 2019; ED = emergency department; EMT = emergency medical technician; GAD = generalized anxiety disorder; GHQ = General Health Questionnaire; HADA = Hamilton Depression Scale; HAMA = Hamilton Anxiety Scale; HCW = health care worker; IES-R = Impact of Event Scale–Revised; IL = interleukin; ISI = Insomnia Severity Index; MERS = Middle East respiratory syndrome; PHQ = Patient Health Questionnaire; PPE = personal protective equipment; SARS = severe acute respiratory syndrome

Supplement Table 3. Results of individual studies, risk factors for SARS-CoV-2 infection in HCWs

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Mutambudzi et al, 2020 (22) Prospective cohort United Kingdom; HCWs throughout the United Kingdom; 16 March to 3 May 2020 **Added for June 1, 2020 update**	11,353 HCWs participating in UK Biobank • Age, sex of HCWs not reported • 16% healthcare professionals, 12% medical support staff, 71% health associate professionals 0.7% (76/10,718) diagnosed with SARS-CoV-2 infection	Incidence of SARS-CoV-2 infection • Healthcare professionals: 0.7% (12/1,779) • Medical support staff: 0.8% (10/1,286) Health associate professionals: 0.7% (54/7,653)	***Not peer reviewed*** No control for confounders; restricted to participants in UK Biobank study
Nguyen et al, 2020 (82) Prospective cohort United Kingdom and United States; Start March 24 or 29, 2020, end date not reported	99,795 frontline HCWs • Mean age, 42 years • 83% female • HCW role/position not reported 4.0% 30-day incidence of SARS-CoV-2 infection	Hazard ratio (95% CI) for SARS-CoV-2 infection Reported inadequate PPE availability vs. adequate: ***1.24 (1.04-1.47)*** • No exposure to COVID-19 patients: ***1.54 (1.12-2.11)*** • Exposure to suspected COVID-19 patients: ***1.88 (1.25-2.84)*** • Exposure to documented COVID-19 patients: ***5.98 (4.61-7.77)*** Adjusted hazard ratio (95% CI) for SARS-CoV-2 infection Reported inadequate PPE availability vs. adequate: ***1.23 (1.03-1.46)*** • No exposure to COVID-19 patients: ***1.53 (1.11-2.09)*** • Exposure to suspected COVID-19 patients: ***1.84 (1.22-2.78)*** • Exposure to documented COVID-19 patients: ***5.94 (4.57-7.72)*** Inpatient HCW (reference general population): ***24.3 (21.8-27.1)*** • Nursing homes: ***16.2 (13.4-19.7)*** • Outpatient clinics in hospital: ***11.2 (8.44-14.9)*** • Home health sites: ***7.86 (5.63-11.0)*** • Ambulatory clinics: ***6.94 (5.12-9.41)*** Other healthcare setting: ***9.52 (7.49-12.1)***	Not peer reviewed; potential selection bias, limited measurement of exposures/risk factors, SARS-CoV-2 infection status based on self-report
Bai et al, 2020 (2) Retrospective cohort China (Wuhan); 1 hospital (neurosurgery	118 HCWs with potential exposure to COVID-19 patient • Mean age, 31 years • 64% female	COVID-19 vs. no COVID-19 Age (years): ***36.6 vs. 30.5, p=0.006*** BMI (kg/m^2): 22.4 vs. 22.0, p=0.85 Contact frequency (median, contacts/day): 3.0 vs. 5.0, p=0.95 Contact duration (median, minutes/contact): 4.0 vs. 4.0, p=0.54 Odds ratio (95% CI) for COVID-19[†] • Female vs. male: 0.78 (0.23-2.64)	Not peer reviewed; potential recall bias; no control for confounders; criteria for COVID-19 diagnosis not described; 4 infected HCWs without

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
department) prior to recognition of outbreak; December 25, 2019 to February 15, 2020 **Added for June 1, 2020 update**	• 25% physician, 75% nurse • 10.2% (12/118) diagnosed with COVID-19	• Current smoking (yes vs. no): 0.41 (0.02-7.49) • Current alcohol (yes vs. no): 0.37 (0.02-6.67) • Regular physical activity (yes vs. no): 2.12 (0.64-7.05) • Nurse vs. physician: 0.65 (0.18-2.34) • Working under pressure (yes vs. no): ***4.24 (1.19-15.05)*** • Contact with index case (yes vs. no): ***0.27 (0.08-0.94)*** • Air contact vs. no contact: 0.32 (0.07-1.50) • Direct contact vs. no contact: 0.22 (0.05-1.03) • Air or direct contact vs. no contact: 0.31 (0.03-3.01) • In same department as index case (yes vs. no): ***62.70 (3.60-1092.46)*** • Chronic pulmonary disease (yes vs. no): 1.11 (0.13-9.76) • Chronic non-pulmonary disease (yes vs. no): 0.62 (0.03-11.65)	exposure data excluded
Folgueira et al, 2020 (6) Retrospective cohort Spain (Madrid); 1 hospital; 1 to 29 March 2020 **Added for June 1, 2020 update**	2085 HCWs tested for SARS-CoV-2 infection • Age, sex, HCW role/position not reported	Incidence of SARS-CoV-2 infection, by department/hospital area • Intensive care unit: 52.3% (34/65) • Emergency department: 37.0% (50/135) • Surgery: 45.1% (79/175) • Oncology/hematology: 44.3% (31/70) • Medical areas without COVID-19: 37.4% (93/249) • Pediatrics/neonatal units: 48.6% (53/109) • Obstetrics/gynecology units: 39.5% (32/81) • Radiology: 38.0% (49/129) • Outpatient setting: 31.8% (14/44) • Administrative areas, clerical, informatics, communication, pharmacy: 55.2% (37/67) • Laboratories: 33.3% (28/84) • Kitchen: 38.3% (18/47)	Not peer reviewed; no control for confounders
Heinzerling et al, 2020 (8) Retrospective cohort United States (California); 1 hospital with unsuspected	37 HCWs with exposure to COVID-19 patient and at least one aerosol-generating procedure • Median age, 39 years • 84% female • 7% physician, 51% nurse, 9% respiratory	Estimated time in patient room (median, minutes): 120 (IQR 120-420) vs. 25 (IQR 10-50), p=0.06 Estimated time in patient room during aerosol generating procedures (median, minutes): 95 (IQR 0-160) vs. 0 (IQR 0-3), p=0.13 Odds ratio (95% CI) for COVID-19 (PCR)* • Taking vital sign (yes vs. no): 7.71 (0.61-97.85) • Taking medical history (yes vs. no): 1.93 (0.15-24.46) • Performing physical examination: ***21.82 (1.02-466.52)*** • Providing medication: 1.20 (0.10-14.79) • Bathing or cleaning patient: 0.97 (0.04-22.02)	Potential recall bias; no control for confounders; few cases and imprecise estimates; 6 tested HCWs were not interviewed and excluded from analysis

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations

COVID-19 case; February 2020	therapist, 9% phlebotomist, 7% certified nursing assistant, 7% environmental services worker, 5% nutrition services worker, 2% pharmacist, 2% other
	• 5.4% (2/37) diagnosed with COVID-19
	• No use of N95 respirators, eye protection, gowns, or PAPR
		• Lifting or positioning patient: 0.92 (0.08-11.18)
		• Emptying bedpan: 8.00 (0.49-13.70)
		• Changing linens: 0.77 (0.03-17.01)
		• Cleaning patient room: 0.97 (0.04-22.02)
		• Peripheral line insertion: 3.19 (0.11-94.15)
		• Central line insertion: 3.19 (0.11-94.15)
		• Drawing arterial blood gas: 16.50 (0.73-372.83)
		• Drawing blood: 0.77 (0.03-17.01)
		• Manipulation of oxygen mask or tubing: 11.60 (0.88-153.29)
		• Manipulation of ventilator or tubing: 0.53 (0.02-11.30)
		• In room while high-flow oxygen delivered: 1.39 (0.11-17.24)
		• Collecting respiratory specimen: 1.29 (0.05-30.38)
		• Airway suctioning: 0.52 (0.02-11.30)
		• Noninvasive ventilation (BiPAP, CPAP): ***15.00 (1.09-205.50)***
		• Manual (bag) ventilation: 8.00 (0.49-130.70)
		• Nebulizer treatments: ***20.67 (1.42-300.55)***
		• Breaking ventilation circuit: 0.77 (0.03-17.01)
		• Sputum induction: 3.19 (0.11-94.15)
		• Intubation: 8.00 (0.49-130.70)
		  o Performed or assisted (vs. no involvement): 8.00 (0.49-130.70)
		  o Present in room (vs. no involvement): 1.86 (0.07-46.97)
		• Bronchoscopy: 1.29 (0.05-30.38)
		  o Performed or assisted (vs. no involvement): 1.29 (0.05-30.38)
		  o Present in room (vs. no involvement): 3.19 (0.11-94.15)
		• Any aerosol generating procedure: 2.53 (0.21-30.68)
		• Always gloves during aerosol generating procedures: 3.10 (0.13-75.19)
		• Always facemask (non-N95) during aerosol generating procedures: 0.77 (0.03-20.02)
		• Always gloves during non-aerosol generating procedures: 4.40 (0.21-91.92)
		• Always facemask (non-N95) during non-aerosol generating procedures: 1.29 (0.05-30.38)
		• Longest single duration of time in room (reference <2 minutes): 2 to 30 minutes: ***32.00 (1.96-522.78)***
		  o 31 to 60 minutes: 1.86 (0.07-46.97)
		  o >60 minutes: 8.00 (0.59-130.70)
		• Within 6 feet of index patient: 1.03 (0.05-23.49)
		• Direct skin-to-skin contact with index patient: 0.45 (0.02-9.52)	

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		• Index patient either masked or on closed system ventilator when contact occurred (reference never): Always: 0.20 (0.01-4.22) o Sometimes: 2.86 (0.24-34.66)	
Lai et al, 2020 (14) Retrospective cohort China (Wuhan); 1 hospital; 1 January-9 February 2020 **Added for June 1, 2020 update**	9,648 HCWs • 12% ≥45 y, 88% <45 y • 74% female • 22% physician, 46% nurse, 32% health care assistant 1.1% (110/9648) diagnosed with COVID-19	Odds ratio (95% CI) for COVID-19 (criteria not described)* • Age <45 y vs. ≥45 y: 0.32 (0.21-0.48) • Female vs. male: 0.91 (0.60-1.39) • Nurse vs. physician: 1.16 (0.73-1.84) o Health care assistant vs. physician: 0.59 (0.33-1.04) • Clinic department for patients presumed not to have COVID-19 vs. fever clinic or ward: 3.00 (1.76-5.09) Department with no patient contact vs. fever clinic or ward: 1.81 (0.95-3.46)	No control for confounders; incident rate ratios reported but unclear how duration of exposure estimated and results discrepant with data in study; criteria for COVID-19 not described
Ng et al, 2020 (83) Retrospective cohort Singapore; February 2020	41 HCWs with exposure to COVID-19 patient and aerosol-generating procedures for ≥10 min at ≤2 m • Age, sex, and HCW role/position not reported 0% (0/41) diagnosed with SARS-CoV-2 infection	Incidence of SARS-CoV-2 infection in exposed HCWs: 0% (0/41); no HCWs developed symptoms • Aerosol-generating procedures: endotracheal intubation (*n* = 10), extubation (*n* = 2), noninvasive ventilation (*n* = 25), other (*n* = 4) Mask type during exposures: surgical mask, 85%; N95, 15%	No cases of COVID-19 occurred
Ran et al, 2020 (40) Retrospective cohort China (Wuhan); 1 hospital serving outbreak; follow-up through 28 January 2020	72 HCW with acute symptoms • Median age, 31 y • 69% female • 53% clinicians and 47% nurses • 38.9% (28/72) diagnosed with COVID-19	RR (95% CI) for COVID-19 (PCR) • High-risk vs. general department: ***2.13 (1.45–3.95)*** • High-exposure operation: 0.54 (0.19–1.53) • Tracheal tube removal: 0.63 (0.06–7.08) • CPR: 0.63 (0.06–7.08) • Fiberoptic bronchoscopy: 0.63 (0.06–7.08) • Sputum suction: 0.43 (0.12–1.55) • Unqualified handwashing: ***2.64 (1.04–6.71)*** • Suboptimal handwashing before patient contact: ***3.10 (1.43–6.73)*** • Suboptimal handwashing after patient contact***: 2.43 (1.34–4.39)*** • Improper PPE (proper PPE defined as use of hospital masks, round caps, gloves, protective clothing, boot covers, and goggles or face shields): ***2.82 (1.11–7.18)***	Potential recall bias; unclear if most risk estimates adjusted; reference group unclear for some estimates; some estimates imprecise; 11 of 83 cases dropped for invalid surveys

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		• Increase in work hours: ***log-rank P = 0.02*** with interaction with high-risk department Contact history: • Diagnosed family member: ***2.76 (2.02–3.77)*** • Suspected family member: 1.30 (0.31–5.35) Diagnosed patient: ***0.36 (0.22–0.59)*** Suspected patient: ***0.49 (0.27–0.89)*** Huanan seafood market: 0.63 (0.06–7.08)	
Wang Q. et al, 2020 (35) Retrospective cohort China (Hubei province); 107 hospital neurosurgery departments; January 20 to March 1, 2020 **Added for June 1, 2020 update**	5,322 HCWs • Mean age, 34 years • 50% female • 45% surgeon, 55% nurse 2.2% diagnosed with COVID-19(120/5,442)	OR (95% CI) for COVID-19 (PCR) Level 2 protection (cap, N95 or higher, goggles/eye protection, gown, gloves, shoe covers) (yes vs. no): ***0.03 (0.003-0.19)******	Not peer reviewed; potential recall bias; no control for confounders
Wang X. et al, 2020 (50) Retrospective cohort China (Wuhan); 1 hospital; January 2020	493 HCWs • Mean age, 32 y • 87% female • 27% doctor, 73% nurse • 2.0% (10/493) diagnosed with COVID-19	Incidence of COVID-19 • Respiratory department: 0% (0/70) • ICU: 0% (0/169) • Infectious disease department: 0% (0/39) • Hepatobiliary and pancreatic surgery department: 11% (8/74) • Trauma and microsurgery department: 2% (1/44) • Urology department: 1% (1/97) Unadjusted OR (95% CI) Nurse vs. doctor: ***0.04 (95% CI 0.005 to 0.31)***† • In department with N95 mask use (no vs. yes): ***28.46 (1.65 to 488.48)**** Adjusted OR (95% CI) for COVID-19 • In department with N95 mask use (no vs. yes): ***464.82 (97.73– ∞)***	Not peer reviewed; mask and other PPE use based on department practice, not individual participant use; estimate for mask very imprecise

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Korth et al, 2020 (13) Cross-sectional German (Essen); 1 hospital; 25 March to April 21 2020 **Added for June 1, 2020 update**	317 HCWs • Mean age, 37 y in high-risk group, 42.3 y in low-risk group • 100% female • 25% physician, 66% nurse, 6% lab assistant, 3% other 1.6% (5/316) diagnosed with SARS-CoV-2 IgG positivity	Prevalence of SARS-CoV-2 IgG positivity • High-risk (daily contact with COVID-19 patients on designated wards and intensive care units): 1.2% (3/244) • Intermediate-risk (daily non-COVID-19 patient contact): 5.4% (2/36) Low-risk (no daily patient contact): 0% (0/35)	No control for confounders
Lombardi et al, 2020 (17) Cross-sectional Italy (Milan); 1 hospital; 24 February to 31 March 31 2020 **Added for June 1, 2020 update**	1,573 HCWs • Mean age, 44 y • 64% female • 37% physician, 33% nurse/midwife, 10% healthcare assistant, 11% health technician, 9% clerical workers/technician • 30% at least 1 symptom 8.8% (138/1573) diagnosed with SARS-CoV-2 infection (PCR)	Odds ratio (95% CI) for SARS-CoV-2 infection (PCR) • Female vs. male: 0.83 (0.58-1.18) • Nurse vs. physician: 0.75 (0.50-1.13) Prevalence of SARS-CoV-2 infection (PCR) • <30 y: 11.7% (29/248) • 30-39 y: 8.8% (34/387) • 40-49 y: 8.0% (26/326) • 50-59 y: 7.9% (35/444) • ≥60 y: 8.3% (14/168) • Physician (including resident): 10.6% (62/582) • Nurses/midwife: 8.2% (43/522) • Healthcare assistant: 8.0% (13/162) • Health technician: 9.4% (16/170) Clerical worker/technician: 2.9% (4/137)	***Not peer reviewed*** No control for confounders
Shields et al, 2020 (28) Cross-sectional United Kingdom (Birmingham, England); four urban hospitals; 25 April 2020	554 asymptomatic HCWs Age, sex, HCW role/position not reported	Prevalence of SARS-CoV-2 (PCR): 2.4% (13/554) Prevalence of SARS-CoV-2 seroconversion (IgG, IgM, IgA): 24.4% (126/516) • Housekeeping: 34.5% (10/29) • Acute medicine: 33.3% (10/30) • General internal medicine: 30.3% (30/99) • Intensive care: 14.8% (9/61) • Emergency medicine: 13.3% (2/15) • General surgery: 13.0% (3/23) • Female: 26.3% (102/388) • Male: 18.8% (24/128) Odds ratio (95% CI) for SARS-CoV-2 seroconversion	***Not peer reviewed*** No information on clinical characteristics of HCWs; no information on clinical outcomes of SARS-CoV-2 infection; participation rate not reported; 7% of patients who underwent PCR testing

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Added for June 1, 2020 update		Female vs. male: 1.55 (0.94-2.54)†	did not undergo antibody testing
von Freyburg et al, 2020 (33) Cross-sectional Germany (Dachau); single hospital; 3-5 and April 2020 **Added for June 1, 2020 update**	1170 HCWs • Age, sex not reported • 17.8% physician, 35.3% nurse, 43.1% nonmedical staff; 3.8% other	Incidence of SARS-CoV-2 seropositivity: • Physician: 3.8% (8/208) • Nurse: 9.7% (40/413) • Nonmedical: 1.6% (8/505) • Other: 4.5% (2/44) OR for SARS-CoV-2 seropositivity Nurse vs. physician: 2.68 (1.23-5.84)†	No information on clinical outcomes of infection; limited information on demographic and no information on clinical characteristics of HCWs
Zheng et al, 2020 (37) Cross-sectional China (Wuhan); throughout Wuhan area; from March 26, 2020 **Added for June 1, 2020 update**	117,100 HCWs • Age not reported • 72% female • 37% physician, 49% nurse, 14% medical staff • 2.1% (2,457/117,100) diagnosed with COVID-19	OR (95% CI) for COVID-19 • Female vs. male: 1.02 (0.94-1.12) • Nurse vs. physician: 1.16 (1.07-1.27) • Nurse vs. medical staff: 1.03 (0.91-1.16) Prevalence of COVID-19 • General hospital: 2.9% (2,193/74,944) • Specialized hospital: 0.80% (140/17,565) • Community hospital: 0.50% (124/24,591)	COVID-19 cases based on requests for financial assistance; denominators based on epidemiological data; limited information on clinical outcomes of COVID-19 infections

Abbreviations: HCW = healthcare worker; OR = odds ratio; PCR = polymerase chain reaction; PPE = personal protective equipment; RR = relative risk
*****Unadjusted OR calculated based on available data.

