# Journal Pre-proof

Association between 2019-nCoV transmission and N95 respirator use

Xinghuan Wang, MD, Zhenyu Pan, MD, Zhenshun Cheng, MD

PII: S0195-6701(20)30097-9

DOI: https://doi.org/10.1016/j.jhin.2020.02.021

Reference: YJHIN 5926

To appear in: Journal of Hospital Infection

Received Date: 22 February 2020

Accepted Date: 27 February 2020

Please cite this article as: Wang X, Pan Z, Cheng Z, Association between 2019-nCoV transmission and N95 respirator use, *Journal of Hospital Infection*, https://doi.org/10.1016/j.jhin.2020.02.021.

This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

© 2020 The Healthcare Infection Society. Published by Elsevier Ltd. All rights reserved.



# Association between 2019-nCoV transmission and N95 respirator use

Xinghuan Wang, MD<sup>1,\*</sup>, Zhenyu Pan, MD<sup>2</sup>, Zhenshun Cheng, MD<sup>3</sup>

<sup>1</sup>Department of Urology, Zhongnan Hospital of Wuhan University, Wuhan, China

<sup>2</sup>Department of Infection Management, Zhongnan Hospital of Wuhan University,

Wuhan, China

<sup>3</sup>Department of Respiratory medicine, Zhongnan Hospital of Wuhan University,

Wuhan, China

\***Corresponding author:** Dr. Xinghuan Wang, Email: wangxinghuan@whu.edu.cn, Tel. +86-27-6781-3104.

#### Journal Pre-proof

Cases of a novel type of contagious pneumonia were first reported in December 2019 in Wuhan, China. The Centers for Disease Control and Prevention (CDC) and Chinese health authorities have determined that a novel coronavirus (CoV), denoted as 2019-nCoV (SARS-CoV-2), is the cause of this pneumonia outbreak (COVID-19)<sup>1,2</sup>. Existing evidence have confirmed the human-to-human transmission of 2019-nCoV<sup>3</sup>.

We retrospectively collected infection data from 2<sup>nd</sup> to 22<sup>nd</sup> January 2020 at six departments (Respiratory, ICU, Infectious Disease, Hepatobiliary Pancreatic Surgery, Trauma and Microsurgery, and Urology) from Zhongnan Hospital of Wuhan University. Medical staff (doctors and nurses) followed differential routines of occupational protection: (a) staff at the Departments of Respiratory Medicine, ICU, and Infectious Disease (mainly quarantined area) wore N95 respirators, and disinfected and cleaned their hands frequently (the N95 group); (b) medical staff in the other three departments wore no medical masks, and disinfected and cleaned their hands only occasionally (the no-mask group). The difference was because the latter departments were not considered to be high risk in the early days of the outbreak.

Suspected cases of 2019-nCoV infection was investigated by chest CT, and confirmed by molecular diagnosis. In total, 28 and 58 patients had confirmed and suspicious 2019-nCov-infection. Patient exposure was significantly higher for the N95 group compared to no-mask group (for confirmed patients: difference: 733%; exposure odds ratio: 8.33, Table I).

Among the 493 medical staff, none of 278 (56 doctors and 222 nurses) in the N95 group became infected, compared with 10 of 213 (77 doctors and 136 nurses) from the no-mask group were confirmed infected (Table I). Regardless of their lower risk

#### Journal Pre-proof

of exposure, the 2019-nCoV infection rate for medical staff was significantly increased in the no-mask group compared with the N95 respirator group (difference: 4.65%, [95% CI: 1.75%-infinite]; P<2.2e-16) (adjusted odds ratio (OR): 464.82, [95% CI: 97.73-infinite]; P<2.2e-16).

Likewise, we analyzed the medical staff infection data from Huangmei People's Hospital (12 confirmed patients) and Qichun People's Hospital (11 confirmed patients), and have observed the similar phenomenon. No medical staff wearing the N95 respirators and following routines of frequent disinfection and hand washing were infected by 2019-nCoV up until 22<sup>nd</sup> January 2020.

