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EVIDENCE SEARCH REPORT

RESEARCH QUESTION: What proportion of HCW are rt-PCR+ and IgM/IgG (serology)+ (in other settings and various times in the epidemic?	UNIQUE IDENTIFIER: LAB040802v3-01 ESR

REQUESTED RESOURCES:

- medRxiv/bioRxiv
- CDC website/database
- Europe PMC
- Google
- Google Scholar
- Health Canada
- Embase
- Medline
- PubMed
- WHO Global Research on COVID-19
- PHAC COVID-19
- CPG Infobase
- Cochrane Special Collection on COVID19
- Saskatchewan Health Association

LIMITS/EXCLUSIONS/INCLUSIONS:
English, 2020-present

DATE: MAY 22, 2020	
LIBRARIAN: Vicky Duncan, Leslie & Irene Dube Health Sciences Library, University of Saskatchewan Brianna Howell-Spooner, Medical Library, Saskatchewan Health Authority	REQUESTOR: Dr. Bruce Reeder
TEAM: LAB	

CITE AS: Duncan, V; Howell-Spooner, B. What proportion of healthcare workers are rt-PCR positive and IgM or IgG positive? 2020 Jun 2; Document no.: LAB040802v3-01 ESR. In: COVID-19 Rapid Evidence Reviews [Internet]. SK: SK COVID Evidence Support Team, c2020. 22 p. (CEST evidence search report)

LIBRARIAN NOTES/COMMENTS

June 1, 2020

- Updated to include new findings

May 22, 2020

- Updated to include new findings which further our understanding of the question but don't change the conclusion.

April 8, 2020

- I was unsuccessful finding literature that identified what proportion of HCW are rt-PCR+ and IgM/IgG (serology)+. After phone conversations with Bruce Reeder and Jason Vanstone, I switched the focus to the proportion of health care workers that have contracted the virus.

SEARCH RESULTS

To obtain full-text articles email library@saskhealthauthority.ca.

SUMMARIES, GUIDELINES & OTHER RESOURCES

Clinical Evidence

None

Recommendations

None

Grey Literature

May 15, 2020
CBC News

CBC. Nurses, lab workers, physicians among 'alarming' number of health-care workers with COVID-19. [May 15, 2020] https://www.cbc.ca/news/canada/toronto/health-care-workers-covid-19-alarming-rate-1.5568711

CBC. Health-care workers make up 1 in 10 known cases of COVID-19 in Ontario. [Apr 2, 2020] https://www.cbc.ca/news/canada/toronto/health-care-workers-make-up-1-in-10-known-cases-of-covid-19-in-ontario-1.5518456

April 8, 2020
Government of Saskatchewan

Cases and Risk of COVID-19 in Saskatchewan 2020
[Twenty-five (25) cases are healthcare workers (out of 260)].
Available from: https://www.saskatchewan.ca/government/health-care-administration-and-provider-resources/treatment-procedures-and-guidelines/emerging-public-health-issues/2019-novel-coronavirus/cases-and-risk-of-covid-19-in-saskatchewan.

ARTICLES FROM LIBRARY DATABASES

Note: References are sorted by year (newest to oldest)

Medline – May 29, 2020, 2:24am

Journal articles

1. Kluytmans-van den Bergh MFQ, Buiting AGM, Pas SD, et al. Prevalence and Clinical Presentation of Health Care Workers With Symptoms of Coronavirus Disease 2019 in 2 Dutch Hospitals During an Early Phase of the Pandemic. JAMA Network Open. 2020;3(5):e209673.

ABSTRACT: Importance: On February 27, 2020, the first patient with coronavirus disease 2019 (COVID-19) was reported in the Netherlands. During the following weeks, at 2 Dutch teaching hospitals, 9 health care workers (HCWs) received a diagnosis of COVID-19, 8 of whom had no history of travel to China or northern Italy, raising the question of whether undetected community circulation was occurring.
Objective: To determine the prevalence and clinical presentation of COVID-19 among HCWs with self-reported fever or respiratory symptoms.
Design, Setting, and Participants: This cross-sectional study was performed in 2 teaching hospitals in the southern part of the Netherlands in March 2020, during the early phase of the COVID-19 pandemic. Health care workers employed in the participating hospitals who experienced fever or respiratory symptoms were asked to voluntarily participate in a screening for infection with the severe acute respiratory syndrome coronavirus 2. Data analysis was performed in March 2020.
Main Outcomes and Measures: The prevalence of severe acute respiratory syndrome coronavirus 2 infection was determined by semiquantitative real-time reverse transcriptase-polymerase chain reaction on oropharyngeal samples. Structured interviews were conducted to document symptoms for all HCWs with confirmed COVID-19.
Results: Of 9705 HCWs employed (1722 male [18%]), 1353 (14%) reported fever or respiratory symptoms and were tested. Of those, 86 HCWs (6%) were infected with severe acute respiratory syndrome coronavirus 2 (median age, 49 years [range, 22-66 years]; 15 [17%] male), representing 1% of all HCWs employed. Most HCWs experienced mild disease, and only 46 (53%) reported fever. Eighty HCWs (93%) met a case definition of fever and/or coughing and/or shortness of breath. Only 3 (3%) of the HCWs identified through the screening had a history of travel to China or northern Italy, and 3 (3%) reported having been exposed to an inpatient with a known diagnosis of COVID-19 before the onset of symptoms.
Conclusions and Relevance: Within 2 weeks after the first Dutch case was detected, a substantial proportion of HCWs with self-reported fever or respiratory symptoms were infected with severe acute respiratory syndrome coronavirus 2, likely as a result of acquisition of the virus in the community during the early phase of local spread. The high prevalence of mild clinical presentations, frequently not including fever, suggests that the currently recommended case definition for suspected COVID-19 should be used less stringently.
URL: https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2766228

Medline – May 22, 2020, 2:31am

Journal articles

1. Brandstetter S, Roth S, Harner S, et al. Symptoms and immunoglobulin development in hospital staff exposed to a SARS-CoV-2 outbreak. Pediatr Allergy Immunol. 2020;15:15.

ABSTRACT: BACKGROUND: Worldwide, the number of SARS-CoV-2 infections is increasing. Serological immunoglobulin tests may help to better understand the development of immune mechanisms against SARS-CoV-2 in COVID-19 cases and exposed but asymptomatic individuals. The aim of this study was to investigate exposure to SARS-CoV-2, symptoms and antibody responses in a large sample of health care workers following a COVID-19 outbreak.
METHODS: A COVID-19 outbreak among staff members of a major German children's and women's hospital was followed by massive RT-PCR SARS-CoV-2 tests and provided the opportunity to study symptoms, chains of

infection and SARS-CoV-2 specific antibody responses (IgG and IgA) by ELISA. Study participants were classified as COVID-19 cases, and persons with close, moderate or no exposure to SARS-CoV-2 in the clinical setting, respectively.
RESULTS: Out of 201 study participants, 31 were COVID-19 cases. While most study participants experienced many symptoms indicative for SARS-CoV-2 infection, anosmia and coughing were remarkably more frequent in COVID-19 cases. Approximately 80% of COVID-19 cases developed some specific antibody response (IgA and IgG) approximately 3 weeks after onset of symptoms. Subjects in the non COVID-19 groups had also elevated IgG (1.8%) and IgA values (7.6%) irrespective of contact history with cases.
CONCLUSION: We found that a significant number of diseased did not develop relevant antibody responses three weeks after symptom onset. Our data also suggests that exposure to COVID-19 positive co-workers in a hospital setting is not leading to the development of measurable immune responses in a significant proportion of asymptomatic contact-persons.
URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/pai.13278?af=R