Supplement Table 4. Results of individual studies, risk factors for SARS-CoV-1 infection in HCWs

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Caputo et al, 2006 (84) Retrospective cohort Canada (Toronto); 10 hospitals; February to 21 April 2003 and 22 April to July 2003	33 HCWs who performed 39 tracheal intubations in 35 SARS-1 patients • Age, sex not reported • 67% anaesthesiologist; 15% respiratory therapist; 9% internal medicine; 9% other physicians • 9.1% (3/33) with SARS-1	Unadjusted OR (95% CI) for SARS-1* • N95 or N95 equivalent vs. surgical mask: 0.12 (0.01–1.92) • 2 glove layers vs. 1 layer: ***0.04 (0.002–0.78)*** • Goggles vs. no goggles: 0.10 (0.01–1.29) • Face shield vs. no face shield: 0.79 (0.06–9.50) • Powered air purifying respirator or Stryker suit vs. no personal protective system: 0.20 (0.01–4.12)	Potential recall bias; no control for confounders
Chang et al, 2004 (51) Retrospective cohort Taiwan; 1 hospital ED; 30 March–30 June 2003	193 HCWs • Mean age, 32.7 y • 72% female • 17% physician, 49% nurse, 8.8% radiology technician, 8.3% clerk, 6.7% sanitation worker, 6.7% administration personnel, 3.1% ambulance drivers • 4.7% (9/193) seropositive for SARS-CoV-1 (8 met criteria for SARS-1)	Prevalence of SARS-CoV-1 seropositivity • Physicians: 6.1% (2/33) • Nurses: 3.2% (3/95) • Ambulance drivers: 16.7% (1/6) • Sanitation workers: 15.4% (2/13) • Clerks: 6.3% (1/16) • Radiology technicians: 0% (0/17) • Administrative personnel: 0% (0/24)	No control for confounding; few cases
Fowler et al, 2004 (52) Retrospective cohort Toronto; 1 hospital intensive care unit; 1–22 April 2003	122 intensive care unit HCWs • Mean age, 35.1 y (cases) • Sex not reported • 54% nurse, 15% nursing aid/patient assistant, 12% physician, 15% respiratory therapist,	Incidence of SARS-1 • Physicians: 16.7% (3/18) • Nurses: 7.6% (5/66) • Respiratory therapist: 11.1% (2/18) Unadjusted RR (95% CI) for SARS-1 • Any involvement in intubation vs. no involvement, physician or nurse: ***13.29 (2.99–59.04)*** o Nurse: ***21.38 (4.89–93.37)*** o Physician: 3.82 (0.23–62.24)	No control for confounding; some estimates imprecise

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
	2.5% physiotherapist, 1.6% other HCW • 8.2% (10/122) diagnosed with SARS-1	• Cared for patient treated with noninvasive positive pressure vs. conventional ventilation (restricted to nurses): 2.33 (0.25–21.76) • Cared for patient treated with high frequency oscillatory vs. conventional ventilation (restricted to nurses): 0.74 (0.11–4.92)	
Ho et al, 2003 (53) Retrospective cohort Hong Kong; 1 hospital; 25 March–5 May 2003	1053 HCWs • Mean age, (cases) 36 y • 78% female (cases) • 13% physician, 47% nurse, 8.4% health care assistant, 10.5% cleaner, 12.4% clerical staff • 3.8% (40/1053) diagnosed with SARS-1	Incidence of SARS-1 • Physician: 5.1% (7/138) • Nurse: 3.8% (19/500) • Health care assistant: 7.9% (10/126) • Cleaner: 1.9% (3/158) • Clerical staff: 0.8% (1/131)	No control for confounding
Ho et al, 2004 (54) Prospective cohort Singapore; 1 hospital; 18 March–29 April 2003	372 HCWs • Mean age, 34.2 y • 77% female • 27.7% physician, 55.1% nurse, 17.2% allied health and clerical • 2.2% (8/372) seropositive for SARS-CoV-1; 6 met criteria for SARS-1	RR (95% CI) for SARS-CoV-1 seropositivity • Exposure only vs. direct contact: 2.40 (0.64–9.00) • Protected direct contact vs. unprotected direct contact: 0.16 (0.03–1.02) • Use of full PPE 100% of the time vs. <100% of the time: 0.19 (0.02–1.49)	No control for confounding; few cases with imprecise estimates
Ip et al, 2004 (55) Retrospective cohort Hong Kong; 1 hospital; blood	742 HCWs • Mean age, 36.2 y (HCWs with serologic testing) • 79% female (HCWs with serologic testing) • 9.0% doctor, 3% nurse, 23% allied health, 14%	Incidence of SARS-1 • Doctors: 2.4% (2/85) • Nurses: 11.6% (38/328) • Allied health: 0.9% (1/114) • Health care/general service assistants: 11.8% (12/102) • Ancillary: 0% (0/113) • Other: 0% (0/12)	No control for confounding

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
samples obtained after 21 May 2003	health care/general service assistant, 13% ancillary, 3.7% other • 7.1% (53/742) diagnosed with SARS-1		
Jiang et al, 2003 (56) Retrospective cohort China (Guangzhou); 1 hospital; 30 January–30 March 2003	431 HCWs • Age, sex, role/type of HCW not reported • 17.9% (77/431) diagnosed with SARS-1	Incidence of SARS-1 • Ward A (no ventilation window, room volume 61.9 m2, 1 SARS-1 patient, total time of hospitalization 43 h): 73.2% (52/71) • Ward B (no ventilation window, room volume 85.1 m2, 1 SARS-1 patient, total time of hospitalization 168 h): 32.1% (9/28) • Ward C (ventilation window 1.1 m2, room volume 104.3 m2, 1 SARS-1 patient, total time of hospitalization 110 h): 27.5% (11/40) • Ward D (ventilation windows 1.9 m2, room volume 74.0 m2, 96 SARS-1 patients, total time of hospitalization 1272 h): 1.7% (5/292)	No control for confounding; too few wards to determine effects of ventilation and patient variables on risk for SARS-1 in HCWs
Lau et al, 2004 (57) Retrospective cohort Hong Kong; 16 hospitals; 4 March–31 May 2003	~28 000 HCWs Age, sex, and HCW role/position not reported 1.2% (339) diagnosed with SARS-1	Mean attack rate (SD) for SARS-1 across 16 hospitals: overall: 1.06% (SD 1.31) • Nurse: 1.07% (SD 1.38) • Nonmedical support staff: 2.34% (SD 3.43) • Other technical and medical staff: 0.32% (SD 0.49); ***P = 0.035*** for job category	No control for confounding; SARS-1 criteria not reported
Li et al, 2003 (58) Retrospective cohort China (Beijing); 1 hospital; 24	770 HCWs • Age, sex and HCW role/position not reported • 2.43% (18/770) diagnosed with SARS-1	Incidence of SARS-1 • Doctor: 2.88% • Nurse: 4.78% • Nursing assistant: 6.67% • Other hospital staff: 0%	No control for confounding; few SARS-1 cases; number of HCWs in different roles/positions not reported

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
March–13 May 2003			
Loeb et al, 2004 (59) Retrospective cohort Canada (Toronto); 1 hospital critical care units; 8–16 March 2003	43 nurses • Mean age, 41 y • 100% female • 18.6% (8/43) diagnosed with SARS-1	Unadjusted OR (95% CI) for SARS-1 (n=43) • Entered patient room (yes vs. no): 7.98 (0.42-150.49)* Unadjusted RR (95% CI) for SARS-1 (n=28 nurses who entered patient room) • Entered patient room (yes vs. no): • Gown vs. inconsistent gown: 0.36 (0.10–1.24) • Gloves vs. inconsistent gloves: 0.45 (0.14–1.46) • Consistent N95 or surgical mask vs. inconsistent mask: ***0.23 (0.07–0.78)*** • Consistent N95 vs. inconsistent mask: ***0.22 (0.05–0.93)*** • Surgical mask vs. no mask: 0.45 (0.07–2.71) • N95 vs. surgical mask: 0.50 (0.06–4.23) • Intubation (yes vs. no): ***4.20 (1.58–11.14)*** • Suctioning before intubation (yes vs. no): ***4.20 (1.58–11.14)*** • Suctioning after intubation (yes vs. no): 0.68 (0.21–2.26) • Nebulizer treatment (yes vs. no): ***3.24 (1.11–9.42)*** • Manipulation of oxygen mask (yes vs. no): 9.00 (1.00–64.89) • Manual ventilation (yes vs. no): 1.19 (0.30–4.65) • Manipulation of BiPAP mask (yes vs. no): 2.60 (0.8–7.99) • Performing an ECG (yes vs. no): 1.67 (0.51–5.46) • Endotracheal aspirate (yes vs. no): 1.00 (0.29–3.45) • Bronchoscopy (yes vs. no): 2.14 (0.46–9.90) • No significant associations: Mouth or dental care, insertion of nasogastric tube, insertion indwelling catheter, insertion of peripheral intravenous catheter, insertion of central venous catheter, bathing or patient transfer, administration of medication, venipuncture, manipulation of commodes or bedpans, feeding, chest physiotherapy, assessment of patient, insertion of peripheral intravenous line, radiology procedures, dressing change, urine specimen collected	Potential recall bias; no control for confounding
Nishiyama et al, 2008 (60) Retrospective cohort	85 HCWs • Age, sex, and HCW role/position not reported • Proportion diagnosed with SARS-1 unclear	Unadjusted estimates not reported Adjusted OR (95% CI) for SARS-1 (factors included in model) • Age: 0.97 (0.90–1.03) • Patient required oxygen vs. no oxygen: 2.65 (0.66–10.7) • Mask use:	Potential recall bias; potential selection bias; some estimates very imprecise

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Vietnam (Hanoi); 2 hospitals; exposure 3–17 March 2003	(29% of 146 HCWs potentially exposed diagnosed with SARS-1 and 40% seropositive for SARS-CoV-1, but analysis evaluated a subgroup of 85 HCWs)	o Always vs. sometimes: ***0.34 (95% CI, 0.09–1.37)**** o Always vs. no use: ***0.38 (95% CI, 0.01–0.50)**** • Handwashing before patient contact: o Sometimes vs. always: 1.25 (0.25–6.10) o No vs. always: 3.69 (0.56–24.2) • Doctor vs. other staff: ***40.9 (2.65–630)*** • Nurse vs. other staff: ***57.3 (5.28–621)*** • Indirect contact with SARS patient vs. direct contact: 6.06 (0.63–58.7) • No attendance at lecture on nosocomial infection vs. attendance: 5.49 (0.90–33.4)	
Raboud et al, 2010 (61) Retrospective cohort Canada (Toronto); 20 hospitals; 5 March–12 June 2003	624 HCWs who provided care to intubated SARS-1 patients • Mean age, 38.5 y (cases) • 75.2% female • 12.3% staff physician, 2.6% medical resident/intern, 45.4% registered nurse, 14.3% respiratory therapist, 10.7% radiology technologist, 6.1% housekeeper, 4.2% personal service assistant, 2.2% laboratory technician/technologist, 0.5% EMT; 1.8% other • 4.2% (26/624) with SARS-CoV-1 seropositivity	Prevalence of SARS-CoV-1 seropositivity • Physicians: 5.2% (4/77) • Medical resident/intern: 12.5% (2/16) • Registered nurse: 3.9% (11/283) • Respiratory therapist: 4.5% (4/89) • Radiology technologist: 1.5% (1/67) • Personal services assistant: 3.8% (1/25) • Paramedic/EMT: 100% (3/3) Unadjusted OR (95% CI) for SARS-1 seropositivity (unit of analysis HCWs)* • Chronic illness (yes vs. no): 0.62 (0.08–4.74) • Always wore goggles in patient room (yes vs. no): ***0.33 (0.15–0.72)*** • Always wore gloves in patient room (yes vs. no): 0.59 (0.17–2.06) • Always wore gown in patient room (yes vs. no): ***0.35 (0.14–0.91)*** • Surgical mask in patient room vs. no mask (reference): 3.27 (0.72–14.79) o N95 or equivalent: 0.59 (0.17–2.08) o Higher protection than N95: 0.25 (0.01–4.98) • N95 or N95 equivalent in patient room vs. surgical mask: ***0.18 (0.06–0.53)*** • Hand hygiene after removal of face protection vs. no hand hygiene (reference): 0.48 (0.19–1.22) o Hand hygiene before removing face protection, with or without hand hygiene after: 0.93 (0.29–3.01) • Infection control training (no vs. yes): ***3.93 (1.75–8.83)*** • Noninvasive ventilation (yes vs. no): ***3.15 (1.39–7.15)*** • High-flow oxygen (yes vs. no): 0.39 (0.09–1.66) • Mechanical ventilation (yes vs. no): 0.87 (0.38–1.97) • Present during intubation (yes vs. no): ***3.03 (1.37–6.70)*** • Present during suctioning before intubation (yes vs. no): 1.71 (0.70–4.17) • Present during suctioning after intubation (yes vs. no): 1.79 (0.79–4.02)	Potential recall bias; SARS-1 diagnosis did not require laboratory confirmation; collinearity in model not addressed

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		• Present during manual ventilation before intubation (yes vs. no): ***2.84 (1.25–6.42)*** • Present during manual ventilation after intubation (yes vs. no): 1.27 (0.50–3.24) • Cardiac compressions (yes vs. no): 2.95 (0.36–24.50) • Sputum sample collection (yes vs. no): 2.68 (0.88–8.17) • Nebulizer treatment (yes vs. no): 1.17 (0.07–20.66) • Manipulation of oxygen mask (yes vs. no): 2.15 (0.94–4.89) • Insertion of nasogastric tube (yes vs. no): 1.02 (0.23–4.47) • Present during ECG (yes vs. no): ***3.74 (1.67–8.39)*** • HCW underlying chronic illness (yes vs. no): 0.94 (0.24–3.59) • Number of times entering patient's room, based on number of shifts with exposure (reference, >10 times): o 1–2 times: 0.67 (0.28–1.63) o 3–5 times: 0.69 (0.39–1.23) o 6–10 times: 0.41 (0.14–1.20) • Duration of face–to-face contact with patient, based on number of shifts with exposure (reference, >4 h) o <1 min: 0.83 (0.11–6.27) o 1–10 min: 0.98 (0.26–3.71) o 11–30 min: 1.33 (0.20–8.88) o 31–60 min: 2.73 (0.33–22.5) o 1–4 h: 2.37 (0.41–13.6) • Always wore recommended PPE, based on number of shifts with exposure (yes vs. no): 0.70 (0.19–2.58) • PPE removal, based on number of shifts with exposure (yes vs. no) o No hand hygiene described: 0.87 (0.16–6.45) o Hand hygiene performed once: 0.67 (0.11–3.99) o Adequate PPE removal: 1.18 (0.20–6.83) • Not statistically significant in univariate analyses: patient recognized as SARS case, Fio_2 on day 2 of hospital admission, bronchoscopy, chest physiotherapy , defibrillation, collection of stool sample, emptying urine bag or taking urine sample, emptying bed pan, insert central venous line, insert urinary catheter, insert peripheral intravenous access line, venipuncture/arterial blood gas, chest tube insertion, bathing, feeding, transporting, taking oral temperature, administering oral medication, or housekeeping activities Adjusted OR (95% CI) for SARS-1 (factors retained in model) • HCWs eye/mucous membranes exposed to body fluids: ***7.34 (2.19–24.52)*** • Patient APACHE II score ≥20: ***17.05 (3.20–90.75)*** • Present during ECG: ***3.52 (1.58–7.86)***	

