

Association of Daily Wear of Eyeglasses With Susceptibility to Coronavirus Disease 2019 Infection

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 Invited Commentary

IMPORTANCE The proportion of daily wearers of eyeglasses among patients with coronavirus disease 2019 (COVID-19) is small, and the association between daily wear of eyeglasses and COVID-19 susceptibility has not been reported.

OBJECTIVE To study the association between the daily wearing of eyeglasses and the susceptibility to COVID-19.

DESIGN, SETTING, AND PARTICIPANTS This cohort study enrolled all inpatients with COVID-19 in Suizhou Zengdu Hospital, Suizhou, China, a designated hospital for COVID-19 treatment in the area, from January 27 to March 13, 2020. COVID-19 was diagnosed according to the fifth edition of Chinese COVID-19 diagnostic guidelines. The proportion of persons with myopia who wore eyeglasses in Hubei province was based on data from a previous study.

EXPOSURES Daily wearing of eyeglasses for more than 8 hours.

MAIN OUTCOMES AND MEASURES The main outcomes were the proportions of daily wearers of eyeglasses among patients admitted to the hospital with COVID-19 and among the local population. Data on exposure history, clinical symptoms, underlying diseases, duration of wearing glasses, and myopia status and the proportion of people with myopia who wore eyeglasses in Hubei province were collected. People who wore glasses for more than 8 hours a day were defined as long-term wearers.

RESULTS A total of 276 patients with COVID-19 were enrolled. Of these, 155 (56.2%) were male, and the median age was 51 (interquartile range, 41-58) years. All those who wore glasses for more than 8 hours a day had myopia and included 16 of 276 patients (5.8%; 95% CI, 3.04%-8.55%). The proportion of people with myopia in Hubei province, based on a previous study, was 31.5%, which was much higher than the proportion of patients with COVID-19 who had myopia in this sample.

CONCLUSIONS AND RELEVANCE In this cohort study of patients hospitalized with COVID-19 in Suizhou, China, the proportion of inpatients with COVID-19 who wore glasses for extended daily periods (>8 h/d) was smaller than that in the general population, suggesting that daily wearers of eyeglasses may be less susceptible to COVID-19.

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Coronavirus disease 2019 (COVID-19), the pathogen of which is severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is a highly infectious disease that broke out in Wuhan, China, in December 2019 and has spread to more than 200 countries.¹ COVID-19 has been proven to be transmitted mainly through droplets and contact.² The eye is also considered an important route of infection.

According to reports published in recent years, the prevalence of myopia in China is now more than 80% of the population. Wearing of eyeglasses is common among Chinese individuals of all ages.³ However, since the outbreak of COVID-19 in Wuhan in December 2019, we observed that few patients with eyeglasses were admitted in the hospital ward. There-

fore, we collected information on the wearing of eyeglasses from all inpatients with COVID-19 as part of their medical history and used the data to examine the association between wearing eyeglasses and COVID-19 infection.

Methods

This cohort study was approved by the ethics committee of Suizhou Zengdu Hospital, Suizhou, China, and followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline. Patients signed written informed consent and were not provided with any

incentive or compensation to participate in the study. The study enrolled patients admitted to the hospital from January 27 to March 13, 2020, with the admission criteria of a diagnosis of COVID-19. The diagnostics and clinical classification of COVID-19 were based on the fifth edition of Chinese COVID-19 diagnostic guidelines.⁴ Throat swab samples were obtained from patients at admission and tested using real-time reverse transcriptase-polymerase chain reaction assays to identify COVID-19 infection. Patients were specifically asked about the reason they wore eyeglasses, the length of time that they wore eyeglasses during daily activities, and whether they wore contact lenses or had ever undergone refractive surgery. This information was recorded by the patients' treating physicians while taking their medical history, starting February 4, 2020. Information on exposure history and clinical symptoms was extracted from the medical records. People who wore eyeglasses for more than 8 hours a day were defined as long-term wearers, and these people were considered to wear eyeglasses when socializing.

To estimate the population myopia rate, we extracted data from the Research on Chinese Student Physique and Health Study,⁵ which recorded data from a survey about the physical and health status of Chinese students, organized by state educational institutions and the Ministry of Health of China in 1985. We used descriptive statistics to characterize the study sample.

Results

As shown in the **Table**, a total of 276 patients with COVID-19 were enrolled in the study. The median age was 51 (interquartile range, 41-58) years; 155 patients (56.2%) were male and 121 (43.8%) were female. Most patients with COVID-19 were moderately ill, with 14 (5.1%) severely ill. Common symptoms were fever (227 [82.2%]), cough (218 [79.0%]), and fatigue (141 [51.1%]). Underlying disease was present in 88 patients (31.9%), with hypertension the most common, accounting for 47 (17.0%) of all admitted patients. Thirty patients with COVID-19 wore eyeglasses (10.9%), including 16 cases of myopia and 14 cases of presbyopia. None of the patients in this study wore contact lenses or underwent refractive surgery. All 16 patients with COVID-19 who wore glasses for more than 8 hours per day had myopia, accounting for 5.8% (95% CI, 3.0%-8.6%), and the median age was 33 years. Their symptoms, underlying disease, and COVID-19 severity were not significantly different from those of other patients.