Pubmed – May 22, 2020, 5:51am

Journal articles

1. Gao W, Sanna M, Tsai MK, et al. Geo-temporal distribution of 1,688 Chinese healthcare workers infected with COVID-19 in severe conditions—A secondary data analysis. PLoS One. 2020;15(5):e0233255. DOI: 10.1371/journal.pone.0233255
ABSTRACT: Introduction The COVID-19 outbreak is posing an unprecedented challenge to healthcare workers. This study analyzes the geo-temporal effects on disease severity for the 1,688 Chinese healthcare workers infected with COVID-19. Methods Using the descriptive results recently reported by the Chinese CDC, we compare the percentage of infected healthcare workers in severe conditions over time and across three areas in China, and the fatality rate of infected healthcare workers with all the infected individuals in China aged 22–59 years. Results Among the infected Chinese healthcare workers whose symptoms onset appeared during the same ten-day period, the percentage of those in severe conditions decreased significantly from 19.7% (Jan 11–20) to 14.4% (Jan 21–31) to 8.7% (Feb 1–11). Across the country, there was also a significant difference in the disease severity, with Wuhan being the most severe (17.3%), followed by Hubei Province (10.2%), and the rest of China (6.6%). The case fatality rate for the 1,688 infected Chinese healthcare workers was significantly lower than that for the 29,798 infected patients aged 20–59 years—0.3% (5/1,688) vs. 0.65% (193/29,798), respectively. Conclusion The disease severity among infected healthcare workers improved considerably over a short period of time in China. The more severe conditions in Wuhan compared to the rest of the country may be attributable to the draconian lockdown. The clinical outcomes of infected Chinese healthcare workers may represent a more accurate estimation of the severity of COVID-19 for those who have access to quality healthcare.
URL: https://doi.org/10.1371/journal.pone.0233255
DOI: 10.1371/journal.pone.0233255

Medline – May 15, 2020, 3:38am

Journal articles

1. **Korth J, Wilde B, Dolff S, et al. SARS-CoV-2-specific antibody detection in healthcare workers in Germany with direct contact to COVID-19 patients. J Clin Virol. 2020:104437.**
ABSTRACT: Background: The novel coronavirus SARS-CoV-2 is associated with a severe respiratory manifestation, COVID-19, and presents a challenge for healthcare systems worldwide. Healthcare workers are a vulnerable cohort for SARS-CoV-2 infection due to frequent and close contact to patients with COVID-19.
Study design: Serum samples from 316 healthcare workers of the University Hospital Essen, Germany were tested for SARS-CoV-2-IgG antibodies. A questionnaire was used to collect demographic and clinical data. Healthcare workers were grouped depending on the frequency of contact to COVID-19 patients in high-risk-group (n = 244) with daily contact to known or suspected SARS-CoV-2 positive patients, intermediated-risk-group (n = 37) with daily contact to patients without known or suspected SARS-CoV-2 infection at admission and low-risk-group (n = 35) without patient contact.
Results: In 5 of 316 (1.6%) healthcare workers SARS-CoV-2-IgG antibodies could be detected. The seroprevalence was higher in the intermediate-risk-group vs. high-risk-group vs. 2/37 (5.4%) vs. (3/244 (1.2%), p = 0.13). Four of the five subject were tested negative for SARS-CoV-2 via PCR. One (20%) subject was not tested via PCR since he was asymptomatic.
Conclusion: The overall seroprevalence of SARS-CoV-2 in healthcare workers of a tertiary hospital in Germany is low (1.6%). The data indicate that the local hygiene standard might be effective.
URL: https://www.sciencedirect.com/science/article/pii/S1386653220301797?via%3Dihub

2. **Treibel TA, Manisty C, Burton M, et al. COVID-19: PCR screening of asymptomatic health-care workers at London hospital. Lancet. 2020;08:08.**
The exponential growth in coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) across the UK has been successfully reversed by social distancing and lockdown.[1] RNA testing for prevalent infection is a key part of the exit strategy, but the role of testing for asymptomatic infection remains unclear.[2] Understanding the determinants of asymptomatic or pauci-symptomatic infection will provide new opportunities for personalised risk stratification and reveal much-needed correlates of protective immunity, whether induced by vaccination or natural exposure.
URL: https://www-sciencedirect-com.shal.idm.oclc.org/science/article/pii/S0140673620311004?via%3Dihub

Medline – May 8, 2020, 2:51am

Journal articles

1. **Clemency BM, Varughese R, Scheafer DK, et al. Symptom Criteria for COVID-19 Testing of Heath Care Workers. Acad Emerg Med. 2020;12:12.**
ABSTRACT: BACKGROUND: Limitations on testing availability has been a challenge during the COVID-19 pandemic. An evidence based symptom criteria for identifying heath care workers (HCW) for testing, based on the probability of positive COVID-19 test results, would allow for a more appropriate use of testing resources.
METHODS: This was an observational study of outpatient COVID-19 testing of HCW. Prior to testing, HCW were asked about the presence of 10 symptoms. Their responses were then compared to their subsequent pharyngeal swab COVID-19 Polymerase Chain Reaction test results. These data were used to derive and evaluate a symptom based testing criteria.

RESULTS: 961 HCW were included in the analysis, of which 225 (23%) had positive test results. Loss of taste or smell was the symptom with the largest positive likelihood ratio (3.33). Dry cough, regardless of the presence or absence of other symptoms, was the most sensitive (74%) and the least specific (32%) symptom. The existing testing criteria consisting of any combination of one or more of three symptoms (fever, shortness of breath, dry cough) was 93% sensitive and 9% specific (AUC = 0.63, 95% CI: 0.59 - 0.67). The derived testing criteria consisting of any combination of one or more of two symptoms (fever, loss of taste or smell) was 89% sensitive and 48% specific (AUC = 0.75, 95% CI: 0.71 - 0.78). The hybrid testing criteria consisting of any combination of one or more of four symptoms (fever, shortness of breath, dry cough, loss of taste or smell) was 98% sensitive and 8% specific (AUC = 0.77, 95% CI: 0.73 - 0.80).

CONCLUSION: An evidence based approach to COVID-19 testing which at least includes fever and loss of taste or smell should be utilized when determining which HCW should be tested.

URL: https://onlinelibrary.wiley.com/doi/pdfdirect/10.1111/acem.14009.

2. **Rivett L, Sridhar S, Sparkes D, et al. Screening of healthcare workers for SARS-CoV-2 highlights the role of asymptomatic carriage in COVID-19 transmission. eLife. 2020;9:11.**

ABSTRACT: Significant differences exist in the availability of healthcare worker (HCW) SARS-CoV-2 testing between countries, and existing programmes focus on screening symptomatic rather than asymptomatic staff. Over a 3-week period (April 2020), 1,032 asymptomatic HCWs were screened for SARS-CoV-2 in a large UK teaching hospital. Symptomatic staff and symptomatic household contacts were additionally tested. Real-time RT-PCR was used to detect viral RNA from a throat+nose self-swab. 3% of HCWs in the asymptomatic screening group tested positive for SARS-CoV-2. 17/30 (57%) were truly asymptomatic/pauci-symptomatic. 12/30 (40%) had experienced symptoms compatible with coronavirus disease 2019 (COVID-19) >7 days prior to testing, most self-isolating, returning well. Clusters of HCW infection were discovered on two independent wards. Viral genome sequencing showed that the majority of HCWs had the dominant lineage B.1. Our data demonstrates the utility of comprehensive screening of HCWs with minimal or no symptoms. This approach will be critical for protecting patients and hospital staff.

URL: https://elifesciences.org/articles/58728

Pubmed – May 8, 2020, 5:48am

Journal articles

1. **Baker MG, Peckham TK, Seixas NS. Estimating the burden of United States workers exposed to infection or disease: A key factor in containing risk of COVID-19 infection. PLoS One. 2020;15(4):e0232452. DOI: 10.1371/journal.pone.0232452**

ABSTRACT: INTRODUCTION: With the global spread of COVID-19, there is a compelling public health interest in quantifying who is at increased risk of contracting disease. Occupational characteristics, such as interfacing with the public and being in close quarters with other workers, not only put workers at high risk for disease, but also make them a nexus of disease transmission to the community. This can further be exacerbated through presenteeism, the term used to describe the act of coming to work despite being symptomatic for disease. Quantifying the number of workers who are frequently exposed to infection and disease in the workplace, and understanding which occupational groups they represent, can help to prompt public health risk response and management for COVID-19 in the workplace, and subsequent infectious disease outbreaks. METHODS: To estimate the number of United States workers frequently exposed to infection and disease in the workplace, national employment data (by Standard

Occupational Classification) maintained by the Bureau of Labor Statistics (BLS) was merged with a BLS O*NET survey measure reporting how frequently workers in each occupation are exposed to infection or disease at work. This allowed us to estimate the number of United States workers, across all occupations, exposed to disease or infection at work more than once a month. RESULTS: Based on our analyses, approximately 10% (14.4 M) of United States workers are employed in occupations where exposure to disease or infection occurs at least once per week. Approximately 18.4% (26.7 M) of all United States workers are employed in occupations where exposure to disease or infection occurs at least once per month. While the majority of exposed workers are employed in healthcare sectors, other occupational sectors also have high proportions of exposed workers. These include protective service occupations (e.g. police officers, correctional officers, firefighters), office and administrative support occupations (e.g. couriers and messengers, patient service representatives), education occupations (e.g. preschool and daycare teachers), community and social services occupations (community health workers, social workers, counselors), and even construction and extraction occupations (e.g. plumbers, septic tank installers, elevator repair). CONCLUSIONS: The large number of persons employed in occupations with frequent exposure to infection and disease underscore the importance of all workplaces developing risk response plans for COVID-19. Given the proportion of the United States workforce exposed to disease or infection at work, this analysis also serves as an important reminder that the workplace is a key locus for public health interventions, which could protect both workers and the communities they serve.

URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7188235/
DOI: 10.1371/journal.pone.0232452

2. **Black JRM, Bailey C, Przewrocka J, et al. COVID-19: the case for health-care worker screening to prevent hospital transmission. Lancet. 2020;395(10234):1418-20. DOI: 10.1016/s0140-6736(20)30917-x**

URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7162624/
DOI: 10.1016/s0140-6736(20)30917-x

3. **Hunter E, Price DA, Murphy E, et al. First experience of COVID-19 screening of health-care workers in England. Lancet. 2020;395(10234):e77-e8. DOI: 10.1016/s0140-6736(20)30970-3**

URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7176380/
DOI: 10.1016/s0140-6736(20)30970-3

Medline – May 1, 2020, 2:28am

Journal articles

1. **Heinzerling A, Stuckey MJ, Scheuer T, et al. Transmission of COVID-19 to Health Care Personnel During Exposures to a Hospitalized Patient - Solano County, California, February 2020. MMWR Morb Mortal Wkly Rep. 2020;69(15):472-6. DOI: 10.15585/mmwr.mm6915e5**

ABSTRACT: On February 26, 2020, the first U.S. case of community-acquired coronavirus disease 2019 (COVID-19) was confirmed in a patient hospitalized in Solano County, California (1). The patient was initially evaluated at hospital A on February 15; at that time, COVID-19 was not suspected, as the patient denied travel or contact with symptomatic persons. During a 4-day hospitalization, the patient was managed with standard precautions and underwent multiple aerosol-generating procedures (AGPs), including nebulizer treatments, bilevel positive airway pressure (BiPAP) ventilation, endotracheal intubation, and bronchoscopy. Several days after the patient's transfer to hospital B, a real-time reverse

transcription-polymerase chain reaction (real-time RT-PCR) test for SARS-CoV-2 returned positive. Among 121 hospital A health care personnel (HCP) who were exposed to the patient, 43 (35.5%) developed symptoms during the 14 days after exposure and were tested for SARS-CoV-2; three had positive test results and were among the first known cases of probable occupational transmission of SARS-CoV-2 to HCP in the United States. Little is known about specific risk factors for SARS-CoV-2 transmission in health care settings. To better characterize and compare exposures among HCP who did and did not develop COVID-19, standardized interviews were conducted with 37 hospital A HCP who were tested for SARS-CoV-2, including the three who had positive test results. Performing physical examinations and exposure to the patient during nebulizer treatments were more common among HCP with laboratory-confirmed COVID-19 than among those without COVID-19; HCP with COVID-19 also had exposures of longer duration to the patient. Because transmission-based precautions were not in use, no HCP wore personal protective equipment (PPE) recommended for COVID-19 patient care during contact with the index patient. Health care facilities should emphasize early recognition and isolation of patients with possible COVID-19 and use of recommended PPE to minimize unprotected, high-risk HCP exposures and protect the health care workforce.

URL: https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e5.htm?s_cid=mm6915e5_w
DOI: 10.15585/mmwr.mm6915e5

Pubmed – May 1, 2020, 5:24am

Journal articles

1. **Canova V, Lederer Schlapfer H, Piso RJ, et al. Transmission risk of SARS-CoV-2 to healthcare workers - observational results of a primary care hospital contact tracing. Swiss Med Wkly. 2020;150:w20257. DOI: 10.4414/smw.2020.20257**

ABSTRACT: BACKGROUND: The coronavirus disease (COVID)-19 epidemic is evolving rapidly. Healthcare workers are at increased risk for infection, and specific requirements for their protection are advisable to ensure the functioning of the basic healthcare system, including the availability of general practitioners (GPs). Understanding the transmission risk is particularly important for guiding evidence-based protective measures in the primary healthcare setting. METHODS: Healthcare worker contacts of an initially undiagnosed COVID-19 case, who were without personal protective equipment, in particular not wearing facemasks, were screened with nasopharyngeal swabs and polymerase chain reaction tests for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), irrespective of respiratory symptoms or fever seven days after initial contact. The details of exposure to the index case were obtained during routine contact investigation after unintentional pathogen exposure. RESULTS: Twenty-one healthcare workers reported contacts with the index case. Three healthcare workers reported respiratory symptoms (cough) or low-grade fever within 4 days. None of them tested positive for SARS-CoV-2 at the time of symptom onset. All 21 healthcare workers tested SARS-CoV-2 negative 7 days after initial index case contact, including the three healthcare workers with previous symptoms. Ten of the 21 healthcare workers reported a cumulative exposure time of >15 minutes. Longer cumulative contact times were associated with more individual contacts, reduced contact time per contact and activities with physical patient contact. The closest relative of the index patient tested SARS-CoV-2 positive 2 days after the index case presented at the hospital emergency department. CONCLUSION: We found a low risk of SARS-CoV-2 transmission in a primary care setting. These findings are compatible with previous reports of the highest transmission probability in household settings with prolonged close contacts. The current protective measures for healthcare workers, including strict adherence to basic standard hygiene and

facemasks, offer considerable protection during short periods of contact with symptomatic COVID-19 cases by diminishing the risk of direct and indirect transmission.

URL: https://smw.ch/article/doi/smw.2020.20257
DOI: 10.4414/smw.2020.20257

April 8, 2020

Pre-printed articles

1. **Bai Y, Wang X, Huang Q, et al. SARS-CoV-2 infection in health care workers: a retrospective analysis and a model study. *medRxiv*. 2020:2020.03.29.20047159. DOI:** 10.1101/2020.03.29.20047159
Background There had been a preliminary occurrence of human-to-human transmissions between healthcare workers (HCWs), but risk factors in the susceptibility for COVID-19, and infection patterns among HCWs have largely remained unknown. Methods Retrospective data collection on demographics, lifestyles, contact status with infected subjects for 118 HCWs (include 12 COVID-19 HCWs) from a single-center. Sleep quality and working pressure were evaluated by Pittsburgh Sleep Quality Index (PSQI) and The Nurse Stress Index (NSI), respectively. Follow-up duration was from Dec 25, 2019, to Feb 15, 2020. ***Risk factors and transmission models of COVID-19 among HCWs were analyzed and constructed.*** Findings A high proportion of COVID-19 HCWs had engaged in night shift-work (75.0% vs. 40.6%) and felt they were working under pressure (66.7% vs. 32.1%) than uninfected HCWs. COVID-19 HCWs had higher total scores of PSQI and NSI than uninfected HCWs. Furthermore, these scores were both positively associated with COVID-19 risk. An individual-based model (IBM) estimated the outbreak duration among HCWs in a non-typical COVID-19 ward at 62-80 days and the basic reproduction number =1.27 [1.06, 1.61]. By reducing the average contact rate per HCW by a 1.35 factor and susceptibility by a 1.40 factor, we can avoid an outbreak of the basic case among HCWs. Interpretation Poor sleep quality and high working pressure were positively associated with high risks of COVID-19. A novel IBM of COVID-19 transmission is suitable for simulating different outbreak patterns in a hospital setting.