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		• Present during intubation: ***2.79 (1.40–5.58)*** • Patient Pa_{O_2}–Fi_{O_2} ratio ≤59: ***8.65 (2.31–32.36)***	
Scales et al, 2003 (62) Retrospective cohort Canada (Toronto); 1 hospital intensive care unit; exposure occurred; 23 March 2003	69 HCWs with brief, unexpected exposure to SARS-1–infected patient • Age, sex, HCW role/position not reported • 10.1% (7/69) diagnosed with SARS-1	Incidence of SARS-1 • Entry into room: 19% (6/31) • Contact duration ≤10 min: 0% (0/11) o 11–30 min: 12.5% (1/8) o 31 min to 4 h: 25% (2/8) o ≥4 h: 75% (3/4) • Nature of contact: touched patient: 32% (6/19) • Contact with mucous membranes: 40% (4/10) • Procedure involving contact with mucous membranes or respiratory secretions: 40% (6/15) • Present during noninvasive positive-pressure ventilation: 18% (4/22) • Performed or assisted intubation: 60% (3/5) • Always wore: o Gloves: 20% (3/15) o Gown and gloves: 20% (3/15) o Any mask (N95 or surgical): 23% (3/13) o Gown, gloves, and N95 mask: 17% (1/6) o Gown, gloves, and surgical mask: 33% (2/6) o Gown, gloves, and any mask: 25% (3/12) o No precautions: 12.5% (1/8) Unadjusted OR (95% CI) for SARS-1 • Any mask (surgical or N95) vs. no mask: 1.50 (0.25-8.98) • Gown, gloves and N95 vs. gown, gloves and surgical mask: 0.40 (0.03-6.18)	Potential recall bias; no control for confounding; few cases
Wang et al, 2007 (63) Retrospective cohort Taiwan; 4 hospitals; study began 1 July 2003	2512 HCWs • Mean age, 33.4 y • 88% female • 13% physician, 83% nurse • 0.36% (9/2512) seropositive for SARS-CoV-1; 1.0% (9/882) among those reporting contact with SARS-1 patients	Unadjusted RR (95% CI) for SARS-CoV-1 seropositivity • All HCWs (*n* = 2197) o Female vs. male: 1.10 (0.14–8.74) o Nurse vs. physician: 1.21 (0.15–9.61) o ED vs. ward: ***25.94 (7.07–95.14)*** • HCWs with contact with suspected or possible SARS cases (*n* = 882) o Female vs. male: 1.00 (0.13–7.91) o Nurse vs. physician: 0.92 (0.12–7.28) o ED vs. ward: ***9.45 (2.58–34.64)***	Potential recall bias; no control for confounding; imprecise estimates

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Wilder-Smith et al, 2005 (85) Retrospective cohort Singapore; 1 hospital; March 2003	98 HCWs (80 with serologic testing) • Median age, 28 y • 91% female • 10% doctor, 77.5%, 12.5% other • 45.9% (45/98) with SARS-CoV-1 infection (37 cases pneumonia, 2 cases subclinical, and 6 cases asymptomatic)	**Unadjusted OR (95% CI) for SARS-CoV-1 infection*** • Female vs. male: 0.47 (0.10–2.07) • Mask use vs. no mask use: ***0.25 (0.09–0.69)*** • Glove use vs. no glove use: ***0.40 (0.17–0.96)*** • Handwashing vs. no handwashing: 0.35 (0.11–1.12) • Close contact with SARS-1 patient (yes vs. no): 1.11 (0.23–5.26) Mean age: ***29.2 y in cases vs. 33.7 in controls; P = 0.04***	Potential recall bias, no control for confounders; analyses appear to exclude 2 patients with subclinical SARS-1
Wong et al, 2004 (64) Retrospective cohort Hong Kong; 1 hospital; 4–10 March 2003	66 medical students • Mean age, 22.3 y (cases) • 50% female (cases) • 24% (16/66) diagnosed with SARS-1	Unadjusted RR (95% CI) for SARS-1 • Definitely visited patient's cubicle vs. did not: ***7.4 (1.0–53.5)*** • Association between distance from patient and likelihood of infection being present	Potential recall bias; no control for confounding
Yen et al, 2006 (86) Retrospective cohort Taiwan; 87 hospitals; 27 April 27–21 May 2003	87 hospitals • Study hospital: o Integrated infection control strategy involving triaging patients and use of physical barriers, separation of hospital space into zones of risk, and extensive installation of alcohol dispensers for glove-on hand rubbing 2 HCWs diagnosed with SARS-1 • Control hospitals:	Incidence of SARS-1 in HCWs • Study hospital vs. control hospitals: ***0.03 case/bed vs. 0.13 case/bed, P = 0.03***	No control for confounding; no description of infection control measures in control hospitals; criteria for SARS-1 diagnosis in control hospitals unclear; only 2 cases in study hospital; analyzed as cases per hospital bed rather than per HCW

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
	o No intervention o 93 HCWs diagnosed with SARS-1		
Chen et al, 2009 (87) Case–control China (Guangzhou); 2 hospitals; dates not reported	91 HCW cases with SARS-CoV-1 seropositivity (80 SARS-1) and 657 controls • 34.9% aged <26 y, 54.2% 26-40 y, 10.8% >50 y • 76.0% female • 31.5% doctor, 49.2% nurse, 7.3% health attendant, 5.0% laboratory technician, 7.0% other	Unadjusted OR (95% CI) for SARS-CoV-1 seropositivity • Single vs. double gowns: ***2.12 (1.36–3.31)*** • Single vs. double cotton masks: ***2.53 (1.56–4.07)*** • Single vs. double gloves: ***5.20 (2.65–10.23)*** • Shoe cover never vs. every time (reference): ***3.80 (2.24–6.45)***; sometimes: ***5.04 (2.04–12.48)***; often: 2.29 (0.96–5.67) • Cap never vs. every time (reference): ***1.79 (1.03–3.10)***; sometimes: 0.48 (0.14–1.67); often: 0.59 (0.13–2.65) • Face shield in SARS ward never vs. every time (reference): 4.05 (0.54–30.34); sometimes: 0.22 (0.01–3.56) • Goggles while performing operation for SARS-1 patients never vs. every time (reference): ***7.83 (1.07-57.63)***; sometimes: 0.84 (0.07–9.45) • Wash uncovered skin after caring for SARS-1 patients never vs. every time (reference): ***3.29 (1.29–8.43)***; sometimes: 2.16 (0.77–6.05); often: 1.47 (0.45–4.79) • Wash hands after caring for SARS-1 patients never vs. every time (reference): 0.89 (0.52–1.51); sometimes: 1.03 (0.38–2.75); often: 1.14 (0.64–2.06) • Wash nasal cavity after caring for SARS-1 patients never vs. every time (reference): 3.21 (0.98–10.53); sometimes: 2.51 (0.72–8.77); often: 0.82 (0.13–5.13) • Wash oral cavity after caring for SARS-1 patients, never vs. every time (reference): ***3.26 (1.15–9.21)***; sometimes: 2.05 (0.67–6.33); often: 0.28 (0.03–2.59) • Special training for SARS-1 (no vs. yes): ***2.44 (1.41–4.23)*** • Performing tracheostomy (yes vs. no): ***4.15 (1.50–11.50)*** • Performing endotracheal intubations (yes vs. no): ***8.03 (3.90–16.56)*** • Caring for “super spreading” patient (yes vs. no): ***4.55 (2.75–7.54)*** • Avoiding face to face while caring for patient, sometimes vs. never (reference): 0.64 (0.36–1.10); often: ***0.53 (0.31–0.93)***; every time: ***0.16 (0.06–0.46)*** • Air ventilation method in offices and SARS-1 wards, natural vs. artificial central ventilation (reference): ***0.28 (0.14–0.54)***; natural and additional electronic exhaust fan: ***0.17 (0.06–0.25)*** • Type of equipment for washing hands non-automatic vs. automatic tap (reference): ***4.18 (1.66–10.51)***; others: 1.09 (0.12–9.74)	Potential recall bias; methods for selecting controls unclear; collinearity in model not addressed

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations

		Adjusted OR (95% CI) for SARS-CoV-1 seropositivity (factors included in forward stepwise model)
		• Single vs. double gloves worn: ***4.13 (1.99–8.55)***
		• Caring for "super spreading" patient (yes vs. no): ***3.57 (1.94–6.57)***
		• Avoiding face to face while caring for patient (reference never)
		  o Sometimes: 0.67 (0.36–1.24)
		  o Often: ***0.30 (0.10–0.90)***
		  o Every time: ***0.30 (0.15–0.60)***
		• Air ventilation method in offices and SAR wards (reference artificial central ventilation)
		  o Natural ventilation: ***0.40 (0.18–0.88)***
		  o Natural ventilation and additional electronic exhaust fan: ***0.27 (0.16–0.63)***
		• Performing endotracheal intubation (yes vs. no): ***2.76 (1.16–6.53)***	

Lau, 2004 (88) Case–control Hong Kong; 5 hospitals; cases diagnosed 28 March–25 May 2003	72 HCW cases with SARS-1 and 143 matched controls • Mean age and sex not reported • 59.7% nurse, 23.6% health care assistant, 9.7% medical officer, 2.8% clerical staff, 4.2% workmen	Unadjusted matched OR (95% CI) for direct contact with SARS patient, direct patient contact in general, and no patient contact • Consistent vs. inconsistent N95 or surgical mask use†: 0.50 (0-20), 0.25 (95% CI, 0.004-4.76), 0.41 (0.06-2.44); for all HCWs, ***0.27 (0.08-0.95)*** • Consistent vs. inconsistent N95 mask use: 0.35 (0.07–1.43), 0.78 (0.10-6.25, 0.55 (95% CI, 0.21–1.39); for all HCWs, ***0.48 (0.25–0.93)*** • Inconsistent goggles use vs. consistent: ***6.41 (2.49–19.49), 6.93 (2.19–28.85), 3.50 (1.42–9.47)***; for all HCWs, unadjusted unmatched OR, ***13.82 (6.71–28.45)**** • Inconsistent glove use vs. consistent: ***20.54 (2.96–887.72)***, 3.53 (0.77–21.85), ***2.42 (1.05–5.81)***; for all HCWs, unadjusted unmatched OR, ***4.54 (2.43–8.47)**** • Inconsistent gown use vs. consistent: ***8.85 (2.46–48.28), 11.54 (2.56–106.36), 3.42 (1.38–9.30)***; for all HCWs, unadjusted unmatched OR, ***8.77 (4.58–16.82)**** • Inconsistent cap use vs. consistent***: 7.30 (2.33–30.21), 12.81 (2.92–116.75), 4.05 (1.68–10.76)***; for all HCWs, unadjusted unmatched OR, ***11.79 (6.03–22.08)**** • 1–2 PPE items inconsistently used vs. 0 items: ***5.35 (1.79–18.53), 4.85 (1.01–31.86),*** 1.56 (0.28–7.97); for all HCWs, unadjusted unmatched OR, ***3.40 (1.81–6.36)**** • ≥3 PPE items inconsistently used vs. 0 items: ***7.84 (2.30–34.83), 10.83 (2.29–102.60), 3.40 (1.38–9.23)***; for all HCWs, ***unadjusted unmatched OR, 3.96 (2.40–6.52)**** • Inconsistent hand hygiene vs. consistent: 4.83 (0.38–∞), 1.00 (0.02–19.21), ***6.38 (1.64–36.17)*** All HCWs, perceived inadequacy of supply (yes vs. no): • Surgical mask: ***28.00 (4.26–∞)*** • N95 mask: ***5.19 (1.95–16.13)***	Potential recall bias; collinearity in model not addressed

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		• Gown: ***8.44 (2.77–34.37)*** • Gloves: ***29.34 (5.79–∞)*** • Goggles: ***19.81 (4.83–174.55)*** • Cap: ***52.41 (9.08–∞)*** • Any PPE item: ***6.78 (2.86–18.51)*** • 1–2 PPE items identified to be inadequate vs. 0 items (reference): ***3.25 (1.17–9.80)***; 3 items: ***52.24 (7.70–2280.07)*** All HCWs: • SARS infection control training <2 h vs. none (reference): 0.47 (0.18–1.14); ≥2 h: ***0.03 (0.001–0.20)*** • Understood infection controls measures (yes vs. no): ***3.14 (1.35–7.73)*** • Acquired updated information (yes vs. no): 0.27 (0.06–1.04) • High-risk procedures with SARS patients (yes vs. no): 1.22 (0.45–3.14) • Direct contact with SARS patients (yes vs. no): 0.57 (0.28–1.14) • Direct contact with patients in general (yes vs. no): 1.68 (0.07–117.74) • Seconded from another unit (yes vs. no): 0.60 (0.29–1.21) • Social contact with SARS patients (yes vs. no): 0.59 (0.28–1.19) • Frequency of touching N95 mask most of the time/always vs. never/occasional: 1.32 (0.63–2.74) • General problems with mask (yes vs. no): 0.66 (0.34–1.27) • Problems with mask fit (yes vs. no): 1.00 (0.51–1.95) • Problems with fogging of goggles (yes vs. no): 0.61 (0.31–1.17) • Overall problems in general compliance (yes vs. no): 0.58 (0.25–1.33) • Number of problems (inconsistent use of ≥1 PPE item with contact with SARS-1 patient, patients in general, or no patient contact; infection control training <2 h, not understanding infection control procedures, at least 1 PPE item perceived to be in inadequate supply, or inconsistent hand hygiene with no direct patient), 1 vs. 0 (reference): ***8.47 (1.37–∞);*** 2: ***17.78 (2.67–∞);*** ≥3: ***44.15 (7.02–∞)*** **Adjusted matched OR (95% CI) for SARS-1 (factors included in forward stepwise model)** • Perceived inadequacy of PPE vs. no perceived inadequacy: ***4.27 (1.66–12.54)*** • SARS infections control training <2 h or no training vs. ≥2 h: ***13.6 (1.24–27.50)*** • Inconsistent use of >1 type of PPE when having direct contact with SARS patients: ***5.06 (1.91–598.92)***	
Liu et al, 2009 (89)	51 HCW cases with SARS-1 and 426 controls	Unadjusted OR (95% CI) for SARS-1 (yes vs. no)* • 12-layer cotton surgical mask: 0.50 (0.23–1.10)	Potential recall bias;

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations

Case–control
 	
China (Beijing); single hospital; cases diagnosed between 5 March and 17 May 2003
	• Mean age, 29.5 y (cases)
	• 68.6% female (cases)
	• 31.4% medical staff, 49.0% nursing staff, 19.6% other occupation
		• 16-layer cotton surgical mask: ***0.27 (0.14–0.51)***
		• N95 mask: 0.52 (0.12–2.24)
		• Disposable mask: 1.12 (0.55–2.27)
		• Glasses: ***0.43 (0.23–0.81)***
		• Multiple layers of protective clothes: ***0.44 (0.20–0.99)***
		• Gloves: ***0.16 (0.05–0.57)***
		• Goggles: 0.54 (0.29–1.00)
		• Performing nose wash: ***0.28 (0.13–0.60)***
		• Taking training: ***0.24 (0.12–0.48)***
		• N95 vs. 12– or 16–layer cotton surgical mask: 1.05 (0.24–4.66)
		• N95 vs. disposable mask: 0.49 (0.10–2.35)
		• Disposable vs. 12- or 16-layer cotton surgical mask: 2.13 (1.00–4.54)
		
		Incidence of SARS-1 (yes vs. no)
		• Contact:
		  o Nursing: 10.6% vs. 10.8%, *P* = 0.96
		  o Physical contact: 11.3% vs. 10.3%, *P* = 0.75
		  o Injection: 10.8% vs. 11.4%, *P* = 0.82
		  o Intubation: ***50.0% vs. 9.7%, P < 0.001***
		  o Chest compression: ***33.3% vs. 11.1%, P = 0.02***
		  o Respiratory secretion: ***18.3% vs. 9.0%, P = 0.004***
		  o Sputum: ***18.0% vs. 8.2%, P = 0.004***
		  o Feces: 12.7% vs. 10.1%, *P* = 0.45
		  o Urine: 11.8% vs. 10.4%, *P* = 0.66
		  o Pulmonary lavage: 0% vs. 11.9%, *P* = 1.0
		  o Equipment: 13.0% vs. 10.6%, *P* = 0.83
		  o Pathologic specimens: ***37.5% vs. 10.2%, P = 0.04***
		  o Deceased: ***27.8% vs. 10.0%, P = 0.04***
		  o Medical waste: 11.5% vs. 10.4%, *P* = 0.75
		• Emergency care experience***: 21.1% vs. 8.4%, P = 0.001***
		• 1 layer of masks: ***27.3% vs. 14.8%; P = 0.002*** for number of layers
		• Multiple layers of masks: 7.0% vs. 14.8%
		• Taking prophylactic medication: ***8.6% vs. 20.2%, P = 0.003***
		• No change in sleeping hours per day: 11.3% vs. 11.4%, *P* = 0.12 for total numbers of sleeping hours
		• Increase in sleeping hours per day: 7.7% vs. 11.4%
		
		Adjusted OR (95% CI) for SARS-1 (factors included in forward stepwise model)
			controls not matched, other than meeting WHO criteria for close contact with SARS patient