The results from previous research⁵ showed that the mean rate of myopia among students aged 7 to 22 years in Hubei province was 31.5%. By 2020, these students were aged 42 to 57 years, which is close to the median age of our patients with COVID-19. The myopia rate of 31.5% is higher than the 5.8% among our patients with COVID-19.

Discussion

At the time of writing, this study was the only research, to our knowledge, to assess the association between wearing eye-

Key Points

Question What is the association between the daily wear of eyeglasses and susceptibility to coronavirus disease 2019 (COVID-19)?

Findings In this cohort of 276 patients hospitalized with COVID-19 in Suzhou, China, the proportion of daily wearers of eyeglasses was lower than that of the local population (5.8% vs 31.5%).

Meaning These findings suggest that daily wearers of eyeglasses may be less likely to be infected with COVID-19.

Table. Clinical Characteristics of the Study Patients

| Characteristic | Data (n = 276) ^a |
|--|-----------------------------|
| Age, median (IQR), y | 51 (41-58) |
| Severe illness | 14 (5.1) |
| Male | 155 (56.2) |
| Reason for wearing eyeglasses | |
| Presbyopia | 14 (5.1) |
| Myopia | 16 (5.8) |
| Wearing glasses >8 h/d | 16 (5.8) |
| Current smokers | 42 (15.2) |
| BMI, median (IQR) | 23.7 (22.0-25.4) |
| Exposure history ^b | |
| Recently visited Wuhan | 43 (15.6) |
| Contact with people who had traveled to Wuhan or diagnosed with COVID-19 | 166 (60.1) |
| Contact with wildlife | 0 |
| Median incubation period, median (IQR), d ^c | 6.0 (4.0-9.0) |
| Symptoms | |
| Fever | 227 (82.2) |
| Cough | 218 (79.0) |
| Sputum production | 137 (49.6) |
| Fatigue | 141 (51.1) |
| Shortness of breath | 42 (15.2) |
| Comorbidities | |
| Any | 88 (31.9) |
| Hypertension | 47 (17.0) |
| Chronic obstructive pulmonary disease | 7 (2.5) |
| Diabetes | 14 (5.1) |
| Coronary heart disease | 12 (4.3) |
| Cerebrovascular disease | 6 (2.2) |
| Cancer ^d | 3 (1.1) |

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by square of height in meters); COVID-19, coronavirus disease 2019; IQR, interquartile range.

^a Unless otherwise indicated, data are expressed as number (percentage) of patients.

^b Source of exposure was unknown in 67 patients.

^c Undetermined incubation period for 205 patients.

^d Included any kind of cancer.

glasses and COVID-19 infection. Our main finding was that patients with COVID-19 who wear eyeglasses for an extended period (>8 h/d) every day were relatively uncommon, which could be preliminary evidence that daily wearers of eyeglasses are

less susceptible to COVID-19. Considering the prevalence of COVID-19, conducting a sample survey among the local population would have been difficult. Instead, we used data from a previous survey for approximate reference and comparison, although the age, region, and educational level of the students in that survey had some differences compared with our study population.

We hypothesized that eyeglasses prevent or discourage wearers from touching their eyes, thus avoiding transferring the virus from the hands to the eyes.⁶ Studies have shown that normal people will involuntarily touch their eyes about 10 times per hour.⁷ Eyes usually lack protection, and an abundance of the SARS-CoV-2 receptor angiotensin-converting enzyme 2 has been found on the ocular surface,⁸ through which SARS-CoV-2 can enter the human body. SARS-CoV-2 may also be transported to the nasal and nasopharyngeal mucosa through continuous tear irrigation of the lacrimal duct, causing respiratory infection.⁹ According to available statistics, nearly 1% to 12% of patients with COVID-19 have ocular manifestations,^{10,11} SARS-CoV-2 was detected in tears or the conjunctival sacs of patients with COVID-19,¹² and some ophthalmologists were reported to be infected during routine treatment.¹³ Therefore, the eyes are considered an important channel for SARS-CoV-2 to enter the human body.¹¹ For daily wearers of eyeglasses, who usually wear eyeglasses on social occasions, wearing eyeglasses may become a protective factor, reducing the risk of virus transfer to the eyes and leading to long-term daily wearers of eyeglasses being rarely infected with COVID-19. Presently, many COVID-19 guidelines state the need to pay attention to preventing infections through the eyes,¹⁴ but most people only focus on wearing masks and home isolation, ignoring recommendations such as washing hands frequently and avoiding touching the eyes with the hands.¹⁵ The results of this study

can be used as evidence of the importance of these 2 recommendations.