URL: http://medrxiv.org/content/early/2020/04/01/2020.03.29.20047159.abstract
https://www.medrxiv.org/content/medrxiv/early/2020/04/01/2020.03.29.20047159.full.pdf
DOI: 10.1101/2020.03.29.20047159

2. **Dy LF, Rabajante JF. A COVID-19 Infection Risk Model for Frontline Health Care Workers. *medRxiv*. 2020:2020.03.27.20045336.**
The number of confirmed COVID-19 cases admitted in hospitals is continuously increasing in the Philippines. Frontline health care workers are faced with imminent risks of getting infected. ***In this study, we formulate a theoretical model to calculate the risk of being infected in health care facilities considering the following factors: the average number of encounters with a suspected COVID-19 patient per hour; interaction time for each encounter; work shift duration or exposure time; crowd density, which may depend on the amount of space available in a given location; and availability and effectiveness of protective gears and facilities provided for the frontline health care workers.*** Based on the simulation results, we recommend the following: (i) decrease the rate of patient encounter per frontline health care worker, e.g., maximum of three encounters per hour in a 12-hour work shift duration; (ii) decrease the interaction time between the frontline health care worker and the patients, e.g., less than 40 minutes for the whole day; (iii) increase the clean and safe space for social distancing, e.g., maximum of 10% crowd density, and if possible, implement compartmentalization of patients; and/or (iv) provide effective protective

gears and facilities, e.g., 95% effective, that the frontline health care workers can use during their shift. Moreover, the formulated model can be used for other similar scenarios, such as identifying infection risk in public transportation, school classroom settings, offices, and mass gatherings.

URL: http://medrxiv.org/content/early/2020/03/30/2020.03.27.20045336.abstract
https://www.medrxiv.org/content/medrxiv/early/2020/03/30/2020.03.27.20045336.full.pdf
DOI: 10.1101/2020.03.27.20045336

3. **Kluytmans M, Buiting A, Pas S, et al. SARS-CoV-2 infection in 86 healthcare workers in two Dutch hospitals in March 2020. *medRxiv*. 2020:2020.03.23.20041913.**
COVID-19 is spreading rapidly over the world. On February 27, 2020, the first patient with COVID-19 was reported in the Netherlands, linked to a trip to Northern Italy. In the following weeks, we identified nine Health Care Workers (HCW) of whom eight had no epidemiological link to countries with a high incidence of COVID-19 at that time. This suggested local spread of SARS-CoV-2 in the community and prompted a low-threshold screening in HCWs. Screening was performed in two large teaching hospitals in the southern part of the Netherlands. HCWs who suffered from fever or mild respiratory symptoms were tested for SARS-CoV-2 by RT-PCR on oropharyngeal samples. Structured interviews were conducted to document symptoms. ***Eighty-six (6.4%) out of 1,353 HCWs were infected with SARS-Cov-2. The median age was 49 years and 15 (17.4%) were male. Most suffered from relatively mild disease. Only 46 (53.5%) HCWs had fever during the course of illness. Seventy-nine (91.9%) HCWs met a case definition of fever and/or coughing and/or shortness of breath. The majority (n=54, 62.8%) reported to have worked while being symptomatic. Within one week after the first case was reported, a substantial proportion of HCWs with fever or respiratory symptoms were proven to be infected with SARS-Cov-2. This observation suggests that there is a relatively high prevalence of mild clinical presentations that may go undetected.*** The spectrum of symptoms present in HCWs with COVID-19, frequently not including fever, asks for less stringent use of the currently recommended case-definition for suspected COVID-19.
URL: http://medrxiv.org/content/early/2020/03/27/2020.03.23.20041913.abstract
https://www.medrxiv.org/content/medrxiv/early/2020/03/31/2020.03.23.20041913.full.pdf
DOI: 10.1101/2020.03.23.20041913

4. **Koh D. Occupational risks for COVID-19 infection. *Occup Med (Lond)*. 2020;70(1):3-5**.
Excerpt: As cases increased and required health care, ***health care workers (HCWs) were next recognized as another high-risk group to acquire this infection. In a case series of 138 patients treated in a Wuhan hospital, 40 patients (29% of cases) were HCWs.*** Among the affected HCWs, 31 (77.5%) worked on general wards, 7 (17.5%) in the emergency department, and 2 (5%) in the intensive care unit (ICU). There was apparently a super-spreader patient encountered in the hospital, who presented with abdominal symptoms and was admitted to the surgical department. This patient infected >10 HCWs in the department [7]. China's Vice-Minister at the National Health Commission said that 1716 health workers had been infected in the country as of Tuesday 11 February 2020, among whom 6 have died [8].

URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7107962/pdf/kqaa036.pdf
DOI: 10.1093/occmed/kqaa036

5. **University I. Rapid SARS-CoV-2 IgG Antibody Testing in High Risk Healthcare Workers. ClinicalTrials2020**.
Brief Summary:
The purpose of this study is to validate the use of a rapid, at home, point-of-care (POC) SARS-CoV-2 IgG antibody test in high risk healthcare workers. Additionally, we would like to evaluate the

incidence of seroconversion in this high-risk population and to identify possible candidates for convalescent plasma donation for therapy/prophylaxis.

No Results Available Diagnostic Test: SARS-CoV-2 IgG Antibody Testing Kit Validation of SARS-CoV-2 IgG Antibody Test|Incidence of Seroconversion|Identify Candidacy All 340 Other Observational Model: Ecologic or Community|Time Perspective: Prospective 2003973826 January 1, 2021

URL: https://ClinicalTrials.gov/show/NCT04334876

6. **World Health O. Protocol for assessment of potential risk factors for 2019-novel coronavirus (2019-nCoV) infection among health care workers in a health care setting. 2020.** Overview This is a case-ascertained prospective investigation of all identified health care contacts working in a health care facility in which a laboratory confirmed 2019-nCoV infected patient (see 2.2 Study population) receives care. Note that this study can be done in health care facilities at all 3 levels of a health system – not just in hospitals. It is intended to provide epidemiological and serologic information which will inform the identification of risk factors 2019-nCoV infection among health care workers. There are three primary objectives of this investigation among health care workers in a health care setting where a 2019-nCoV infected patient is being cared for: To better understand the extent of human-to-human transmission among health care workers, by estimating the secondary infection rate1 for health care worker contacts at an individual level. To characterize the range of clinical presentation of infection and the risk factors for infection among health care workers. To evaluate effectiveness of infection prevention and control measures among health care workers To evaluate effectiveness of infection prevention and control programmes at health facility and national level Early investigations are critical to carry out early in an outbreak of a new virus. The data collected from the study protocols provided here can be used to refine recommendations for surveillance and case definitions, to characterize the key epidemiological transmission features of 2019-nCoV, help understand spread, severity, spectrum of disease, impact on the community and to inform operational models for implementation of countermeasures such as case isolation, contact tracing and isolation. If you require word versions of any of the early investigation protocols, please email earlyinvestigations-2019-nCoV@who.int

URL: https://www.who.int/publications-detail/protocol-for-assessment-of-potential-risk-factors-for-2019-novel-coronavirus-(2019-ncov)-infection-among-health-care-workers-in-a-health-care-setting

7. **World Health O. Situation Report 2: Novel Coronavirus (2019-nCoV). 2020.** Situation update: • As of 21 January 2020, a total of 314 confirmed cases have been reported for novel coronavirus (2019-nCoV) globally; • Of the 314 cases reported, 309 cases were reported from China, two from Thailand, one from Japan and one from the Republic of Korea; • Cases in Thailand, Japan and the Republic of Korea were exported from Wuhan City, China; • Of the 309 confirmed cases in China, 270 cases were confirmed from Wuhan; • Of the 270 cases, 51 cases are severely ill1 and 12 are in critical condition2 ; • Six deaths have been reported from Wuhan; • Four of five deaths, with available epidemiological information, had underlying comorbidities; • ***To date, sixteen health care workers have been infected***.