A randomized clinical trial has reported that the N95 respirators vs medical masks resulted in no significant difference in the incidence of laboratory confirmed influenza<sup>4</sup>. In our study, we observed that the N95 respirators, disinfection and hand washing appear to help reduce the infectious risk of 2019-nCoV in doctors and nurses. Interestingly, departments with a high proportion of male doctors seemed to have a higher risk of infection. Our results emphasize the need for strict occupational protection measures in fighting COVID-19.

### **Conflict of interest statement**

None declared.

#### **Funding sources**

This study was supported by the Medical Science Advancement Program (Clinical Medicine) of Wuhan University (TFLC2018002).

## References

1. David S. Hui, Esam I Azhar, Tariq A. Madani, Francine Ntoumi, Richard Kock, Osman Dar, *et al.* The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health — The latest 2019 novel coronavirus outbreak in Wuhan, China. *Int J Infect Dis* 2020;91:264-266.

2. WHO. (2020). Novel Coronavirus (2019-nCoV). https://www.who.int/emergencies/diseases/novel-coronavirus-2019.

3. Xu X, Chen P, Wang J, Feng J, Zhou H, Li X, *et al.* Evolution of the novel coronavirus from the ongoing Wuhan outbreak and modeling of its spike protein for risk of human transmission. *Sci China Life Sci* 2020; published online Jan 21, DOI: 10.1007/s11427-020-1637-5.

4. Radonovich LJ Jr, Simberkoff MS, Bessesen MT, Brown AC, Cummings DAT, Gaydos CA, *et al.* N95 Respirators vs Medical Masks for Preventing Influenza Among Health Care Personnel: A Randomized Clinical Trial. *JAMA* 2019;322(9):824-33.

Journal Press

## Table 1. The infection data of patients and medical staff at Zhongnan Hospital of Wuhan University (2<sup>nd</sup> to 22<sup>nd</sup> January 2020)

	Department	Protection Mask	Protective Clothing	Surgical Cap	2019-nCoV	Medical staff										
Environment					Patients Exposure	Doctors			Nurses					Total		
					Confirmed /	Total#	Age otal# (years)	Sex (M/F, %)	Confirmed /Suspicious	Total#	Age (years)	Sex (M/F, %)	Confirmed	Confirmed	Per-Group	p value
					Suspicious								/Suspicious	cases	confirmed	(adj.OR,
					cases				cases (n,%)				cases (n,%)	(n/total, %)	cases (n, %)	95% CI)
Quarantined Area	Respiratory	N95	-	+	6/9	11	44.0±9.5	6/5 (55%/45%)	0/0 (0%/0%)	59	29.0±5.7	3/56 (3%/95%)	0/0 (0%/0%)	0/70 (0%)		<2.2E-16 (464.82, 97.73-inf)
	ICU	N95	+	+	8/7	30	35.2±8.7	16/14 (53%/47%)	0/0 (0%/0%)	139	27.4±4.2	39/100 (28%/72%)	0/0 (0%/0%)	0/169 (0%)	N95 group: 0/278 (0%)	
	Infectious Diseases	N95	-	-	11/42	15	41.4±8.6	7/8 (46%/54%)	0/0 (0%/0%)	24	30.7±5.7	0/24 (0%/100%)	0/0 (0%/0%)	0/39 (0%)		
Open area	Hepatobiliary Pancreatic Surgery	-	-	-	1/0	25	44.0±11.1	24/25 (96%/4%)	7/1 (28%/4%)	49	31.0±8.4	1/48 (2%/98%)	1/1 (2%/2%)	8/74 (11%)	No-mask	
	Trauma and Microsurgery	-	-	-	1/0	18	41.0±9.8	18/18 (100%/0%)	1/1 (6%/6%)	26	34.0±8.0	1/26 (4%/96%)	0/0 (0%/0%)	1/44 (2%)	group: 10/215 (4.651%)	
	Urology	-	-	-	1/0	36	40.1±10.3	35/1 (97%/3%)	1/1 (3%/3%)	61	28.2±8.2	6/56 (2%/98%)	0/4 (0%/7%)	1/97 (1%)		

adj.OR: adjusted odds ratio; CI: confidence interval; M: male; F: female; ICU: intense care unit;