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		• 16-layer cotton surgical mask (no vs. yes): ***6.04 (2.43–15.00)*** • 12-layer cotton surgical mask (no vs. yes): ***4.54 (1.62–12.74)*** • Emergency care experience (yes vs. no): ***2.97 (1.26–6.96)*** • Nose wash (no vs. yes): 2.41 (0.98–5.93) • Respiratory secretion contact (yes vs. no): ***3.27 (1.41–7.57)*** • Not taking prophylactic medicine vs. taking: ***2.77 (1.10–6.98)*** • Not taking training vs. taking: ***2.40 (1.08–5.31)*** • Multiple layers of masks (no vs. yes): ***2.44 (1.03–5.77)*** • Contact: chest compression (yes vs. no): ***4.52 (1.08–18.81)*** • Contact with sputum was excluded from the model owing to a high correlation with respiratory secretions; 12-layer and 16-layer surgical mask, intubation and chest compression, respiratory secretion and sputum, pathologic specimens and deceased, contact date and taking training, nose wash and taking training, and glasses and goggles highly correlated	

Ma et al, 2004 (90)
 	
Case–control
 	
China (Beijing); 5 hospitals; 2003 (exact dates not reported)
	47 HCW cases and 426 controls
	• Mean age, 29 y (cases)
	• 70% female
	• Physicians, nurses, care givers and custodians and other medical personnel (numbers not provided)
		Unadjusted OR (95% CI) for SARS-1
		• HCW role: caregiver/custodian vs. other role (reference): 1.29 (0.27–5.86)
		  o Nurse: 0.49 (0.19–1.29)
		  o Physician: ***0.32 (0.11–0.95)***
		• Time in current position <1 y vs. ≥1 y: ***3.08 (1.52–6.19)***
		• Participation in emergency rescue vs. not: ***3.10 (1.56–6.16)***
		• Eye goggles vs. no goggles: ***0.24 (0.10–0.55)***
		• Exposure to secretions vs. not: ***3.98 (2.00–7.92)***
		• Mask use vs. no mask: ***0.24 (0.09–0.64)***
		• Mask type: disposable vs. ≤12-layer (reference): ***0.13 (0.05–0.34)***
		  o >16-layer: ***0.06 (0.03–0.15)***
		  o N95 and respirator: ***0.00 (0.00–0.33)***
		• Gowns vs. no gowns: ***0.03 (0.01–0.08)***
		• 1 gown layer vs. no gown (reference): ***0.03 (0.01–0.09)***; 2 layers: ***0.03 (0.01–0.12)***; 3 layers: ***0.02 (0.00–0.07)***; 4 layers: ***0.04 (0.01–0.19)***
		• Gloves vs. no gloves: ***0.43 (0.22–0.85)***
		• Eye cover vs. no eye cover: ***0.28 (0.14–0.57)***
		• Prophylactic medicine (yes vs. no): ***0.31 (0.15–0.65)***
		• Use of disinfectant for hands (yes vs. no): ***0.40 (0.19–0.81)***
		• Handwashing (yes vs. no): 0.53 (0.26–1.06)
		• Nasal cleaning (yes vs. no): ***0.27 (0.11–0.62)***
		• Training (yes vs. no): ***0.18 (0.09–0.36)***
		• Accumulated contact days: ***0.83 (0.80–0.86)***
		• Average number of patients contacted each day: ***0.73 (0.66–0.80)***
			Potential recall bias; controls were exposed to SARS-1 patients but otherwise not matched; collinearity in model not addressed

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		• Average hours working in the isolation room each day: ***0.73 (0.68–0.78)***; maximum hours: ***0.79 (0.75–0.83)*** • Average hours working in the contaminated area each day, ***0.67 (0.61–0.72)***; maximum hours, ***0.76 (0.71–0.80)*** • Average hours working in the semicontaminated area each day, ***0.63 (0.55–0.71)***; maximum hours, ***0.70 (0.63–0.77)*** • Number of supervised beds: ***0.84 (0.80–0.88)*** • Caring everyday life and contact with patients' secretions vs. medical exam, radiological exam, transferring infected patients, contact with dead body (reference): ***3.22 (1.29–8.24)*** o Transfusion: 1.06 (0.21–4.57) o Intubation, tracheotomy, airway management, chest compressions: ***6.22 (2.19–18.05)*** o ICU and special care: 2.59 (0.61–10.31) Adjusted OR (95% CI) for SARS-1 (factors in forward stepwise model) • Goggles vs. no goggles: ***0.27 (0.10 to 0.73)*** • Exposure to secretions vs not: ***4.70 (1.84–11.97)*** • Gowns vs. no gowns: ***0.02 (0.01–0.04)*** • Time in current position <1 y vs. ≥1 y: ***4.22 (1.67–10.66)*** • Daily care with and contact with patients' secretions: ***3.02 (1.23–7.46)*** • Type of mask (≤12 layers of cotton vs. others): ***76.68 (16.74–351.31)***	
Nishiura et al, 2005 (91) Case–control Vietnam (Hanoi); single hospital; 26 February–28 April 2003	29 HCW cases with SARS-1 and 98 controls • 57% aged 29–39 y; 33% 30–39 y; 43% 40–50 y • 60% female • 13% doctor, 26% nurse, 54% other HCW, 33% relative of patient	Unadjusted OR (95% CI) for SARS-1 • Female vs. male: ***3.3 (1.2–9.0)*** • Age: o 29 y: 0.9 (0.3–2.3) o 30–39 y: 0.4 (0.2–1.1) o 40–49 y: ***2.8 (1.2–6.6)*** o 50 y: 0.7 (0.1–3.2) • Occupation: o Doctor: 0.8 (0.2–2.9) o Nurse: ***3.2 (1.3–7.7)*** o Other HCW: 2.2 (0.9–5.2) • Relative of patient: ***<0.1 (0.0–0.4)*** *Period 1 (26 February–4 March) and period 2 (5–10 March)* • All precautionary measures (yes vs. no): ***0.2 (0.0–1.0)*** and ***<0.1 (0.0–0.3)*** • Handwashing before (yes vs. no): 1.0 (0.4–2.3) and not calculated (100% in cases)	Potential recall bias; controls not matched; 42% of controls were non-HCW relatives of patients

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		• Handwashing after (yes vs. no): 1.1 (0.5–2.8) and not calculated (100% in cases) • Mask vs. no mask: ***0.3 (0.1–0.7)*** and ***0.1 (0.0 to 0.3)*** • Gloves vs. no gloves: 0.7 (0.3–1.9) and not calculated (100% in cases) • Gowns vs. no gowns: ***0.2 (0.0–0.8)*** and not calculated (100% in controls)	
Pei et al, 2006 (92) Case–control China; 3 hospitals; April–June 2004	147 HCW cases with SARS-1 and 296 controls • Mean age, 32 y (cases) • 81.6% female (cases) • 25.9% doctor, 51.7% nurse, 4.1% nursing staff, 3.4% worker, 11.6% technician, 1.4% administrator, 2.0% other (cases)	Unadjusted OR (95% CI) for SARS-1 • SARS-1 education before treating SARS-1 patients (yes vs. no): ***0.38 (0.17–0.80)*** • SARS-1 preventive training (yes vs. no): ***0.07 (0.03–0.13)*** • Isolated areas in SARS-1 wards (yes vs. no): ***0.25 (0.16–0.40)*** Working areas didn't overlap (yes vs. no): ***0.24 (0.15–0.40)*** • Endotracheal intubation (yes vs. no): ***9.06 (4.12–19.92)*** • Participating in care of critical care patients (yes vs. no): ***1.72 (1.11–2.65)*** • Avoiding face to face contact with patients (yes vs. no): ***0.29 (0.13–0.64)*** • Keeping a certain distance from SARS-1 patients (yes vs. no): ***0.45 (0.28–0.73)*** • 1-layer disposable suit vs. no suit (reference): ***0.23 (0.12–0.42)***; at least double layer: ***0.03 (0.01–0.10)*** • General cotton mask vs. no mask (reference): ***0.48 (0.25–0.95)***; double 12-layer cotton mask: ***0.13 (0.05–0.30)*** • 1-layer plastic gloves vs. no gloves (reference): ***0.11 (0.04–0.27)***; one layer latex medical gloves: ***0.08 (0.04–0.19)***; at least double layer latex medical gloves: ***0.07 (0.03–0.16)*** • Face screen or goggles (yes vs. no): ***0.50 (0.27–0.75)*** • Changing PPE <4 h (yes vs. no): ***0.50 (0.31–0.82)*** • Isolating medical staff's offices from SARS-1 wards (yes vs. no): ***0.57 (0.38–0.87)*** • Using ventilator in the office (yes vs. no): ***0.18 (0.11–0.31)*** • Well-ventilated office (yes vs. no): ***0.11 (0.06–0.22)*** • No-touch hand washing equipment (yes vs. no): ***0.11 (0.02–0.45)*** • Gargling (yes vs. no): 0.47 (0.22–1.01) • Interferon-alfa for prophylaxis (yes vs. no): ***0.19 (0.06–0.65)*** • History of diabetes (yes vs. no): ***3.04 (2.65–3.47)*** Adjusted OR (95% CI) for SARS-1 (factors included in multivariate model) • Endotracheal intubation vs. no intubation: ***30.79 (7.91–119.84)*** • At least double-layer disposable suit when caring for SARS patients vs. no suit: ***0.05 (0.007–0.39)*** • 1-layer plastic gloves vs. no gloves: ***0.10 (0.02–0.42)*** • 1-layer latex gloves vs. no gloves: ***0.10 (0.03–0.42)*** • Hand-sanitizing with iodine (yes vs. no): 0.23 (0.04–1.32) • Well-ventilated office (yes vs. no): 0.32 (0.09–1.15)	Potential recall bias; controls were exposed to SARS-1 patients but otherwise not matched; collinearity in model not addressed

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Reynolds et al, 2006 (93) Case–control Vietnam (Hanoi); single hospital; contact with infected patient occurred between 26 February and 5 March 2003	36 HCW cases with SARS-1 and 157 controls (nested analysis based on 22 cases and 45 controls) • Mean age, and sex and not reported • 19.4% physician, 38.9% nurse, 11.1% midwife, 5.6% other clinical staff, 16.7% sanitation/kitchen, 5.6% other nonclinical staff	Unadjusted OR (95% CI) for SARS-1 • Touched index patient: 2.8 (0.9–8.5) • Talked to or touched index patient without mask: 1.9 (0.6–5.9) • Came within 1 m of index patient: ***9.3 (2.8–30.9)*** • Came within 1 m of index patient without mask: ***5.4 (1.8–16.3)*** • Spoke with index patient: ***3.5 (1.2–10.4)*** • Entered patient room: ***20.0 (4.1–97.1)*** • Spoke with index patient in his room: ***3.7 (1.1–12.6)*** • Saw (viewed) index patient: ***14.0 (3.6–55.3)*** Visited patient room when patient was not there: ***3.7 (1.3–10.9)*** • Touched visibly contaminated surface: ***7.8 (2.3–25.9)*** • Entered general ward: ***8.0 (1.7–38.4)*** • Upper respiratory infection within prior 6 months: ***0.2 (0.04–0.9)*** • "Other" clinical job: ***0.2 (0.03–0.7)*** • Direct patient care activities: 2.0 (0.7–5.6) • Sanitation/kitchen job: 2.2 (0.7–7.0)	Potential recall bias; controls were exposed to SARS-1 patients but otherwise not matched; potential selection bias for nested analysis
Seto et al, 2003 (94) Case–control Hong Kong; 5 hospitals; dates not reported	13 HCW cases and 241 controls • Age not reported • 69% female (cases) • 15% doctor, 46% nurse, 31% health care assistant, 8% domestic staff (cases)	SARS-1 cases by mask type • Paper mask: 7.1% (2/28) • Surgical mask: 0% (0/51) • N95: 0% (0/92) Adjusted OR (95% CI) for SARS-1; based on response of “yes” or “most of the time” • Mask use vs. non-use: ***0.08 (0.02–0.33)*** Unadjusted OR (95% CI) for SARS-1; based on response of “yes” or “most of the time” • Paper mask use vs. nonuse: 0.50 (0.10–2.42)* • Surgical mask use vs. nonuse: 0.06 (0.004–1.06)* • N95 mask use vs. nonuse: ***0.003 (0.002–0.59)**** • Glove use vs. non-use: 0.5 (0.14–1.7) • Gown use vs. non-use: OR not calculated, ***use 0% in cases vs. 34% in controls, P = 0.006*** • Hand-washing vs. no handwashing: 0.2 (0.05–1) • All infection control measures vs. not all measures: OR not calculated, all measures ***0% in cases vs. 29% in controls, P = 0.02***	Potential recall bias; no control for confounding; controls not matched other than exposure to patients with SARS; laboratory confirmation of cases not reported
Teleman et al, 2004 (95) Case–control	36 HCW cases with SARS-1 and 50 controls • 63.9% aged <30 y (cases)	Unadjusted OR (95% CI) for SARS-1 • Female vs. male: 6.1 (0.7–57.3) • Chinese vs. non-Chinese: 2.4 (1.0–5.9) • Age <30 vs. ≥30 y: 1.4 (0.3–1.7)	Potential recall bias; controls not matched other than exposure to patients with

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Singapore; 1 hospital; 1–22 March 2003	• 88.9% female (cases) • 72% doctor or nurse; 28% other HCW	• Comorbid condition (yes vs. no): 0.9 (0.3–3.2) • Vaccination in previous 5 y (yes vs. no): 1.03 (0.4–2.7) • Doctor or nurse vs. other HCWs: 0.7 (0.3–1.9) • Distance to source of infection < 1 meter vs. ≥1 meter: 0.9 (0.2–3.6) • Duration of exposure ≥60 min vs. <60 min: 0.7 (0.3–1.6) • Wearing N95 mask vs. not wearing: ***0.1 (0.03–0.4)*** • Wearing gloves vs. not wearing: 0.5 (0.2–1.2) • Wearing gowns vs. not wearing: 0.5 (0.1–1.4) • Touched patients (yes vs. no): 1.0 (0.4–3.0) • Touched patients' personal belongings (yes vs. no): 0.6 (0.2–1.7) • Contact with respiratory secretions (yes vs. no): ***6.9 (1.4–34.6)*** • Performed venipuncture (yes vs. no): 0.8 (0.3–2.4) • Performed/assisted in intubation (yes vs. no): 1.5 (0.4–5.4) • Performed suction of body fluids (yes vs. no): 1.01 (0.4–2.8) • Administered oxygen (yes vs. no): 1.0 (0.3–2.8) • Hand washing after each patient (yes vs. no): ***0.06 (0.007–0.5)*** Adjusted OR (95% CI) for SARS-1 (factors with *P* < 0.20 in univariate analysis included) • Male vs. female: 2.9 (0.2–34.0) • Chinese vs. non–Chinese: 2.0 (0.7–6.1) • Wearing N95 mask vs. not wearing: ***0.1 (0.02–0.9)*** • Wearing gloves vs. not wearing: 1.5 (0.3–7.2) • Wearing gowns vs. not wearing: 0.5 (0.4–6.9) • Hand washing after each patient (yes vs. no): ***0.07 (0.008–0.7)*** • Contact with respiratory secretions (yes vs. no): ***21.8 (1.7–274.8)***	probable SARS; collinearity in model not addressed
Yen et al, 2011 (96) Case–control Taiwan; 50 hospitals; 25 February–5 July 2003	50 hospitals • Cases: 19 hospitals with at least 1 case of SARS-1 in HCWs • Controls: 31 hospitals with no cases	Unadjusted OR (95% CI for effectiveness (defined as the last nosocomial SARS-1 infection in the hospital occurred before the date of implementation of the measure* • Triage for patients with fever of unknown origin in ED: ***0.10 (0.02–0.43)*** • Set up fever ED station outside ED: ***0.04 (0.01–0.22)*** • Body temperature screening in main entrance: ***0.02 (0.00–0.40)*** • Body temperature screening for patients: ***0.05 (0.01–0.41)*** • Body temperature screening for HCWs: ***0.05 (0.01–0.41)*** • Separation of fever patients within physical barrier isolated region in ED: 0.26 (0.06–1.08) • Moving patient into a special designated centralized isolation ward or evaluate patients within a general ward: ***0.04 (0.01–0.18)*** • Separate elevators and routes for patients and HCWs: ***0.09 (0.02–0.33)***	No control for severity of outbreak across hospital; unit of analysis is hospitals rather than HCWs; highly correlated risk factors dropped from model but correlated risk factors not reported