URL: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200122-sitrep-2-2019-ncov.pdf?sfvrsn=4d5bcbca_2

8. **Mao Y, Lin W, Weng J, et al. Epidemiological and clinical characteristics of SARS-CoV-2 and SARS-CoV: a system review. *medRxiv*. 2020:1-20.**

In 2002-2003, a severe pulmonary infectious disease occurred in Guangdong, China. The disease was caused by severe acute respiratory syndrome coronavirus (SARS-CoV), 17 yr apart, also happen in China, and also the novel coronavirus, this epidemic has posed a significant hazard to people's health both China and the whole world. Now the data of 2019 corona virus disease (COVID-19) are still limited. In this article, we summarized the early epidemiol. and clin. characteristics of SARS and COVID-19 in different countries. the aim is to provide recommendations for the understanding and prevention of COVID-19. By searching pubmed, we analyzed and compared the typical cases of SARS and COVID-19 in different countries in the early stage of the outbreak. Clin. records, laboratory results, imageol. diagnosis, and pathol. condition were retrospectively reviewed for these cases. This paper adopts the method of descriptive statistics and tables and graphs. Six SARS-related articles (N = 337 participants) and 12 COVID-19-related articles (N = 50,096 participants) were eligible for this systematic review. Fever, cough, and Malaise/Fatigue were the most common symptoms in SARS and COVID-19. But in general, the clin. symptoms and signs of COVID-19 were not obvious. Compared with SARS, COVID-19 was transmitted in a more diverse way, from person to person, asymptomatic infected people, and possible fecal-oral transmission, created the conditions for a large-scale spread. The mortality rates of SARS and COVID-19 were (7.7%) and (2.2%) resp., but the overall infection rate of healthcare worker of COVID-19 (3.9%) was lower than that of SARS (40.0%). We also summarize the current reports on the pathol. of COVID-19, we found that the pathol. features of COVID-19 have greatly similar with SARS, which manifested as acute respiratory distress syndrome (ARDS). The epidemiol. and clin. characteristics of SARS and COVID-19 in China are very similar, but also difference. In general, COVID-19 is transmitted in more diverse ways and is more infectious, so the early recognition of disease by healthcare worker and patient is very important. Active and effective isolation measures for suspected and close contacts are necessary.

URL: https://www.medrxiv.org/

9. University College L, Hospital SBs, Trust RFHNHSF, et al. COVID-19: Healthcare Worker Bioresource: Immune Protection and Pathogenesis in SARS-CoV-2. ClinicalTrials2020.

URL: https://ClinicalTrials.gov/show/NCT04318314

10. **Ye G, Lin H, Chen L, et al. Environmental contamination of the SARS-CoV-2 in healthcare premises: An urgent call for protection for healthcare workers. *medRxiv*. 2020:2020.03.11.20034546. DOI:** 10.1101/2020.03.11.20034546

Importance A large number of healthcare workers (HCWs) were infected by SARS-CoV-2 during the ongoing outbreak of COVID-19 in Wuhan, China. Hospitals are significant epicenters for the human-to-human transmission of the SARS-CoV-2 for HCWs, patients, and visitors. No data has been reported on the details of hospital environmental contamination status in the epicenter of Wuhan. Objective To investigate the extent to which SARS-CoV-2 contaminates healthcare settings, including to identify function zones of the hospital with the highest contamination levels and to identify the most contaminated objects, and personal protection equipment (PPE) in Wuhan, China. Design A field investigation was conducted to collect the surface swabs in various environments in the hospital and a laboratory experiment was conducted to examine the presence of the SARS-CoV-2 RNA. Setting Six hundred twenty-six surface samples were collected within the Zhongnan Medical Center in Wuhan, China in the mist of the COVID-19 outbreak between February 7 - February 27, 2020. Participants Dacron swabs were aseptically collected from the surfaces of 13 hospital function zones, five major objects, and three major personal protection equipment (PPE). The SARS-CoV-2 RNAs were detected by reverse transcription-PCR (RT-PCR). Main Outcomes and Measures SARS-CoV-2 RNAs Results The most contaminated zones were the intensive care unit specialized for taking care of novel coronavirus pneumonia (NCP) (31.9%), Obstetric Isolation

Ward specialized for pregnant women with NCP (28.1%), and Isolation Ward for NCP (19.6%). We classified the 13 zones into four contamination levels. The most contaminated objects are self-service printers (20.0%), desktop/keyboard (16.8%), and doorknob (16.0%). Both hand sanitizer dispensers (20.3%) and gloves (15.4%) were most contaminated PPE. Conclusions and Relevance Many surfaces were contaminated with SARS-CoV-2 across the hospital in various patient care areas, commonly used objects, medical equipment, and PPE. The 13 hospital function zones were classified into four contamination levels. These findings emphasize the urgent need to ensure adequate environmental cleaning, strengthen infection prevention training, and improve infection prevention precautions among HCWs during the outbreak of COVID-19. The findings may have important implications for modifying and developing urgently needed policy to better protect healthcare workers during this ongoing pandemic of SARS-CoV-2.Competing Interest StatementThe authors have declared no competing interest.Funding StatementThe investigation was supported by the Emergency Science and Technology Project of 2019, Novel Coronavirus Pneumonia from Science and Technology Department of Hubei Province (2020FCA008)Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesThe reported data are available from the corresponding authors on reasonable request. After publication of the findings, the data will be available for others upon the request. Our team will provide contact information including an email address for future communication once the data are ready to be shared with others. The detailed study plan will be needed for assessment of the reasonability to request for the data. The corresponding authors will make a decision based on the provided documents. Additional information may also be needed during the process.

URL: http://medrxiv.org/content/early/2020/03/16/2020.03.11.20034546.abstract
DOI: 10.1101/2020.03.11.20034546

Journal articles

1. **Bersano A, Pantoni L. On being a neurologist in Italy at the time of the COVID-19 outbreak.** ***Neurology*****. 2020. DOI:** 10.1212/wnl.0000000000009508
Italy is facing its fifth week of crisis due to the COVID-19 outbreak, with affected patients and deaths near to 70.000 and 6000 respectively [1], numbers that are increasing every day. Whether government imposition of quarantines, travel bans and lockdown throughout the country will have effect in the next weeks in limiting the spreading of this disease has still to be seen. Meanwhile, a great spirit of sacrifice is required to health care personnel and authorities have to manage resource allocation to rapidly increase the number of intensive care beds to assist COVID-19 patients [2]. Although operating rooms and a number of wards have been turned into dedicated intensive units, beds and resources are hardly sufficient to satisfy the needs of so many simultaneously critically ill patients [3,4]. ***Notably, among infected people about 10% are health workers and their number is increasing, also due to the scarcity of efficacious protective measures.***

URL: https://n.neurology.org/content/neurology/early/2020/04/01/WNL.0000000000009508.full.pdf
DOI: 10.1212/wnl.0000000000009508

2. **Cheng VCC, Wong SC, Chen JHK, et al. Escalating infection control response to the rapidly evolving epidemiology of the Coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in Hong Kong. *Infection Control & Hospital Epidemiology*. 2020:1-24. DOI:** https://dx.doi.org/10.1017/ice.2020.58
BACKGROUND: To describe the infection control preparedness for Coronavirus Disease (COVID-19) due to SARS-CoV-2 [previously known as 2019-novel coronavirus] in the first 42 days after announcement of a cluster of pneumonia in China, on 31 December 2019 (day 1) in Hong Kong. METHODS: A bundle approach of active and enhanced laboratory surveillance, early airborne infection isolation, rapid molecular diagnostic testing, and contact tracing for healthcare workers (HCWs) with unprotected exposure in the hospitals was implemented. Epidemiological characteristics of confirmed cases, environmental and air samples were collected and analyzed. RESULTS: From day 1 to day 42, forty-two (3.3%) of 1275 patients fulfilling active (n=29) and enhanced laboratory surveillance (n=13) confirmed to have SARS-CoV-2 infection. The number of locally acquired case significantly increased from 1 (7.7%) of 13 [day 22 to day 32] to 27 (93.1%) of 29 confirmed case [day 33 to day 42] (p 0.001). Twenty-eight patients (66.6%) came from 8 family clusters. ***Eleven (2.7%) of 413 HCWs caring these confirmed cases were found to have unprotected exposure requiring quarantine for 14 days. None of them was infected and nosocomial transmission of SARS-CoV-2 was not observed***. Environmental surveillance performed in a patient with viral load of 3.3x106 copies/ml (pooled nasopharyngeal/ throat swab) and 5.9x106 copies/ml (saliva) respectively. SARS-CoV-2 revealed in 1 (7.7%) of 13 environmental samples, but not in 8 air samples collected at a distance of 10 cm from patient's chin with or without wearing a surgical mask. CONCLUSION: Appropriate hospital infection control measures could prevent nosocomial transmission of SARS-CoV-2.