Limitations

Our study had some notable limitations. First, it was a single-center study with a small sample size. The numbers of patients who wear eyeglasses and long-term wearers were limited, which limits the extension of the results to a larger population, so our results need to be verified by large-sample multicenter studies. Second, the proportion of wearers of eyeglasses was based on data from previous literature and was not calculated from current local populations. Third, the myopia rate obtained in previous studies included a small number of people with myopia who did not wear eyeglasses. Information on these people was lacking and partly affected the integrity and validity of our data. Fourth, none of our research participants wore contact lenses, so the association between wearing contact lenses and susceptibility to COVID-19 remains to be studied. In addition, further studies are needed to clarify the reasons that wearing eyeglasses may decrease susceptibility to COVID-19.

Conclusions

Our study found that the proportion of inpatients with COVID-19 who wear eyeglasses for extended daily periods was lower than that of the general population, suggesting that daily wear of eyeglasses is associated with less susceptibility to COVID-19 infection. These findings suggest that the eye may be an important infection route for COVID-19, and more attention should be paid to preventive measures such as frequent hand washing and avoiding touching the eyes.

ARTICLE INFORMATION

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REFERENCES

1. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. *JAMA*. 2020. doi:10.1001/jama.2020.2648
2. Pongpirul WA, Pongpirul K, Ratnarathon AC, Prasithsirikul W. Journey of a Thai taxi driver and novel coronavirus. *N Engl J Med*. 2020;382(11):1067-1068. doi:10.1056/NEJM2001621
3. Chen M, Wu A, Zhang L, et al. The increasing prevalence of myopia and high myopia among high school students in Fenghua City, eastern China: a 15-year population-based survey. *BMC Ophthalmol*. 2018;18(1):159. doi:10.1186/s12886-018-0829-8
4. General Office of National Health Commission. Diagnosis and treatment protocols for novel coronavirus pneumonia (trial version 5, revised) [in Chinese]. Published February 4, 2020. Accessed March 15, 2020. http://www.gov.cn/zhengce/zhengceku/2020-02/09/content_5476407.htm
5. Chinese Student Physique and Health Research Group. *Research on Chinese Students' Physique and Health [in Chinese]*. People's Education Press; 1987.
6. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N Engl J Med*. 2020;382(16):1564-1567. doi:10.1056/NEJM2004973
7. Kwok YL, Galton J, McLaws ML. Face touching: a frequent habit that has implications for hand hygiene. *Am J Infect Control*. 2015;43(2):112-114. doi:10.1016/j.ajic.2014.10.015
8. Holappa M, Vapaatalo H, Vaajanen A. Many faces of renin-angiotensin system—focus on eye. *Open Ophthalmol J*. 2017;11:122-142. doi:10.2174/1874364101711010122
9. Xiao X, Chakraborti S, Dimitrov AS, Gramatikoff K, Dimitrov DS. The SARS-CoV S glycoprotein: expression and functional characterization. *Biochem Biophys Res Commun*. 2003;312(4):1159-1164. doi:10.1016/j.bbrc.2003.11.054
10. Guan WJ, Ni ZY, Hu Y, et al; China Medical Treatment Expert Group for Covid-19. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med*. 2020;382(18):1708-1720. doi:10.1056/NEJMoa2002032
11. Wu P, Duan F, Luo C, et al. Characteristics of ocular findings of patients with coronavirus disease 2019 (COVID-19) in Hubei Province, China. *JAMA*

Ophthalmol. 2020;138(5):575-578. doi:10.1001/jamaophthalmol.2020.1291

12. Seah IYJ, Anderson DE, Kang AEZ, et al. Assessing viral shedding and infectivity of tears in coronavirus disease 2019 (COVID-19) patients. *Ophthalmology.* 2020;127(7):977-979. doi:10.1016/j.ophtha.2020.03.026

13. Lu CW, Liu XF, Jia ZF. 2019-nCoV transmission through the ocular surface must not be ignored. *Lancet.* 2020;395(10224):e39. doi:10.1016/S0140-6736(20)30313-5

14. World Health Organization. Coronavirus disease (COVID-19) advice for the public. Updated June 4, 2020. Accessed April 1, 2020. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public>

15. Machida M, Nakamura I, Saito R, et al. Adoption of personal protective measures by ordinary citizens during the COVID-19 outbreak in Japan. *Int J Infect Dis.* 2020;94:139-144. doi:10.1016/j.ijid.2020.04.014

2020.04.014