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		• Installation of physical barriers between zones of risk for isolation ward: ***0.07 (0.01–0.38)*** • Installation of handwashing station in ED: 0.53 (0.14–2.00) • Disinfectant solution available at main entrance (of hospital): ***0.04 (0.004–0.33)*** • Set up handwashing facilities around whole hospital: ***0.20 (0.06–0.69)*** • Set up alcohol dispensers at checkpoints for glove-on hand rubbing between zones of risk: ***0.01 (0.001–0.11)*** • Set up standardized negative pressure isolation room in hospital: ***0.17 (0.05–0.63)*** • Set up simplified negative pressure isolation room within hospital: ***0.29 (0.09–0.93)*** • Wearing N95 mask in ED: 0.35 (0.11–1.13) • Wearing N95 mask within zones of risk: ***0.02 (0.001–0.39)*** • Mask worn when entering hospital: ***0.02 (0.001–0.40)*** • Wearing surgical mask in outpatient department: ***0.09 (0.01–0.88)*** • Wearing surgical mask in ward: ***0.09 (0.01–0.88)*** • Established crisis response team: ***0.02 (0.001–0.40)*** • Exclude visitors from hospital: ***0.11 (0.03–0.41)*** • Support from administration for infection control practitioner: ***0.11 (0.03–0.41)*** • Support from administration for infectious diseases specialist or physician: ***0.09 (0.02–0.52)*** • Support from superintendent/directors for infection control: ***0.08 (0.01–0.42)*** Adjusted OR (95% CI) for effectiveness (defined as the last nosocomial SARS-1 infection occurred before the date of implementation of the measure) (factors included in forward stepwise model) • Set up fever screen station outside of ED: ***0.05 (0.004–0.69)*** • Set up alcohol dispensers at checkpoint for glove-on hand rubbing between zones of risk: ***0.04 (0.003–0.63)***	
Yin et al, 2004 (97) Case–control China (Guangdong); 10 hospitals; April to May 2003	77 HCW cases and 180 controls • 54% aged 18–29 y; 38% aged 30–39 y (cases) • 77% female (cases) • 38% physician, 62% nurse (cases)	Unadjusted OR (95% CI) for SARS-1 • Use of mask vs. no mask: ***0.08 (0.01–0.43)*** • ≥12-layer mask vs. no mask: ***0.07 (0.01–0.34)*** • Disposable mask vs. no mask: 0.22 (0.02–1.29) • Disposable mask vs. ≥12 layer mask: ***3.39 (1.72–6.67)**** • Use of goggles vs. no goggles: ***0.10 (0.05–0.20)*** • Protection of nasal and eye mucosa: ***0.13 (0.02–0.97)*** • Use of shoe cover vs. no shoe cover: ***0.18 (0.10–0.35)*** • Use of gown vs. no gown: ***0.22 (0.12–0.39)*** • Use of gloves vs. no gloves: ***0.30 (0.17–0.53)*** • Mouth washing vs. no mouth washing: ***0.35 (0.13–0.93)***	Potential recall bias; controls were exposed to SARS-1 patients but otherwise not matched; collinearity in model not addressed

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		• Showering and changing after work (before going home) vs. not: ***0.37 (0.19–0.72)*** • Check facial mask: ***0.42 (0.23–0.78)*** • Take oseltamivir phosphate vs. not: ***0.43 (0.24–0.78)*** • Food/drink/smoking in patient area (no vs. yes): ***0.43 (0.24–0.77)*** • Disinfection and wash hands (yes vs. no): ***0.49 (0.28–0.85)*** • Use of nose clip vs. no nose clip: ***0.70 (0.38–1.31)*** • Preventive measures recommended by Ministry of Health adopted 1 vs. 0 (reference): 0.62 (0.20–1.96); 2: 0.63 (0.19–1.99); 3: 0.33 (0.09–1.18); 4: ***0.23 (0.07–0.74)***; 5: ***0.07 (0.02–0.27)***; 6: ***0.02 (0.00–0.15)*** • WHO guide adopted (yes vs. no): ***0.00 (0.00–0.08)*** Adjusted OR (95% CI) for SARS-1 (factors in forward stepwise model) • Use of mask (12 layers or better) vs. no mask: ***0.78 (0.60–0.99)*** • Use of goggles: ***0.20 (0.10–0.41)*** • Use of shoe cover: ***0.58 (0.39–0.86)*** *Dose–response relationship present for mask, gown, gloves, goggles, shoe cover, gargle, use of eye and nose drops, and showering and changing after work. Attack rate in HCWs without any protection was 61.5% (16/26).*	

Chen et al, 2005 (65)
 	
Cross-sectional
 	
China (Guangzhou); 3 hospitals; May 2003
	1856 HCWs (1135 worked with SARS patients)
	• Mean age, 30.8 y
	• 71.6% female
	• 30.7% doctor, 48.3% nurse, 5.5% health attendant, 4.0% laboratory technician, 11.5% other
	• 8.3% (95/1147) seropositive for SARS-CoV-1
		Prevalence of SARS-CoV-1 seropositivity among HCWs who worked with SARS patients
		• Age
		  o <26 y: 12.4% (44/355)
		  o 26–30 y: 5.5% (17/310)
		  o 31–35 y: 6.6% (14/211)
		  o 36–40: y 7.6% (9/118)
		  o >40 y: 7.8% (11/141)
		• Male: 4.7% (15/306)
		• Female: 9.7% (80/743)
		• Department SARS ward: 3.2% (13/409)
		• ED/fever clinic: 2.1% (4/188)
		• Infectious disease department: 15.2% (19/125)
		• Respiratory diseases department: 36.0% (36/100)
		• ICU: 12.7% (7/55)
		• Radiography: 3.5% (2/57)
		• Laboratory: 0% (0/66)
		• Others (internal medicine, surgery, logistic service): 9.5% (14/147)
		• Job title:
			No control for confounding; 16% of HCWs with SARS-CoV IgG did not have symptoms of SARS

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		o Doctor: 6.2% (24/388) o Nurse: 10.2% (52/510) o Health attendant: 13.2% (12/91) o Technician in laboratory: 0% (0/66) o Others: 7.6% (7/92)	

APACHE = Acute Physiology and Chronic Health Evaluation; CoV = coronavirus; COVID-19 = coronavirus disease 2019; CPR = cardiopulmonary resuscitation; ECG = electrocardiogram; ED = emergency department; ELISA = enzyme-linked immunosorbent assay; HCW = health care worker; IIFT = indirect immunofluorescence test; MERS = Middle East respiratory syndrome; MICU = medical intensive care unit; OR = odds ratio; RR = relative risk; PCR = polymerase chain reaction; PPE = personal protective equipment; SARS = severe acute respiratory syndrome; WHO = World Health Organization.

* Unadjusted OR calculated based on available data.

† Comparison was reversed.

Supplement Table 5. Results of individual studies, risk factors for MERS-CoV infection in HCWs

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Alraddadi et al, 2016 (68) Retrospective cohort Saudi Arabia; 1 hospital; May 2014 to June 2014	283 HCWs • Mean age, 40 y (cases) • 64.4% female • 55% nurse, 16% physician, 12% respiratory therapist, 6.8% radiology technicians, 9.2% other (MICU and EDU HCWs) • 7.0% (20/283) seropositive for MERS-CoV	Incidence of MERS-CoV seropositivity in HCWs • MICU: 11.7% (15/128) • ED: 4.1% (5/122) • Neurology unit: 0% (0/33) • Radiology technician (MICU and ED): 29.4% (5/17) • Nurses (MICU and ED): 9.4% (13/138) • Respiratory therapist (MICU and ED): 3.2% (1/31) • Physicians (MICU and ED): 2.4% (1/41) • Patient transport or clerical staff (MICU and ED): 0% (0/21) Mortality: 0% (0/20) Mechanical ventilation: 15% (3/20) Hospital admission without mechanical ventilation: 10% (2/20) RR (95% CI) for MERS-CoV seropositivity, present vs. absent • Comorbidity: 1.67 (0.70–3.96) o Diabetes mellitus: 1.89 0.60–5.95) • Exposure to MERS-CoV patient: 1.38 (0.20–9.72) • Taking vital signs: 0.92 (0.39–2.20); providing medication: 1.05 (0.44–2.49); placing urinary catheter: 0.67 (0.20–2.21); bathing: 1.14 (0.47–2.77); feeding: 1.02 (0.40–2.56); lifting, positioning: 1.99 (0.74–5.33); emptying bedpan: 1.57 (0.66–3.73); changing linen: 1.45 (0.61–3.47); providing injection: 1.54 (0.65–3.63); placing intravascular device: 2.30 (0.98–5.41); performing hemodialysis: 0.59 (0.14–2.46); taking medical history: 0.59 (0.23–1.50); performing physical exam: 0.54 (0.23–1.27); drawing blood: 1.21 (0.51–2.90); collecting respiratory laboratory specimens: 0.92 (0.39–2.17); performing radiograph: 1.99 (0.84–4.70); processing clinical specimen: 1.72 (0.54–5.45); visiting in the hospital: 0.79 (0.29–2.10) • Present for procedures listed below: 1.42 (0.43–4.66) o Manipulation of oxygen face mask or tubing: 0.92 (0.37–2.33) o Airway suction: 0.67 (0.29–1.60) o Noninvasive ventilation: 1.02 (0.43–2.41) o Manual ventilation: 0.53 (0.20–1.42) o Nebulizer treatments: 1.05 (0.45–2.50) o Intubation: 0.66 (0.27–1.63) o Cardiopulmonary resuscitation: 0.73 (0.29–1.84) o High-frequency oscillatory ventilation: 0.60 (0.08–4.25) o Chest tube insertion or removal: 0% vs. 9.3%, $P = 0.23$ o Insertion of nasogastric tube: 0.89 (0.34–2.38) o Insertion of peripheral line: 0.93 (0.39–2.21)	Potential recall bias

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		o Insertion of central venous line: 0.62 (0.22–1.81) o Chest physiotherapy: 0.67 (0.20–2.21) o Tracheostomy care: 1.10 (0.41-2.91) o Bronchoscopy: 0% vs. 8.6%, *P* = 1 o Extubation: 3.06 (0.53–17.67) o Any aerosol-generating procedure: 1.13 (0.39–3.27) • Direct contact with blood, body fluid, or excretion of MERS-CoV patient: 0.66 (0.25–1.77) o Blood: 0.86 (0.30–2.48) o Sputum: 0.88 (0.31–2.54) o Urine: 1.37 (0.43–4.39) o Feces: 1.12 (0.35–3.64) o Other fluids: 1.50 (0.23–9.89) • Smoking: 1.82 (0.77–4.29) • Currently smokes tobacco: 0.88 (0.31–2.54) • Smoked tobacco in the past: ***3.08 (1.12–7.99)*** • Respiratory pathogen infection control training: ***0.32 (0.12–0.85)*** • MERS-CoV infection control training: ***0.35 (0.14–0.85)*** • Same room or <2 m of any hospitalized patients with pneumonia or respiratory illness: 1.16 (0.28–4.80) RR (95% CI) for MERS-CoV seropositivity, always vs. sometimes/never • Gloves: 9.1% cases vs. 0% controls, RR not calculated • Gown: 0.89 (0.36–2.21) • Eye protection, direct contact: 0.21 (0.03–1.51) • Eye protection, aerosol-generating procedure: 0.44 (0.13–1.51) • Medical mask or N95 respirator, direct contact: 0.69 (0.28–1.69) o Medical mask: 2.06 (0.86–4.95) o N95: 0.44 (0.17–1.12) • Medical mask or N95 respirator, aerosol generating procedure: ***0.32 (0.12–0.86)*** o Medical mask: 0.59 (0.20–1.71) o N95: 0.45 (0.16–1.29) Adjusted RR (95% CI) for MERS-CoV seropositivity (factors included in backward stepwise model) • N95 use always vs. sometimes or never: 0.44 (0.15–1.24) (medical mask almost always worn in sometimes or never group) • Past or current smoking vs. none: 2.51 (0.92–6.87) • Participation in MERS-CoV training: ***0.33 (0.12–0.90)***	

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
		Factors not included in model: Glove use, gown use, eye protection, time spent in MERS patient room, handling of MERS patient bedding, equipment, or fluids, or number of MERS patients cared for	
Kim et al, 2016 (12) Retrospective cohort South Korea; 1 hospital; May 26, 2015 **Added for June 1, 2020 update**	9 HCWs within 3 to 6 feet of MERS patients in ED, without goggles or gloves • 56% <30 y, 22% 30-39 y, 22% 40-49 y • 56% female • 33% physician, 44% nurse, 11% nurse assistant, 11% security guard 11.1% (1/11) positive for MERS	OR (95% CI) for MERS Mask (N95 respirator or surgical mask) vs. no mask: 0.07 (0.002-2.56)*	Potential recall bias; no control for confounders; small sample size and 1 case
Kim C. et al, 2016 (70) Retrospective cohort South Korea; 31 hospitals; dates not reported	737 HCWs with direct contact with MERS patient • Mean age, 33 y • 78% female • 19% physician; 69% nurse; 12% other • 0.27% (2/737) positive for MERS-CoV (ELISA and confirmatory IIFT); 2.0% (15/737) MERS cases excluded	Incidence of MERS-CoV seropositivity (ELISA and confirmatory IIFT); MERS cases excluded • Exposure without appropriate PPE vs. never: 0.7% (2/294) vs. 0% (0/443), *P* = 0.16 • Exposure without powered air-purifying respirator during aerosolizing procedure vs. never: 0.8% (1/122) vs. 0.2% (1/615), *P* = 0.30	Potential for recall bias; MERS cases excluded; only 2 cases
Park et al, 2016 (24) Retrospective cohort South Korea; 1 hospital; May to June 2015	40 HCWs with exposure to MERS patient • Mean age, sex, HCW role/position not reported 12.5% (5/40) with confirmed (1/40) or probable (4/40) MERS-CoV infection	OR (95% CI) for MERS-CoV infection (criteria not reported) • Saw (viewed) index case (yes vs. no): 5.85 (0.30-114.66) • Entered index case's room (yes vs. no): 13.00 (0.67-252.99) • Outpatient clinic area (yes vs. no): 0.35 (0.02-6.97) • Contact only with specimen (yes vs. no): 1.22 (0.05-28.93) • Surgical mask during contact (yes vs. no): 0.14 (0.01-1.43) • Gloves during contact (yes vs. no): 0.78 (0.03-18.75) • Touched index case (yes vs. no): 0.96 (0.13-6.95) • Touched fomite (yes vs. no): 1.38 (0.19-9.83) • Distance from index case <2 m (yes vs. no): 1.88 (0.08-42.07) • Talked with index case (yes vs. no): 3.08 (0.30-31.98)	Published as conference abstract only; potential recall bias; no control for confounders; criteria for confirmed or probable MERS-CoV infection not reported

Study, Year (Reference) Study Design Setting and Study Dates	Population Characteristics	Outcomes	Limitations
Added for June 1, 2020 update		• Taking temperature (yes vs. no): 2.33 (0.32-16.82) • Checking blood pressure (yes vs. no): 0.57 (0.05-6.08) • Venipuncture or venous access (yes vs. no): 0.71 (0.07-7.66) • Intravenous infusion by IV line (yes vs. no): 0.39 (0.04-4.06) • Cleaning the bedding (yes vs. no): 0.39 (0.02-8.50) • Index case coughing during contact (yes vs. no): ***24.20 (1.18-496.41)*** • Hand washing after contact (yes vs. no): 1.38 (0.19-9.83) Cases vs. non-cases • Maximal contact number per day: 2.2 vs. 1.9, P=0.49 • Contact days: 2.0 vs. 2.3, P=0.47 • Total number of contact: 4.4 vs. 4.5, P=0.94 • Longest exposure time, minutes: 3.2 vs. 5.8, P=0.50 Total exposure time, minutes: 9.6 vs. 12.8 P=0.56	

APACHE = Acute Physiology and Chronic Health Evaluation; CoV = coronavirus; COVID-19 = coronavirus disease 2019; CPR = cardiopulmonary resuscitation; ECG = electrocardiogram; ED = emergency department; ELISA = enzyme-linked immunosorbent assay; HCW = health care worker; IIFT = indirect immunofluorescence test; MERS = Middle East respiratory syndrome; MICU = medical intensive care unit; OR = odds ratio; RR = relative risk; PCR = polymerase chain reaction; PPE = personal protective equipment; SARS = severe acute respiratory syndrome; WHO = World Health Organization.

* Unadjusted OR calculated based on available data.