URL:
https://www.cambridge.org/core/services/aop-cambridge-core/content/view/52513ACC56587859F9C601DC747EB6EC/S0899823X20000586a.pdf/div-class-title-escalating-infection-control-response-to-the-rapidly-evolving-epidemiology-of-the-coronavirus-disease-2019-covid-19-due-to-sars-cov-2-in-hong-kong-div.pdf
DOI: https://dx.doi.org/10.1017/ice.2020.58

3. **Lin M, Beliavsky A, Katz K, et al. What can early Canadian experience screening for COVID-19 teach us about how to prepare for a pandemic? *CMAJ: Canadian Medical Association Journal*. 2020;192(12):E314.**
Excerpt: "***Recent data from Wuhan, China, show high rates of transmission of COVID-19 to health care workers (29% in 1 series), which is higher than the rates seen with Middle East Respiratory Syndrome (MERS) and SARS (18.6% and 21%, respectively),*** highlighting a pressing need to contain mildly symptomatic patients who do not need acute medical services and to reduce unnecessary exposures to hospital staff and other patients. Systems that favour assessment of nearly all patients in hospital emergency departments will lead to a surge during a pandemic of COVID-19"

URL: https://www.cmaj.ca/content/192/12/E314

4. **Liu M, He P, Liu HG, et al. [Clinical characteristics of 30 medical workers infected with new coronavirus pneumonia]. *Zhonghua Jie He He Hu Xi Za Zhi*. 2020;43(3):209-14.**

Objective: To investigate the clinical characteristics of medical staff with novel coronavirus pneumonia(NCP). Methods: 30 patients infected with novel coronavirus referred to jianghan university hospital between January 11, 2020 and January 3, 2020 were studied. The data reviewed included those of clinical manifestations, laboratory investigation and Radiographic features. Results: The patients consisted of 10 men and 20 women, including 22 doctors and 8 nurses,aged 21~59 years(mean 35+/-8 years).They were divided to 26 common type and 4 severe cases, all of whom had close(within 1m) contact with patients infected of novel coronavirus pneumonia. The average contact times were 12 (7,16) and the average cumulative contact time was 2 (1.5,2.7) h.Clinical symptoms of these patients were fever in 23 patients (76.67%) , headache in 16 petients (53.33%) , fatigue or myalgia in 21patients (70%) , nausea, vomiting or diarrhea in 9 petients (30%) , cough in 25 petients (83.33%) , and dyspnea in 14 petients (46.67%) .Routine blood test revealed WBC<4.0x10(9)/L in 8 petients (26.67%) , (4-10) x10(9)/L in 22 petients (73.33%) , and WBC>4.0x10(9)/L in 4 petients (13.33%) during the disease.Lymphocyte count<1.0x10(9)/L occurred in 12 petients (40%),abnormal liver function in 7 petients (23.33%) ,myocardial damage in 5 petients(16.67%), elevated D-dimer (>0.5mg/l) in 5 patients (16.67%). Compared with normal patients, the average exposure times, cumulative exposure time, BMI, Fever time, white blood cell count, liver enzyme, LDH, myoenzyme and D-dimer were significantly increased in severe patients, while the lymphocyte count and albumin levels in peripheral blood were significantly decreased.Chest CT mainly showed patchy shadows and interstitial changes.According to imaging examination, 11 patients (36.67%) showed Unilateral pneumonia and 19 patients (63.33%) showed bilateral pneumonia,4 patients (13.33%) showed bilateral multiple mottling and ground-glass opacity.Compared with the patients infected in the protected period, the proportion of severe infection and bilateral pneumonia were both increased in the patients infected in unprotected period. Conclusion: ***Medical staffs are at higher risk of infection.Infection rates are associated with contact time, the amount of suction virus.*** Severe patients had BMI increased, heating time prolonged, white blood cell count, lymphocyte count, D-dimer and albumin level significantly changed and were prone to be complicated with liver damage and myocardial damage.Strict protection measures is important to prevent infection for medical workers.

DOI: 10.3760/cma.j.issn.1001-0939.2020.03.014

5. **Mann DL. Chinese Health Care Workers and COVID-19: For Whom the Bell Tolls. *JACC: Basic to Translational Science*. 2020. DOI:** https://doi.org/10.1016/j.jacbts.2020.03.009
Excerpt: Alice Su reports that there were "18 reported deaths of medical workers involved in the COVID19 response as of Monday (February 24th), including nurses and doctors who died not because of infection but because of cardiac arrest or other ailments due to overwork and fatigue. One victim was hit by a car while taking temperatures on a highway."

DOI: https://doi.org/10.1016/j.jacbts.2020.03.009

6. **Ng K, Poon BH, Kiat Puar TH, et al. COVID-19 and the Risk to Health Care Workers: A Case Report. *Annals of internal medicine*. 2020;16:16.**
Objective: To describe the clinical outcome of health care workers who took care of a patient with severe pneumonia before the diagnosis of COVID-19 was known….. On the basis of contact tracing, ***41 health care workers were identified as having exposure to aerosol-generating procedures for at least 10 minutes at a distance of less than 2 meters from the patient.*** The aerosol-generating procedures included endotracheal intubation, extubation, noninvasive ventilation, and exposure to aerosols in an open circuit (4). All 41 health care workers were placed under home isolation for 2 weeks, with daily monitoring for cough, dyspnea, and myalgia and twice-daily temperature measurements. In addition, they had nasopharyngeal swabs scheduled on the first day of home isolation, which could have been day 1, 2, 4, or 5 after last exposure to patient, and a

second swab scheduled on day 14 after their last exposure. The swabs were tested for SARS–CoV-2 by using a PCR assay. ***None of the exposed health care workers developed symptoms, and all PCR tests were negative***

DOI: https://dx.doi.org/10.7326/L20-0175

7. **Shi H, Han X, Jiang N, et al. Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. *The Lancet Infectious Diseases*. 2020.**
Excerpt: 81 patients who were admitted to Wuhan Jinyintan hospital (n=49) or Union Hospital of Tongji Medical College (n=32) between Dec 20, 2019, and Jan 23, 2020, and who had confirmed COVID-19 pneumonia were retrospectively enrolled in our study. Epidemiologically, there were four main clusters of patients: 31 (38%) patients had direct exposure to Huanan seafood market, ***15 (19%) were health-care workers who had close contact with patients at the hospital who had confirmed COVID-19 pneumonia***, seven (9%) were familial clusters, and the remaining 28 (35%) did not have any obvious history of exposure. Patients were assigned to groups on the basis of time between symptom onset and first CT scan: 15 (19%) patients (including h ealth-care workers who had had close contact with patients with confirmed COVID-19 pneumonia) were assigned to group 1, 21 (26%) to group 2, 30 (37%) to group 3, and 15 (19%) to group 4.

URL: https://www.thelancet.com/article/S1473-3099(20)30086-4/fulltext

8. **The L. COVID-19: protecting health-care workers. *Lancet*. 2020;395(10228):922.**
Worldwide, as millions of people stay at home to minimise transmission of severe acute respiratory syndrome coronavirus 2, health-care workers prepare to do the exact opposite. They will go to clinics and hospitals, putting themselves at high risk from COVID-2019. Figures from China's National Health Commission show that more than 3300 health-care workers have been infected as of early March and, according to local media, by the end of February at least 22 had died. , ***20% of responding health-care workers were infected, and some have died.*** Reports from medical staff describe physical and mental exhaustion, the torment of difficult triage decisions, and the pain of losing patients and colleagues, all in addition to the infection risk.