Supplement Table 6. Demographic characteristics and HCW role or position and risk for infection with SARS-CoV-2, SARS-CoV-1, or MERS-CoV in HCWs

Study, Year (Reference)	Age	Sex	Physician	Nurse	Other HCW Role
SARS-CoV-2					
Bai et al, 2020 (2) **Added for June 1, 2020 update**	Mean age: 36.6 y in cases vs. 30.5 in non-cases, ***P=0.006***	Female vs. male: OR, 0.78 (0.23-2.64)	--	Nurse vs. physician: OR, 0.65 (0.18-2.34)	--
Lai et al, 2020 (14) **Added for June 1, 2020 update**	Age <45 y vs. ≥45 y: OR, 0.32 (0.21-0.48)	Female vs. male: OR, 0.91 (0.60-1.39)	--	Nurse vs. physician: OR, 1.16 (0.73-1.84)	Health care assistant vs. physician: OR, 0.59 (0.33-1.04)
Lombardi et al, 2020 (17) **Added for June 1, 2020 update**	<30 y: 11.7% (29/248) 30-39 y: 8.8% (34/387) 40-49 y: 8.0% (26/326) 50-59 y: 7.9% (35/444) ≥60 y: 8.3% (14/168)	Female vs. male: OR, 0.83 (0.58-1.18)	Physician (including residents): 10.6% (62/582)	Nurse/midwife: 8.2% (43/522) Nurse vs. physician: OR, 0.75 (0.50-1.13)	Healthcare assistant: 8.0% (13/162) Health technician: 9.4% (16/170) Clerical worker, technician: 2.9% (4/137)
Mutambudzi et al, 2020 (22) **Added for June 1, 2020 update**	--	--	--	--	Healthcare professionals: 0.7% (12/1,779) Medical support staff: 0.8% (10/1,286) Health associate professionals: 0.7% (54/7,653)
Shields et al, 2020 (28)	--	Female vs. male: OR, 1.55 (0.94-2.54)	--	--	--
von Freyburg et al, 2020 (33) **Added for June 1, 2020 update**	--	--	3.8% (8/208)	9.7% (40/413) Nurse vs. physician: OR, 2.68 (1.23-5.84)	4.5% (2/44)
Wang X. et al, 2020 (50) **Added for June 1, 2020 update**	--	--	--	Nurse vs. physician: OR, 0.04 (0.005-0.31)	--
SARS-CoV-1					

Study, Year (Reference)	Age	Sex	Physician	Nurse	Other HCW Role
Chang et al, 2004 (51)	Adjusted OR, 0.97 (95% CI, 0.90–1.03)	–	6.1% (2/33)	3.2% (3/95) Nurse vs. physician: OR, 0.51 (0.08-3.17)†	Ambulance drivers: 16.7% (1/6) Sanitation workers: 15.4% (2/13) Clerks: 6.3% (1/16) Administrative personnel: 0% (0/24) Radiology technician: 0% (0/17)
Chen et al, 2005 (65)	<26 y: 12.4% (44/355) 26–30 y: 5.5% (17/310) 31–35 y: 6.6% (14/211) 36–40 y: 7.6% (9/118) >40 y: 7.8% (11/141)	Male: 4.7% (15/306) Female: 9.7% (80/743)	6.2% (24/388)	10.2% (52/510) Nurse vs. physician: ***OR, 1.72 (1.04-2.85)***†	Laboratory technician: 0% (0/66)
Fowler et al, 2004 (52)	–	–	16.7% (3/18)	7.6% (5/66) Nurse vs. physician: OR, 0.41 (0.09-1.91)†	Respiratory therapist: 11.1% (2/18)
Ho et al, 2003 (53)	–	–	5.1% (7/138)	3.8% (19/500) Nurse vs. physician: OR, 0.74 (0.30-1.80)†	Health care assistant: 7.9% (10/126) Cleaner: 1.9% (3/158) Clerical staff: 0.8% (1/131)
Ip et al, 2004 (55)	–	–	2.4% (2/85)	11.6% (38/328) Nurse vs. physician: OR, 5.44 (1.28-23.01)†	Allied health: 0.9% (1/114) Health care/general service assistants: 11.8% (12/102) Ancillary: 0% (0/113) Other: 0% (0/12)
Lau et al, 2004 (57)	–	–	–	1.07% (SD 1.38)	Nonmedical support staff: 2.34% (SD 3.43) Other technical and medical staff: 0.32% (SD 0.49);
Li et al, 2003 (58)	–	–	2.88%	4.78%	Nursing assistant: 6.67% Other hospital staff: 0%
Ma et al, 2004 (90)	–	–	Physician vs. other HCW (not physician, nurse or caregiver/custodian): ***OR, 0.32 (95% CI, 0.11–0.95)****	Nurse vs. other HCW (not physician, nurse, or caregiver/custodian): OR, 0.49 (95% CI, 0.19–1.29)*	–

Study, Year (Reference)	Age	Sex	Physician	Nurse	Other HCW Role
Nishiura et al, 2005 (91)	29 y: OR, 0.9 (95% CI, 0.3–2.3) 30–39 y: OR, 0.4 (95% CI, 0.2–1.1) 40–49 y: ***OR, 2.8 (95% CI, 1.2–6.6)*** 50 y: OR, 0.7 (95% CI, 0.1–3.2)	Female vs. male: ***OR, 3.3 (95% CI, 1.2–9.0)***	OR, 0.8 (95% CI, 0.2–2.9)	***OR, 3.2 (95% CI, 1.3–7.7)***	–
Nishiyama et al, 2008 (60)	–	–	Physician vs. other staff: ***adjusted OR, 40.9 (95% CI, 2.65–630)***	Nurse vs. other staff: ***adjusted OR, 57.3 (95% CI, 5.28–621)***	–
Raboud et al, 2010 (61)	Not in model	Not in model	5.2% (4/77)	3.9% (11/283) Nurse vs. physician: OR 0.74 (0.22-2.39)†	Medical resident/intern: 12.5% (2/16) Personal services assistant: 3.8% (1/25) Paramedic/EMT: 100% (3/3) Radiology technician 1.5% (1/67) Respiratory therapist: 4.5% (4/89)
Teleman et al, 2004 (95)	OR, 1.4 (95% CI, 0.3–1.7)*	Male vs. female: adjusted OR, 2.9 (95% CI, 0.2–34.0)	–	–	–
Wang et al, 2007 (63)	–	Female vs. male: RR, 1.10 (95% CI, 0.14–8.74)	–	Nurse vs. physician: RR, 1.21 (95% CI, 0.15–9.61)	–
Wilder-Smith et al, 2005 (85)	Mean age: 29.2 y in cases vs. 33.7 y in controls, ***P = 0.04***	Female vs. male: OR, 0.47 (95% CI, 0.10–2.07)	–	–	–
MERS-CoV					
Alraddadi et al, 2016 (68)	--	--	MICU and ED: 2.4% (1/41)†	MICU and ED: 9.4% (13/138) Nurse vs. physician (MICU and ED): OR, 4.16 (0.53-32.80)†	Radiology technician (MICU and ED): 29.4% (5/17) Respiratory therapist (MICU and ED): 3.2% (1/31) Patient transport or clerical staff (MICU and ED): 0% (0/21)†

Abbreviations: EMT = emergency medical technician; HCW = health care worker; OR = odds ratio; RR = relative risk.

* Variable not included in a multivariate model.
† Data updated for June 1, 2020 update

Supplement Table 7. Exposure history and risk for infection with SARS-CoV-2, SARS-CoV-1, or MERS-CoV in HCWs

Author, Year (Reference)	Intubation	Directness of Contact	Oxygen Administration and Related Exposures	Number or Duration of Contacts and Proximity to Patient	Other Exposures
SARS-CoV-2					
Bai et al, 2020 (2) **Added for June 1, 2020 update**	--	Contact with index case (yes or no): ***OR, 0.27 (0.08-0.94)*** Air contact vs. no contact: OR, 0.32 (0.07-1.50) Direct contact vs. no contact: OR, 0.22 (0.05-1.03) Air or direct contact vs. no contacts: OR, 0.31 (0.03-3.01)	--	Contact frequency (median, contacts/day): 3.0 in cases vs. 5.0 in non-cases, P=0.95 Contact duration (median, minutes/contact): 4.0 in cases vs. 4.0 in non-cases, P=0.54 In same department as index case: OR, 62.70 (3.60-1092.46)	--
Heinzerling et al, 2020 (8) **Added for June 1, 2020 update**	--	Direct skin-to-skin contact with index patient: 0.45 (0.02-9.52)	--	Estimated time in patient room (median, minutes): 120 vs. 25, P=0.06 Estimated time in patient room during aerosol generating procedures (median, minutes): 95 vs. 0, P=0.13 Longest single duration of time in room (reference <2 minutes): 2 to 30 minutes: ***32.00 (1.96-522.78)*** • 31 to 60 minutes: 1.86 (0.07-46.97) • >60 minutes: 8.00 (0.59-130.70) Within 6 feet of index patient: 1.03 (0.05-23.49)	Taking vital sign (yes vs. no): OR, 7.71 (0.61-97.85) Taking medical history (yes vs. no): OR, 1.93 (0.15-24.46) Performing physical examination: ***OR, 21.82 (1.02-466.52)*** Taking vital sign, taking medical history, providing medication, bathing or cleaning patient, lifting or positioning patient, emptying bedpan, changing linens, cleaning patient room, peripheral line insertion, central line insertion, drawing arterial blood bas, drawing blood: No statistically significant associations

Author, Year (Reference)	Intubation	Directness of Contact	Oxygen Administration and Related Exposures	Number or Duration of Contacts and Proximity to Patient	Other Exposures
Ran et al, 2020 (40)	Endotracheal tube removal: RR, 0.63 (0.06-7.08)	--	--	--	CPR: RR, 0.63 (0.06-7.08) Fiberoptic bronchoscopy: RR, 0.63 (0.06-7.08) Sputum suction: RR, 0.43 (0.12-1.55)
SARS-CoV-1					
Chen et al, 2009 (87)	Performing endotracheal intubation vs. not: adjusted ***OR, 2.76 (95% CI, 1.16–6.53)***	Avoiding face to face contact (reference never) Sometimes: adjusted OR, 0.67 (95% CI, 0.36–1.24) Often: ***adjusted OR, 0.30 (95% CI, 0.10–0.90)*** Every time: ***adjusted OR, 0.30 (95% CI, 0.15–0.60)***	–	–	Caring for "super spreading" patient vs. not: adjusted ***OR, 3.57 (95% CI, 1.94-6.57)*** Performing tracheostomy (yes vs. no): ***OR, 4.15 (95% CI, 1.50-11.50)****
Fowler et al, 2004 (52)	Any involvement in intubation vs. no involvement: ***adjusted OR, 13.29 (95% CI, 2.99–59.04)***	–	Patient treated with noninvasive positive-pressure vs. conventional ventilation: adjusted OR, 2.33 (95% CI, 0.25–21.76) Patient treated with high-frequency oscillatory vs. conventional ventilation: adjusted OR, 0.74 (95% CI, 0.11–4.92)	–	–
Ho et al, 2004 (54)	–	Exposure only vs. direct contact: RR 2.40 (95% CI, 0.64–9.00)	–	–	–
Lau et al, 2004 (88)	–	Direct contact with SARS-1 patients (yes vs. no): OR, 0.57 (95% CI, 0.28–1.14)*	–	–	–

Author, Year (Reference)	Intubation	Directness of Contact	Oxygen Administration and Related Exposures	Number or Duration of Contacts and Proximity to Patient	Other Exposures
Liu et al, 2009 (89)	Contact: intubation (yes vs. no): ***50.0% vs. 9.7%; P < 0.001****	Contact: physical contact (yes vs. no): 11.3% vs. 10.3%; *P* = 0.75*	–	–	Contact with respiratory secretion vs. no contact: ***adjusted OR, 3.27 (95% CI, 1.41–7.57)*** Chest compression vs. no contact: ***adjusted OR, 4.52 (95% CI, 1.08–18.81)*** Contact with sputum vs. no contact: ***18.0% vs. 8.2%; P = 0.004**** Contact with feces vs. no contact: 12.7% vs. 10.1%; *P* = 0.45* Contact with urine vs. no contact: 11.8% vs. 10.4%; *P* = 0.66*
Loeb et al, 2004 (59)	Intubation (yes vs. no): ***RR, 4.20 (95% CI, 1.58–11.14)*** Suctioning before intubation (yes vs. no): ***RR, 4.20 (95% CI, 1.58–11.14)*** Suctioning after intubation (yes vs. no): RR, 0.68 (0.21-2.26)	–	Manipulation of oxygen mask (yes vs. no): RR, 9.00 (95% CI, 1.00–64.89) Nebulizer treatment (yes vs. no): ***RR, 3.24 (95% CI, 1.11–9.42)*** Manual ventilation (yes vs. no): RR, 1.19 (95% CI, 0.30–4.65) Manipulation of BiPAP mask (yes vs. no): RR, 2.60 (95% CI, 0.8–7.99)	Entered patient room (yes vs. no): OR, 7.98 (0.42-150.49)	Performing ECG (yes vs. no): RR, 1.67 (95% CI, 0.51–5.46) Endotracheal aspirate (yes vs. no): RR, 1.00 (95% CI, 0.29–3.45) Bronchoscopy: RR, 2.14 (95% CI, 0.46–9.90)
Ma et al, 2004 (90)	–	–	–	Accumulated contact days: ***OR, 0.83 (95% CI, 0.80–0.86)****	Exposure to secretions vs not: ***adjusted OR,***

Author, Year (Reference)	Intubation	Directness of Contact	Oxygen Administration and Related Exposures	Number or Duration of Contacts and Proximity to Patient	Other Exposures
				Average number of patients contacted each day: ***OR, 0.73 (95% CI, 0.66–0.80)**** Average hours working in the isolation room each day: ***OR, 0.73 (95% CI, 0.68–0.78)****; maximum hours: ***OR, 0.79 (95% CI, 0.75–0.83)**** Average hours working in the contaminated area each day: ***OR, 0.67 (95% CI, 0.61–0.72)****; maximum hours: ***OR, 0.76 (95% CI, 0.71–0.80)****	***4.70 (95% CI, 1.84–11.97)*** Daily care with and contact with patients' secretions: ***adjusted OR, 3.02 (95% CI, 1.23–7.46)***
Nishiyama et al, 2008 (60)	–	Indirect contact with SARS patient vs. direct contact: adjusted OR, 6.06 (95% CI, 0.63–58.7)	–	–	–
Pei et al, 2006 (92)	Endotracheal intubation vs. no intubation: ***adjusted OR, 30.79 (95% CI, 7.91–119.84)***	Avoiding face to face contact with patients (yes vs. no): ***adjusted OR, 0.29 (95% CI, 0.13–0.64)****	–	Keeping a certain distance from patients with SARS-1 (yes vs. no): ***OR, 0.45 (95% CI, 0.28–0.73)****	–
Raboud et al, 2010 (61)	Present during intubation (yes vs. no): ***Adjusted OR, 2.79 (95% CI, 1.40–5.58)***	–	Noninvasive ventilation (yes vs. no): ***OR, 3.15 (95% CI, 1.39–7.15)**** High-flow oxygen (yes vs. no): OR, 0.39 (95% CI, 0.09–1.66)*	Number of times entering patient's room, based on number of shifts with exposure (reference, >10 times)* • 1–2 times: OR, 0.67 (0.28–1.63) • 3–5 times: OR, 0.69 (0.39–1.23)	Eye/mucous membranes exposed to body fluids: ***adjusted OR, 7.34 (95% CI, 2.19–24.52)*** Present during ECG: ***adjusted OR, 3.52 (95% CI, 1.58–7.86)***

Author, Year (Reference)	Intubation	Directness of Contact	Oxygen Administration and Related Exposures	Number or Duration of Contacts and Proximity to Patient	Other Exposures
			Mechanical ventilation (yes vs. no): OR, 0.87 (95% CI, 0.38–1.97)* Nebulizer treatment (yes vs. no): OR, 1.17 (95% CI, 0.07–20.66)* Manipulation of oxygen mask (yes vs. no): OR, 2.15 (95% CI, 0.94-4.89)* Present during manual ventilation or not, before intubation: ***OR, 2.84 (95% CI, 1.25-6.42)****; after intubation: OR 1.27 (95% CI, 0.50-3.24)*	• 6–10 times: OR, 0.41 (0.14–1.20) Duration of face-to-face contact with patient, based on number of shifts with exposure (reference, >4 h)* • <1 min: OR, 0.83 (0.11–6.27) • 1–10 min: OR, 0.98 (0.26–3.71) • 11–30 min: OR, 1.33 (0.20–8.88) • 31-60 min: OR, 2.73 (0.33–22.5) 1-4 h: OR, 2.37 (0.41–13.6)	Present during suctioning or not, before intubation: OR, 1.71 (95% CI, 0.70–4.17)*; after intubation: OR, 1.79 (95% CI, 0.79–4.02)* Cardiac compressions (yes vs. no): OR, 2.95 (95% CI, 0.36–24.50)* Sputum sample collection (yes vs. no): OR, 2.68 (95% CI, 0.88–8.17)* Not statistically significant in univariate analyses: Other patient care activities
Reynolds et al, 2006 (93)	–	Touched index patient: OR, 2.8 (95% CI, 0.9–8.5) Spoke with index patient in his room: ***OR, 3.7 (95% CI, 1.1–12.6)***	–	Came within 1 meter of index patient: ***OR, 9.3 (95% CI, 2.8–30.9)*** Entered patient room: ***OR, 20.0 (95% CI, 4.1–97.1)*** Visited patient room when patient was not there: ***OR, 3.7 (95% CI, 1.3–10.9)***	Touched visibly contaminated surface: ***OR, 7.8 (95% CI, 2.3–25.9)*** Entered general ward: ***OR, 8.0 (95% CI, 1.7–38.4)*** Saw (viewed) index patient: ***OR, 14.0 (95% CI, 3.6–55.3)***
Scales et al, 2003 (62)	–	–	–	Contact duration: • ≤10 min: 0% (0/11) • 11–30 min: 12.5% (1/8) • 31 min–4 h: 25% (2/8) ≥4 h: 75% (3/4)	–

Author, Year (Reference)	Intubation	Directness of Contact	Oxygen Administration and Related Exposures	Number or Duration of Contacts and Proximity to Patient	Other Exposures
Teleman et al, 2004 (95)	Performed/assisted in intubation (yes vs. no): OR, 1.5 (95% CI, 0.4–5.4)*	Touched patients (yes vs. no): OR, 1.0 (95% CI, 0.4–3.0)*	Administered oxygen (yes vs. no): OR, 1.01 (95% CI, 0.4–2.8)*	Distance to source infection <1 m vs. ≥1 m: OR, 0.9 (95% CI, 0.2–3.6)* Duration of exposure ≥60 min vs. <60 min: OR, 0.7 (95% CI, 0.3–1.6)*	Contact with respiratory secretions: ***adjusted OR, 21.8 (1.7–274.8)*** Touched patients' personal belongings (yes vs. no): OR, 0.6 (95% CI, 0.2–1.7)* Performed suction of body fluids (yes vs. no): OR, 1.01 (95% CI, 0.4–2.8)*
Wilder-Smith et al, 2005 (85)	–	–	–	Close contact with SARS-1 patient (yes or no): OR, 1.11 (95% CI, 0.23–5.26)	–
Wong et al, 2004 (64)	–	–	–	Definitely visited patient's cubicle vs. did not: RR 7.4 (95% CI, 1.0–53.5); association between distance from patient and likelihood of infection	–
MERS-CoV					
Alraddadi B et al, 2016 (68)	Present for intubation (yes vs. no): RR, 0.66 (0.27-1.63)*	Exposure to MERS-CoV patient (yes vs. no): RR, 1.38 (0.20-9.72)* Same room or <2 m of any hospitalized patients with pneumonia or respiratory illness (yes vs. no): RR, 1.16 (0.28-4.80)*	Present for manipulation of oxygen face mask or tubing (yes vs. no): RR, 0.92 (0.37-2.33)* Present for airway suction (yes vs. no): RR, 0.67 (0.29-1.60)* Present for noninvasive ventilation (yes vs. no): RR, 1.02 (0.43-2.41)* Present for manual ventilation (yes vs. no): RR, 0.53 (0.20-1.42)*	Not statistically significant or included in model: Time spent in MERS patient room, number of MERS patients cared for	Present for cardiopulmonary resuscitation (yes vs. no): RR, 0.73 (0.29-1.84) Not statistically significant or included in model: Other patient care activities, handling of MERS patient bedding, equipment or fluids

Author, Year (Reference)	Intubation	Directness of Contact	Oxygen Administration and Related Exposures	Number or Duration of Contacts and Proximity to Patient	Other Exposures
			Present for nebulizer traetments (yes vs. no): RR, 1.05 (0.45-2.50)* Present for high-frequency oscillatory ventilation (yes vs. no): RR, 0.60 (0.08-4.25)*		
Park et al, 2016(24) **Added for June 1, 2020 update**	--	Touched index case (yes vs. no): OR, 0.96 (0.13-6.95) Distance from index case <2 m (yes vs. no): OR, 1.88 (0.08-42.07) Saw (viewed) index case (yes vs. no): OR, 5.85 (0.30-114.66)	--	Entered index case's room (yes vs. no): OR, 13.00 (0.67-252.99) Maximal contact number per day: 2.2 vs. 1.9, P=0.49 Contact days: 2.0 vs. 2.3, P=0.47 Total number of contacts: 4.4 vs. 4.5, P=0.94 Longest exposure time, minutes: 3.2 vs. 5.8, P=0.50 Total exposure time, minutes: 9.6 vs. 12.8, P=0.56	Contact only with specimen (yes vs. no): OR, 1.22 (0.05-28.93) Talked with index case (yes vs. no): OR, 3.08 (0.30-31.98) Taking temperature (yes vs. no): OR, 2.33 (0.32-16.82) Checking blood pressure (yes vs. no): OR, 0.57 (0.05-6.08) Venipuncture or venous access (yes vs. no): OR, 0.71 (0.07-7.66) Intravenous infusion by IV line (yes vs. no): OR, 0.39 (0.04-4.06) Cleaning the bedding (yes vs. no): OR, 0.39 (0.02-8.50)

Author, Year (Reference)	Intubation	Directness of Contact	Oxygen Administration and Related Exposures	Number or Duration of Contacts and Proximity to Patient	Other Exposures
					Index case coughing during contact (yes vs. no): ***OR, 24.20 (1.18-496.41)***

Abbreviations: BiPAP = bilevel positive airway pressure; CPR = cardiopulmonary resuscitation; ECG = electrocardiography; HCW = health care worker; OR = odds ratio; RR = relative risk; SARS = severe acute respiratory syndrome.

* Variable not included in a multivariate model.

Supplement Table 8. Education or training, environmental and physical factors, and infection control policies and risk for infection with SARS-CoV-2, SARS-CoV-1, or MERS-CoV in HCWs

Study, Year (Reference)	Education or Training on Infection Control	Ventilation or Negative Pressure Isolation Room	Environment and Physical Layout	Infection Control Policies
SARS-CoV-2				
No studies				
SARS-CoV-1				
Chen et al, 2009 (87)	Special training for SARS-1 (no vs. yes): ***OR, 2.44 (95% CI, 1.41–4.23)****	Air ventilation method in offices and SARS wards (reference, artificial central ventilation): Natural ventilation: ***adjusted OR, 0.40 (95% CI, 0.18–0.88)*** Natural ventilation and additional electronic exhaust fan: ***adjusted OR, 0.27 (95% CI, 0.16–0.63)***	Type of equipment for washing hands: Nonautomatic vs. automatic tap (reference): ***OR, 4.18 (95% CI, 1.66–10.51)**** Others: OR, 1.09 (95% CI, 0.12–9.74)*	–
Lau, 2004 (88)	SARS infection control training <2 h or no training vs. ≥2 h: ***adjusted OR, 13.6 (95% CI, 1.24–27.50)***	–	–	–
Liu et al, 2009 (89)	Not taking training vs. taking training: ***adjusted OR, 2.40 (95% CI, 1.08–5.31)***	–	–	–
Ma et al, 2004 (90)	Training (yes vs. no): ***OR, 0.18 (95% CI, 0.09–0.36)****	–	–	–
Nishiyama et al, 2008 (60)	No attendance at lecture on nosocomial infection vs. attendance: adjusted OR, 5.49 (95% CI, 0.90–33.4)	–	–	–
Pei et al, 2006 (92)	SARS-1 education before treating SARS-1 patients (yes vs. no): ***OR, 0.38 (95% CI, 0.17–0.80)**** SARS-1 preventive training (yes vs. no): ***OR, 0.07 (95% CI, 0.03–0.13)****	Using ventilator in the office (yes vs. no): ***OR, 0.18 (95% CI, 0.11–0.31)**** Well-ventilated office (yes vs. no): adjusted OR, 0.32 (95% CI, 0.09–1.15)	No touch hand washing equipment (yes vs. no): ***OR, 0.11 (95% CI, 0.02–0.45)**** Isolating medical staff's offices from SARS-1 wards (yes vs. no): ***OR, 0.57 (95% CI, 0.38–0.87)**** Isolated areas in SARS-1 wards (yes vs. no): ***OR, 0.25 (95% CI, 0.16–0.40)**** Working areas didn't overlap (yes vs. no): ***OR, 0.24 (95% CI, 0.15–0.40)****	–

Study, Year (Reference)	Education or Training on Infection Control	Ventilation or Negative Pressure Isolation Room	Environment and Physical Layout	Infection Control Policies
Yen et al, 2011 (96)		Set up standardized negative pressure isolation room in hospital: ***OR, 0.17 (95% CI, 0.05-0.63)**** Set up simplified negative pressure isolation room within hospital: ***OR, 0.29 (95% CI, 0.09–0.93)****	Set up fever screen station outside of ED: ***adjusted OR, 0.05 (95% CI, 0.004–0.69)*** Set up alcohol dispensers at checkpoint for glove-on hand rubbing between zones of risk: ***adjusted OR, 0.04 (0.003–0.63)*** Body temperature screening in main entrance: ***OR, 0.02 (95% CI, 0.00-0.40)**** Separation of fever patients within physical barrier isolated region in ED: OR, 0.26 (95% CI, 0.06–1.08)* Installation of handwashing station in ED: OR, 0.53 (95% CI, 0.14–2.00)* Disinfectant solution available at main entrance (of hospital): ***OR, 0.04 (95% CI, 0.004–0.33)**** Set up handwashing facilities around whole hospital: ***OR, 0.20 (95% CI, 0.06–0.69)****	Wearing N95 mask in ED: OR, 0.35 (95% CI, 0.11–1.13)* Wearing N95 mask within zones of risk: ***OR, 0.02 (95% CI, 0.001–0.39)**** Mask worn when entering hospital: ***OR, 0.02 (95% CI, 0.001-0.40)**** Wearing surgical mask in outpatient department: ***OR, 0.09 (95% CI, 0.01–0.88)**** Wearing surgical mask in ward: ***OR, 0.09 (95% CI, 0.01–0.88***)* Established crisis response team: ***OR, 0.02 (95% CI, 0.001–0.40)**** Exclude visitors from hospital: ***OR, 0.11 (95% CI, 0.03–0.41)**** Support from administration for infection control practitioner: ***OR, 0.11 (95% CI, 0.03–0.41)**** Support from administration for infectious diseases specialist or physician: ***OR, 0.09 (95% CI, 0.02–0.52)**** Support from superintendent or directors for infection control: ***OR, 0.08 (95% CI, 0.01–0.42)****
MERS-CoV				
Alraddadi B et al, 2016 (68)	Participation in MERS-CoV training: ***Adjusted RR, 0.33 (0.12-0.90)***	--	--	--

Abbreviations: ED = emergency department; OR = odds ratio; RR = relative risk; SARS = severe acute respiratory syndrome.
* Variable not included in a multivariate model.

Supplement Table 9. Mask use and risk for infection with SARS-CoV-2, SARS-CoV-1, or MERS-CoV in HCWs

Author, Year (Reference)	Mask Use Versus Nonuse	Comparison of Mask Types	Consistency of Mask Use	Multiple Mask Layers Versus Single Layer
SARS-CoV-2				
Heinzerling et al, 2020 (8) **Added for June 1, 2020 update**	--	--	Always facemask (non-N95) during aerosol generating procedures: OR, 0.77 (0.03-20.02) Always facemask (non-N95) during non-aerosol generating procedures: OR, 1.29 (0.05-30.38)	--
Wang et al, 2020 (50) **Added for June 1, 2020 update**	In department with mask use (no vs. yes): ***Adjusted OR, 464.82 (97.73– ∞)***	--	--	--
SARS-CoV-1				
Caputo et al, 2006 (84)	–	N95 or N95 equivalent vs. surgical mask: OR, 0.12 (95% CI, 0.01–1.92)*	–	–
Chen et al, 2009 (87)	–	–	–	Double-layer vs. single-layer cotton masks: ***OR, 0.40 (95% CI, 0.25–0.64)***†
Lau et al, 2004 (88)	–	–	Consistent N95 or surgical mask use vs. inconsistent use: • All HCW: ***matched OR, 0.27 (95% CI, 0.08–0.95)***† • Direct contact with SARS-1 patient: matched OR, 0.50 (95% CI, 0–20) (note: reversed from inconsistent vs. consistent as reported in study, 95% CI, 0.05–∞) • Direct patient contact in general: matched OR, 0.25 (95% CI, 0.004–4.76) • No patient contact: matched OR, 0.41 (0.06–2.44)† Consistent N95 mask use vs. inconsistent†	–

Author, Year (Reference)	Mask Use Versus Nonuse	Comparison of Mask Types	Consistency of Mask Use	Multiple Mask Layers Versus Single Layer
			• All HCWs: ***matched OR, 0.48 (95% CI, 0.25–0.93)***† • Direct contact with SARS-1 patient: matched OR, 0.35 (95% CI, 0.07–1.43)† • Direct patient contact in general: matched OR, 0.78 (95% CI, 0.10–6.25)† • No patient contact: matched OR, 0.55 (95% CI, 0.21–1.39)†	
Liu et al, 2009(89)	• 12-layer cotton surgical mask (yes vs. no): OR, 0.50 (95% CI, 0.23-1.10); ***adjusted 0.22 (95% CI, 0.08–0.62)***† • 16-layer cotton surgical mask (yes vs. no): ***OR, 0.27 (95% CI, 0.14–0.51)***; ***adjusted OR, 0.17 (95% CI, 0.07–0.41)***† • N95 mask (yes vs. no): 0.52 (95% CI, 0.12–2.24); adjusted OR, 0.52 (95% CI, 0.12–2.24) • Disposable mask (yes vs. no): OR, 1.12 (95% CI, 0.55–2.27) *Not in model: disposable mask, glasses, gloves, goggles*	• N95 vs. 12- or 16-layer cotton surgical mask: OR, 1.05 (95% CI, 0.24–4.66) • N95 vs. disposable mask: OR, 0.49 (95% CI, 0.10–2.35) • Disposable vs. 12- or 16-layer cotton surgical mask: OR, 2.13 (95% CI, 1.00–4.54)	–	Multiple layers of masks (yes vs. no): ***adjusted OR, 0.41 (95% CI, 0.17–0.97)***†
Loeb et al, 2004(59)	Surgical mask vs. no mask: RR, 0.45 (95% CI, 0.07–2.71)	N95 vs. surgical mask: RR, 0.50 (95% CI, 0.06–4.23)	• Consistent N95 or surgical mask vs. inconsistent mask: ***RR, 0.23 (95% CI, 0.07–0.78)*** • Consistent N95 vs. inconsistent mask: ***RR, 0.22 (95% CI, 0.05–0.93)***	–

Author, Year (Reference)	Mask Use Versus Nonuse	Comparison of Mask Types	Consistency of Mask Use	Multiple Mask Layers Versus Single Layer
Ma et al, 2004(90)	Mask use vs. no mask: ***OR, 0.24 (95% CI, 0.009–0.64)***	• Disposable vs. ≤12 layer: ***OR, 0.13 (95% CI, 0.05–0.34)*** • >16 layer vs. ≤12 layer : ***OR, 0.06 (95% CI, 0.03–0.15)*** • N95 and respirator vs. ≤12 layer: ***OR, 0.00 (95% CI, 0.00–0.33)*** • ≤12 layer vs. others: ***adjusted OR, 76.68 (95% CI, 16.74–351.31)***	–	–
Nishiura et al, 2005(91)	Mask use vs. no mask: • Period 1 (26 February–4 March 2003): ***OR, 0.3 (95% CI, 0.1–0.7)*** • Period 2 (5–10 March 2003): ***OR, 0.1 (95% CI, 0.0–0.3)***	–	–	–
Nishiyama et al, 2008(60)	Mask use, always vs. no: ***adjusted OR, 0.38 (95% CI, 0.01–0.50)***	–	Sometimes vs. always: adjusted OR, 0.34 (95% CI, 0.09–1.37)†	–
Pei et al, 2006(92)	General cotton mask vs. no mask: ***OR, 0.48 (95% CI, 0.25-0.95)*** Double 12-layer cotton mask vs. no mask: ***OR, 0.13 (95% CI, 0.05–0.30)***	–	–	–
Raboud et al, 2010(61)	Surgical mask in patient room vs. no mask (reference): OR, 3.27 (95% CI, 0.72–14.79) N95 or equivalent: OR, 0.59 (95% CI, 0.17–2.08) Higher protection than N95: OR, 0.25 (95% CI, 0.01–4.98)	N95 or N95 equal vs. surgical mask: ***OR, 0.18 (95% CI, 0.06–0.53)******	–	–

Author, Year (Reference)	Mask Use Versus Nonuse	Comparison of Mask Types	Consistency of Mask Use	Multiple Mask Layers Versus Single Layer
Scales et al, 2003 (62)	Any mask (surgical or N95) vs. no mask: OR, 1.50 (95% CI, 0.25-8.98)	Gown, gloves and N95 vs. gown, gloves and surgical mask: OR, 0.40 (95% CI, 0.03-6.18)	–	–
Seto et al, 2003(94)	Mask use vs. nonuse: OR, ***0.08 (95% CI, 0.02–0.33)***[†] • Paper mask use vs. nonuse: OR 0.50 (95% CI, 0.10–2.42) • Surgical mask use vs. nonuse: OR 0.06 (95% CI, 0.004–1.06) • N95 mask use vs. nonuse: ***OR 0.003 (95% CI, 0.002–0.59)***	Number of cases by mask type: • Paper mask: 7.1% (2/28) Surgical mask: 0% (0/51) N95: 0% (0/92)	–	–
Teleman et al, 2004(95)	Wearing N95 mask vs. not wearing: ***OR, 0.1 (95% CI, 0.03–0.4)***; ***adjusted OR, 0.1 (95% CI, 0.02–0.9)***	–	–	–
Wilder-Smith et al, 2005(85)	Mask use vs. no mask: ***OR, 0.25 (95% CI, 0.09–0.69)******	–	–	–
Yin et al, 2004(97)	Mask vs. no mask: ***OR, 0.08 (95% CI, 0.01–0.43)*** • Disposable mask vs. no mask: OR, 0.22 (95% CI, 0.02–1.29) • ≥12-layer mask vs. no mask: ***OR, 0.07 (95% CI, 0.01–0.34)***; ***adjusted OR, 0.78 (95% CI, 0.60–0.99)***	Disposable mask vs. ≥12 layer mask: ***OR, 3.39 (95% CI, 1.72–6.67)***	–	–
MERS-CoV				

Author, Year (Reference)	Mask Use Versus Nonuse	Comparison of Mask Types	Consistency of Mask Use	Multiple Mask Layers Versus Single Layer
Alraddadi B et al, 2016(68)	--	--	N95 use always vs. sometimes or never: ARR 0.44 (0.15-1.24) Medical mask always vs. sometimes or never • Direct contact: RR 2.06 (0.86-4.95)* • Aerosol generating procedure: RR 0.59 (0.20-1.71)*	--
Kim et al, 2016 (12) **Added for June 1, 2020 update**	N95 respirator or surgical mask vs. no mask: OR, 0.07 (0.002-2.56)	--	--	--
Park et al, 2016 (24) **Added for June 1, 2020 update**	Surgical mask during contact (yes vs. no): OR, 0.14 (0.01-1.43)	--	--	--

Abbreviations: HCW = health care worker; OR = odds ratio; RR = relative risk; SARS = severe acute respiratory syndrome

* Variable not included in a multivariate model.