URL: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30644-9/fulltext
DOI: 10.1016/s0140-6736(20)30644-9

9. **Wang D, Hu B, Hu C, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *Jama*. 2020;07:07.**
Importance: In December 2019, novel coronavirus (2019-nCoV)-infected pneumonia (NCIP) occurred in Wuhan, China. The number of cases has increased rapidly but information on the clinical characteristics of affected patients is limited. Objective: To describe the epidemiological and clinical characteristics of NCIP. Design, Setting, and Participants: Retrospective, single-center case series of the 138 consecutive hospitalized patients with confirmed NCIP at Zhongnan Hospital of Wuhan University in Wuhan, China, from January 1 to January 28, 2020; final date of follow-up was February 3, 2020. Exposures: Documented NCIP. Main Outcomes and Measures: Epidemiological, demographic, clinical, laboratory, radiological, and treatment data were collected and analyzed. Outcomes of critically ill patients and noncritically ill patients were compared. Presumed hospital-related transmission was suspected if a cluster of health professionals or hospitalized patients in the same wards became infected and a possible source of infection could be tracked. Results: Of 138 hospitalized patients with NCIP, the median age was 56 years (interquartile range, 42-68; range, 22-92 years) and 75 (54.3%) were men. ***Hospital-associated transmission was suspected as the presumed mechanism of infection for affected health professionals (40 [29%])*** and hospitalized patients (17 [12.3%]). Common symptoms included fever (136 [98.6%]), fatigue (96 [69.6%]), and

dry cough (82 [59.4%]). Lymphopenia (lymphocyte count, 0.8 x 109/L [interquartile range {IQR}, 0.6-1.1]) occurred in 97 patients (70.3%), prolonged prothrombin time (13.0 seconds [IQR, 12.3-13.7]) in 80 patients (58%), and elevated lactate dehydrogenase (261 U/L [IQR, 182-403]) in 55 patients (39.9%). Chest computed tomographic scans showed bilateral patchy shadows or ground glass opacity in the lungs of all patients. Most patients received antiviral therapy (oseltamivir, 124 [89.9%]), and many received antibacterial therapy (moxifloxacin, 89 [64.4%]; ceftriaxone, 34 [24.6%]; azithromycin, 25 [18.1%]) and glucocorticoid therapy (62 [44.9%]). Thirty-six patients (26.1%) were transferred to the intensive care unit (ICU) because of complications, including acute respiratory distress syndrome (22 [61.1%]), arrhythmia (16 [44.4%]), and shock (11 [30.6%]). The median time from first symptom to dyspnea was 5.0 days, to hospital admission was 7.0 days, and to ARDS was 8.0 days. Patients treated in the ICU (n = 36), compared with patients not treated in the ICU (n = 102), were older (median age, 66 years vs 51 years), were more likely to have underlying comorbidities (26 [72.2%] vs 38 [37.3%]), and were more likely to have dyspnea (23 [63.9%] vs 20 [19.6%]), and anorexia (24 [66.7%] vs 31 [30.4%]). Of the 36 cases in the ICU, 4 (11.1%) received high-flow oxygen therapy, 15 (41.7%) received noninvasive ventilation, and 17 (47.2%) received invasive ventilation (4 were switched to extracorporeal membrane oxygenation). As of February 3, 47 patients (34.1%) were discharged and 6 died (overall mortality, 4.3%), but the remaining patients are still hospitalized. Among those discharged alive (n = 47), the median hospital stay was 10 days (IQR, 7.0-14.0). Conclusions and Relevance: In this single-center case series of 138 hospitalized patients with confirmed NCIP in Wuhan, China, presumed hospital-related transmission of 2019-nCoV was suspected in 41% of patients, 26% of patients received ICU care, and mortality was 4.3%.

URL: https://jamanetwork.com/journals/jama/articlepdf/2761044/jama_wang_2020_oi_200019.pdf
DOI: https://dx.doi.org/10.1001/jama.2020.1585

DOI:

10. **Xiang YT, Jin Y, Wang Y, et al. Tribute to health workers in China: A group of respectable population during the outbreak of the COVID-19.** ***Int J Biol Sci*****. 2020;16(10):1739-40.**

The health authorities reported that 3,019 Chinese health workers were infected with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), of whom, ten died. This article explored relevant reasons and offered suggestions to reduce the risk of infection and provide emergency psychological response for this population.

URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7098026/pdf/ijbsv16p1739.pdf
DOI: 10.7150/ijbs.45135

11. **Zhou P, Huang Z, Xiao Y, et al. Protecting Chinese Healthcare Workers While Combating the 2019 Novel Coronavirus.** ***Infection Control & Hospital Epidemiology*****. 2020:1-4.**

Hospital-associated transmission is an important route of spreading the 2019 novel coronavirus (2019-nCoV) infection and pneumonia (Corona Virus Disease 2019, COVID-19) [1]. Healthcare workers (HCWs) are at high risk while combating COVID-19 at the very frontline, and nosocomial outbreaks among HCWs are not unusual in similar settings; the 2003 severe acute respiratory syndrome (SARS) outbreak led to over 966 HCW infections with 1.4% deaths in mainland China [2]. ***As of 11 February 2020, 3019 HCWs might have been infected with 2019-nCov in China, 1716 HCW cases were confirmed by nucleic acid testing[3], and at least 6 HCWs died, including the famous whistleblower Dr Li Wenliang***. In view of this severe situation, we are recommending urgent interventions to help to protect HCWs.

URL: https://www.cambridge.org/core/services/aop-cambridge-core/content/view/03DEB8D3BF68A674ADAB3FC4EF245E40/S0899823X20000604a.pdf/div-class-title-protecting-chinese-healthcare-workers-while-combating-the-2019-novel-coronavirus-div.pdf
DOI: https://dx.doi.org/10.1017/ice.2020.60

12. **Al-Raddadi RM, Shabouni OI, Alraddadi ZM, et al. Burden of Middle East respiratory syndrome coronavirus infection in Saudi Arabia.** ***Journal of infection and public health*****. 2019. DOI:** 10.1016/j.jiph.2019.11.016

10.1016/j.jiph.2019.11.016.

MERS-coronavirus infection is currently responsible for considerable morbidity and mortality in Saudi Arabia. Understanding its burden, as an emerging infectious disease, is vital for devising appropriate control strategies. In this study, the burden of MERS-CoV was estimated over 31 months period from June 6, 2012 to January 5, 2015. ***The total number of patients was 835; 528 (63.2%) patients were male, 771 (92.3%) patients were /=25 years of age, and 210 (25.1%) patients were healthcare workers.*** A total of 751 (89.9%) patients required hospitalization. The median duration between onset of illness and hospitalization was 2 days (interquartile range, 0-5). The median length of hospital stay was 14 days (IQR, 6-27). The overall case fatality rate was 43.1%. Basic reproductive number was 0.9. Being Saudi, non-healthcare workers, and age /=65 years were significantly associated with higher mortality. In conclusion, MERS-CoV infection caused a substantial health burden in Saudi Arabia.

DOI: 10.1016/j.jiph.2019.11.016

13. **Zhanga YY, Liu S. Epidemiological study on COVID-19 virus transmission network in northeast China.**

Hospital-associated transmission is an important route of spreading the 2019 novel coronavirus (2019-nCoV) infection and pneumonia (Corona Virus Disease 2019, COVID-19) [1]. Healthcare workers (HCWs) are at high risk while combating COVID-19 at the very frontline, and nosocomial outbreaks among HCWs are not unusual in similar settings; the 2003 severe acute respiratory syndrome (SARS) outbreak led to over 966 HCW infections with 1.4% deaths in mainland China [2]. ***As of 11 February 2020, 3019 HCWs might have been infected with 2019-nCov in China, 1716 HCW cases were confirmed by nucleic acid testing[3], and at least 6 HCWs died, including the famous whistleblower Dr Li Wenliang***. In view of this severe situation, we are recommending urgent interventions to help to protect HCWs.