† Comparison was reversed.

Supplement Table 10. Infection Prevention and Control Factors (Other Than Masks) and Risk for Infection With SARS-CoV-2, SARS-CoV-1, or MERS-CoV in HCWs

Study, Year (Reference)	Gown	Glove	Handwashing	Eye Protection	PPE
SARS-CoV-2					
Heinzerling et al, 2020 (8) **Added for June 1, 2020 update**	--	Always gloves during aerosol generating procedures: 3.10 (0.13-75.19) Always gloves during non-aerosol generating procedures: 4.40 (0.21-91.92)	--	--	--
Ran L et al, 2020 (40) **Added for June 1, 2020 update**	--	--	Unqualified hand washing: RR 2.64 (1.04-6.71) Suboptimal hand-washing before patient contact: RR 3.10 (1.43-6.73) Suboptimal hand-washing after patient contact: RR 2.43 (1.34-4.39)	--	Improper PPE: RR 2.82 (1.11-7.18)
Wang et al, 2020 **Added for June 1, 2020 update**	--	--	--	--	Level 2 protection (cap, N95 or higher, goggles/eye protection, gown, gloves, shoe covers) (yes vs. no): ***OR, 0.03 (0.003-0.19)***†
SARS-CoV-1					
Caputo et al, 2006 (84)	–	Double vs. single layer gloves: ***OR, 0.04 (95% CI, 0.002–0.78)***	–	Goggles vs. no goggles: OR, 0.10 (95% CI, 0.01–1.29) Face shield vs. no face shield: OR, 0.79 (95% CI, 0.07–9.50)	Powered air purifying respirator or Stryker suit vs. no personal protective system: OR, 0.02 (95% CI, 0.01–4.12)
Chen et al, 2009 (87)	Single vs. double gowns: ***OR, 2.12 (95% CI, 1.36–3.31)******	Single vs. double gloves: ***adjusted OR, 4.13 (95% CI, 1.99–8.55)***	Wash hands after caring for SARS-1 patients: • Never vs. every time: OR, 0.89	Face shield in SARS ward: • Never vs. every time: OR, 4.05 (95% CI, 0.54–30.34);*	Shoe cover use: • Never vs. every time: ***OR, 3.80 (95% CI, 2.24–6.45)***;* Sometimes vs. every time: ***OR 5.04 (2.04–12.48)***;*

Study, Year (Reference)	Gown	Glove	Handwashing	Eye Protection	PPE
			(95% CI, 0.52–1.51)* • Sometimes vs. every time: OR, 1.03 (95% CI, 0.38–2.75)* • Often vs. every time: OR, 1.14 (95% CI, 0.64–2.06)*	• Sometimes vs. every time: OR, 0.22 (95% CI, 0.01–3.56)* Goggles while performing operation for SARS-1 patient: • Never vs. every time: ***OR, 7.83 (95% CI, 1.07–57.63)**** • Sometimes vs. every time: OR, 0.84 (95% CI, 0.07–9.45)*	• Often vs. every time: OR 2.29 (95% CI, 0.96–5.67)* Cap worn: • Never vs. every time: ***OR 1.79 (95% CI, 1.03–3.10)**** Sometimes vs. every time: OR 0.48 (0.14–1.67)* • Often vs. every time: OR 0.59 (95% CI, 0.13–2.65)* Wash uncovered skin after caring for SARS-1 patients: • Never vs. every time: ***OR, 3.29 (95% CI, 1.29–8.43)**** Sometimes vs. every time: OR, 2.16 (95% CI, 0.77–6.05)* • Often vs. every time: OR, 1.47 (0.45–4.79)* Wash nasal cavity after caring for SARS-1 patients: • Never vs. every time: OR, 3.21 (95% CI, 0.98–10.53)* • Sometimes vs. every time: OR, 2.51 (95% CI, 0.72–8.77)* • Often vs. every time: OR, 0.82 (95% CI, 0.13–5.13)* Wash oral cavity after caring for SARS-1 patients: • Never vs. every time: OR, ***3.26 (95% CI, 1.15–9.21)**** • Sometimes vs. every time: OR, 2.05 (95% CI, 0.67–6.33)* • Often vs. every time: OR, 0.28 (95% CI, 0.03–2.59)*

Study, Year (Reference)	Gown	Glove	Handwashing	Eye Protection	PPE
Ho et al, 2004 (54)	–	–	–	–	Use of full PPE 100% of the time vs. <100%: RR, 0.19 (95% CI, 0.02–1.49) Protected direct contact vs. unprotected direct contact: RR, 0.16 (95% CI, 0.03–1.02)
Lau et al, 2004 (88)†	Inconsistent gown use vs. consistent use‡: • Direct contact with SARS-1 patient: ***OR, 8.85 (95% CI, 2.46–48.28)*** • Direct patient contact in general: ***OR, 11.54 (95% CI, 2.56–106.36)*** • No patient contact: ***OR, 3.42 (95% CI, 1.38–9.30***)	–	Inconsistent hand hygiene vs. consistent use‡: • Direct contact with SARS-1 patient: ***OR, 4.83 (95% CI, 0.38–∞)*** • Direct patient contact in general: OR, 1.00 (95% CI, 0.02–19.21) • No patient contact: ***OR, 6.38 (95% CI, 1.6–36.17)***	Inconsistent goggles use vs. consistent use‡: • Direct contact with SARS-1 patient: ***OR, 6.41 (95% CI, 2.49–19.49)*** • Direct patient contact in general: ***OR, 6.93 (95% CI, 2.19–28.85)*** • No patient contact: ***OR, 3.50 (95% CI, 1.42–9.47)*** Problems with fogging of goggles (yes vs. no): OR, 0.61 (0.31–1.17)*	Inconsistent use of >1 type of PPE vs. consistent use: ***adjusted OR, 5.06 (95% CI, 1.9–598.92)*** Perceived inadequacy of PPE vs. no perceived inadequacy: ***adjusted OR, 4.27 (95% CI, 1.66–12.54)***
Liu et al, 2009 (89)	Multiple layers of protective clothes (yes vs. no): ***OR, 0.44 (0.20-0.99)******	Gloves (yes vs. no): ***OR, 0.16 (95% CI, 0.5-0.57)******	–	Glasses (yes vs. no): ***OR, 0.43 (95% CI, 0.23-0.81)**** Goggles (yes vs. no): OR, 0.54 (95% CI, 0.29-1.00)*	Nose wash (no vs. yes): adjusted OR, 2.41 (95% CI, 0.98-5.93)
Loeb et al, 2004 (59)	Gown vs. inconsistent gown: RR, 0.36 (95% CI, 0.10-1.24)	Gloves vs. inconsistent gloves: RR, 0.45 (95% CI, 0.14–1.46)	–	–	–

Study, Year (Reference)	Gown	Glove	Handwashing	Eye Protection	PPE
Ma et al, 2004 (90)	Gowns vs. no gowns: ***adjusted OR, 0.02 (95% CI, 0.01-0.04)*** Number of gown layers vs no gown*: • 1 layer: ***OR, 0.03 (95% CI, 0.01–0.09)*** • 2 layers: ***OR, 0.03 (95% CI, 0.01–0.12)*** • 3 layers: ***OR, 0.02 (95% CI, 0.00–0.07)*** • 4 layers: ***OR, 0.04 (95% CI, 0.01–0.19)***	–	Handwashing vs. no handwashing: OR, 0.53 (95% CI, 0.26–1.06)* Hands in disinfectants (yes vs. no): ***OR, 0.40 (95% CI, 0.19–0.81)******	Goggles vs. no goggles: ***adjusted OR, 0.27 (95% CI, 0.10–0.73)***	Nasal cleaning (yes vs. no): OR, 0.53 (95% CI, 0.26–1.06)*
Nishiura et al, 2005 (91) (reported in two periods)	*Period 1 and 2* Gowns vs. no gowns: ***OR, 0.2 (95% CI, 0.0–0.8)*** and not calculated (100% in controls)	*Period 1 and 2* Gloves vs. no gloves: OR, 0.7 (95% CI, 0.3–1.9) and not calculated (100% in cases)	*Period 1 and 2* Handwashing before vs. not: OR, 1.0 (95% CI, 0.4–2.3) and not calculated (100% in cases) Handwashing after vs. not: OR, 1.1 (95% CI, 0.5–2.8) and not calculated (100% in cases)	–	*Period 1 and 2* All precautionary measures vs. not: ***OR, 0.2 (95% CI, 0.0–1.0)*** and ***OR, <0.1 (95% CI, 0.0–0.3)***

Study, Year (Reference)	Gown	Glove	Handwashing	Eye Protection	PPE
Nishiyama et al, 2008 (60)	–	–	Sometimes vs. always before patient contact: adjusted OR, 1.25 (95% CI, 0.25–6.10) No vs. always: adjusted OR, 3.69 (95% CI, 0.56–24.2)	–	–
Pei et al, 2006 (92)	At least double-layer disposable suit when caring for SARS patients vs. no suit: ***adjusted OR, 0.05 (95% CI, 0.007–0.39)***	1-layer plastic gloves vs. no gloves: ***adjusted OR, 0.10 (95% CI, 0.02–0.42)*** 1-layer latex gloves vs. no gloves: ***adjusted OR, 0.10 (95% CI, 0.03–0.42)***	Hand sanitizing with iodine vs. not: adjusted OR, 0.23 (95% CI, 0.04–1.32)	Face shield of goggles (yes vs. no): ***OR, 0.50 (95% CI, 0.27–0.75)****	Gargling (yes vs. no): OR, 0.47 (95% CI, 0.22–1.01)* Changing PPE <4 h (yes vs. no): ***OR, 0.50 (95% CI, 0.31–0.82)****
Raboud et al, 2010 (61)	Always wore gown in patient room (yes vs. no): ***OR, 0.35 (95% CI, 0.14–0.91)****	Always wore gloves in patient room (yes vs. no): OR, 0.59 (95% CI, 0.17–2.06)*	Hand hygiene after removal of face protection vs. no hand hygiene (reference): OR 0.48 (95% CI, 0.19–1.22)* Hand hygiene before removing face protection, with or without hand hygiene after: OR 0.93 (95% CI, 0.29–3.01)*	Always wore goggles in patient room (yes vs. no): ***OR, 0.33 (95% CI, 0.15–0.72)****	Always wore recommended PPE, based on number of shifts with exposure (yes vs. no): OR, 0.70 (0.19–2.58)* PPE removal, based on number of shifts with exposure (yes vs. no): • No hand hygiene described: OR, 0.87 (0.16–6.45)* • Hand hygiene performed once: OR, 0.67 (0.11–3.99)* • Adequate PPE removal: OR, 1.18 (0.20–6.83)*
Seto et al, 2003 (94)	Gown use vs. nonuse: ***0% in cases vs. 34% in controls, P = 0.006***	Glove use vs. nonuse: OR, 0.5 (95% CI, 0.14–1.7)	Hand-washing vs. no handwashing: OR, 0.2 (95% CI, 0.05–1)	–	All PPE measures vs. not all PPE measures: All measures ***0% in cases and 29% in controls, P = 0.02***
Teleman et al, 2004 (95)	Gowns vs. not wearing: OR, 0.5 (95% CI, 0.1-1.4)*	Gloves vs. not wearing: adjusted OR, 1.5 (95% CI, 0.3–7.2)	Hand washing after each patient (yes vs. no): ***adjusted OR, 0.07 (95% CI, 0.008–0.7)***	–	–

Study, Year (Reference)	Gown	Glove	Handwashing	Eye Protection	PPE
Wilder-Smith et al, 2005 (85)	–	Glove use vs. no glove use: ***OR, 0.40 (95% CI, 0.17–0.96)***	Handwashing vs. no handwashing: OR 0.35 (95% CI, 0.11–1.12)	–	–
Yin et al, 2004 (97)	Gown vs. no gown: ***OR, 0.22 (95% CI, 0.12–0.39)****	Gloves vs. no gloves: ***OR, 0.30 (95% CI, 0.17-0.53)****	Disinfect and wash hands (yes vs. no): ***OR, 0.49 (95% CI, 0.2–0.85)****	Use of goggles vs. no use: ***adjusted OR, 0.20 (95% CI, 0.10–0.41)***	Mouth washing vs. no mouth washing: ***OR, 0.35 (95% CI, 0.13–0.93)**** Shower and change after work (before going home) vs. not: ***OR, 0.37 (95% CI, 0.19–0.72)**** Nose clip vs. no nose clip: OR, 0.70 (95% CI, 0.38–1.31)* Protection of nasal and eye mucosa: ***OR, 0.13 (95% CI, 0.02–0.97)**** Shoe cover vs. no shoe cover: ***adjusted OR, 0.58 (95% CI, 0.39–0.86)***
MERS-CoV					
Alraddadi et al, 2016 (68)	Gown always vs. sometimes or never: RR, 0.89 (0.36-2.21)*	Gloves always vs. sometimes or never: 9.1% cases vs. 0% controls*	--	Eye protection always vs. sometimes or never • Direct contact: RR, 0.21 (0.03-1.51)* • Aerosol-generating procedure: RR, 0.44 (0.13-1.51)*	--
Kim et al, 2016 (70) **Added for June 1, 2020 update**	--	--	--	--	Exposure without appropriate PPE vs. never: 0.7% (2/294) vs. 0% (0/443), *P* = 0.16
Park et al, 2016 (24) **Added for June 1, 2020 update**	--	Gloves during contact (yes vs. no): OR, 0.78 (0.03-18.75)	Hand washing after contact (yes vs. no): OR, 1.38 (0.19-9.83)	--	--

Abbreviations: HCW = health care worker; OR = odds ratio; PPE = personal protective equipment; RR = relative risk; SARS = severe acute respiratory syndrome.
* Variable not included in a multivariate model.
† Study reports ORs as matched ORs, except where indicated.

‡ Addressed in model as inconsistent use of >1 type of PPE item of model.

Supplement Table 11. Results of individual studies, household transmission of SARS-CoV-1 from health care workers

Study	Study design	Setting	Population characteristics	Outcomes	Limitations
Chan D et al, 2004 (98)	Retrospective cohort study	Hong Kong; 243 household; February 28 to June 8, 2003	268 SARS-1 cases (169 HCWs) and 622 household contacts • Mean age: 30.8 and 34.7 (infected HCWs, two time periods) • Sex and HCW role/position not reported	Incidence of SARS-1 in households and household contacts • HCW index case with infection related to unprotected exposure (prior to March 12): 9.8% (6/61) and 5.8% (10/171) • HCW index case with infection following implementation of infection control measures: • 0% (0/90) and 0% (0/261) • Non-HCWs index case: 26.1% (24/92) and 19.2% (51/265) • HCWs with infection following implementation of infection control measure vs. HCWs with infection due to unprotected exposure or non-HCWs with infection: p<0.05	No control for confounding; HCW role/position, exposure details, and infection control procedures not described
Goh D et al, 2004 (99)	Prospective cohort study	Singapore; 114 households; February 23 to April 29, 2003	114 SARS-1 cases (72 HCWs) and 417 household contacts • Age and sex of HCW SARS-1 index cases not reported • 13.8% doctor, 51.4% nurse, 5.6% nursing student, 29.2% paramedical staff	Incidence of SARS-1 in households and household contacts • HCW index cases: 5.6% (4/72) and 1.4% (4/277) **Adjusted hazard ratio (95% CI) for SARS-1 transmission to household member** • HCW vs. non-HCW index case: ***0.16 (0.04 to 0.59)***	Potential for residual confounding; risk factors for transmission from HCWs not evaluated
Lau J et al, 2004 (100)	Case-control study	Hong Kong; 881 households; on or before May 16, 2003	881 SARS-1 cases (267 HCWs) and 2,324 household contacts (730 HCW household contacts) • 50.7% 18 to 40 years of age (all cases)	Incidence of SARS-1 in households and household contacts • HCW index case: 3.8% (12/267) and 1.9% (14/730) • Amoy Garden Block E resident index case: 38.9% (14/36) and 24.4% (19/78) • Amoy Garden other Block resident index case: 19.6% (21/107) and 11.0% (28/255) • Other community member index case: 18.3% (86/471) and 9.8% (124/1261)	No control for confounding; risk factors for transmission from HCWs not evaluated

Study	Study design	Setting	Population characteristics	Outcomes	Limitations
			• 54.6% female (all cases) • Role/position of HCWs not reported	**Adjusted odds ratio (95% CI) for SARS-1 transmission to household member (reference HCW index case)** • Amoy Gardens Block E resident index case: ***17.95 (7.35-43.83)*** • Amoy Gardens other Block resident index case: ***5.26 (2.32-11.95)*** • Other community member index case: ***4.01 (2.01-7.98)***	
Wilson-Clark S et al, 2006 (101)	Retrospective cohort study	Canada (Toronto); 74 households; May 25 to October 31, 2003	74 SARS-1 index cases (50 HCWs) and 176 household contacts • Median age 43.5 years (index cases) • 50% female (index cases) • Role/position of HCWs not reported	**Adjusted relative risk (95% CI) for SARS-1 transmission to household member** • HCW index case vs. non-HCW index case: 0.60 (0.22-1.67)	High nonparticipation rate; risk factors for transmission from HCWs not evaluated

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