URL: https://www.cambridge.org/core/services/aop-cambridge-core/content/view/03DEB8D3BF68A674ADAB3FC4EF245E40/S0899823X20000604a.pdf/div-class-title-protecting-chinese-healthcare-workers-while-combating-the-2019-novel-coronavirus-div.pdf
DOI: https://dx.doi.org/10.1017/ice.2020.60

Additional references added April 8, 2020 at 9:40pm

14. **Hoe Gan W, Wah Lim J, Koh D. Preventing intra-hospital infection and transmission of COVID-19 in healthcare workers.** ***Safety and Health at Work*****. 2020. DOI:** 10.1016/j.shaw.2020.03.001

URL: https://linkinghub.elsevier.com/retrieve/pii/S209379112030161X
DOI: 10.1016/j.shaw.2020.03.001

15. **Reusken CB, Buiting A, Bleeker-Rovers C, et al. Rapid assessment of regional SARS-CoV-2 community transmission through a convenience sample of healthcare workers, the Netherlands, March 2020.** ***Eurosurveillance*****. 2020;25(12):2000334. DOI:** doi:https://doi.org/10.2807/1560-7917.ES.2020.25.12.2000334

URL: https://eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.12.2000334
DOI: doi:https://doi.org/10.2807/1560-7917.ES.2020.25.12.2000334

16. **Semple S, Cherrie JW. Covid-19: Protecting Worker Health.** ***Annals of Work Exposures and Health*****. 2020. DOI:** 10.1093/annweh/wxaa033

At the time of writing (5 March 2020) Coronavirus Disease 2019 (Covid-19) has spread to 76 countries with over 93 000 cases (WHO, 2020a) around the world since it was first identified and described in China on 31 December 2019 (WHO, 2020b). The case fatality rate may be as high as 3.4% and, although the indications are that it is a mild, self-limiting illness for the majority of those infected, it clearly has the potential to cause significant disruption globally. Many countries are moving from the 'containment' to the 'delay' phase in controlling the outbreak with a recent UK model suggesting a potential peak in June 2020 (Danon et al., 2020). Occupational hygienists have particular skills in understanding exposure to hazards in the workplace and a long history of introducing simple and effective measures that reduce risk to workers' health. These skills may be able to contribute to protecting the global workforce from Covid-19. Workers involved in healthcare have always had a recognized increase in risk of developing infections present in the community where their patients are drawn. Health care workers are often on the front line dealing with those who are ill and at the most infectious period of a disease, as in the cases of SARS, MERS, and Ebola. Healthcare facilities can therefore act as a focus for infection spreading, giving rise to disease clusters linked to hospitals, social care facilities, and other health locations (Rajakaruna et al., 2017). In the SARS and MERS outbreaks between 2003 and 2015, between 44 and 100% of cases were linked to healthcare settings and healthcare workers made up around a quarter of those infected (Chowell et al., 2015). Other workers involved in providing services to the public may also be at increased risk during particular outbreaks where transmission is through face-to-face or close contact. A recent analysis in the USA has estimated that 10% of the workforce are employed in roles where exposure to disease or infection occurs at least once per week (Baker et al., 2020). Beyond caring and protective service workers, there are a wide range of service-economy workers who may be at risk from a respiratory infection like Covid-19. Shop workers, bus drivers, cleaners, teachers, bank workers and hospitality staff are among the many service-sector employees who will have frequent and close interaction with many people over the course of a shift. Many of these workers will either have physical contact with the public or indirect contact through exchange of money or goods—an exposure route for transmission that is poorly understood (Angelakis et al., 2014). There are also complex societal issues around workers who are ill but feel that they have to work for economic or other reasons, and thereby increase the risks for colleagues and the public.[truncated]

URL: https://academic.oup.com/annweh/advance-article/doi/10.1093/annweh/wxaa033/5810996
DOI: 10.1093/annweh/wxaa033

17. **Zhou P, Huang Z, Xiao Y, et al. Protecting Chinese Healthcare Workers While Combating the 2019 Novel Coronavirus.** ***Infection Control & Hospital Epidemiology*****. 2020:1-4. DOI:** https://dx.doi.org/10.1017/ice.2020.60

Hospital-associated transmission is an important route of spreading the 2019 novel coronavirus (2019-nCoV) infection and pneumonia (Corona Virus Disease 2019, COVID-19) [1]. Healthcare workers (HCWs) are at high risk while combating COVID-19 at the very frontline, and nosocomial outbreaks among HCWs are not unusual in similar settings; the 2003 severe acute respiratory syndrome

(SARS) outbreak led to over 966 HCW infections with 1.4% deaths in mainland China [2]. As of 11 February 2020, 3019 HCWs might have been infected with 2019-nCov in China, 1716 HCW cases were confirmed by nucleic acid testing[3], and at least 6 HCWs died, including the famous whistleblower Dr Li Wenliang. In view of this severe situation, we are recommending urgent interventions to help to protect HCWs.

URL: https://www.cambridge.org/core/services/aop-cambridge-core/content/view/03DEB8D3BF68A674ADAB3FC4EF245E40/S0899823X20000604a.pdf/div-class-title-protecting-chinese-healthcare-workers-while-combating-the-2019-novel-coronavirus-div.pdf
DOI: https://dx.doi.org/10.1017/ice.2020.60

SEARCH STRATEGIES

May 14, 2020
Pubmed

(((Health Personnel/ OR students, health occupations/ OR students, dental/ OR students, medical/ OR students, nursing/ OR students, pharmacy/ OR students, public health/ OR Social Workers/ OR (acupuncturist* OR allergists OR anatomist* OR anesthesiologist* OR anesthetist* OR audiologist* OR cardiologist* OR chiropractor* OR clinican* OR dental hygienist* OR dentist* OR dermatologist* OR diabetologist* OR dietician* OR doctor OR doctors OR doula OR doulas OR endocrinologist* OR gastroenterologist* OR general practitioner* OR geriatrician* OR gynecologist* OR haematologist* OR (health OR health care OR healthcare) AND adj2 AND (worker* OR practitioner* OR provider OR professional OR navigator* OR student*) OR hospitalist* OR internist* OR medical resident* OR medical student* OR midwife OR midwives OR neonatologist* OR nephrologist* OR neurologist* OR neurosurgeon* OR nurse OR nurses OR nursing student* OR nutritionist* OR obstetrician* OR oncologist* OR ophthalmologist* OR optometrist* OR osteopath OR osteopaths OR otolaryngologist* OR pathologist* OR pediatrician* OR pharmacist* OR pharmacolog* OR phlebotomist* OR physician* OR podiatrist* OR prosthetist* OR psychologist* OR psychiatrist* OR pulmonologist* OR radiographer OR radiologist* OR radiotherapist* OR rheumatologist* OR social worker* OR sonographer* OR surgeon* OR therapist* OR toxicologist* OR urologist* OR veterinarian*)) AND (TITLE-ABSTRACT AND ((coronavirus OR "corona virus" OR coronavirinae OR coronaviridae OR betacoronavirus OR covid19 OR "covid 19" OR nCoV OR "CoV 2" OR CoV2 OR sarscov2 OR 2019nCoV OR "novel CoV" OR "wuhan virus") OR ((wuhan OR hubei OR huanan) AND ("severe acute respiratory" OR pneumonia) AND (outbreak))) OR "COVID-19"[Supplementary Concept] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept]))) AND ((screening OR transmission OR serology OR "throat swabs" OR prevalence OR testing OR IgM OR IgG OR PCR positive OR RT-PCR+))

May 1, 2020
Medline

1	coronavirus/ or exp betacoronavirus/ or coronavirus infections/
2	(coronavirus* or corona virus* or coronovirus* or coronaviral or (wuhan adj1 virus) or (wuhan adj1 viral) or cov or covid or WN-CoV or ncov or 2019ncov or ncov2019 or ncovid or ncovid2019 or 2019ncovid or covid-19 or covid19 or covid 19 or corvid 19 or HCov-19 or HCov-2019 or hcov19 or hcov2019 or severe acute respiratory syndrome coronavirus 2 or severe acute respiratory syndrome corona virus 2 or SARS Coronavirus 2 or SARS Corona virus 2 or SARS-COV-2 or SARSCOV2 or SARSCOV 2 or SARS2 or SARS-2 or coronavirus disease 2019 or corona virus disease 2019 or 2019 novel coronavirus infection* or 2019 novel coronavirus disease or 2019-nCoV infection* or coronavirus disease-19 or new coronavirus or novel corona

	virus).mp,kf,hw,rn,in.
3	1 or 2
4	exp "health care facilities, manpower, and services"/
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6	4 or 5
7	exp immunoglobulin g/ or exp immunoglobulin m/ or polymerase chain reaction/ or real-time polymerase chain reaction/ or reverse transcriptase polymerase chain reaction/
8	(IgM or IgG or "immunoglobulin m" or "immunoglobulin g" or "immunoglobulin g positive" or "immunoglobulin m positive" or PCR positive or PCR or polymerase chain reaction?).tw,kf.
9	7 or 8
10	3 and 6 and 9
11	limit 10 to yr="2020 -Current"

April 7, 2020, 21:41

PubMed (search alert created April 7, 2020 at 21:41)

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"COVID-19"[Supplementary Concept] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept]))) AND ((screening OR transmission OR serology OR "throat swabs" OR prevalence OR testing))

- Other sources were searched by keyword and included variations and synonyms of the following key concepts: health care workers; prevalence/transmission of COVID19 virus to HCW